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ENVIRONMENTAL SCIENCES DIVISION PUBLICATIONS 1-500 AN ABSTRACTED, INDEXED BIBLIOGRAPHY

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OAK RIDGE NATIONAL LABORATORY
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ENVIRONMENTAL SCIENCES DIVISION PUBLICATIONS 1-500

AN ABSTRACTED, INDEXED BIBLIOGRAPHY

Compiled and Edited by
staff of the
ECOLOGICAL SCIENCES INFORMATION CENTER

MARCH 1974

Environmental Sciences Division

S. I. Auerbach, Director

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
U. S. ATOMIC ENERGY COMMISSION

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ABSTRACT

The first 500 Environmental Sciences Division publications are references and abstracted in this volume. Indexes are provided by author, keywords, and publication description.

PREFACE

The first 500 publications of the Environmental Sciences Division have each been abstracted and indexed and prepared for use as a convenient reference.

The first paper, ESD #1, was published in 1956, when ecology research was the responsibility of a small staff (3) within the Health Physics Division. By 1959 a radiation ecology section became a separate entity in that division. In 1970, a separate Ecological Sciences Division was organized under S. I. Auerbach, Director, staffed by about thirty-five investigators. The present Division name, Environmental Sciences, reflected broadened areas of research involvement by 1972. At present there are well over 100 staff members.

This volume is intended to be used as a handy reference by staff members, as an orientation aid to visitors and new staff members, and as a guide to the historic development of ecological research at Oak Ridge National Laboratory.

INTRODUCTION

The material presented is published from a computerized information file maintained by the Ecological Sciences Information Center. The references are presented in order of their publication numbers. This highlights the evolution of publications by placing them in their historical context. The author and keyword indexes may be used to locate papers of particular interest. The treatment given annual reports has been mixed. In some instances separate abstracts were prepared for each major section of the report; in others, each individual part was abstracted separately. However, all abstracts for any given annual report are grouped together.

We have published the authors, publication date, title, citation, ESD number and abstract for each entry. The computer file contains a number of additional fields of information, such as date and geographic description of data gathering and scientific names of organisms studied. The file is dynamic. Each new division publication is added. Corrections and deletions of any field or part of a field may be made as deemed desirable.

The bibliographic data were arranged according to the Environmental Information System standard format for computer entry of information.[1] As a result of computer limitations in printing superscripts and subscripts in the traditional manner, the following conventions have been used: 1) X sub t (X being a variable) means X_t or X subscript t, 2) in chemical compounds and elements, NaIO3 (for example) means $NaIO_3$, 3) 10(E+3) or X(E-3) (E denoting exponent) means 10^3 or X^{-3}, respectively, and 4) for units of measurement, such as centimeters, meters, feet, etc., X3 means X^3. The notation in parentheses tells that the abstract was written by the author (Auth) or by an abstractor, e.g., (BBM), (KM).

Any comments from users of this bibliography will be given full consideration in improving the usefulness of both the computer information file and of any future

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[1]Oen, C. J., N. F. Sollins, and D. K. Trubey, Guide to the Generalized Bibliographic Format for the Environmental Information System, ORNL-EIS-71-3 (February, 1972), 36 p.

bibliographic publications. A user may request a search of the computer file at any time and receive computer printout designed to meet his information needs. A complete listing of division publications is given in each annual progress report, along with information on how to obtain reprints when these are available.

Credits

Preparation of this bibliography has been the primary responsibility of Beth B. McMullin, Bobbie Neal Collier, and Carol Oen. Others who have shared in the development of the computer file and preparation of this publication include Karen Meyers, Cathy Sanders, Lorie Weinberg, Helen Pfuderer, Elaine Huber, Fay Martin, Sylvia Talmage, and Paula Cottrell.

Acknowledgements

The assistance of the division staff in reviewing the abstracts and index terms used for their work and offering their comments is gratefully acknowledged. Appreciation is expressed to J. S. Olson who suggested this project about three years ago, D. J. Nelson and R. L. Burgess, who have given their suggestions and helped place the works in their proper historical context, and Nancy Ferguson who has offered many useful suggestions in preparing this publication.

Ruth Slusher, Frank Hammerling, and Carolyn Gard of the Computer Sciences Division, and Faye Fletcher of the Environmental Information Systems Office at ORNL have managed the computer production of this document. The computer programs supporting the composition and indexing for publications constitute a part of the Oak Ridge Computerized Hierarchical Information System (ORCHIS).[2]

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[2] Brooks, A. A., Oak Ridge Computerized Hierarchical Information System (ORCHIS) Status Report - July 1973, ORNL-4929 (January, 1974), 63 p.

<1>
Rohde, C.J., Jr. 1956, October. A Modification of the Plaster-Charcoal Technique for the Rearing of Mites and Other Small Arthropods. Ecology, 37(4), 843-844 (ESD #1)

A modification was developed from the method used by Rohde during observations on the life history of phthiracarid mites which used 2-dram vials filled to 1/3 capacity with plaster-charcoal mixture. The unique feature of the modification is the lucite cylinder of 1 cm inside diameter and 2 cm length which has four 0.5 cm (3/16") holes at one end. These cylinders are imbedded in a single mass of plaster in a container of suitable size for use under the stereomicroscope. This technique has been successful in the rearing and handling of acarid, uropodine and phthiracarid mites and is equally useful in similar studies on collembolans. (KM)

<2>
Howden, H.F. 1957, January. Investigations of Sterility and Deformities of ONTHOPHAGUS (Coleoptera, Scarabaeidae) Induced by Gamma Radiation. Annals of the Entomological Society of America, 50(1), 1-9 (ESD #2)

This paper discusses the biology of ONTHOPHAGUS TEXANUS Schaeffer and the effects of gamma radiation on both the adults and larvae of this species. The ONTHOPHAGUS were used since they had a short life cycle (35 to 45 days), were easily reared in earth-filled flower pots, and had males and females that were easily distinguishable externally. Eight pairs of adult beetles given a dose of 5000 R and one pair given 3000 R failed to reproduct. Second stage larvae irradiated with 2000 R showed normal development. The resulting adults, however, failed to produced offspring. Ninety percent of the second stage larvae receiving 4000 R failed to complete development. In some cases, larval development was arrested with death occurring in one to three weeks. The majority of deaths occurred in the pupal stage. The few adults that developed from the larvae receiving the 4000 R were badly deformed. Most noticable were the crumpled wings, fused antennal segments and tarsi with the tarsal claws often lacking. The beetles were incapable of burrowing or of reproducing. Except for larvae irradiated with 4000 R, a dose that killed the larvae or shortened the adult life span, the treatments had no effect on the life expentancy of the larvae or adult beetles. (Auth)

<3>
Howden, H.F., and S.I. Auerbach 1958. Some Effects of Gamma Radiation on TROGODERMA STERNALE Jayne. Annals of the Entomological Society of America, 51(1), 48-41 (ESD #3)

Some aspects of the biology of TROGODERMA STERNALE and the effects of single and fractionated doses of gamma radiation on reproduction and larval development are discussed. It was found that all doses delivered to full grown larvae affected reproduction adversely. Reduction in population size at doses of 1,000 to 4,000 R may be explained in terms of lowered vitality and/or morphological deformities affecting the mating behavior. There was no apparent difference in effects on numbers of offspring between instantaneous and fractionated exposures below 5,000 R, but there was a difference between 5,000 and 6,000 R with fractionated and instantaneous exposures. At instantaneous exposures of 5,000 R and above there was no reproduction, but when fractionated, exposures of 6,000 R were needed to prevent reproduction. Larval development was delayed more by instantaneous doses than fractionated ones. (BBM)

<4>
Lackey, J.B. 1957, October. The Suspended Microbiota of the Clinch River and Adjacent Waters, in Relation to Radioactivity in the Summer of 1956. ORNL-2410; 35 p. (ESD #4)

The Clinch River enters the Oak Ridge area virtually free of plankton due to Norris Dam. It is fertilized in this area and develops considerable plankton by the time it enters Watts Bar Lake. This plankton may acquire considerable amounts of radioactivity from the very small amounts contributed by the Oak Ridge operations. Some figures are presented showing the radioactivity accumulated by various species, and the rate of accumulation as compared to reproductive rates. Diminution of radioactivity in both plankton and water is traced downstream. Conditions in the Clinch are compared with the Columbia. The principal source of radioactive wastes for the Clinch River insofar as known is the effluent from the ORNL settling basin, which empties via White Oak Creek. Along with this small quantity of radioactive waste the river receives some nutrient materials and mixed population of microorganisms. A small amount of radioactive seepage form the ORNL disposal pits may enter the creek. The possibility of other sources of radioactivity for the river was not investigated in this study. The Clinch and neighboring waters yielded 425 species of algal or protozoan microorganisms, which are listed in an appendix, in the summer of 1956. (Auth)

<5>
Morgan, K.Z., and S.I. Auerbach 1957, December. Need for Reserving Melton Valley for Long Range Ecological Studies. ORNL-CF-57-12-25; 5 p. (ESD #5)

Reasons are presented to support reserving Melton Valley for long range ecological studies. This valley is unique for ecological studies because of the large variety of forest and field habitats, most of which have been undisturbed since acquisition of the property by the Federal Government. It contains both contaminated land and uncontaminated land. The eastern half of Melton Valley should be preserved in its present relatively undisturbed condition and no laboratory facilities should be established in this area. (BBM)

<6>

<6>

Auerbach, S.I. 1958. The Soil Ecosystem and Radioactive Waste Disposal to the Ground. Ecology, 38(3), 522-529 (ESD #6)

A brief review is presented of the ecosystem concept applied to soils. Some aspects of current research pertaining to soil disposal of fission products are reviewed, and results of research started at the Oak Ridge National Laboratory are presented. The soil ecosystem includes mineral particles, plant and animal residues, living systems, free and bound water and gases. The possibility of using the ion exchange capacity of soil to retain large volumes of radioactive wastes is under investigation. Much ecological data is needed for the establishment of health and safety criteria. Strontium appears to be the fission product most readily translocated by plants studied. Deposition of radionuclides is greatest in leaves. Weighed samples of tree-bole substrate containing dense, complex arthropod populations were exposed to various doses of gamma radiation from a cobalt source. A series of samples were taken at intervals up to 90 days. It appears from data on Collembola and Acarina that related species can differ in radiosensitivity. Evidence of predator-prey differential radiosensitivity was also obtained from two species of mites. (BBM)

<7>

Williams, L.G., and H.D. Swanson 1958, January. Concentration of Cesium 137 by Algae. Science, 127(3291), 187-188 (ESD #7)

The accumulation of Cs by EUGLENA INTERMEDIA and CHLORELLA PYRENOIDOSA was studied by measuring the extent to which these algae decontaminated their nutrient medium. In 6 days EUGLENA decontaminated the medium by 69%; in 11 days, by 82%, in 18 days, by 86%; and in 34 days, by 96%. Chlorella decontaminated the medium by about 47% at each concentration of Cs 137 in 13 days. The rate of decontamination appeared to vary directly with the number of cells in CHLORELLA, but in EUGLENA there was an increase in uptake per cell from the time cells ceased dividing, as the population became maximum. Studies with dead algae indicate that structural components persist in dead CHLORELLA which adsorb Cs from very dilute solutions and that this absorption is not affected by the concentration of K in the medium. In killed cells of CHLORELLA, K and Cs behave independently, but in live cells of CHLORELLA and EUGLENA, particularly at tracer levels of K, ions of K and Cs form a metabolic pool. (KM)

<8>

Auerbach, S.I., D.A. Crossley, Jr., and M.D. Engelman 1957, September. Effects of Gamma Radiation on Collembola Population Growth. Science, 126(3274), 614 (ESD #8)

The effect of acute gamma radiation on growth of PROISOTOMA MINUTA population units was demonstrated by bidaily counts of individuals at feeding points. The effect of radiation seems to be chiefly one of lengthening the threshold period. When this lag phase has been passed, the population generally proceeds to multiply at the control rate. Until asymptotic levels are approached by all experimental cultures, the totals at any sampling point in time prior to reaching plateau reflect the lag effect. (KM)

<9>

Auerbach, S.I., and D.A. Crossley, Jr. 1958. Strontium 90 and Cesium 137 Uptake by Vegetation under Natural Conditions. Part of Proceedings of the Second International Conference on the Peaceful Uses of Atomic Energy, Vol. 18 held in Geneva, Switzerland. Pergamon Press, London, England, (p. 494-499) (ESD #9)

White Oak Lake, a former radioactive waste impoundment, was drained leaving contaminated terrain with concentrations of 2.0 Ci of strontium 90 and 14.0 Ci of cesium 137 per acre. Soil chemical properties in an agricultural plot on the lake bed and the uptake of strontium 90 and cesium 137 by corn (ZEA MAYS) grown on the plot are reported. A survey of strontium 90 and cesium 137 concentration in various native plants on the lake bed are included. Strontium/calcium ratios for the wild plant species (average of plant parts) varied around 7.0 X 10(E+4) muCi strontium 90 per 1000 g. calcium. The range was 5.5 to 8.2 X 10(E+4). Discrimination factors slightly higher than 1 were obtained for these plants. In the more detailed corn studies strontium/calcium ratios averaged 7.1 X 10 (E+4); for plant parts these ranged from 2.3 X 10(E+4) for grain to 12.5 X 10(E+4) for flowers. Discrimination factors varied around 1; for plant parts these were from 0.5 for grain to 2.8 for flowers. The cesium 137/potassium ratios for native plants ranged from 0.8 to 8.4 X 10(E+4) and discrimination factors varied from 0.06 to 0.60. In corn, the radiocesium/potassium ratio averaged 2.7 X 10(E+4) with plant parts ranging from 1.0 X 10(E+4) for grain to 10.8 X 10(E+4) for flowers. The discrimination factors varied from 0.07 to 0.77. A difference of an order of magnitude exists both between species and plant parts. The combination of these suggests that differences of two orders of magnitude might exist between plant parts of different species. (BBM)

<10>
Davis, R.J., V.L. Sheldon, and S.I. Auerbach 1956, October. Lethal Effects of Gamma Radiation Upon Segments of a Natural Microbial Population. Journal of Bacteriology, 72 (4), 505-510 (ESD #10)

The effect of gamma radiation upon certain segments of a natural microbial population was investigated. The population studied was the microflora in a tree-hole in a mature beech tree, and seven segments of this population were studied. Population decreased rapidly with increase in dose at radiation doses up to 10(E+4) R, then leveled off at 1-2 x 10(E+4) R, and continued to decrease at a fairly steady rate. At 4 x 10(E+4) R there was only one type of colony on all of the bacterial plates. Delayed effect studies indicated that if an entire segment of the population is not eliminated, the population will return in time to equilibrium. (BBM)

<11>
Graham, E.R. 1958, August. Uptake of Waste Strontium 90 and Cesium 137 by Soil and Vegetation. Soil Science, 86(2), 91-97 (ESD #11)

A study was conducted on the uptake of strontuim 90 and cesium 137 by the primary vegetation and on some properties of the White Oak Lake bed area. It was found that the distribution of radionuclide in the surface is heterogeneous. Higher levels of radioactivity are associated with high pH values and a relatively greater salt content. The industrial wastes and fission products mixed with transported earth material formed a sediment similar to a heterogeneous saline calcareous soil deposited on the salt-free acid Pope fine sandy loam. Physical and chemical properties were conducive to good plant growth. Available calcium and magnesium levels were high. POLYGONUM LAPATHIFOLIUM was abnormally high in unreduced nitrogen and total nitrogen. The total strontuim 90 uptake by POLYGONUM LAPATHIFOLIUM varied from 0.057 to 0.178 microcuries per 100 g dry plant material. The low concentration was associated with high sodium and calcium sections of the area. The best soil index associated with the plant uptake of strontuim 90 under these conditions was the concentration of strontium 90 in the saturated extracts. The total cesium 137 uptake varied from 0.133 to 0.334 microcuries per 100 g dry plant material. The higher uptake was associated with the moderately low supply of available potassium in tree sediment. (BBM)

<12>
Howell, J.C. 1958, June 3. Long-Range Ecological Study of the Oak Ridge Area. I. Observations on the Summer Birds in Melton Valley. ORNL-CF-58-6-14; 35 p. (ESD #12)

A study of the bird species occurring in Melton Valley was made to gather ecological information and data for the selection of study sites for long-term environmental research programs on the ecological effects of radiation. Eighteen hundred seventy individual birds belonging to 65 species were recorded at 157 stations established in the valley. More birds were heard (92%) than seen (8%). A scheme grouping the ecological habitats in four stages based on plant succession is given. The percent of habitats belonging to each of the four stages in succession is estimated for the entire area. Included in this analysis are the species of the more common birds found in each stage. A comparison of the birds of Melton Valley with those of Knox County shows that Knox County has many common birds which are characteristic of the earlier stages of succession that are no longer extensively present in Melton Valley. Birds of overgrown fields and woods are more common in Melton Valley. The number of individuals of each species observed in Melton Valley constitutes a population index which is influenced by differences in conspicuousness of various species. The 20 most common species of birds found in Melton Valley and Knox County are compared and only eight species are common to the two lists. It is predicted that the birds of Stage IV in plant succession will replace or greatly outnumber those of the three earlier stages if plant succession is permitted to continue without interruption. (BBM)

<13>
Williams, L.G. 1960, July. Uptake of Cesium 137 by Cells and Detritus of Euglena and Chlorella. Limnology and Oceanography, 5(3), 301-311 (ESD #13)

Standard "Euglena" medium putrefied by three common species of bacteria and filtered was found to support unusally heavy blooms of EUGLENA and CHLORELLA. Mass culturing demonstrated that uptake of Cs 137 by EUGLENA and CHLORELLA is linear with concentrations at all levels that might be encountered in natural aquatic habitats. The rate of uptake of cesium during population growth is greatest in cells of EUGLENA during the stationary period following the exponential growth phase. At this stage the cesium taken in is mostly unbound. Following this it is released so that in old cells and detritus it is largely bound cesium. Cesium and potassium behave independently in killed cells of CHLORELLA. Alkali ions, known to be chemically similar, are selected or rejected discriminately by these algae. The presence of antibiotics significantly depresses the uptake of cesium by CHLORELLA and EUGLENA. (Auth)

<14>
Auerbach, S.I., and D.A. Crossley, Jr. 1960. A Sampling Device for Soil Microarthropods. Acarologia, 2(3), 279-287 (ESD #14)

A sampling tool and a high-gradient Berlese-type apparatus are described that will permit sampling and extraction of soil arthropods under conditions which easily may be duplicated for numbers of samples and which will be efficient for the majority of the microarthropods. The efficiency of the high-gradient apparatus was compared to that of a standard Tullgren-type funnel with both kept in a constant environment. No difference in efficiency between the two types was found. In terms of day-to-day recoveries of arthropods there is evidence that the action of the high-gradient apparatus is less than that of the Tullgren apparatus. The advantages of the high-gradient apparatus over the Tullgren funnel are those of compactness and greater control of the variables (temperature and humidity) which govern extraction efficiency. (Auth)

<15>
Crossley, D.A., Jr., and K.K. Bohnsack 1960, October. Long-Term Ecological Study in the Oak Ridge Area. III. The Oribatid Mite Fauna in Pine Litter. Ecology, 41(4), 628-638 (ESD #15)

From 215 samples (approximately 3000 sq cm) of pine forest litter taken in the Oak Ridge area during the summer of 1956, a total of 30,371 arthropods were obtained. Of this number, mites (Acarina) comprised 82.9%, collembolans 12.2%, and other insects 3.6%. Particular attention was directed toward the oribatid mites. The samples were taken from 3 similar areas, each of which was represented by 3 stations. Three samples were taken from each station each week for a period of 8 weeks during July and August. Thus, a hierarchic measure of the variation in abundance was obtained for the more abundant oribatid species. Results of analysis of variance tests showed that significant variation occurs both between stations within areas and between the areas, for certain of the abundant oribatid mites. Fager's (1957) trellis diagram method was used to detect significant joint occurrences between species; only a single recurrent group of species was found. Although the 3 study areas have different relative abundances of certain of the more numerous species, it is concluded that the differences between areas represent local variations in a single oribatid fauna, rather than elements of 2 or more faunas. (Auth)

<16>
Rohde, C.J. 1959, October. Studies on the Biologies of Two Mite Species, Predator and Prey, Including Some Effects of Gamma Radiation on Selected Developmental Stages. Ecology, 40(4), 572-579 (ESD #16)

The effects of gamma radiation upon 2 members of the Acarina, prey and predator were studied. The life history of CALOGLYPHUS MYCOPHAGUS, the prey, is described in detail. The average duration of the life cycle was slightly more than 6 days with a range from 4 to 9 days. Observations on the life history of FUSCUROPODA MARGINATA, the predator, are also presented. These indicate a life cycle ranging from 30 to 40 days. Data on the effects of radiation upon hatchability of eggs and upon viability of eggs from irradiated virgin adults are presented. FUSCUROPODA eggs are insensitive to doses producing 50% mortality in CALOGLYPHUS eggs of comparable age. The predator male is rendered permanently sterile by doses that produce temporary sterility in the prey male. (Auth)

<17>
Auerbach, S.I. (Ed.) 1957. Waste-Pit Area Studies. ORNL-2384; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1957, (p. 27-38) (ESD #17, Part, Section)

Because of evidence that trees and vegetation were taking up radioactive material from the waste-pit area, it was felt that a more detailed study of radionuclide uptake in the vicinity was necessary. Objectives were to determine specific activity of ruthenium 106 in tree components and ground litter, to determine if Ru 106 and other fission products were being concentrated, and to compare the geographical distribution of radionuclides in the trees and ground litter with that obtained from core well data. Gross activity and specific activity for the monitored trees at the various sites along the seeps were tabulated in the report. Because of the unexpected occurance of cesium 137 in trees at the ORNL Waste Pit area, studies were made on bean plants grown in uncontaminated soil and watered with liquid obtained from seeps. No cesium 137 could be detected in the plants, but ruthenium 106 and cobalt 60 were present. Soils in the flower pots appear to have retained most of the ruthenium 106 added in the seep water. (BBM)

<18>
Anderson, R.M., S.I. Auerbach, D.A. Crossley, Jr., C. Krauth, C.J. Rohde, Jr., A. Broseghini, H. Conner, M.D. Engelmann, E.R. Graham, H.F. Howden, and J.B. Lackey 1957. Ecological Research. ORNL-2384; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1957, (p. 10-39) (ESD #17, Section)

Progress in ecological research is summarized for the annual report of the Health Physics Division. The purpose of the program is to obtain information on the release of radioactive fission products to man's environment. Data is needed for hazard problems in three areas: radioactive waste disposal, reactor site selection and associated hazards, and weapons fallout. Two interrelated phases of the program concern applied environmental studies and longe-range environmental studies. Summaries of work are given for White Oak Lak Bed studies, field studies and laboratory studies on arthropods, and waste-pet area studies. (BBM)

<19>
Auerbach, S.I. (Ed.) 1957. White Oak Lake Bed Studies. ORNL-2384; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1957, (p. 10-18) (ESD #17, Part, Section)

In October 1955, White Oak Lake, an inpoundment which served as a final holding basin for the ORNL's low-level radioactive wastes, was drained. The lake bed contained various amounts and kinds of transported soil and subsoil material contaminated with mixed fission products. Initial studies were concerned with determining the yield and productivity of the newly developing community. Background radiation varies from 5-35 mrad/hr in the lower area to 10-120 mrad/hr in the upper area. Most studies were confined to the lower area. Soil samples were analyzed for general soil properties and in relation to air dose rates. Plant leaves (POLYGONUM LAPATHIFOLIUM) were also collected for analysis. Distribution of radioactivity, pH, and salt pH of the soils were tabulated. There was a high concentration of nitrate and sulfate ions and low chloride ions, and related to plant growth, the soils represent a calcium-rich, potash-deficient system. Plant samples ranged from 0.057-0.178 uCi/100 g of strontium 90 in dry material. Cesium 137 content ranged from 0.133-0.334 uCi/100 g. (BBM)

<20>
Auerbach, S.I. (Ed.) 1957. Field Studies on Arthropods. ORNL-2384; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1957, (p. 18-23) (ESD #17, Part, Section)

A program of field studies on arthropods has been initiated, with the basic aspects oriented towards investigations of populations and of the food web, and the applied studies concerned with the passage and dissemination of radionuclides through these components of the ecosystem. A sampling regime for soil microarthropods and macroarthropods was begun on White Oak Lake bed. Thus far, no estimates have been made of kinds and concentrations of radionuclides present in the insect. (BBM)

<21>
Auerbach, S.I. (Ed.) 1957. Laboratory Studies on Arthropods. ORNL-2384; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1957, (p. 23-27) (ESD #17, Part, Section)

Some research emphasis is being placed on radiation effects on populations of different soil arthropods. The effects of gamma radiation on collembola population growth were investigated by bidaily counts of individuals. All the population units had an initial threshold period followed by the typical phase of exponential growth. The effect of radiation seems to lengthen the threshold period. Studies were continued on radiation effects on TROGODERMA STERNALE Jayne and two species of mites. (BBM)

<22>
Auerbach, S.I. (Ed.) 1958. Ecological Research. ORNL-2590; Part of Health Physics Division Annual Progress Report, July 31, 1958, (p. 27-52) (ESD #18, Section)

Ecological studies have been conducted in the past year in areas contaminated by waste disposal operations, with major emphasis placed on the concentration and distribution of radionuclides in soil, plants, and animals. White Oak Lake bed and the surrounding forest areas are being investigated. Estimations of animal populations and community structure in contaminated and uncontaminated areas have been made to provide a basis for more refined work on the turnover of radionuclides by these tropic levels. Preliminary investigations were started on programs concerned with the long-term ecological effects of radiation. Studies have been conducted of mammal populations in areas of White Oak Lake bed which have an exposure rate of about 500 mr/day. An analysis of summer bird populations in Melton Valley was conducted. Laboratory experiments on the uptake of cesium 137 by algae have been reported and published in the open literature. Summer survey work on plankton of the Clinch River and its tributaries was continued; sections of the report dealing with White Oak Lake bed studies and the waste pit area studies are entered separately into the data base. (BBM)

<23>
Auerbach, S.I. (Ed.) 1962, November 21. Waste Pit Studies. ORNL-2590; Part of Health Physics Division Annual Progress Report, July 31, 1958, (p. 41-52) (ESD #18, Part, Section)

Initial studies on contamination of trees by fission products from the radioactive waste pits were continued. Because of new patterns of contamination, particularly those caused by the appearance of cesium 137 in the trees, additional trees were added to the monitored group. Twigs, leaves, and litter were analyzed by gamma spectrometry for Cs 137, Zr 95-Nb 95, and Co 60. Radiochemical analysis was done for Ru 106. Cerium 144 has been detected in many of the samples. Tabular data is given for the concentrations of radionuclides in the monitored trees. The indication was that some mode of contamination besides ground seepage from the waste pits, possible air borne contamination is involved. Fission product contamination in ground litter did not show on increase over the previous year. Preliminary studies have been conducted on the microarthropod fauna of short-leaf pine tree litter. The study was performed to characterize this habitat in terms of its microarthropod fauna as a prelude to studies on the accumulation and turnover of radionuclides by these animals. Special consideration was given to oribat id mites since these were the most numerous animal group in the litter. Results of counts for different arthropod groups in three locations are tabulated. Studies have just begun on the role of the microarthropod fauna in the release of fission products from contaminated litter. (BBM)

<24>
Auerbach, S.I. (Ed.) 1958. White Oak Lake Bed Studies. ORNL-2590; Part of Health Physics Division Annual Progress Report, July 31, 1958, (p. 30-41) (ESD #18, Part, Section)

There was considerable change in plants growing on White Oak Lake bed because of succession. Additional analysis for fission products and common nutrient elements in the soil were made at five locations and are tabulated. Samples of natural vegetation and corn were collected and analyzed for radiostrontium, radiocesium, and nutrient elements. Tabular data indicates the concentrations found. A series of samples was taken of insects on vegetation in the lake bed to ascertain summer population size and biomass relationships so uptake and turnvoer of fission products could be estimated. A sampling program for soil microarthropods was initiated. Species identification, estimation of numbers, succession, and the role of arthropods in the turnover of radionuclides are being ivestigated. A program was started to conduct long-term studies of small mammals (rats, mice, and shrews) in areas contaminated with low-level radioactive wastes. This program is directed toward the problems of low-level chronic exposure, internal and external, and is related to many aspects of fallout. (BBM)

<25>

<25>
Lee, P.K., and S.I. Auerbach 1960, February 12. Determination and Evaluation of the Radiation Field Above White Oak Lake Bed. ORNL-2755; M.Sc. Thesis, Vanderbilt University, 64 p. (ESD #19)

The radiation above the contaminated soil of White Oak Lake bed was characterized in terms of horizontal and vertical distribution of air dose rates over most of the bed. These data are needed for studies investigating effects of this chronic low-level radiation upon mammals and other organisms inhabiting this area. The radiation intensity was determined at heights of 5, 25, 50, and 100 cm above the ground, and at one location at heights upward of 15 meters. The survey disclosed that 90% of the radiation was gamma, and consequently, variation of intensity with height were slight. The radiation field was nonuniform over the lake bed and ranged from less than 1 mR/hr to a maximum of 100 mR/hr. Regions having higher dose rates (50 mR/hr) were located near the inlet end of the lake bed, while lower dose rates (10 mR/hr) were registered above regions along the shore line. Some marked variations of the radiation field are related to changes in distribution and quantity of radionuclides in the soil. These changes are induced by soil erosion in the lake bed, periodic flooding of the contaminated creek flowing through the area, and by seepage from radioactive waste disposal pits in the vicinity of these environmental factors, seepage from disposal pits introduces the greatest alteration of the radiation field. Weekly fluctuations over portions of the lake bed in which the radioactive material (Ru 106) is being deposited were as much as 50 mR/hr during the course of the investigation. An equation was derived which determines the expected dose rate above a large slab source of thickness in which radionuclide concentrations are uniformly distributed. Solution for a section of the lake bed after scattered radiation was considered gave a theoretical value of 18 mR/hr, which compared favorably with the measured value of 16 mR/hr. Based on the mathematical analysis it was estimated that because of decay of the radionuclides, the average dose rate above the area will decrease 20% in the next two years and 50% in the next 10 years (1968). (Auth) (BBM)

<26>
Auerbach, S.I., R.M. Anderson, D.A. Crossley, Jr., P.B. Dunaway, J.H. Marks, J.S. Olson, V.I. Dodson, M.W. Pryor, and J.P. Witherspoon 1959. Ecological Research. ORNL-2806; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1959, (p. 18-54) (ESD #20)

Research in White Oak Lake bed and in the forest sites of the reservation have emphasized the uptake and food chain transfer of strontium 90, cesium 137 and other radioisotopes within a unique, heavily contaminated system. Research has been undertaken in the following areas: soil; native vegetation; forage crops; insect studies; and small mammals. Forest studies have involved the gathering and organizing of information that is needed for predicting the future movement of isotopes in natural ecosystems, particularly forests. These studies include analysis of the elements which influence the movements of the radioisotopes, as well as tracer experiments and other investigations indicating directions and rates of isotope movement. The investigations include studies of analysis of forest growth, translocation of tracer radioisotopes in trees, foilage contamination by fallout patterns of leaf dispersal by wind, and rates of litter breakdown in contrasting forests. (KM)

<27>
Howell, J.C., and P.B. Dunaway 1959, October 26. Long-Term Ecological Study of the Oak Ridge Area. II. Observations on the Mammals with Special Reference to Melton Valley. ORNL-CF-59-10-126; 24 p. (ESD #21)

This study of the mammals occurring in Melton Valley has had two important functions: first, to secure ecological information about this important segment of the animal ife and, second, to select areas suitable for long-term studies of the ecological effects of radiation. Records of occurrence of 27 species of mammals in the area were secured by qualified observers. The level of mammal populations in the valley was low except near streams. The fertility of the soil is also low except in the valleys along streams, and the litter and humus are thin. During the period from June 5 to August 1, 1958, 48 specimens representing 5 species were collected with snap-back traps, live traps, and pitfall traps in habitats of 4 plant successional stages. (Auth)

<28>
Crossley, D.A., Jr., and M.E. Pryor 1960. The Uptake and Elimination of Cesium 137 by a Grasshopper - ROMALEA MICROPTERA. Health Physics, 4, 16-20 (ESD #22)

Adults of ROMALEA MICROPTERA, the eastern lubber grasshopper, were fed cesium 137 in bean plants to investigate uptake and elimination of this isotope. A biological half-life of 4-5 days was obtained. In experiments where grasshoppers were allowed to feed repeatedly on cesium-contaminated food the biological half-life was used to predict the equilibrium values. Most of the ingested cesium 137 was concentrated in muscular tissue, and also occurred in the digestive tract and reproductive organs. Only trace amounts were found in the exoskeleton. (Auth)

<29>
Plummer, G.L. 1960, April. Biometric Analysis of a Growth Response of Two Plant Species in a Radioactive Waste Area. ORNL-2903; 10 p. (ESD #23)

Lengths of pistillate inflorescences of sedges (CAREX spp.) growing in the contaminated soils of White Oak Lake bed were measured in relation to radiation fields. CAREX FRANKII Kunth and CAREX VULPINOIDEA Michx. populations were sampled from areas with air dose rates of 0, 10, 20, and 40 mR/hr. Analyses of variance showed that mean lengths of inflorescences of C. VULPIONIDEA were similar to each other in these areas but that those of C. FRANKII were significantly different: 0 mR/hr, 93.8 mm; 10 mR/hr, 96.4 mm; 20 mR/hr, 122.0 mm; and 40 mR/hr, 110.7 mm. However, the sites differ in such factors as soil moisture, fertility, and alkalinity, so that these differences in the length of inflorescence may not be accounted for primarily by the exposure dose rate of the radiation field. (Auth)

<30>
Cottrell, W.D. 1960, May. Radioactivity in Silt of the Clinch and Tennessee Rivers. ORNL-2847; 47 p. (ESD #24)

The Area Monitoring Group conducts annual surveys of radioactivity in the Clinch and Tennessee Rivers. A report has been prepared on the radioactivity in the silt of these rivers. Data is presented for cesium, strontium, cerium, ruthenium, cobalt, trivalent rare earth elements, and gross beta count vs gamma count in silt at various points along the waterway. Since most silt is removed by water treatment plants, no ingestion hazard exists due to the discharge of the present amount of radioactive wastes to the Clinch river. It is concluded that no immediate hazard exists due to reconcentration of radioactive materials in downstream bottom sediments. However, if the amount of radioactivity continues to increase for the next few years, it will be necessary to re-evaluate our present waste disposal policy in order to further restrict the release of radioactive wastes. The most probable effect of radioactive sediment on industry would be through the use of sand from the river bottom for making concrete for construction of counting rooms and use of water as process water in the manufacture of film emulsions or other photographic materials. (BBM)

<31>
Schurr, J.M., and M.N. Stamper 1962, October. Model for the Accumulation of Strontium and Calcium by Recently Molted Crayfish (CAMBARUS LONGULUS LONGEROSTRIS ORT.). Limnology and Oceanography, 7(4), 474-477 (ESD #25)

After molting, crayfish absorbed Sr 85 rapidly; rates of uptake decreased exponentially as an upper limit was approached (T 1/2 = 1 to 2 days). A simple mathematical model attributes this limit to the number of sites available for deposition in the exoskeleton. Deposited ions are relatively immobile until 2 to 4 days prior to the next molt, when some are redistributed to the calcareous gastroliths prior to reuse. (Auth)

<32>
Olson, J.S., S.I. Auerbach, D.G. Jacobs, and T. Tamura 1960. Distribution of Radioactive Isotopes in Plants, Insects and Soils. Nuclear Safety, 1(3), 2-9 (ESD #26)

Evaluation of hazards from contamination of crops and other constituents of the biological environment require formulation of a coherent theory of movement of radionuclides and stable chemical elements in ecosystems and application of this theory. A review is presented of studies on contamination of vegetation, dispersal of radioactive materials by insects, and retention and movement of radionuclides in the soil. (BBM)

<33>
Crossley, D.A., Jr., and H.F. Howden 1961, April. Insect-Vegetation Relationships in an Area Contaminated by Radioactive Wastes. Ecology, 42(2), 302-317 (ESD #27)

The development of insect populations on vegetation growing on White Oak Lake bed was followed for 3 years (1956-1958), immediately following the draining of White Oak Lake. This lake had served as a final holding basin for Oak Ridge National Laboratory's low-level wastes, and the alluvial terrain exposed upon drainage contained significant concentrations of radioisotopes, including strontium 90 and cesium 137. The insect biomass, estimated by sweep-net and box-trap methods, was about 200-300 mg/sq. m. No change could be demonstrated during the seasons, and evidently little change occurred between years. Significant concentrations of both strontium 90 and cesium 137 were found in samples of herbivorous insects. Concentrations of strontium 90 were about 25% of the soil values, and cesium 137 concentrations were about 1% of the soil values. However, the biomass of insects was minute compared to plant and soil masses, and the herbivorous insects contained but a minute fraction of the fission products in the system, since the bulk of these radioisotopes are in the soil. A sizeable fraction of the materials taken up by plants, however, may pass through the herbivorous insects in the system. Insect populations were followed in 2 areas each of smartweed, sedge-rush, and willow vegetation. Each of the vegetation types acquired its own characteristic insects. First-year insect populations tended to be dominated by one or a few species represented by many individuals. The second-year populations showed a reduction in numbers for the dominant species and an influx of additional species, accompanying an increase in plant diversity. No such reduction of the dominant species occurred in the willow areas, presumably because the willows were increasing their coverage each year, and additional species of plants were not invading the willow stands. (Auth)

<34>

<34>
Willard, W.K. 1960, July. Avian Uptake of Fission Products from an Area Contaminated by Low-Level Atomic Wastes. Science, 132(3420), 148-150 (ESD #28)

Birds living on the Oak Ridge White Oak Lake bed, an area contaminated by low-level atomic wastes, revealed a striking seasonal difference in uptake of fission products. Because the omnivorous diet of passerine birds is ecologically comparable to the mixed diet of man, uptake of radionuclides by wild birds provides an assay of amounts to be expected at the trophic level of primary interest to man. (Auth)

<35>
Sealander, J.A., Jr. 1960. The Effects of Sociopsychological and Radiation Stress on the Serum Proteins of the White-Footed Mouse, PEROMYSCUS LECUCOPUS. Subproject 4.010; Progress Report on Summer Research, 16 p. (ESD #29)

A study was initiated to determine the effects of crowding stress and low-level radiation on the blood protein picture in small mammals, since blood would be expected to reflect physiological changes produced by stress through alteration in some of its characteristic components. A total of 13 protein fractions were detected in sera from white-footed mice. Of this total, two components were completely absent in mice subjected to crowding stress. These components were present in control mice and, at a somewhat higher frequency, in irradiated mice. Under conditions of stress and ionizing radiation, the beta globulin band appeared to be separated into a fast and slow component, and the relative proportions of these components were reversed in crowding-stressed and irradiated mice from White Oak Lake bed. (BBM)

<36>
Crossley, D.A., Jr., and J.H. Schnell 1961, March. Comparative Elimination of Radiocesium and Radiostrontium by Grasshoppers. Annals of the Entomological Society of America, 54 (2), 459-461 (ESD #30)

Experiments with MELANOPLUS DIFFERENTIALIS showed that strontium 85 was eliminated much more rapidly than was cesium 137. Elimination of Cesium 137 proceeds at a rate corresponding to a biological half-life of about 2 days. Strontium 85 was eliminated with a shorter biological half-life of about 12 hours. For MELANOPLUS FEMUR-RUBRUM biological half-lives were about 30 hours for cesium 137 and 10 hours for strontium 85. The smaller species of grasshopper eliminated both isotopes more rapidly than did the large one indicating that elimination appears to increase with decreasing size of the insect. (KM)

<37>
Auerbach, S.I. (Ed.) 1960. Ecological Research. ORNL-2994; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1960, (p. 147-190), 298 p. (ESD #31)

Ecological research performed by the Radiation Ecology of the Health Physics Division has been conducted in three areas, the White Oak Lake bed studies, forest studies, and Clinch River studies. All investigation involves work contaminated by radioactive waste material from the Oak Ridge National Laboratory. White Oak Lake bed studies takes advantage of the radioactive contamination present to obtain information on the movement distribution and biological cycling of mixed fission products under field conditions. The diverse coniferous and deciduous forests on the contrasting soils of the reservation provide opportunities for controlled tracer experiments and other studies concerned with the movement of chemical elements from soil to plants and plants back to the soil. Clinch River studies concern the distribution and fate of radioactive materials essential to evaluate the potential hazard and the effects of the continuous releases to the river. The sections of the report are entered separately into the data base. (BBM)

<38>
Auerbach, S.I., D.A. Crossley, Jr., P.B. Dunaway, G.L. Plummer, S.V. Kaye, R.H. Anderson, H.P. Hoglund, V.I. Dodson, and J.H. Schnell 1960. White Oak Lake Bed Studies. ORNL-2994; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1960, (p. 147-166), 298 p. (ESD #31, Part, Section)

The biological community developing on the contaminated White Oak Lake bed illustrates the movement of Sr 90 and Cs 137 from soil to plants to animals. Little change in soil Sr 90 from 1958 to 1959 suggests a decrease in former losses due to physical processes. In the upper soil Cs 137 and Co 60 have remained almost the same (except for decay) since the lake was drained. Morphological features in two plant species (sedges) are affected more by the different site factors on the lake bed than by the differing dose rates. Rates of uptake of radionuclides by plants (smartweed) decrease relative to rates of plant growth throughout the growing season. Only a minute fraction of the Sr 90 and Cs 137 taken up by plants is found in the insects at any one time, but laboratory studies of elimination rates led to estimates that about 3 to 5% of the radionuclides taken up to plants pass through the insects in the ecosystem. Analyses of IBM data for over 4900 small-mammal captures from the lake bed and other study areas include estimations of population parameters for small mammals which are significant for new work on radiation effects. Radioassay studies of the small mammals show that concentrations of Cs 13 in insect and mammal herbivores per unit area are similar, but the concentration of Sr 90 is three times as high in mammals as in insects. (Auth)

<39>
Nelson, D.J., R.C. Early, C.W. Wiser, R.L. Herman, M.N. Stamper, and J.M. Schurr 1960. Clinch River Studies. ORNL-2994; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1960 (p. 186-190), 298 p. (ESD #31, Part, Section)

The first year of Clinch River investigations determined which species of bottom organisms were present and their relative abundance. Tubificid worms are being used as an experimental organism for uptake and excretion studies with radioisotopes, and their role in the turnover and transport of river bottom sediments is being evaluated. Chronic lowlevel radiation effects onf bottom organism populations are being studied by means of chromosome analyses of the salivary glands of CHIRONOMUS TENTANS larvae. Crayfish, CAMBARUS LONGULUS LONGEROSTRIS ORT., have been used in the study of the uptake and excretion of Sr 85, and similar investigations are now under way with Co 60. (Auth)

<40>
Olson, J.S., W.C. Cate, D.A. Crossley, Jr., M.P. Hoglund, R.B. Neel, H.D. Waller, M. Witkamp, J.P. Witherspoon, and J.A. Wolfe 1960. Forest Studies. ORNL-2994; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1960, (p. 167-185), 298 p. (ESD #31, Part, Section)

Theoretical studies included the use of analog computers to simulate the cycle of movement of chemical elements and isotopes through biological systems. In 1959-1960 studies emphasizing methodology were illustrated by the flow of C and C 14 in very simple model systems. Direct extensions should help predict how rapidly other isotopes might become distributed in more complex systems. Tracer experiments on translocation in dogwood trees showed how Sr 85 lags behind Ca 45, while both lag far behind K 42. Like K 42, Cs 134 in white oaks moved rapidly from trunks into foliage, then quickly began leaching out of intact or plucked leaves, and started reappearing in other plants within a few weeks--a rapid ecological cycle. Slower movements of Ru 106, Co 60, and Sr 85, which were introduced in tagged tree litter on top of soil, were approximately proportional to the rate of litter weight loss. New work on soil arthropods, bacteria, and fungi is helping to explain large differences in the rate of litter breakdown which were measured in conifer and deciduous forests of Oak Ridge and Great Smoky Mountains. These studies, and others on biomass and productivity of pine forests, included extensive chemical and gammaspectrometric analyses. The latter provided new informaiton on several local sources of radioactive contamination. a vegetation and soil survey is helping to plan future experiments and land use in the Oak Ridge AEC-Controlled Area. (Auth)

<41>
Childs, H.E., Jr. 1960, November. The Effects of Chronic Irradiation in Nature on Wild Small Mammals in the AEC-Controlled Area at Oak Ridge, Tennessee. Subproject 4.011; Progress Report on Summer Research; 9 p. (ESD #32)

Information is presented on the gross and microscopic pathological conditions exhibited in a chronically irradiated, natural population of small mammals on the White Oak Lake bed. The incidences of pathological lesions in wild small mammals which had resided in a radioactively contaminated area were compared with incidences in animals from uncontaminated area. The mammals from the contaminated area failed to show radiation-induced lesions. Several hypotheses are proposed to explain these results and the study will be continued. (KM)

<42>
Dunaway, P.B., and S.V. Kaye 1961. Effects of Industrial Oil Disposal on Wild Mammals. Journal of Mammalogy, 42(4), 554-556 (ESD #33)

The effects of oil on golden mice, PEROMYSCUS NUTTALLI, is reported from observations of a trench pit located near the U.S. Atomic Energy Commissions Y-12 plant at Oak Ridge, Tennessee. Seven of 9 mice caught had oily fur and were cold and moribund; the pelage of the other 2 mice appeared to be normal and the animals were alert and active. Oil on the hair of the mice caused the fur to become less efficient as insulation, and consequently the mice became chilled and even though the temperature was above freezing and nesting material was available. (KM)

<43>
Nelson, D.J. 1960. Biological Concentration of Radioisotopes from Aquatic Environments. Nuclear Safety, 2(1), 81-84 (ESD #34)

Release of low level radioactive wastes to freshwater streams occurs either intermittently or continuously at various AEC installations. Such releases are regulated, but maximum permissible concentrations in water (MPC sub w) consider only drinking water and additional effects may result from concentrations of isotopes in aquatic food chains. Discussion is given for factors affecting accumulation of radioisotopes by the biota including elements within the environment, functional processes, and mode of uptake of radionuclides. Concentration factors, especially for cesium, must be considered with the consequences of biological accumulation of radioisotopes. (BBM)

<44>

<44>
Howell, J.C. 1960, November-December. The Birds of a Valley. Audubon Magazine, 62, 283-288 (ESD #35)

The bird population in Melton Valley, Oak Ridge, Tennessee was studied in order to determine which species of birds lived there and their relative abundance since the land had been abandoned. A natural plant succession has been permitted to take place in the study area, and the birds of the Melton Valley are a direct product of this plant succession. Older, more mature, habitats support fewer individual birds but more species of birds. The habitats of the last stage of succession, the forest or tree stage, are more varied than those of the stages preceding it. (KM)

<45>
Atyeo, W.T., E.W. Baker, and D.A. Crossley, Jr. 1961. The Genus RAPHIGNATHUS Duges (Acarina, Raphignathidae) in the United States with Notes on the Old World Species. Acarologia, 3(1), 14-17 (ESD #36)

Many mites have been placed in the genus RAPHIGNATHUS, but the taxonomic position and definition of the genus are uncertain. Species that appear to be valid are listed after the diagnosis of the genus. (BBM)

<46>
Dunaway, P.B., and S.V. Kaye 1961. Studies of Small-Mammal Populations on the Radioactive White Oak Lake Bed. Part of Transactions of the Twenty-Sixth North American Wildlife and Natural Resources Conference, March 6-8, 1961, (p. 167-185) (ESD #37)

Populations of small mammals were studied on the radioactive White Oak Lake bed after the lake was drained. The lake served for 12 years as a holdup basin for radioactive wastes until it was drained in 1955. Small-mammal populations were also studied on an uncontaminated old field. More species and a greater total number of small mammals were present in later successional stages on the lake bed than in earlier stages. The cotton rat was the dominant small-mammal species on the lake-bed area from the summer of 1957 to the winter of 1959-60. The populations of cotton rats were exterminated on the lake-bed and old-field areas during the severe winter of 1959-60. This species is used as an example for further discussion of population dynamics. Greatest trapping success at the lake bed was in the summers. The number of animals caught on the lake bed in spring was only slightly less than in fall because of immigration during winter and early spring. The average greatest distance between points of capture was 573 plus or minus 216 ft. for males and 236 plus or minus 54 ft. for females in the months from May through October (1957-1959). The average greatest distance from November through April was 276 plus or minus 96 ft. for the males and 175 plus or minus 65 ft. for the females. Only 28 out of 248 rats were captured for over six months at the lake bed and only one was trapped for over a year. About 35 percent of the 248 rats were apparently transients. Significantly more males than females were caught at the lake bed (178 males to 137 females; chi squared = 5.336, P = 0.025). More females than males were trapped from late spring or summer to late fall or early winter, while more males were captured during the remaining time. The reproductive season occurred mainly from about April to October. Strontium 90 was the most abundant radioisotope in the tissues and was the only radioisotope present in greater concentrations in the tissues (625 micromicro Ci/g, dry wt.) than in the food (132 micromicrocuries micromicro Ci/g, dry wt.). Effects of atomic radiation were not detected in this study. (Auth)

<47>
Shanks, R.E., and J.S. Olson 1961, July. First-Year Breakdown of Leaf Litter in Southern Appalachian Forests. Science, 134(3473), 194-195 (ESD #38)

Breakdown of organic matter, an important step in the ecological circulation of chemical elements, was measured in Great Smoky Mountain and Oak Ridge forests. Greatest variation in first-year weight loss of leaves in nylon net bags was due to species FAGUS GRANDIFLORIA 21 percent, ACER SACCHARUM 32 percent, QUERCUS SHUMARDII 34 percent, QUERCUS ALBA 39 percent, MORUS RUBRA 64 percent. At elevations of 5200, 3400, and 850 feet, losses for all five species averaged, respectively, 29, 34, and 40 percent for leaves placed in spruce, hemlock, and pine stands, and 35, 40, and 46 percent for leaves placed in beech, cove hardwood, and white oak stands. (Auth)

<48>
Howden, H.F., and D.A. Crossley, Jr. 1961, April. Insect Species on Vegetation of the White Oak Lake Bed, Oak Ridge, Tennessee. ORNL-3094; 38 p. (ESD #39)

Studies on the insects inhabiting the vegetation on White Oak Lake bed, Oak Ridge, Tennessee, revealed 401 species present during 1956 and 1957. Most numerous were members of the insect orders Hymenoptera, Diptera, and Coleoptera. In 1957, there were relatively more species of insects, but fewer individuals. By the end of the summer of 1957, only two years after the lake was drained, the vegetation supported a rich and varied insect fauna. (Auth)

<49>
Kaye, S.V., and P.B. Dunaway 1962. Bioaccumulation of Radioactive Isotopes by Herbivorous Small Mammals. Health Physics, 7, 205-217 (ESD #40)

This paper reports body burdens of radionuclides and dose-rate estimations for wild mammals from areas contaminated by radioactive waste disposal. Body burdens determined by radioassay are compared with body burdens estimated by an equilibrium equation. The data were gathered in a pilot-scale field study and will be used to design a more comprehensive study of large numbers of wild mammals. The more abundant radionuclides included Sr 90, Ru 106, Cs 137, and Co 60. Almost all of the mammals radioassayed had body burdens that were greater than body burdens expected from world-wide weapons fallout. The estimated whole-body dose rate from internal sources to one muskrat trapped in a setting basin for radioactive liquid waste was 112 rads/week. The estimated whole-body dose rate from internal and external sources to cotton rats trapped on the White Oak Lake bed was 2.9 rads/week. Information from a population ecology study was used with the bioaccumulation data to estimate the quantity of radionuclides held by a cotton-rat population. (Auth)

<50>
Crossley, D.A., Jr., and M.P. Hoglund 1962. A Litter-Bag Method for the Study of Microarthropods Inhabiting Leaf Litter.. Ecology, 43(3), (ESD #41)

The litter bag method of sampling shows promise for revealing the succession of microarthropod species. The method uses fresh leaf litter in net bags which are placed on the forest floor. Sampling at intervals permits estimates of the rate of break down of the litter. With a sampling regimen the microarthropod associates of an annual increment of leaf litter can be followed as decay proceeds and the invasion of successive species of arthropods can be demonstrated initially. Weight loss by leaf litter was rapid, evidentally due to loss of readily soluble materials, and microarthropods rapidly built up populations within the bags. During the winter months rate of weight loss decreased as did the population of the microarthropod populations. In late spring the rate of weight loss again accelerated and the arthropod population increased. Populations were generally higher in bags of dogwood leaves, which decay more rapidly. Moisture exerted a profound influence upon the numbers of microarthropods. Results of mite (TYDEUS) population studies suggested a bag effect was operating to produce high populations. One sq dm litter bags are a better quantitative sampling method for TYDEUS sp. and possibly other species than are the usual Berlese methods. (KM) (ST)

<51>
Dunaway, P.B., and S.V. Kaye 1961, May. Cotton Rat Mortality During Severe Winter. Journal of Mammalogy, 42(2), 265-268 (ESD #42)

Four cotton rats were found dead in a nest box on an ecological studies site at Oak Ridge National Laboratory, Oak Ridge, Tennessee. The quantity and/or quality of food available may have been insufficient to maintain necessary metabolic functions, and the 4 cotton rats may have fallen victim to what has been termed cold weather starvation. Serious demands had been imposted on the vital processes of the individuals by an especially severe winter. The population of cotton rats was eradicated in the study area at Oak Ridge during the winter of 1959-1960. (KM)

<52>
Morton, R.J. (Ed.) 1961, August 4. Status Report No. 1 on Clinch River Study. ORNL-3119; 81 p. (ESD #43)

This is the first of a series of status reports on the study of the Clinch River initiated in February 1960. Objectives and plans for the cooperative study are detailed, and preliminary data is included. The purpose of the study is to obtain fundamental information on the physical, chemical, and biological dynamics of the freshwater stream which receives large volumes of low-level radioactive wastes. The objectives are to: (1) determine the fate of radioactive materials currently being discharged to the Clinch River, (2) determine and understand the mechanisms of dispersion, (3) evaluate direct and indirect hazards of current disposal practices, and (4) evaluate the over-all usefulness of the river for radioactive waste disposal purposes. Parts of the report dealing with the introduction to the study area, sampling and analysis, biological phases, and hydrologic studies are entered separately into the data base. (BBM)

<53>
Morton, R.J. (Ed.) 1961, August 4. Hydrologic Studies. ORNL-3119; Part of Status Report No. 1 on Clinch River Study, (p. 67-70), 81 p. (ESD #43, Part, Section)

Records collected at various gaging stations on the Clinch River are needed for a variety of purposes in the study. At continuous-record and partical-record stream gaging stations, basic data on discharge, stage, and velocity are or will be collected. These data will be used to describe variability of flow and hydraulic characteristics of the streams throughout the study area. Special studies include velocity and temperature profiles for four cross sections of the Clinch River. (BBM)

<54>

<54>
Morton, R.J. (Ed.) 1961, August 4. Introduction. ORNL-3119; Part of Status Report No. 1 on Clinch River Study, (p. 1-17), 81 p. (ESD #43, Part, Section)

The Clinch River, a tributary of the Tennessee River and located in the TVA system, receives radioactive waste from the Oak Ridge National Laboratory. Studies are being conducted on the impact of low-level radiation on the aquatic system and dispersion of radionuclides. A description of the Clinch and Tennessee Rivers is detailed. From 1948 - 1957, approximately 3600 Ci were discharged from the Oak Ridge National Laboratory to White Oak Creek and into the Clinch River. Major constituents discharged were Sr 89, SR 90, Cs 137, and Ru 106. The Y-12 and K-25 plants discharge low activity uranium and uranium-derived elements through Poplar Creek to the Clinch River. Past and present water monitoring programs are discussed. The primary emphasis of normal ORNL monitoring of releases to the Clinch River is to insure that concentrations of radioactive materials in the river are below the maximum permissible concentrations (MPC sub w) for drinking water recommended by the National Committee on Radiation Protection and Measurements. Agencies participating in the study and meetings of the steering committee are listed. (BBM)

<55>
Morton, R.J. (Ed.) 1961, August 4. Biological Phases. ORNL-3119; Part of Status Report No. 1 on Clinch River Study, (p. 43-66), 81 p. (ESD #43, Part, Section)

A study plan was detailed to determine biological factors of the Clinch River related to the release of radioactive waste products to the river. Preliminary work was done on fish populations and tubificid worms. Uptake of Co 60 by crayfish, radiation effects on biota specifically CHIRONOMUS TENTANS, and studies concerning aquatic plants were started. (BBM)

<56>
Morton, R.J. (Ed.) 1961, August 4. Sampling and Analysis. ORNL-3119; Part of Status Report No. 1 on Clinch River Study, (p. 18-42), 81 p. (ESD #43, Part, Section)

Much time in the early stages of the Clinch River studies has been devoted to the selection of sampling points and deciding on the frequency of sampling, types of samples, and analytical procedures. Water samples are taken to determine the radioactive and chemical constituents both in the water phase and suspended matter. Core sampling of bottom sediments was taken and radionuclide content, activity levels, sediment-size distribution and composition of the cores will be determined. Preliminary work has been started to investigate radionuclide interactions with minerals and river sediment. Previous studies are related to the current interest. (BBM)

<57>
Olson, J.S. 1961, September. Ecological Sampling and Meteorological Calculations of Fallout on Forests Near Oak Ridge. ORNL-3181; 57 p. (ESD #44)

Spatial patterns of radioactive contamination on forest foliage were measured by gamma spectrometry and are discussed with respect to local VS. world wide origin of the fallout and implications for ecology, health physics and management of nuclear facilities. In September 1959, I 131 on dogwood leaf samples varied from over 500 uuCi/g dry wt near Oak Ridge National Laboratory stacks to 1-7 uuCi/g near the margins of the Oak Ridge Reservation. Stack fallout tended to occur closer to the source than was calculated from hourly wind data by an IBM 610 computer program based on Culkowski's adaptation of the Sutton-Chamberlain theory of atmospheric diffusion and depostion. Over most of the reservation, levels of Ru 106, Cs 137, Zr 95-Nb 95 and Ce 144 were similar to levels found elsewhere (2-9, 1-3, 2-9 and 10-20 uuCi/g respectively) and were presumably controlled by weapons fallout. Higher levels were found in small areas and indicate the need for attention to localized contamination, even though indirect estimates of concentration per unit area did not yet approach levels considered hazardous from the standpoint of health physics. (Auth)

<58>
Dunaway, P.B., and S.V. Kaye 1963. Effects of Ionizing Radiation on Mammal Populations on the White Oak Lake Bed. Part of Schultz, V. and Klement, A.W., Jr., (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collings, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 333-338), 746 p. (ESD #45)

No effects attributable to ionizing radiation were detected during a study of small-mammal populations on the dry bed of the former White Oak Lake, which had been contaminated with radioactive waste, and an uncontaminated old field. Succession on both areas seemed normal, the populations of both areas were decimated during the winter of 1959-60 and the incidence of injuries and abnormalities in cotton rats on both areas was about the same. Male cotton rats and rice rats were trapped on the lake bed in significantly greater numbers than the females, breeding continued longer in cotton rats on the old field in 1959, and average litter size of cotton rats on the lake bed was smaller than the average litter size on the old field. Residence time of cotton rats on the lake bed was longer than on the old field, and the incidence of pathological conditions in white-footed mice from uncontaminated areas was greater than in the same species from contaminated areas. (Auth)

<59>
Kaye, S.V., and P.B. Dunaway 1963. Estimation of Dose Rate and Equilibrium State from Bioaccumulation of Radionuclides by Mammals. Part of Schultz, V. and Klement, A.W., Jr., (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 107-111), 746 p. (ESD #46)

Dynamics of elemental cycling and equilibrium may be understood when concentrations of radioelements are measured in components of the ecosystem. Concentrations of radioactivity in mammals can be used also to estimate the dose received by individual organs or the whole body for correlation of somatic or ecological effects of radiation. Body burdens of cotton rats from the radioactively contaminated White Oak Lake bed are used as examples for calculating whole-body dose rates from radionuclides in tissues and radionuclides in the gastrointestinal tract. The dose rates estimated from the body burdens of radionuclides in muskrats from a settling basin for radioactive liquid wastes are much higher than for the cotton rats. A hypothetical situation is proposed whereby a man eats one pound of muskrat muscle and the liver of the muskrat. After two such meals separated by one week, the man's whole-body dose rate reaches the maximum permissible rate of 0.03 rems per week for the vicinity of an atomic energy installation, but decreases exponentially because of elimination if there are no subsequent ingestions. Equations are presented which give estimates of dose and dose rate for several different situations. (Auth)

<60>
Crossley, D.A., Jr. 1963. Movement and Accumulation of Radiostrontium and Radiocesium in Insects. Part of Schultz, V. and Klement, A.W., Jr., (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 427-430), 746 p. (ESD #47)

Studies of the insect inhabitants of vegetation on the contaminated White Oak Lake bed measured the transfer of strontium 90 and cesium 137 from plants to insects, and evaluated the accumulation of the radionuclides by the tropic levels involved. Data on accumulation of these radionuclides by individual insect species showed that transfer of cesium 137 from plant to insect tissue was more efficient than transfer of strontium 90 (80 per cent versus 10 per cent). Differences seem due to the more rapid elimination of strontium by insects, with resulting lower equilibrium values. Per gram concentrations showed reductions in movement from soil to insects, with the major reduction occurring in the soil-to-plant step for cesium 137 and in the plant-to-insect step for strontium 90. The magnitude of such reductions is dependent upon the nature of the organisms involved. Transfer through trophic levels in this food chain (concentration per unit area) showed vast reductions at each step, due to the increasingly smaller masses of organisms involved in higher trophic levels. (Auth)

<61>
Kaye, S.V. 1961. Movements of Harvest Mice Tagged with Gold 198. Journal of Mammalogy, 42(3), 323-337 (ESD #48)

Four eastern harvest mice, REITHRODONTOMYS H. HUMULIS, were tagged with gold 198 wires and traced in the field by the use of a Geiger counter. This method is superior to live-trapping because multiple-handling of animals is eliminated, animal movements are unrestricted, and more information about an individual can be obtained in a shorter length of time. When mice were released from live-traps their movements during the following several hours were suggestive of meandering, indicating that they may have been confused, frightened, or hungry from overnight trap confinement. Small globular-shaped grass nests located in or under the herbaceous layer of vegetation were used as den sites. The nests were situated on the periphery of the range and varied from 2 to 4 per animal. Harvest mice movements were mostly limited to night, but during winter occasional short diurnal movements from nests were recorded. Certain areas within the range of each tagged mouse were avoided completely. The behavior and movements of the tagged mice presented a complex picture of spatial relationships. Calculation of range size was not undertaken because presently used methods and concepts were difficult to apply to the data. (Auth)

<62>
Crossley, D.A., Jr. 1963. Consumption of Vegetation by Insects. Part of Schultz, V. and Klement, A.W., Jr., (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 427-430), 746 p. (ESD #49)

Radioactive tracers can be used to estimate the consumption of vegetation by populations of insects. Such estimates were made for insects on the contaminated White Oak Lake bed, Oak Ridge, Tennessee, where insect populations contained cesium 137 and strontium 90 concentrations which were in equilibrium with concentrations in the plants. The rate of feeding was estimated from the whole-body burden of cesium 137, the biomass, and an average elimination rate for the insects, plus cesium 137 concentrations and biomass of the host plants. The calculations indicate that approximately six percent of the plant biomass was consumed by insects during a growing season. (Auth)

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Olson, J.S. 1963. Analog Computer Models for Movement of Nuclides through Ecosystems. Part of Schultz, V. and Klement, A.W., Jr. (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 121-125), 746 p. (ESD #50)

The interpretation of information on the rates of income and loss of radionuclides (or of nutrients, carbon, biomass, or free energy) between compartments of an ecosytem involves assumptions about the system which can be formalized in mathematical models. Electronic analog computer techniques can be viewed either as a means of solving the differential equations describing the income and losses for each compartment of the system, or as a device for simulating the natural processes operating in the system. An example of a small analog computer model for the transfer of organic carbon or carbon 14 from photosynthetic vegetation, to roots or organic litter, to humus in mineral soil was discussed and further details are given in an Oak Ridge National Laboratory Report (Neel and Olson, 1962). Newer work in 1961 involved the use of two consoles, one to simulate the transfer of the energy, of carbon, or of biomass, and a second one to simulate the cycling movement of inorganic nutrient elements or of radioactive nuclides. (Auth)

<64>
Witkamp, M. 1961. Influence of Radiation From an Unshielded Reactor on A Natural Microflora. ORNL-TM-29; 9 p. (ESD #51)

The soil microflora and its respiratory activity were measured in soil cores collected at different distances from an unshielded reactor. No direct correlation was found between dose received and microbial counts or respiration. Indication of a correlation between dose and microbial respiration was obtained after eliminating the overriding influence of moisture. Radiation probably affected the soil microflora through damage to the phanerogam vegetation rather than directly. This preliminary study indicates the need to have undisturbed sampling areas close to the new ORNL fast burst reactor. Extensive dosimetry, both in and above the soil, in these areas, and a program of long-term ecological description should be started before the reactor becomes operational. (Auth)

<65>
Olson, J.S., and D.A. Crossley, Jr. 1963. Tracer Studies of the Breakdown of Forest Litter. Part of Schultz, V. and Klement, A.W., Jr. (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 411-416), 746 p. (ESD #52)

The transfer of chemical elements from fresh dead organic litter to the surface layers of the forest floor to deeper layers of soil and back into living organisms commonly imposes the limiting rate factors on the biogeochemical cycle that occurs within an ecosystem. Radioactive tracers therefore provide powerful methods for investigating the general rate of mineral nutrient turnover as well as the detailed pathways of movement of individual elements and radioactive contaminants. Previous studies by repeated weighing and chemical analysis of litter have been supplemented by repeated counting of radioactive tracers in standardized counting positions over a scintillation crystal. Labeled litter in decimeter square bags of nylon net or fiberglass curtain material was counted in plastic sandwich boxes. In some cases decimeter square slabs of humus materials, 1.3 to 3 centimeters thick, were placed in plastic boxes with openings in sides and bottom beneath the litter bags in approximately natural position on the forest floor. Whereas cobalt 60, ruthenium 106, and strontium 85 or strontium 90 are released from tree leaf litter at rates similar to or slightly greater than the rate of weight loss, cesium 134 is released considerably more rapidly. Much of the nuclide released is intercepted by the surface slab of humus, especially in types in which mineral soil layers were included. However, there was significant release to lower parts of the soil profile even for these soils. (Auth)

<66>
Witherspoon, J.P., Jr. 1963. Cycling of Cesium 134 in White Oak Trees on Sites of Contrasting Soil Type and Moisture. I. 1960 Growing Season. Part of Schultz, V. and Klement, A.W., (Eds.), Proceedings of the First National Symposium on Radioecology held at Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 127-132), 746 p. (ESD #53)

White Oak trees (QUERCUS ALBA) growing on 4 different soil types were inoculated at 1m height with 2.0 mCi of Cs 134 as CsCl in weak HCl in a volume of 100 ml by use of 4 Mauget feeders in order to ascertain the fate and distribution of cesium 134. Translocation in trees was rapid with about 1/3 of the input quantity reaching the leaves. During the growing season a reduction of 62.6% in leaf Cs content was observed. Of this decrease 12.7% was leached by rain and 49.9% returned to wood, leaving 37.4% in the leaves to fall as litter. Radiocesium was not held strongly by the litter layer. Significant differences in mobility of Cs were found between wet and dry soil. Transfers of radiocesium from litter to soil to plants was small in quantity, but very rapid, indicating that a plant to soil to plant cycle may occur in a brief portion of the growing season. (KM)

<67>
Kaye, S.V. 1961. Laboratory Life History of the Eastern Harvest Mouse. The American Midland Naturalist, 66(2), 439-451 (ESD #54)

The gestation period of REITHRODONTOMYS H. HUMULIS appears to be approximately 21 days. The sizes of nine litters born in the laboratory ranged from two to four, with a mean of 3.2. A mean of 1.2 grams was recorded from the weights of 27 young at birth. The reproductive efficiencies of two females were 50.4 and 50.8 per cent, close to the highest known reproductive efficiency of any mammal. Harvest mice at birth appear unpigmented, are pink, have a translucent skin, and have tiny, white natal hairs present on most parts of the body. By the end of the first week, the brownish hair on the head and nape almost completely hides the underlying skin. All young are weaned by the end of the third week and are cared for only by the female parent. Parent mice occasionally killed and ate their young, and on one occasion two 30-day-old females were killed and eaten by their two litter mates. Males get along well with females, although males rarely tolerate each other in the same cage. Females are exceedingly tolerant of members of their own sex. (Auth)

<68>
Nelson, D.J. 1963. The Strontium and Calcium Relationships in Clinch and Tennessee River Mollusks. Part of Schultz, V. and Klement, A.W., Jr. (Eds.), Proceedings of the First National Symposium on Radioecology held at Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 203-211), 746 p. (ESD #55)

The shells of a number of mollusk species were analyzed for strontium, calcium, and strontium 90 to determine: (1) the content of elements and the radioisotope of strontium as a function of species, age, and location in the Clinch and Tennessee Rivers, and (2) by considering the strontium 90 released from the Oak Ridge National Laboratory as a tracer, to test whether clams may be used as biological indicators of the strontium 90 concentration in the river system. The shells of a number of species of clams from the Clinch and Tennessee Rivers were analyzed for calcium, strontium, and strontium 90 to determine: (1) the content of these elements and this isotope of strontium as a function of species and location in the river, and (2) whether they could be used as biological indicators of strontium 90 in the water. The calcium content of the shells was relatively constant and constituted 40 per cent of the shell ash weight as would be expected with calcium carbonate. The average strontium content of shells of different species of clams ranged from 156 to 382 micrograms per gram. The differences in strontium content are due to inherent differences between species rather than to the strontium to calcium ratio in the environment. Two factors which appear to affect strontium deposition in clam shells are growth rate and surface to volume relationships. The strontium content of clam shells increases with growth rate and with a reduced surface to volume ratio. These factors do not explain the strontium content of all species, and the inherent species differences may be related to the nonhomogeneous distribution of strontium within the clam shells. The low level releases of strontium 90 by the Laboratory were used as a tracer to determine the behavior of strontium 90 released to the Tennessee River system. There was a very good agreement between the strontium 90 to stable strontium atom ratios observed and expected in clam shells on the basis of dilution of Clinch River water Tennessee River water. This agreement suggests that clams may be used as samplers of strontium 90 and that strontium 90 released to the Clinch River is in equilibrium with the living and nonliving components of the river system. Concentrations of strontium 90 in the Tennessee River will be directly related to dilution of the contaminated water by noncontaminated water. (Auth)

<69>
Auerbach, S.I., and J.S. Olson 1963. Biological and Environmental Behavior of Ruthenium and Rhodium. Part of Schultz, V. and Klement, A.W., Jr. (Eds.), Proceedings of the First National Symposium on Radioecology held at Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 509-519), 746 p. (ESD #56)

Ruthenium 103 and Ru 106-Rh 106 must be considered among the more important environmental contaminants because of their relatively high yield from fission and their moderately long half-lives. Experiments involving waste effluents and nitrosyl compounds of ruthenium, which are formed in the common types of radioactive waste, have shown that these compounds may be taken up in greater quantities or behave differently when released into environmental situations. Near industrial sources, levels of ruthenium radioisotopes may rise well above the levels contributed by atmospheric fallout, barring outbreak of nuclear war. In the event of nuclear war, ruthenium radioisotopes could be one of the most significant contributors to gamma radiation from local and world-wide fallout during the first year or so following the detonation of nuclear weapons. Regardless of origin, the instability of ruthenium compounds in changing environments will require the utmost care in interpretation of biological and environmental behavior of ruthenium. (Auth)

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Neel, P.B., and J.S. Olson 1962, January. Use of Analog Computers for Simulating the Movement of Isotopes in Ecological Systems (Thesis). ORNL-3172; 111 p. (ESD #57)

Linear differential equations and elementary analog computer techniques were applied to the movement of carbon and C 14 in simple compartment models for a terrestrial ecological system (including soil, organic litter, plant roots and above-ground vegetation). Extensions of these methods should become helpful in simulating the movement of other elements and radioactive isotopes in the environment. Analytical solutions and analog computer chart records for a sequence of compartments were compared. They show a series of linear lags in the approach of each compartment toward a steady state. An oscillating photosynthetic input (seasonal cycle) imposes an oscillating response, but with decreasing amplitude and shift of phase with each stage. Exponential "transient" terms in the input (representing trend over several years) modify the lags of successive compartments. A small electronic analog computer (Donner 3400) illustrated effects of varying k sub i parameters on the behavior of a small model system. A large computer, the Reactor Controls Analog Computer Facility, was more versatile and offers far more technical possibilities for future ecological studies. A function generator was used to simulate the expected increase in C 14 content of the atmosphere as a result of nuclear testing. The transmission of this pulse of C 14 through the ecological system showed the effects of lag and attenuation in the pulses of C 14 in each compartment of the system (Auth)

<71>
Auerbach, S.I. 1961. Ecological Research White Oak Lake Bed Studies. ORNL-3189; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1961, Oak Ridge National Laboratory, Oak Ridge, Tennessee, (p. 81-105) (ESD #58)

Research in the White Oak Lake bed and surrounding environs takes advantage of the presence of mixed radioisotopes, both as a source of radiation and as a tool for studying the behavior of these radioelements in the environment. The research encompasses the following phases: movement of mixed radionuclides from soil to vegetation and related applications; the ecological relationship between insects and plants utilizing contaminants as tracers; equilibrium relationships between radioisotopes in herbivorous mammals and their foods; and the effects of chronic radiation upon native mammals. Experiments with two species of LESPEDEZA revealed that the pattern of uptake is essentially the same for strontium 90, cesium 137, cobalt 60, and ruthenium 106. Strontium 90, which can be metabolized by this calcium utilizing plant, has the highest initial concentration of the four isotopes. A comparison of these results with those using smartweed indicates that smartweed is approximately 4.5 times more effective than LESPEDEZA in accumulating strontium 90. Fertilizer studies showed that phosphate fertilizers may be useful in treating contaminated soil and massive treatments may be justified economically in some situations. Feeding studies using CHRYSOMELA KNABE suggest that under conditions of a constant rate of feeding, equilibrium with isotope concentrations of food would occur in less than two days. Variation in the elimination rate of radioisotopes between members of the same insect species seems to be influenced more by factors other than body weight. Studies on mammals are underway but no significant results or conclusions have been found. (KM)

<72>
Nelson, D.J., R.L. Herman, R.C. Early, C.W. Wiser, and N.A. Griffith 1961. Clinch River Studies. ORNL-3189; Part of Health Physics Division Annual Progress Report for Period Ending July 31, 1961, (p. 129-139) (ESD #59)

The Clinch River studies are concerned with both the fate of released radioactive isotopes in the river environment and the effects of ionizing radiation from released radioactive wastes on a selected aquatic species. Organisms or groups of organisms were selected as being suitable for specific studies which will permit the evaluation of the hazard and effects of continuous releases of low-level radioactive wastes to the river system. The effect of tubificid worms in the downstream distribution of bottom sediments was evaluated through a mathematical model. Sediment movement by these worms is insignificant when compared with the transport of suspended sediment by water currents. Diptera appear to offer possibilities as indicators of the genetic effects of chronic low-level radiation arising from the release of radioactive wastes to aquatic environments. The uptake of Co 60 from solution by crayfish (CAMBARUS LONGULUS LONGEROSTRIS) was studied by placing crayfish in 50 or 500 ml. volumes of liquid containing from 10 to 10 (E+5) dis/min/ml and in a flowing system in which a solution containing 2.52 x 10(E+3) dis/min/ml was pumped through the containers holding the crayfish. The uptake of Co 60 by crayfish weighing about 0.5 g. each was directly proportional to the concentration of Co 60 in the solution in which the crayfish were maintained. The equilibrium level of Co 60 increased with the increasing size of the crayfish, but the uptake per g decreased with increasing size. Excretion rates were much less than rates of uptake. Dissection and radioassay of crayfish tagged with radioactive solutions showed the exoskeleton had the highest concentration per g. Clam studies were undertaken to: (1) determine the content of stable strontium and calcium and strontium 90 as a function of species and location in the Clinch and Tennessee Rivers; (2) test whether clams may be used as biological samplers of strontium 90; (3) obtain information on long-term changes in stable strontium and calcium in clams by analysis of prehistoric Indian midden, pre-TVA, and present day clam shells. Fish studies indicate that strontium 90 released to surface water streams remains in solution, and concentrations downstream from a release point may be predicted solely on the basis of dilution of the contaminated water by noncontaminated water. There is very little ion exchange between strontium in the water and the bottom sediments. Fish which have been in the Clinch River in the vicinity of White Oak Creek will move considerable distances in the Tennessee River system. (auth) (KM)

<73>
Auerbach, S.I. 1962. Summary of Session, First National Symposium on Radioecology 1961, Cycling in the Terrestrial Environment. TID-7632; Part of Proceedings of a Conference on Radioactive Fallout from Nuclear Weapons Tests held in Germantown, Maryland, November 15-17, 1961, (p. 318-347) (ESD #60)

Papers presented at the First National Symposium on Radioecology that concerned radionuclide cycling in the terrestrial environment are reviewed. Information on the ecological factors which affect the initial distribution of radioactive contamination in the biosphere, its subsequent circulation and accumulation, and its ultimate fate, is essential for judging whether radioactivity from fallout would affect natural ecosystems or would be transferred through food chains leading ultimately to man. Differences in vegetation cover and accumulation will affect the quantity and availability of fallout nuclides to plant feeding animals. There are relatively little systematic data on the accumulation of radionuclides by native animals. Information on accumulation of radionuclides by wild animals, which occupy various niches in our environments, may be extremely useful in the interpretation of accumulation and distribution of radionuclide contamination in localized situations. The understanding of the biogeochemistry of natural major and minor elements in ecosystems is closely related to the interpretation of the mov ment of radioactive contamination through these systems. The possibility of such contamination arising from radioactive waste disposal, weapons fallout, or perhaps from nuclear war, leads to the need for mathematical models of conditions which could predict the extent and time scale of such contamination. The formulation and testing of such models must draw upon tracer experiments and other basic research on the processes taking place in ecosystems. (Auth)

<74>
Auerbach, S.I. 1961. Introductory Statement. Effect of Radiation on Ecological System of the Biosphere Due to Atomic Industry Operation. PL-30(II)/SR/11; Part of Proceedings of a Meeting of the IAEA Study Group on the Coordination of Research Contracts on Selected Topics in Radiobiology held in Vienna, Austria, March 28-30, 1961, (2 p.) (ESD #61A)

Ecology is concerned with two major aspects: the relationship between the environment and the higher levels of biological organization; and the numerous cycles of the biosphere. Both aspects have to be considered in relation to radiation. There are three sources of radiation; nuclear attack, nuclear weapons testing and radioactive by products of the nuclear industry. The extent to which these materials will reach man and have a long-term effect on his environment is of concern to the ecologist whose role is related to the chemical cycles and the part played by the biota in moving these materials. (KM)

<75>
Auerbach, S.I. 1961. A United States Ecological Survey Limited to the Biological Effects of Radiation. PL-30(II)/SR/19; Part of Proceedings of a Meeting of the IAEA Study Group on the Coordination of Research Contracts on Selected Topics in Radiobiology held in Vienna, Austria, March 28-30, 1961, (10 p.) (ESD #61B)

A program has been initrated in the U.S. which uses radiation and radionuclides in an attempt to understand the functioning of ecological systems and which uses contamination, where it exists, for the same purpose. The work being done at Oak Ridge, is reported. The uptake of Sr 90 in clams seems to be related more directly to the stable strontium content than to the calcium content. The clam offers an interesting possibility as a long-term biological integrator of Sr 90 in a large river system. Numerous other studies currently being carried out are described, but results and conclusions are lacking. (KM)

<76>
Olson, J.S., D.A. Crossley, Jr., R.L. Doub, M.P. Hoglund, H.D. Waller, M. Witkamp, W.C. Cate, G. Dodson, R.J. Hutnik, R.O. Petty, and J.P. Witherspoon 1961. Forest Ecology. ORNL-3189; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1961, (p. 105-128), 243 p. (ESD #62)

Experimental and field research for Forest ecology is reported for: 1) characterization of the habitats, biomass, productivity, and chemical turnover of terrestrial ecological systems of Oak Ridge; 2) tracer experiments on the ecological or biogeochemical cycles of radioactive isotopes and chemical elements; and 3) biological studies of the soil fauna and microorganisms which participate in the natural circulation of nutrients and radioisotopes. Ecological models aimed at the synthesis of quantitative information from all parts of the ecology program are being developed with the aid of analog computer simulations. (BBM)

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Nelson, D.J., and B.G. Blaylock 1963. The Preliminary Investigation of Salivary Gland Chromosomes of CHIRONOMUS TENTANS Fabr. from the Clinch River. Part of Schultz, V. and Klement, A.W., Jr. (Eds.), Proceedings of the First National Symposium on Radioecology held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Reinhold Publishing Company, New York, New York, (p. 367-373), 746 p. (ESD #63)

The waste releases of Oak Ridge National Laboratory include a heterogeneous mixture of stable and radioactive chemicals, and the organisms in the environment of White Oak Creek and the Clinch River are exposed to both kinds of materials. Some of the CHIRONOMUS TENTANS Fabr. larvae collected from White Oak Creek and the Clinch River have unusual forked preanal gills. A subsequent cytogenetic study showed the salivary gland chromosomes of the C. TENTANS population contain what appears to be a relatively high frequency of chromosomal aberrations. Twenty-three individuals in a sample of about 300 were found which had three chromosomes each instead of the usual four. These populations from areas contaminated with radioactive waste effluents have not been compared with other local populations not exposed to these effluents. The radiation from radionuclides sorbed on the river and creek bottom sediments is 20 to 1,000 times that of natural background. The larvae are also exposed to a heterogeneous mixture of chemicals in the effluent released to the environment. The mutagenic effect of chemicals is erratic when compared with the effect of ionizing radiation. (Auth)

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Auerbach, S.I., D.A. Crossley, Jr., P.B. Dunaway, S.V. Kaye, D.J. Nelson, J.S. Olson, H.D. Waller, and M. Witkamp 1961. Ecological Research. ORNL-3189; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1961, (p. 81-139), 248 p. (ESD #64)

White Oak Lake bed studies are discussed in relation to changes in vegetation, uptake of radionuclides by LESPEDEZA, fertilizer studies, insect studies, and mammalogy. Also discussed is Forest ecology involving studies of the Oak Ridge Reservation, tracer experiments and ecological cycles, biological populations and processes affecting the movement of elements and isotopes and compartment models and analog computer simulation. Clinch River studies are also presented in relation to bottom organism studies and fish studies. (LCW)

<79>
Witkamp, M., and J.L. Shoopman 1961. Carbon and Nitrogen in a Pioneer Ecosystem of Kudzu Vine at Copperhill, Tennessee. Unpublished Manuscript, 17 p. (ESD #65)

Techniques to measure carbon and nitrogen cycles including magnitudes, rates, and the mechanism of these cycles were studied in a kudzu vegetation on bare soil. Planted kudzu seedlings were successful in an eroded area after initial cultivation and addition of fertilizer. The three year old vegetation covered 100% of the area and yielded 500 g/m2, equaling agriculturally grown kudzu crops, and had a litter layer with microflora and fauna. Carbon, nitrogen, and total weight of vegetation, litter, soil, humus, and biota increased with vegetative age, except where dolomite and fertilizer were added. There, microbial and especially bacterial populations and their activities were stimulated and this resulted in a net loss of organic matter, carbon, and nitrogen in the soil. As a result of this and a relative increase of stem tissue, there was less nitrogen in the 5 year old than in the 3 year old vegetation. The C/N ratios in vegetation and soil increased with increasing vegetation development because of changing plant structure and continued addition of litter residues to the native humus, and decreased in the litter because of immobilization of nitrogen in microbial tissue and delayed decomposition. Kudzu is valuable as a pioneer to curb erosion, produce forage and establish ecosystems on eroded landscapes as may result from an atomic calamity. (Auth)

<80>
Morton, R.J. (Ed.) 1962, March. Status Report No. 2 on Clinch River Study. ORNL-3202; 97 p. (ESD #66)

The second of the series of status reports on the study of the Clinch River covers major aspects of work performed from September 1960 through April 1961. The Clinch River receives low-level radioactive wastes from the AEC installations. The necessary specific information and basic data for the study are obtained primarily by field measurements of stream flow and other hydraulic parameters, and by sampling and analysis of water, sediments, and biological materials in the river. Study on water sampling and analysis, sediment sampling and analysis, biological phases, and hydrologic activites are entered separately in the data base. (BBM)

<81>
Morton, R.J. (Ed.) 1962, March 30. Water Sampling and Analysis. ORNL-3202; Part of Status Report No. 2 on Clinch River Study, (p. 6-38), 97 p. (ESD #66, Part, Section)

The primary purpose of the water sampling and analysis program is to determine what fractions of the total loads of selected radionuclides discharged to the Clinch River from White Oak Creek remain in the flowing waters of the Clinch and Tennessee Rivers at various locations downstream from Oak Ridge. A secondary purpose is to determine the mineral (stable chemical) quality of river waters at and downstream from Oak Ridge, with special attention to phosphates and nitrates. Determinations were made of the concentrations of Sr 90, Cs 137, Co 60, and Ru 106, and these concentrations are presented in tabular form for five sampling stations over the study period. Stable-chemical analyses were made on all weekly composite samples from two stations on the Clinch River. Since both nitrates and phosphates are being released, four forms of nitrogen were determined in samples collected during November, December, and January. The analyses show no significant increases in various forms of nitrogen or in phosphates between the upper and lower Clinch River stations. The results of stable-chemical analyses of the Clinch River at the water plant of the Gaseous Diffusion Plant show that the principal constituents were sodium, potassium, calcium, magnesium, chlorides, nitrates, sulphates, phosphates, and bicarbonates. The pH ranged from 6.9 to 7.9. The additional elements determined include the stable forms of radionuclides; for example, rubidium, cesium, strontium, barium, titanium, zirconium, cobalt, nickel, fluorine, bromine, iodine, and ruthenium. Low concentrations, less than 1 ppm, of several ions were found, and trace amounts of certain elements examined for could not be detected. (KM)

<82>
Morton, R.J. (Ed.) 1962, March 30. Sediment Sampling and Analysis. ORNL-3202; Part of Status Report No. 2 on Clinch River Study, (p. 39-60), 97 p. (ESD #66, Part, Section)

Gamma monitoring data for 1960 indicates that contaminated silt in the Tennessee River system seems to be working its way downstream from one reservoir to the next. Gross gamma measurement of 1-in core samples showed no uniform continuous distribution pattern. In general there was a decrease of activity with depth. Gamma spectrometric analysis showed that cesium 137, ruthenium 106, and cobalt 60 were present in all composited samples. Analyses for strontium 90 and the total rare earths by radiochemical separations have shown these radionuclides are present at all sections. Cesium 137 is the predominant radionuclide at all sections of the study reach. Ratios of specific activities (mCi/kg) of cobalt, cesium, and strontium are relatively constant. The ratio of cobalt activity to cesium activity is everywhere between 0.14 and 0.08; strontium to cesium is between 0.022 and 0.011. These constant ratios suggest that the same, or at least concurrent, processes govern the deposition of the nuclides (except, perhaps, ruthenium). Inasmuch as cobalt is not expected to be sorbed onto the surface of the sediment bed, most of the cobalt activity in the silt probably comes from deposition of suspended sediments and colloids. Apparently cobalt, as a complexed colloid, is being precipitated at the same time as strontium and cesium, which are sorbed on suspended sediments. The total radioactivity in the bottom sediments is the product of the specific activity (curies per unit of mass) and the mass of sediment. Inasmuch as the mass per unit leght of reach varies throughtout the study reach, the variation in specific activity with distance fives no indication of the total activity which has accumulated in the unit length of reach. Accordingly, the radioactivity in curies per mile was computed for each reach. Results of the computations are listed and plotted in the report. (KM)

<83>
Morton, R.J. (Ed.) 1962, March 30. Hydrologic Activities. ORNL-3203; Part of Status Report No. 2 on Clinch River Study, (p. 79-86), 97 p. (ESD #66, Part, Section)

In cooperation with the Oak Ridge National Laboratory, the U.S. Geological Survey provides stream-flow information which is vital to the Clinch River Study and to waste-disposal operations at ORNL. Stream-gaging stations are operated at White Oak Creek below ORNL, Melton Branch near White Oak Lake, the settling basin effluent into White Oak Creek, and the Clinch River near Scarboro. The station on White Oak Creek at White Oak Dam was re-established as a discharge station and sites for new gaging stations were established on the Poplar Creek basin. These stations provide local inflow data to the Clinch River and to ultimately define the stream-flow characteristics on the Oak Ridge reservation. Discharge measurements over a wide range in stage have been made at each station to define the relation between stage and discharge. Staff gages were installed at fourteen sites on the Clinch River and Emory River. Charts of temperature and velocity profiles were determined at several stations. A study was made of the fluctuation in discharge of the Clinch River near Scarboro to determine the best sampling time for the water sampler at the Oak Ridge water plant. (BBM)

<84>

<84>
Morton, R.J. (Ed.) 1962, March 30. Biological Phases. ORNL-3202; Part of Status Report No. 2 on Clinch River Study, (p. 61-78), 97 p. (ESD #66, Part, Section)

Studies were undertaken of two important aspects of biological interest in the Clinch River Study. One was a chemical study of clams collected from the Clinch and Tennessee Rivers aimed to improve understanding of the movement and accumulation on radiostrontium in the river system. The mean strontium concentration of collections of different species was variable and ranged from 382 ppm (ANODONTA CORPULENTA) to 156 ppm (QUADRULA PUSTULOSA). The highest strontium content in A. CORPULENTA was 518 ppm, and the lowest strontium content in Q. PUSTULOSA was 146 ppm. These values, which differ by a factor of 3.5, also represent the extreme range for all strontium determinations. Data on different species of clams indicate that there are inherent species differences associated with the nonhomogenous distribution of strontium in clam shells. The second investigation was a continuation of the study to determine radiation effects on biota, particularly to estimate the radiation dosage of organisms living in contaminated bottom sediments. Radiation dose received by Diptera with life stages in bottom sediments was estimated. The radiation from radionuclides sorbed on the river and creek bottom sediments in the environment of the larvae is 20 to 1000 times that of natural background. The larvae are also exposed to a heterogeneous mixture of stable chemicals in the effluent released to the environment. However, the mutagenic effect of chemicals is erratic when compared with the effect of ionizing radiation. (KM)

<85>
Strandtmann, R.W., and D.A. Crossley, Jr. 1962. A New Species of Soil-Inhabiting Mite, HYPOASPIS MARKSI (Acarina, Laelaptidal). Journal of the Kansas Entomological Society, 35, 180-185 (ESD #67)

During a study of the soil arthropods inhabiting White Oak Lake bed, USAEC Controlled Reservation, Oak Ridge, Tennessee, several undescribed species of mites were found. One of these, a member of the genus HYPOASPIS, was found often enough that a name for it has become necessary. This species may be separated clearly from all others of the genus by the 2-segmented pretarsus of leg 1 and by the very characteristic long, curved seta at the dorsal apex of tarsus 1. It is extremely unlikely that the status of HYPOASPIS MARKSI as a nominal species would be in any way affected by the fact that the type locality contains a radiation field. (KM)

<86>
Olson, J.S. 1963. Energy Storage and the Balance of Producers and Decomposers in Ecological Systems. Ecology, 44(2), 322-331 (ESD #68)

While some fraction of the solar energy fixed by producing plants is released by respiration of these plants and of animals, much of it is stored in dead organic matter until released by decomposing organisms, at rates which vary greatly from place to place. The general differential equation for the rate of change in energy storage is illustrated by models for build-up and decomposition of organic matter, particularly for litter in deciduous or evergreen forests. Equations of Jenny et al. (1949) and Greenland and Nye (1959) each have a useful place in estimating decay parameters. For the case of steady production and decay, the ratio of annual litter production, L, to the amount accumulated on top of mineral soil in a steady state, X sub ss, provides estimates of the decomposition parameter k. Estimates range from over 4 in certain tropical forests to less than 0.01 in subalpine forests. Decomposition rates for organic matter within mineral soils may range from near 0.01 to 0.001. Since it takes a period of about 3 k yearsabout 3,000 years before storage has attained 95% of its steady-state level, many ecosystems continue to show a positive net community production for centuries-perhaps long after changes in numbers and biomass of some species are reduced to minor fluctuations around a "climax" composition. On the other hand, the slow change in soil conditions may in some cases facilitate the introduction of new species after some delay during succession. The change in productivity or decomposition parameters controlled by these species may lead in turn to a series of later readjustments in energy storage and release, which modify litter and soil conditions. Modified microenvironments in turn may further alter the succession and "climax." (Auth)

<87>
Witkamp, M. 1963, Spring. Microbial Populations of Leaf Litter in Relation to Environmental Conditions and Decomposition. Ecology, 44(2), 370-337 (ESD #69)

The microflora of five species of tree litter decomposing on north and south slopes of hardwood and coniferous stands at 1,600, 1,040, and 260 m elavation was estimated in the four seasons by the serial dilution plate method. Microbial counts from the various leaf species, stands, and altitudes differed singificantly and were positively correlated with differences in litter breakdown rates. Microbial counts made in the four seasons were also significantly different. Chief factors controlling the rates of litter breakdown and the microbial populations were stage of decomposition and moisture for the five leaf species; temperature and moisture at the three elevations; and possibly soluble inhibitors and pH in the two types of stands. Moisture, temperature, and stage of decomposition of the litter governed the microbial populations in the different seasons. Microbial respiration rates at the end of the 1-year cycle were correlated with microbial populations, total weight loss, and per cent moisture of the leaves. Most correlations were not significant. Enumeration of the microflora throughout the year reflected breakdown rates of litter. One-time measurements of microbial population and respiration did not. (Auth)

<88>
Auerbach, S.I. 1962. Analytical Requirements for Environmental Surveys. Nuclear Safety, 3(3), 51-54 (ESD #70)

The analytical requirements of an environmental survey are influenced by many factors. The intensity of the survey will depend on the purpose and whether it is preoperational or continuing. The kinds of radionuclides for which analyses are made, the environmental media which may be contaminated by waste effluents, and the kinds of biological material requiring analysis are among the primary factors that will govern the organization of the work. A brief review is given for the analysis of strontium 90, iodine 131, and cesium 137 and for mixed-fission products, alpha emitters, and stable elements. (BBM)

<89>
Witkamp, M., and J. Van der Drift 1961, December. Breakdown of Forest Litter in Relation to Environmental Factors. Plant and Soil, 15(4), 295-311 (ESD #71)

Production and breakdown of forest litter in a single stand were compared in different forest floor types (mull and mor) during several years. Litter production was almost equal in both types. The fluctuations of density and activity of the floral and faunal elements taking part in the breakdown of litter in mull were generally synchronous with those in mor. Biological activities were higher in calcareous mull than in mor. In mull, larger litter feeding animals, bacteria, and actinomycetes dominated because of the higher air humidity, presence of calcium carbonate and larger amounts of protein and easily decomposable carbohydrates. Fungi and microarthropods were more numerous in mor. In mull, the anual breakdown of shed litter was almost completed in half a year, but the breakdown continued a full year in mor. It was concluded that differences in forest floor type in the area of work were primarily conditioned by edaphic factors which influence vegetation, litter composition, air humidity, soil microflora and fauna, and ultimately forest floor type. (BBM)

<90>
Nelson, D.J. 1962, June. Strontium, Strontium 90, and Calcium Analysis of Clinch and Tennessee River Clams. ORNL-TM-270; 22 p. (ESD #72)

Analyses of clam shells for Sr, Sr 90, and Ca are reported in order to provide data on individual clams of 16 species for other workers. The data include 208 Sr, 80 Sr 90, and 35 Ca analyses. Information on age of the clam and shell weight are also included because the Sr concentration in some shells is affected by age and growth rate. A detailed description of sample treatment and preparation is also included. An interpretation of the results of these analyses has been published. (Auth)

<91>
Nelson, D.J. 1962, July 6. Clams as Indicators of Strontium 90. Science, 137(3523), 38-39 (ESD #73)

Freshwater clams concentrate strontium 90 in their shells and may be used as indicators of the strontium 90 contamination of their environment. Analysis of data derived from the specific activity of strontium 90 shells showed that strontium 90 released to the Tennessee River system remained in solution and that concentrations to a distance of 500 miles from the release site can be predicted on the basis of the dilution of contaminated White Oak Creek water by uncontaminated Clinch-Tennessee River water. (Auth)

<92>
Plummer, G.L. 1962. Growth Responses of HELIANTHUS ANNUUS to Internal Calcium 45. The Botanical Gazette, 123, 272-278 (ESD #74)

Solutions of either Ca 45-labeled CaCl2, stable calcium chloride, or deionized water alone were delivered through hypodermic needles inserted into the stems of young sunflower plants (HELIANTHUS ANNUUS L.). In all, 160 mCi were delivered to each treated plant by needle and 99 mCi were available from the soil. The second and third internodes of the plants treated with this beta-emitting isotope were shorter than those of the two control groups. The apparent effects of radiation were overcome with age, particularly when the treatment was reduced in intensity near the end of the experiment. The radioactive plants were the tallest at the time of flowering. The radioisotope was abundant in epidermal hairs. The results confirm some early suggestions that internal irradiations may cause reductions in plant growth. This is probably the first controlled experiment, however, in which plant height was shown to be significantly changed by an internal radionuclide. (Auth)

<93>

<93>
Witherspoon, J.P., Jr., S.I. Auerbach, and J.S. Olson 1962. Cycling of Cesium 134 in White Oak Trees on Sites of Contrasting Soil Type and Moisture. ORNL-3328; 143 p. (ESD #75)

The cycle of cesium 134 in white oak trees was followed from spring, 1960, to autumn, 1961. Three trees on each of four sites differing in soil type and moisture were each inoculated with 2.0 microcuries of Cs 134. Gains, losses, and transfers of this radioisotope were estimated by sampling from inoculated trees, understory, litter, and soil. With rapid translocation into leaves from initial trunk inoculations in the spring, white oak leaves contained 10(E+5) to 10(E+6) dpm per g dry weight by early June. This represented a total transfer of about 40 per cent of the original input. With the first rains following inoculation, loss of radiocesium from leaves began and continued throughout the growing season until September, by which time a total loss of 15 per cent of the observed maxium concentration in leaves had occurred. Approximately 70 per cent of this rain-induced loss reached the mineral soil by September, the remainder located in litter and understory vegetation. Radiocesium transferred from trees via annual leaf fall was two times greater than the quantity exported by rain. With subsequent leaching over the winter months, the litter produced by inoculated trees lost about half of its radiocesium to the mineral soil. Passage of this element through trees, litter, and roots was found to be very rapid. Transfers from litter to vegetation were demonstrated, as well as transfers from living leaves to understory vegetation by rain. Downward transfer of radiocesium in soils under inoculated trees was observed, and soils on wet sites had significantly greater percentages at lower depths down to 12 inches. However, 92 per cent of the total soil radiocesium remained in the top 4 inches one year and seven months after tree inoculation. A definite pattern of distribution, presumably related to rain-leaching and stem flow, was found under tagged trees. Eighty per cent of the soil radiocesium was confined to the area within crown perimeters, and 19 per cent occurred in a small area around the trunks. Total annual loss of this radioisotope from inoculated trees was estimated at 19 per cent of the original input. Results from analysis of four trees harvested at the end of the study indicated that estimates of radiocesium remaining in trees one year and seven months postinoculation were 13.3 + or - 3.0 per cent high. Stable cesium determinations for soil horizons and white oak leaves showed that the amounts of Cs 134 involved in all stages of this experiment were very small compared to natural levels of cesium. Ascertaining the rates and percentages of Cs 134 transfer from one forest system compartment to another has ecological significance in that knowledge of the natural behavior of a trace element in nature is gained. This knowledge is important in both its relation to chemically related elements such as potassium, and to radiocesium which may enter such a system as fallout or as a product of atomic waste disposal operations. (Auth) QUERCUS ALBA

<94>
Dunaway, P.B. 1962, August. Litter-Size Record for Eastern Harvest Mouse. Journal of Mammalogy, 43(3), 428-429 (ESD #76)

A record litter of 8 eastern harvest mice (REITHRODONTOMYS HUMULIS) was recorded at Oak Ridge National Laboratory. The pregnant female was caught in a live trap on an old-field study area and gave birth to her young in captivity. The entire litter of 8 was cannibalized within 2 days of birth, but most of the young were not entirely consumed. (KM)

<95>
Lammers, W.T. 1962, April. Density Gradient Separation of Plankton and Clay from River Water. Limnology and Oceanography, 7(2), 224-229 (ESD #77)

A method involving centrifugation is described by which lake or river water can be fractioned into noncolloidal organic matter, noncolloidal inorganic matter, colloids, and solutes. These isolated fractions may then be analyzed for radionuclide accumulation both qualitatively and quantitatively. (Auth)

<96>
Morton, R.J. (Ed.) 1962, November 21. Status Report No. 3 on Clinch River Study. ORNL-3370; 123 p. (ESD #78)

This is the third of the series of status reports on the Clinch River Study which has been in progress since February 1960. The report is based on progress reports submitted to the Steering Committee for the period May to October 1961. It includes data on some earlier work that were not available for inclusion in Status Reports No. 1 and 2. Separate sections of the report dealing with water sampling and analysis, radioactivity in bottom sediments, biological phases, and hydrologic measurements and analyses have been entered separately into the data base. (BBM)

<97>
Horton, R.J. (Ed.) 1962, November 21. Water Sampling and Analysis. ORNL-3370; Part of Status Report No. 3 on Clinch River Study, (p. 9-43), 123 p. (ESD #78, Part, Section)

The water sampling program is carried out by three different sources to determine radioactive constituents and stable chemical found in the Clinch River and distributed to the Tennessee River system. The basic sampling network has water taken from 6 network stations and analyzed for radioactive constituents in Cincinnati and stable chemicals in Nashville. Portions of these samples and weekly samples taken at Clinch River Mile (CRM) 14.4 are analyzed for selected stable chemicals at ORNL in the Supplementary Sampling program. Radiological determinations are made on water samples collected as a part of the Public Health Service quarterly environmental surveys. Tabular data is included in the report giving concentrations of Sr 90, Cs 137, Co 60, and Ru 106 at various collection stations. The data shows the marked reduction in concentration of radionuclides by the dilution of White Oak Creek water in the Clinch River. Ruthenium 106 and strontium 90 have not localized appreciably in bottom sediments or biota and are still in the water 123 miles downstream. Incomplete tests were started on artificial media placed in the river. Results of the survey for stable chemical analyses are presented in tabular form at CRM 5.5, and 41.5 and TRM (Tennessee River Mile) 471.0, 529.9 and 591.8. Stable strontium was found in all samples. Cesium and ruthenium were below detectable limits. Cobalt was detected in two weekly samples and chromium in 3 of 7 samples. Copper, zinc, aluminum, iron, silicon, titanium, zirconium are fluorides are commonly present. (BBM)

<98>
Horton, R.J. (Ed.) 1962, November. Hydrologic Measurements and Analyses. ORNL-3370; Part of Status Report No. 3 on Clinch River Study, (p. 86-111), 123 p. (ESD #78, Part, Section)

Activities relative to surface water hydrology have included establishment and operation of gaging stations and provision of stream flow data as part of the cooperative program of the U.S. Geological Survey. Several joint studies were made by ORNL and the USGS in efforts to define specific factors important to the study. Twenty three gaging stations provided before and during 1960 have been supplemented by 24 partial record, low-flow and crest-stage stations established on principal and selected streams within and adjacent to the ORNL area. Velocity and temperature measurements are taken at specific points. A radiotracer study using Au 198 was made to investigate the effectiveness of the Clinch River in diluting and dispersing a "slug" of radioactive materials discharged to the river from White Oak Creek at Clinch River Mile (CRM) 20.8. Relatively uniform stream-wide distribution was evident at CRM 17.0. Maximum concentration of activity was very rapidly reduced in the reach between the injection point and the point of uniform cross-stream distribution. The time of travel was 8 hours from CRM 20.8 to CRM 14.5 and 30 hours to CRM 4.4. Statistical studies of the simple volumetric dilution of discharges from White Oak Creek by flows in the Clinch River were initiated. From the duration curve of daily factors, the median daily dilution factor is 570. The range is from 5.1 to 4330. (BBM)

<99>
Horton, R.J. (Ed.) 1962, November 21. Biological Phases. ORNL-3370; Part of Status Report No. 3 on Clinch River Study, (p. 72-85) 123 p. (ESD #78, Part, Section)

Current investigations are reported on results of fish tagging studies to determine the movements of fish and data on oxygen concentrations in river water during a 24 hr period. Tagging was conducted in the vicinity of White Oak Creek on 5,244 fish. Two hundred sixty six (4.31%) recoveries were made. Most fish move downstream and have been recovered up to 100 miles away. Average distance for white bass was 38 miles and only 10 miles for white crappie. Studies are being conducted on the metabolism of strontium and cesium in white crappie. Diet changes in dissolved oxygen concentrations of flowing water are used as a quantitative measure of photosynthetic productivity by aquatic plants. A study was initiate to separate and isolate major groups of organic and inorganic matter suspended in the Clinch River and to investigate their behavior with respect to radionuclides being released from White Oak Creek. A report on the study will be published in the open literature. Average radionuclide concentrations in fish collected and analyzed by the U.S. Public Health Service are tabulated for stations on the Clinch and Tennessee rivers. (BBM)

<100>

<100>
Morton, R.J. (Ed.) 1962, November 21. Radioactivity in Bottom Sediments. ORNL-3370; Part of Status Report No. 3 on Clinch River Study, (p. 44-71), 123 p. (ESD #78, Part, Section)

Data summarized in this section are from three sources each using different techniques in collection and analysis. Since techniques are different, results are not comparable and each report is summarized separately. The Subcommittee on Bottom Sediment Sampling and Analysis reviewed previous investigations, defined purposes of future work and outlined the program of investigations. Fourteen soil-sampling tools were evaluated to determine the best cutting action, penetration and retention characteristics. It was concluded that accurate determination of sediment volume may be based on as few as four sections. The influence of river bends on deposition on sediments was summarized, but distribution of particle sizes in bends must be investigated before firm conclusions may be drawn. In a study of Clinch River Sediments in the laboratory, the sorption capacity of sediments was relatively constant throughout the study reach. The ORNL Applied Health Physics Section conducted the annual survey of radioactivity in the silt of the Clinch and Tennessee Rivers during the summer of 1961. A table shows a comparison of the curies of each of the principal radionuclides discharged to the Clinch River with the average microcuries per gram of these radionculides found in the Clinch and Tennessee river silts. Sampling of sediments by the U.S. Public Health Service was designed to indicate radionuclide distribution in the river beds in both transverse and longitudinal directions. The ratio of cesium 137 to ruthenium 106 in bottom sediments decreased with distance downstream. Cobalt 60 appears to be associated with the suspended organic matter, and higher concentrations were found in mud samples that contained larger amounts of organic debris. Tables show the average radionuclide concentration in bottom sediment samples from various stations on the Clinch, Emory, and Tennessee rivers and their tributaries for ruthenium 106, cesium 137, cobalt 60, strontium 90 and zirconium 95-niobium 95. (BBM)

<101>
Auerbach, S.I., D.A. Crossley, Jr., P.B. Dunaway, S.V. Kaye, D.J. Nelson, J.S. Olson, H.D. Waller, M. Witkamp, and J.P. Witherspoon, Jr. 1962. Radiation Ecology. ORNL-3347; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending, July 31, 1962, (p. 47-72), 168 p. (ESD #79)

White Oak Lake bed studies are discussed in relation to the transfer of fission products through plant to insect food chains, the accumulation of radionuclides by mammal residents, in vivo dosimetry with minature glass rods, field studies of mammals labeled with radioactive tags, hematology of native mammals and a penned mammal study. Also discussed are forest studies which involved an analog computer model for biomass and cesium 137 in a herbaceous ecosystem, arthropod populations associated with decaying leaf litter, radioactive tracer studies with millipedes, gross effects of arthropods and microflora on rates of leaf litter breakdown, microbiology of forest litter and microbial immobilization of radionuclides in it, cycling of cesium 134 in White Oak trees and mobility of cesium 137 tracer in a forest of tulip poplar. Clinch River studies discussed include strontium in White Crappie (POMOXIS ANNULARIS) flesh and bone, biological half-life of strontium and cesium in fish, fish marking and population studies, radiation effects on CHIRONOMUS TENTANS and strontium in freshwater clam shells. (LWC)

<102>
Crossley, D.A., Jr., P.B. Dunaway, S.V. Kaye, L.L. Smith, C.L. Corley, R.J. Pryor, H.E. Childs, Jr., W.L. Tietjen, and W.K. Willard 1962. White Oak Lake Bed Studies. ORNL-3347; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1962, (p. 47-56), 168 p. (ESD #79, Section)

Samples taken in 1961 from White Oak Lake bed showed that concentrations of radionuclides in plants and herbivorous insects were essentially unchanged since 1958. Significant concentrations of ten radionuclides were detected in the carcasses of 26 wild small mammals from upper White Oak Lake bed. Ruthenium 106 in rice rats averaged highest and ranged from 5 x 10(E+2) to 8 x 10(E+3) millimicron per gram of dry carcass. The radioanalyses indicated that rice rats fed in the vicinity of the radioactive surface seeps, which are contaminated with predominately ruthenium 106. Metaphosphate glass rods (fluorods) were adopted as in vivo dosimeters for estimation of dose accumulated by wild mammals on the lake bed. Experiments were performed to determine the response of the fluorods to the radiation energy spectrum from mixed radionuclides in the soil. Fourteen cotton rats were tagged with 100-microcuries Ta 182 wires and released into enclosures delimiting the uncontaminated natural habitat. Hematological measurements are being used as a possible indication of radiation effects in wild mammals on White Oak Lake bed. Basic blood studies were undertaken on some of the wild mammals from uncontaminated areas. Within the rodent family Cricetidae, an inverse relation was found between erythrocyte number and body weight for the six species studied. A comparison of total leukocyte counts for a small sample of rice rats from uncontaminated areas and the lake bed indicated a lower number of cells for the lake-bed animals (4.2 x 10(E+3)/mm3 vs 6.0 x 10(E+3)/mm3). Breeding pairs of known-history cotton rats were released during mid-June 1962 into pens on the upper lake bed for the first phase of an experiment to test for radiation effects on blood and food chain transfer of radionuclides. The animals were sampled for blood, weighed, and tagged subcutaneously with glass rod dosimeters prior to release. (Auth)

<103>
Olson, J.S., D.A. Crossley, Jr., M. Witkamp, H.D. Waller, C.L. Corley, R.M. Anderson, G.J. Dodson, W.C. Cate, and J.P. Witherspoon 1962. Forest Studies. ORNL-3347; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1962, (p 56-66), 168 p. (ESD #79, Section)

Analog computer methods were used to simulate changes in the succession and cesium 137 redistribution in a herbaceous ecosystem. A combination of positive and negative feedback loops regulated the rapid buildup to maximum oscillations in biomass per unit area. Litter-bag techniques are providing data on the functional nature of arthropod communities inhabiting decaying leaf litter, whereas radioactive tracer techniques are providing a means of quantifying the role of these organisms. Differences in forest substrate produced greater effects on the type of arthropod community than did differences between the leaf species. The accumulation of Sr 85, Co 60, and Cs 134 by forest floor millipedes (DIXIDESMUS ERASUS) was measured in both field and laboratory experiments. Effects of arthropods and of microflora on rates of litter breakdown were studied by comparing loss of weight and cesium-134 from oak leaves decomposing in the presence and in the absence of arthropods. Over a 35-week period, 100 gram of naphthalene on 1 m2 of oak litter reduced the arthropod numbers by 2 orders of magnitude, increased microbial plate counts two to three times, had no effect on direct counts of soil microflora and soil and litter respiration, reduced litter weight loss by 15%, and reduced loss of cesium 134 by 50%. Results of microbial counts show a positive correlation between microflora and rate of litter breakdown, temperature, and moisture. Litter-leaf species influenced composition as well as abundance of the microflora. Microbial immobilization of radionuclides in decomposing leaf litter may surpass 50% of the initial mineral content. The second year of a tracer study of cesium 134 in white oak trees was completed. An average of 40% of the 2 mc injected in the tree trunk was transferred to plants. Of this approximately one-half returned to woody tissue, one-third fell with leaves, and one-sixth rained out. Horizontal and vertical distribution in understory, litter, and mineral soil was studied around three trees on each of four soils plot dominated by tulip poplar. A plot dominated by tulip poplar was tagged with cesium 137. Except for a short delay due to drought, translocation to tree crowns approached seasonal maximum values in 2 to 4 weeks. Soon after rain began leaching cesium 137 from the canopy to the litter and soil, mushrooms showed a steady accumulation. (Auth)

<104>
Nelson, D.J., B.G. Blaylock, R.E. Martin, R.C. Early, and N.A. Griffith 1962. Clinch River Studies. ORNL-3347; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Periods Ending July 31, 1962, (p. 67-77), 168 p. (ESD #79, Section)

Aquatic ecology studies continue to emphasize the fate and effects of radionuclides released to the Clinch River. A study under way suggests that fish populations may be tagged with radionuclides deposited in the bony tissues (scales). The biological half-lives of radionuclides in fish are being measured in connection with population tagging studies and with investigations pertaining to the role of fish in the dispersal of radioactive contamination of the environment. Preliminary results indicate a 40-day half-life for radiocesium in bluegills (LEPOMIS MACROCHIRUS), and a 1-day half-life for radiostrontium in soft tissues of white crappie (POMOXIS ANNULARIS). The stable strontium content of white crappie flesh and bone is being determined to test the possibility of predicting concentrations of Sr 90 in fish on the basis of the stable strontium content of fish tissue and water. The study of the effect of radiation from low-level radioactive waste releases on a natural population of CHIRONOMUS TENTANS is continuing. The comparative strontium concentrations of contemporary and prehistoric clam shells were used to determine the biogeochemical strontium cycle in the environment. Current studies showed that there is a nonhomogeneous distribution of strontium within fresh-water clam (Unionidae) shells. The outer layers contain an average of 77% as much strontium as do the inner layers: Barium concentrations are correlated with strontium, whereas the correlation of manganese, magnesium, and sodium concentrations in the shell layers is not consistent and appears to depend upon the species. (Auth)

<105>
Olson, J.S. 1962. Surveys of Environmental Radioactivity. Nuclear Safety, 4(1), 88-95 (ESD #80)

The increase in the number of nuclear installations and the increase in levels of radioactivity of the materials they handle have kept environmental contamination among the major long-range problems of nuclear technology. This review considers some lessons learned by workers who are experienced in evaluating environmental contamination. Examples are drawn from the major production facilities at Savannah River and Hanford, where the need to release radioactive materials to the environment requires the purchase of large government reservations and extensive monitoring systems. (Auth)

<106>

<106>
Auerbach, S.I. (Ed.), and V. Schultz (Ed.) 1962. Onsite Ecological Research of the Division of Biology and Medicine at the Oak Ridge National Laboratory. TID-16890; 146 p. (ESD #81)

A report has been prepared to describe research programs supported by the Division of Biology and Medicine of the U.S. Atomic Energy Commission. Its purpose is to aquaint scientists with the biomedical program of the commission, its objectives and justification. Experimental procedives are described to stimulate and improve research in radioecology. The two research themes for the radiation ecology program at Oak Ridge National Laboratory are pursued under four projects. One theme for radioecological research emphasizes the processes of movement and behavior of radionuclides and other chemical elements in natural ecosystems such as forests, fields, and rivers. The second theme deals with the effects of coverging radiation as a factor influencing organisms, populations, and ecosystems. The four projects are: (1) laboratory studies of the effects of radioactivity on natural populations; (2) processes and components of terrestrial ecosystems; (3) research in areas contaminated by radioactive waste, and (4) aquatic studies. (BBM)

<107>
Dunaway, P.B., and S.V. Kaye 1964, January. Weights of Cotton Rats in Relation to Season, Breeding, and Environmental Radioactive Contamination. The American Midland Naturalist, 71(1), 141-155 (ESD #82)

Monthly body weights of cotton rats, SIGMODON HISPIDUS KOMAREKI, over a two-year period in radioactive and nonradioactive areas showed detailed changes in relation to season and reproduction. The population of major interest was resident on the radioactive dry bed of the former White Oak Lake, Roane County, Tennessee. The other population lived on a nearby uncontaminated old field. Weight was not a useful index to age, especially during cold weather when animals either gained weight slowly or lost weight. Average weights of females were greater than average weights of males during much of the breeding season, but males were heavier than females during nonbreeding periods and during the first few months of the breeding season. The incidences of descended testes and pregnancies, and the rate of weight gain increased with each year during months of favorable weather. The cotton rats of both areas were extirpated after a period of unusually cold weather and heavy snows. Possible effects of radiation on weights and breeding condition of White Oak Lake-bed cotton rats could not be demonstrated unequivocally on the basis of the criteria studied. It was concluded that if possible effects are to be demonstrated, a study will have to be continued for many years on a routine basis until the populations have gone through several cycles of abundance in order to separate effects of natural environmental stresses from effects of low-level radiation. (Auth)

<108>
Crossley, D.A., Jr. 1963. Use of Radioactive Tracers in the Study of Insect-Plant Relationships. Part of Proceedings of a Symposium on Radiation and Radioisotopes Applied to Insects of Agricultural Importance held in Vienna, Austria, 1963, (p. 43-54) (ESD #83)

In early uses of radioactive tracers in ecological investigations of pest insects, dispersion and migration phenomena were studied with radioisotopes as markers for individual insects. A more recent development is the use of radioisotopes to evaluate insect-plant and predator-prey associations through estimates of food utilization. Biological elimination of radioisotopes, a nuisance in dispersion studies, is being utilized as a measure of feeding rates. In both field and laboratory experimentation, insects are allowed to reach steady-state concentrations of radioisotopes through feeding. Then the rate of intake is equal to the rate of elimination of the radioisotopes: rate of ingestion = steady-state amount x fractional rate of loss. Measurements of elimination rates (biological half-lives) permit the steady-state concentrations to be translated into intake rate functions. Food consumption studies have been performed for single-insect-species populations. In a single-species investigation, radiocesium in a tagged field site was used to estimate the consumption of willow leaves by populations of the beetle CHRYSOMELA KNABI. Direct measurements of food consumption made in the laboratory showed good agreement with field estimates of feeding rates based on the radioisotope techniques. Biological half-lives differed for the larval stages and these had to be considered separately. Radioisotopes provided a means of separating overwintering adults from newly emerged ones, through the more rapid elimination of cesium from overwintering adults. In multiple-species work, the relationship between size of insect and elimination rate was used to derive an average biological half-life for radiocesium elimination from herbivorous insects in a field site tagged with cesium 137. This average rate, used in conjunction with data on plant and insect biomasses and concentrations of radiocesium, permitted an evaluation of plant consumption by an entire insect community. Similarly, the utilization of insects as food by predaceous arthropods was estimated from steady-state concentrations of radiocesium in predators and prey, biomasses, and an average elimination rate. (Auth)

<109>
Witkamp, M. 1960. Biological Uptake of Radionuclides. Nuclear Safety, 2(2), 65-69 (ESD #84)

Radionuclides reaching the environment from nuclear waste effluents or from the testing of nuclear devices can create hazards for man, animals, and plants. These hazards, which originate from external radiation or from the internal radiation of assimilated radionuclides, can upset the balance of the ecological system. As a result, a new equilibrium may be established at lower efficiency. To understand and predict the effects of radionuclides released to the environment, several ecological programs, tracing pathways and rates of turnover of the radioisotopes through biota, water, soil, and air, are underway. In addition, much work is being conducted on the biological uptake and translocation of radionuclides in segments of the environmental cycles, especially those leading to man. (Auth)

<110>
Witkamp, M., and J.S. Olson 1963. Breakdown of Confined and Nonconfined Oak Litter. Oikos, 14(2), 138-147 (ESD #85)

A new method is introduced to recover specific leaves that are not confined, except by strings attached to petioles. Results using this method with oak leaves were compared with those from bagged leaves in the same forest to interpret the process of breakdown and the methods of investigating it. In mesh bags, large fragments, which are formed as the leaves are weakened, tend to be retained and continue decomposing at a steady rate. By minimizing the abrupt weight losses from gross fragmentation, bags provide certain advantages for comparative studies of decay by a variety of organisms. The method, however, underestimates true total decomposition. The bias is small until sometime in spring and increases during the summer. The string method provides an upper limit on this bias yet results from strings are not simply an overestimate of true breakdown rate because the consumption of part of the litter by large invertebrates and the comminution and distribution of both detached and adhering fragments all enhance total decomposition, energy flow, and nutrient circulation. True total decomposition rates remain unknown. (KM)

<111>
Wiser, C.W., and D.J. Nelson 1964, July. Uptake and Elimination of Cobalt 60 by Crayfish. The American Midland Naturalist, 72(1), 181-202 (ESD #86)

Comparative studies of cobalt 60 uptake by living and dead crayfish (CAMBARUS LONGULUS LONGEROSTRIS Ort.) indicated that about one-half of the accumulation was by adsorption and one-half by absorption. However, most of the absorbed cobalt 60 was deposited in the exoskeleton, and 95 percent of the body burden was lost at molting. Newly molted crayfish accumulated about one-half as much cobalt as did individuals with hardened exoskeletons. Large animals accumulated more cobalt than small ones, but the uptake per gram was greater in the small crayfish, indicating the importance of surface adsorption phenomena. Rates of accumulation, measured by biological half-times, were 70 hours for small animals and 66 hours for large animals living in a continuously renewed medium. Uptake half-times under conditions where the medium was not renewed were 24 hours for small crayfish and 16.5 hours for large ones, showing the higher percentages of total uptake occurred more quickly when the supply of cobalt 60 was limited and with larger animals. The half-time for accumulation by dead crayfish was about three times that for live crayfish. Elimination rates were much slower than accumulation, with losses being as slow as 0.9% to 1.6% per day until ecdysis occurred. The half-time for elimination by small crayfish was 37 days and that for large crayfish 70 days, both having been dosed by exposure to radioactive solutions. Elimination by crayfish dosed by injection was more rapid, with half-times 13 3/4 and 19 days for low-activity and high-activity injections, respectively. Cobalt 60 occurred at low and equal levels in blood, muscle, and gonads, while higher concentrations were found in the gut, hepatopancreas, and integument. The integument contained the greatest amount per unit weight, with the hepatopancreas ranking second. (Auth)

<112>
Kaye, S.V. 1965. Use of Miniature Glass Rod Dosimeters in Radiation Ecology. Ecology, 46(1,2), 201-206 (ESD #87)

A system is discussed for radiation dose measurements in ecological studies with 1 x 6 mm silver-activated metaphosphate glass rods. The miniature size of the dosimeters, their low cost, simplicity of use, and wide range of sensitivity make them especially well suited for use in radiation ecology. The system measures radiation dose by the principle of radiophotoluminescence, whereby ionizing radiation entering the glass matrix reduces ionic silver to its ground state. This change is directly proportional to dose and is easily measured in a fluorometer which can be calibrated to give the actual dose that was received by the rods. Two important radioecological applications are (1) the measurements of exposure, and (2) the measurement of absorbed dose in media of interest such as tissue, soil, and water. Air exposure can be measured at particular locations around gamma irradiation facilities or above an infinite plane source (radioactive fallout on soil or radionuclides mixed with soil). Glass rods used to measure the exposure above the radioactive White Oak Lake bed showed that the exposure rate at five feet is reduced to only one half of the dose rate at the soil surface. Cotton rats tagged with glass rod dosimeters on White Oak Lake bed had an absorbed dose rate of approximately 2.8 rads/day in mid-June of 1962, but the dose rate decreased to 1.5 rads/day by mid-December. This decrease in dose rate was attributed to the gradually rising water table which filtered low energy photons and caused a corresponding decrease of the dose rate above the soil surface. The miniature fluorods were successfully implanted in acorns, in and on living plants, and in soil. Many other applications are possible in radiation ecology including the use of glass rods to monitor wildlife. (Auth)

<113>

<113>
Olson, J.S. 1963. Models for Simulating Ecological Systems with the Aid of Analog and Digital Computers. Unpublished Manuscript, 12 p. (ESD #88)

Ecosystems can be divided into such diverse "compartments" as foliage, stems and roots of plants, herbivorous and predatory animals, and dead organic matter, soil, and perhaps bodies of water (or soil solutions). A class of models is suggested for describing both the changes in compartment size (usually defined as mass per unit area of ground surface), and concentrations of certain elements or isotopes, expressed either per unit of ground area (X) or per unit of mass (U). Many such variables (represented in general by V) may be summarized by sets of equations expressing net rate of change as income minus loss. This paper illustrates some differences in interpretation of an equation with various meanings attached to "V" and the use of analog and digital computer methods for simulating cumulative changes and rates of response in either masses of organic material, or concentrations of particular substances in ecosystems. (Auth)

<114>
Morton, R.J. (Ed.) 1963, September. Status Report No. 4 on Clinch River Study. ORNL-3409; 115 p. (ESD #89)

The fourth status report for the Clinch River Study covers the period from November 1961 to April 1962. The purpose of the study is to improve knowledge of prevailing conditions, relevant phenomena, and potential health hazards in the Clinch and Tennessee river systems with respect to radioactive contamination. Separate sections of the report dealing with assessment and control of waste discharges, biological phases, hydrological measurements and analyses, and safety evaluation studies have been entered separately into the data base. (BBM)

<115>
Morton, R.J. (Ed.) 1963, September. Assessment and Control of Waste Discharges. ORNL-3409; Part of Status Report No. 4 on Clinch River Study, (p. 7-32), 115 p. (ESD #89, Part, Section)

Management of liquid wastes at ORNL and accumulation and movement of radionuclides in White Oak Creek Basin must be defined and evaluated to determine effects of radioactive contamination in the Clinch River. At ORNL the management of radioactive wastes and the provision of waste disposal facilities are the responsibility of the Operations Division. The intermediate level waste program and process waste program are explained. Ninety nine percent of the radioactivity in liquid wastes from the laboratory are handled through the intermediate level system. Waste is collected in 17 underground monitoring tanks and pumped to waste disposal open pits and covered trenches. Process wastes carry no radioactivity except in event of an accident. Monitors have been set up along the systems. Approximately 65% of the strontium 90 and 50% of the cesium 137 in White Oak Creek is due to release from the Process Waste Water Treatment Plant and seepage from waste pits accounts for practically all of the ruthenium 106 and cobalt 60. During periods of high stream flow and/or suspended solids load in White Oak Creek, there are substantial increases in quantities of cesium and strontium transported downstream. Several thousand curies per year of ruthenium flow onto the bed of former White Oak Lake from the waste pits, but less than half finds its way into White Oak Creek. Larger amounts of ruthenium flow over the lake bed and enter the creek in wet winter months. (BBM)

<116>
Morton, R.J. (Ed.) 1963, September. Safety Evaluation Studies. ORNL-3409; Part of Status Report No. 4 on Clinch River Study, (p. 77-107), 115 p. (ESD #89, Part, Section)

The report on safety evaluation studies is based on two progress reports submitted to the steering committee. The first report involved exposure pathways of released radioactive wastes and preliminary information on various uses of Clinch and Tennessee River water that might cause radiation exposure. Tabular data are included for yearly discharges of radionuclides in curies to the Clinch River and calculated mean annual concentration of nine radionuclides at Clinch River Mile 14.5 and Tennessee River Mile 465.5. Community water systems downstream from ORNL supplied by intakes on the Clinch and Tennessee rivers and its tributaries that may be affected by main stream conditions are listed. The second report gave preliminary results of analyses on calculations of estimated radiation doses that might be attained from human exposures to radioactive materials in the river system through the various exposure pathwyas. Summaries are tabulated for the preliminary estimates of potential dosages from drinking water, immersion in the water, and contaminated bottom sediments. (BBM)

<117>
Morton, R.J. (Ed.) 1963, September. Hydrologic Measurements and Analyses. ORNL-3409; Part of Status Report No. 4 on Clinch River Study, (p. 46-76), 115 p. (ESD #89, Part, Section)

Programmatic cooperation by the U.S. Geological Survey and four special studies by joint efforts of the USGS and the ORNL are summarized. The network of stream gaging stations continue to monitor stage, discharge, and temperature. Partial-record stations provide background data for flood frequency and low-flow analysis. Water samples are collected for background data on sediment transport and chemical water quality. Studies were conducted for the time of travel using fluorescein dye and gold 198. The estimated effects of power releases from Melton Hill Reservoir on Water levels in White Oak Creek were figured, but present information is not sufficient to predict effects of power releases on radioactivity levels in the Clinch River downstream from the mouth of White Oak Creek. Tracer studies using gold 198 were conducted to determine the dispersion and dilution and the variability of dilution factors of radionuclides. Findings were plotted on graphs included with the report. (BBM)

<118>
Morton, R.J. (Ed.) 1963, September. Biological Phases. ORNL-3409; Part of Status Report No. 4 on Clinch River Study, (p. 33-45), 115 p. (ESD #89, Part, Section)

Biological investigations of the Clinch River study are conducted in the areas of biological and chemical relationships, radionuclide accumulation and radiation effects. Melton Hill Dam will impound a portion of the Clinch River, and the studies are being made on the flora and fauna of the river, their abundance and movement, and present quality of fishing including commercial fishing from Watts Bar Reservoir. The flesh and bone of white crappie are being analyzed for stable strontium in order to make predictions of the levels of strontium 90. If one half pound of crappie is eaten each week, 39% of the maximum permissible body burden would be accumulated in 50 years. The biological half-life of cesium 134 in bluegills appears to be about 40 days. However the study on uptake and elimination of radionuclides in organisms is still in progress. (BBM)

<119>
Nelson, D.J. 1964, July 25. Biological Vectors and Reservoirs of Strontium 90. Nature, 203(4943), 420 (ESD #90)

An assessment is made of the role of emergent Chironomidae as vectors of strontium 90 and freshwater clams as reservoirs of strontium 90 in the Clinch and Tennessee Rivers. There is a significant concentration of strontium in clam shells, but there is no large reservoir of strontium 90 due to the low specific activity ratio in the river water. Detection of contaminated insects is a useful tool for examining their biology, but when mass movement of radioactive material is considered, quantities are small. Localized problems may exist, but a general contamination of the landscape by mobile organisms is unlikely. (BBM)

<120>
Auerbach, S.I., G.N. Brown, D.A. Crossley, P.B. Dunaway, S.V. Kaye, W.R. Kevern, D.J. Nelson, J.S. Olson, H.D. Waller, J.P. Witherspoon, Jr., and M. Witkamp 1963. Progress in Terrestrial and Freshwater Ecology. ORNL-3492; Part of Health Physics Division Annual Progress Report for Period Ending June 30, 1963, (p. 81-115) (ESD #91)

Radiation ecology studies are described under the following sections: radioactive waste area and radiation effects studies, forest studies, and Clinch River and related aquatic studies. Each of the 26 parts are separately abstracted for the data base. (HP)

<121>
O'Farrell, T.P., and S.V. Kaye 1963, June. Use Of Radioactive Tags to Evaluate Movements of Wild Mammals. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 88), 115p. (ESD #91, Part)

Pine mice were tagged with Co 60, Ta 182, and Au 198 to study the ecology of pine mice and to determine the optimum in soil depth of sheet metal walls which would prevent escape of burrowing pine mice. Both nocturnal and crepuscular activity periods were observed and a soil temperature-moisture influence on vertical subterranean movement was apparent. A piece of sheet metal extending 12 in. into the soil almost completely confines the pine mice. (KM)

<122>
Auerbach, S.I., and J.C. Ritchie 1963, June. Distribution of Gamma-Emitting Nuclides in Trees Bordering Radioactive Waste Pit No. 5. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1953, Part 2, (p. 89-91), 115 p. (ESD #91, Part)

Significant concentrations of four gamma-emitting radionculides were found in the pine trees. These nuclides were Ru 106, Zr 95, Nb 95, Cs 137, and Ce 144. The distribution of radioactively hot trees indicates that there are 3 fingers of seepage away from the center of the pit. (KM)

<123>
Witherspoon, J.P., Jr. 1963, June. Vegetation Studies Around the HPRR. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 92), 115 p. (ESD #91, Part)

The Health Physics Research Reactor (HPRR) is surrounded by a forest of pine-hardwood type vegetation which will be subject to neutron and gamma radiation in doses of several thousand rads per year. Changes in growth rate, phenological behavior and structure of the plant community will be measured and noted. (KM)

<124>

<124>
Dunaway, P.B., S.V. Kaye, L. Lawrence, B.E. Jacobs, R.J. Pryor, R.M. Anderson, F.G. Taylor, and T.P. O'Farrell 1963, June. Penned-Mammal Study. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 81-87), 228 p. (ESD #91, Part)

This study is testing for effects of continuous low-level environmental radiation on the blood of wild small animals that live in 100 sq. m. pens on the upper White Oak Lake bed. The concentrations Ru 106 in the soil underlying the pens are greater than the concentrations of Cs 137, Co 60, and Sr 90 combined. Concentrations of Ru 106, Cs 137, and Co 60 in the plants in the pens were considerably less than the burdens of these radionuclides in the soil, but concentrations of Sr 90 in the soil and plants were essentially the same. Effects of ionizing radiation were not apparent in the blood of the cotton rats. The apparent radioresistance of wild rodents such as cotton rats, relative to laboratory rats, may be the result of the greater adaptability and physiological readiness of the heterogenous wild species. Or, perhaps effects of environmental factors in the experiment were of sufficient magnitude to mask any radiation effects that might have been present. (KM)

<125>
Brown, G.N. 1963, June. Determination of Potential Cesium-Organic Binding Sites in LIRIODENDRON and other Woody Species. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 102-104), 115 p. (ESD #91, Part)

A study was designed to investigate both the chemical form of cesium in sap and retention of cesium by wood. Cesium 137 exists in root and stem sections only in ionic form. The bulk of radioactivity after extraction of sap is retained in the woody tissue. Much of the radioactivity was in the parenchyma and other living cells of the phloem. A certain degree of cesium-organic ionic bonding was demonstrated. (KM)

<126>
Waller, H.D., M. Witkamp, J.S. Olson, W.C. Cate, and R.M. Anderson 1963, June. Entry of Cesium 137 into Litter and Soil of a Tagged LIRIODENDRON Forest. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 104-105), 115 p. (ESD #91, Part)

Cs 137 enters the soil from rainfall and litter fall and by the downward movement of Cs 137 in roots of tulip poplar. The contribution by the roots increases in importance as sample depth increases and is especially important to the early entry of Cs 137 into the soil. (KM)

<127>
Witkamp, M., and M.L. Frank 1963, June. Microbial Immobilization of Radionuclides in Forest Litter. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 105-106), 115 p. (ESD #91, Part)

Microbial uptake of radionuclides from liquid media is proportional to the nuclide concentration in the liquid. Uptake on a mixture of solid and liquid substrates is proportional to the concentration of nuclides in the solids rather than that in the surrounding liquid. In natural soil wide differences in nuclide environment may be expected, depending on nuclide concentration in the substrate. (KM)

<128>
Crossley, D.A., Jr., G.J. Dodson, C.L. Corley, and W.L. Tietjen 1963, June. Mobility of Cesium 137 in Forest Food Chains. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 106-107), 115 p. (ESD #91, Part)

Two types of food chains were compared: the green foliage-herbivorous arthropod-predaceous arthropod type; (Type A) and the leaf litter-herbivorous arthropod-predaceous arthropod type. (Type B) Cesium 137 concentrations were lower in type B than in type A since leaching of cesium from green leaves was the radioisotope source for the litter layers. Radioisotope concentration in leaf litter increased gradually during the summer and abruptly during the early autumn as leaf fall progressed. Herbivores had Cesium 137 concentrations almost as high as leaf litter during the summer months. Herbivore radioactivity increased in the autumn but not as raddily as did leaf litter radioactivity. Predators also showed an increase in Cesium 137 content during the summer and early autumn. During July and August the herbivore and predator parts of type B had an added input due to direct feeding on the green foliage. Some of the predators fed on the green food chain causing abnormally high animal portions of the type B food chain during July and August. On October resembling that of type A. (KM)

<129>
Nelson, D.J., N.A. Griffith, and R.C. Early 1963, June. Strontium in White Crappie (POMOXIS ANNULARIS) Flesh and Bone. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 107-109), 115 p. (ESD #91, Part)

The relation of the distribution of stable strontium and Sr 90 between the environment and the fish was studied. The biological half-life of Sr in the flesh of different individuals ranged from 12 to 48 minutes. The concentration of Sr 90 in flesh reflects the Sr 90 concentration in the water; consequently, the water may as well be sampled as the fish flesh. The distribution of Sr and Sr 90 should be compared in bone only and not in flesh. (KM)

<130>
Nelson, D.J., R.C. Early, and N.A. Griffith 1963, June. Biological Movement and Reservoirs of Strontium 90. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 109), 115 p. (ESD #91, Part)

The transport of Sr 90 from the Clinch River by emerging midges (Chironomidae) was compared with the accrual of Sr 90 to the river from weapons-testing fallout. Fallout entering the river directly would add 45 times as much Sr 90 as removed by emerging Chironomids. Calculations made to estimate the removal of Sr 90 from the river in clamshells indicated that 64 mCi/yr are removed in this way. Assuming an average weight of 250 g each and an average Sr 90 concentration, the resevoir of Sr 90 in clams in the river is calculated as 79 mCi. The annual removal and reservoir of Sr 90 in clamshells is small compared to the releases of Sr 90. (KM)

<131>
Dunaway, P.B., L. Lawrence, S.V. Kaye, B.E. Jacobs, R.M. Anderson, T.P. O'Farrell, F.G. Taylor, and R.J. Pryor 1963, June. Hematology of Native Mammals. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 88), 115 p. (ESD #91, Part)

Studies of the blood of free-ranging native mammals are being done so that the changes caused by ionizing radiation can be distinguished from the changes that result from other environmental factors. The number of erythrocytes is inversely related to species size and the mean erythrocyte volume is directly related to species size in the families Muridae, Sciuridae, Soricidae and Cebidae, but the relation is different for each family. Sex, season and age may influence the relation. (KM)

<132>
Kevern, N.R., N.A. Griffith, G.M. Rosenthal, and D.J. Nelson 1963, June. Uptake and Accumulation of Strontium by Algae and Snails. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 109-110), 115 p. (ESD #91, Part)

The influence of stable strontium and calcium concentrations in the culture medium on the accumulation process was studied using OOCYSTIS EREMOSPHAERIA. Both stable strontium and calcium concentrations influenced the accumulation of Sr 85. The accumulation of stable strontium decreased with increasing calcuim concentration and increased with increasing strontium concentration. The concentration of strontium was the predominant influence. (KM)

<133>
Martin, R.E., D.J. Nelson, and S.I. Auerbach 1963, June. Smallmouth Buffalo Population Studies and Fish Marking. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 110-112), 115 p. (ESD #91, Part)

A study of the age distribution, growth rates, and dispersion of ICTIOBUS BUBALUS in watts Bar Reservoir, and of their importance as an accumulator of radionuclides was undertaken. The ages of 1271 commercially caught fish ranged from four to 15 years, with the largest number being from year class 6, the youngest year class which was completely vulnerable to commercial fishing gear. The most relative growth occurred during the second year of life. Calcium was the most abundant element in fish scales. Fish scales and bone contained radionuclides of ruthenium, cesium, zirconium, zinc and cobalt. Other analyses showed the presence of Sr 90. A high concentration of radionuclides in the environment was necessary for the organism to accumulate measurable quantities in their scales . The smallmouth buffalo fish population of Watts Bar Reservoir is a relatively minor accumulator of radionuclides. Scales can be tagged with Cs 134, a method which has definate advantages over the conventional method. (KM)

<134>
Olson, J.S. 1963, June. Computer Feedback Models. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 95-96), 115 p. (ESD #91, Part)

Analog computer methodology has been used for a review of the productivity parameters of ecosystems. Recent models have included compartments for woody materials. Positive feedback representing increased foliage mass is counteracted by negative feedbacks representing losses from a variety of factors. Diurnal and seasonal cycles of production are included. A digital computer program was used. (KM)

<135>
Witherspoon, J.P., Jr. 1963, June. Gamma-Ray Dosimetry in Cesium 137-Tagged Tulip Poplar. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 93-94), 115 p. (ESD #91, Part)

In order to investigate the possible use of dosimetry as a means of tracing radionuclide movement, metaphosphate glass-rod dosimeters were placed in root, trunk, and branch tissues of a Cs 137-inoculated tulip poplar tree. This method proved to be faster and easier than harvest-radioassay techniques and involves no destruction of the sampling material. (KM)

<136>

<136>
Crossley, D.A., Jr., C.L. Corley, and W.L. Tietjen 1963, June. Use of Radioactive Tracers for Analysis of Food Chains. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 94-95), 115 p. (ESD #91, Part)

Biological half-lives were used for estimating metabolic rates for arthropod populations and for refining tracer techniques for estimations of food consumption. The data offer abundant evidence of a relationship between elimination rate for some radioisotopes and environmental temperatures. Future work includes simultaneous measurement of biological elimination and respiration, laboratory measurements under fluctuating temperatures, and field tests to define the value of elimination rates for radioisotopes as a means of measuring metabolism in populations of animals. (KM)

<137>
Blaylock, B.G., S.I. Auerbach, D.J. Nelson, and N.A. Griffith 1963, June. Population Genetics and Radiation Effects Studies on CHIRONOMUS TENTANS. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 112-114), 115 p. (ESD #91, Part)

The salivary gland chromosomes of larvae exposed to a dose rate of 230 rads/yr, collected from White Oak Creek, were examined for Chromosomal aberrations. Chronic low-level irradiation from radioactive waste increased the variability of chromosomal abernations without significantly increasing the frequency. The three inversions which occurred at the highest frequencies are endemic to the populations of East Tennessee and have been established in the population for a long time. The results are discussed in relation to the Hardy-Weinberg Law and Levene's model. Chromosomal polymorphism can be maintained in a natural population without superiority of the heterozygous individuals. (KM)

<138>
Auerbach, S.I., and D.J. Nelson 1963, June. Safety Evaluation of Clinch River Fisheries. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 114-115), 115 p. (ESD #91, Part)

Data were obtained on the radionuclide concentration in Clinch River fish, the commercial fish harvest in Watts Bar Reservoir and the distribution of sports fishing pressure in this area. The data were submitted to the Clinch River Steering Committee for their continuing analyses of Clinch River conditions. (KM)

<139>
Witherspoon, J.P., and S.V. Kaye 1963, June. Glass-Rod Dosimetry in Environmental Studies. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 81), 115 p. (ESD #91, Part)

Miniature metaphosphate glass rods are being used to estimate absorbed dose in air and in the plants and soils of White Oak Lake bed. Soil beta and gamma dose rates may be high enough to prohibit germination or seedling establishment of radiosensitive plants such as conifers and an experiment is being conducted to test this possibility. (KM)

<140>
Witherspoon, J.P., Jr., and M. Heaslip 1963, June. Neutron Dosimetry and Seed Irradiation. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 92-93), 115 p. (ESD #91, Part)

Fission foil threshold detectors were used to determine the fast-neutron dose absorbed by white oak acorns irradiated in the west animal tunnel of the ORNL Graphite Reactor. The boron carbide-plastic box in which the seeds were irradiated was effective in absorbing thermal neutrons. (KM)

<141>
Olson, J.S., W.C. Cate, H.D. Waller, and R.M. Anderson 1963, June. First-Season Redistribution of Cesium 137 in Canopy of a Tagged LIRIODENDRON Forest. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 100-102), 115 p. (ESD #91, Part)

The prompt movement of Cesium ions into leaves reaches a maximum in June but does not cease as the month progresses. The maximum presumably represents a moment when income balances opposing loss rate in dynamic steady state. The rate of decrease of foliage activity on a unit-area basis through late summer (about 1.2% of foliage cesium per day) represents a minimal estimate of total turnover per day. (KM)

<142>
Olson, J.S., H.D. Waller, and W.C. Cate 1963, June. Transfer of Cobalt 60 and Ruthenium 106 from Oak and Ash Leaves to Several Forest Soils. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 97), 115 p. (ESD #91, Part)

Cobalt disappeared faster than organic matter, in spite of the strong tendency for organic compounds to complex cobalt. Ru 106 disappeared little faster, if at all, than did litter. This indication of dead organic materials contrasts with the rapid elimination of ruthenium from living organisms. (KM)

<143>
Witkamp, M., and M.L. Frank 1963, June. Microbiology of Forest Litter. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 98), 115 p. (ESD #91, Part)

Microbial populations of four leaf species and three contrasting forest types were measured on a seasonal basis. Bacterial and fungal populations decreased on leaf species in the following order: mulberry, redbud, white oak, and pine. During litter decay microbial populations of mulberry decreased, but those of pine and oak increased. Those on redbud remained constant. Growth rates of fungal mycelium increased throughout the year and was lowest on mulberry leaves and highest on pine needles. Rates of microbial respiration and loss of weight are significantly correlated with microbial populations. Seasonal fluctuations of microbial respiration are primarily correlated with temperature but may also be related to bacterial counts, moisture content of leaves, and age of litter. Permissible approximations for the measurement of microbial mass in soil can be obtained by using normal light microscopy. (KM)

<144>
Crossley, D.A., Jr., M. Witkamp, and G.J. Dodson 1963, June. Gross Effects of Arthropods and Microflora on Rates of Leaf Litter Breakdown. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 98-99), 115 p. (ESD #91, Part)

An insecticide was used to reduce the arthropod populations in leaf litter, and the resulting changes in rate of wight loss and leachability of incorporated Cs 134 were measured. By the 35th week of the experiment, there was 15 per cent less litter in control plots than in plots treated with 100 g naphthalene per sq.m, as measured with litter bags. Bagged litter in treated plots retained twice as much Cs 134 as did litter bags in control plots. These trends were confirmed by measurements taken to mid-October when the study ended. (KM)

<145>
Crossley, D.A., Jr., and C.L. Corley 1963, June. Leaf Litter Consumption by Millipedes. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 100), 115 p. (ESD #91, Part)

Lab work was done to refine tracer techniques for estimating food consumption with emphasis on: identification of factors influencing the shorter component in multicomponent curves of radioisotope elimination; temperature influences on rates of elimination; and methodology for radioisotopes with long biological half-lives. The shorter component is due to the passage of unassimilated material from the intestines. Decreasing the temperature increased both the shorter and longer components. Radioisotopes with long biological half lives may have definite advantages for estimating food consumption. (KM)

<146>
Olson, J.S., W.C. Cate, H.D. Waller, and R.M. Anderson 1963, June. Components of Forest Litter Fall. ORNL-3492; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending June 30, 1963, Part 2, (p. 96-97), 115 p. (ESD #91, Part)

Cumulative curves of litter fall over a two-year period from four pine forests, three upland deciduous forests, and three lowland deciduous forests indicate surprisingly little variation between yearly averages for the three stand groups and thus provide an improved basis for estimating seasonal characteristics and magnitudes of loss rates from tree crowns. Large amounts of Zr 95-Nb 95, Ru 106, and Ce 144 were detected in currently falling litter. (KM)

<147>
Plummer, G.L., D.A. Crossley, Jr., and D.A. Gardiner 1965. Growth Response of Two Sedges Inhabiting A Radioactive Waste Disposal Area. Ecology, 46(3), 346-348 (ESD #92)

An observed increse in the size of the inflorescences of two sedges inhabiting a radioactive waste disposal area is correlated with the complex interaction between various edaphic factors that contribute to plant growth and an "effect" of ionizing radiation. The perennial sedges, CAREX FRANKII and CAREX VULPINOIDEA, tolerate a continuous dose rate generally in excess of 2 R/day at ground level. Although radiation has been associated with excessive plant growth, it is not entirely independent of other factors, such as the combined contribution of potassium and organic matter, soil pH, calcium, as well as other unmeasured edaphic conditions. (Auth)

<148>

<148>
Auerbach, S.I., J.S. Olson, and H.D. Waller 1964, February. Landscape Investigations Using Cesium 137. Nature, 201(4921), 761-764 (ESD #93)

A forest ecosystem was tagged with cesium 137 in order to: determine cycles and rates of cycling of cesium and related elements in a mesic forest ecosystem, to measure cesium transfer between components of an ecosystem and apply these results to a theoretical model of element circulation; and to derive information useful for predicting the fate of problem radionuclides in those ecosystems which potentially may have a large capacity for storage in biological materials. The rapid attainment of maximum foliage concentrations, averaging 1.3 uCi/g dry weight on June 6 and June 20, 1962, was followed by a decrease throughout the growing season to about 0.6 uCi/g dry weight during August 22-early October. Concentrations in fallen leaves decreased from only 0.25 uCi/g dry weight on September 10 to 0.13 by October 25. This decrease suggests a marked withdrawal of cesium 137 (and presumably total content of alkali metal elements) before leaf drop and a leaching of leaves by rain before and after leaf drop. Through-canopy rain-water collected in the funnels showed maximum cesium 137 concentrations in June, when foliage radioactivity was highest. Transfer of radiocesium to the forest floor via falling LIRIODENDRON leaves reached a maximum rate of 3.2 uCi/m2/day in the week of October 4-11, 1962. If the late June cesium 137 concentration per unit mass of 1.27 uCi/g dry wt. is representative of the whole canopy, then foliage activity on a unit-area basis was 1.27 uCi/g x 196 g/m2 = 249 uCi/m2 at a seasonal maximum. This quantity represents about 27 per cent of the total radiocesium introduced into tree trunks (approximately 1 mCi/m2). The preliminary results emphasize the importance of rain as an agent in radiocesium transfer. (KM)

<149>
Crossley, D.A., Jr., and M. Witkamp 1964. Forest Soil Mites and Mineral Cycling. Acarologia, 6, 138-145 (ESD #94)

Mites and other small arthropods in forest soil exert an influence on the forest ecosystem in several ways. Their feeding processes cause a physical breakdown of fallen leaf litter, and the material passed through their intestines is more susceptible to decay by microorganisms. Fragments of leaf litter become more intimately mixed with mineral soil and are distributed vertically by the feeding activities and vertical migrations of soil mites. The impact of these activities on maintenance of the forest may be assessed by measuring quantities which reflect the functioning of the entire ecological system. Rates of cycling of minerals from tree through litter and soil and back to tree constitute one of the functional measurements which can now be made conveniently by the use of radioactive tracer techniques. In experiments at the Oak Ridge National Laboratory, leaf litter was confined in small (1 dm2) net bags and placed on the forest floors of pine, oak, and tulip poplar stands. Gross loss of weight and of radioactive isotopes of cesium, ruthenium, strontium, and cobalt were then measured at weekly intervals; simultaneously, the succession of soil mites in the bags was followed so that the loss of weight and of minerals could be related to arthropod activities. In other experiments naphthalene was used to exclude mites and other arthropods from experimental plots (1 m2). Comparisons with control plots showed that, after 1 year, plots without arthropods retained 55% of their leaf litter (by weight) whereas control plots retained 40%. Retention of radioactive cesium by leaf litter was changed also. Plots without arthropods retained 16% of their initial cesium content, as compared to 7.5% in control plots. (Auth)

<150>
Witkamp, M., and M.L. Frank 1965. First Year of Movement, Distribution and Availability of Cesium 137 in the Forest Floor Under Tagged Tulip Poplars. Radiation Botany, 4, 485-495 (ESD #95)

Influx, distribution, and leachability of cesium 137 in the forest floor were measured for environmental description. Rain, leachates, litter, soil and roots were collected under of crowns of tulip poplars (LIRIODENDRON TULIPIFERA L.) tagged in May. The cesium 137 content of the samples was measured by scintillation counting. Before leaf fall 85 per cent of the cesium 137 in the forest floor was found in roots which consequently set the distribution pattern. Concentrations of cesium 137 in soil varied by 2 orders of magnitude within a few cm distance. Distribution of cesium 137 was less influenced by rainout and runoff. Ten soil cores of 7 cm3, 2.1 cm diameter and 2 cm deep, were found sufficiently large to estimate local mean distribution of cesium 137 in litter and in soil, in the various seasons. Variabilities (s as percentage of X) ranged from 31-62% of the mean. Leaf fall doubled the total amount of cesium 137 in the forest floor and increased the amount of cesium 137 in litter 15 fold. Leachability of cesium 137 in the fresh litter was nine times greater than in old litter and increased the content of mobile cesium 137 in the entire litter layer by two orders of magnitude. During winter more than half of the cesium 137 in litter and roots leached into the soil. In spring there was renewed rainout from the canopy. The large differences in amount, concentration, and leachability of cesium 137 over short periods of time and distances could only be measured by combining the results of detailed and frequent sampling using a variety of methods. (Auth)

<151>
Martin, R.E., S.I. Auerbach, and D.J. Nelson 1964, January 6. Growth and Movement of Smallmouth Buffalo, ICTIOBUS BUBALUS (Rafinesque), in Watts Bar Reservoir, Tennessee. ORNL-3530; Ph.D. Thesis, University of Tennessee, 100 p. (ESD #96)

The smallmouth buffalo, ICTIOBUS BUBALUS (Rafinesque), population of Watts Bar Reservoir, Tennessee, was investigated in order to describe its age distribution, growth rates, dispersion, and importance as an accumulator of radionuclides. Scale impressions were analyzed for age and growth phenomena. Dispersion of smallmouth buffalo was investigated by conventional tagging methods and by autoradiographic analysis of scales. The fish ranged from four to fifteen years of age, and the species characteristically exhibited the largest relative growth during the second year of life. Calcium was the most abundant element in fish scales with at least twenty-three other elements present in varying quantities. Fish scales and bone were found to contain radionuclides of ruthenium, cesium, zirconium, zinc, and cobalt. Radiometric surveys of scales revealed the Watts Bar reservoir smallmouth buffalo population was a relatively minor accumulator of radionuclides with only 0.08 per cent showing the presence of artifically produced radionuclides. Limited data on dispersion were determined from conventional tags. Much more dispersion and life history data were determined from autoradiographic analyses of scales. All normal scales containing radionuclide accumulations were found to produce identical autoradiographic patterns of concentric circles which were associated with growth of the fish in contaminated areas. A laboratory experiment showed that scales could be tagged with cesium 134, but this radionuclide was found to accumulate in much larger concentrations in the soft tissues than in the bony tissues. (Auth) (BBM)

<152>
Taylor, F.G., Jr. 1965, August 26. Supernumerary Incisors in LYNX RUFUS Schreber. Journal of Mammalogy, 46(3), 507 (ESD #97)

On 30 April 1963 a skull of LYNX RUFUS Schreber which exhibited supernumerary incisors, was collected in Bethel Valley, Anderson County, Tennessee, within the controlled area of the United States Atomic Energy Commission's Oak Ridge Reservation. In addition to the anomalous tooth condition, this specimen provides the first confirmed evidence of the presence of this species on the reservation. (Auth)

<153>
Blaylock, B.G., S.I. Auerbach, and D.J. Nelson 1964, January 14. Chromosomal Aberrations in a Natural Population of CHIRONOMUS TENTANS Exposed to Chronic Low-Level Environmental Radiation. ORNL-3531; Ph.D. Thesis, University of Tennessee, 76 p. (ESD #98)

The salivary gland chromosomes of CHIRONOMUS TENTANS larvae collected from White Oak Creek, an area contaminated by radioactive wastes, and from six uncontaminated areas were examined for chromosomal aberrations. White Oak Creek populations were exposed to absorbed doses as high as 230 rads per year. Chromosomal maps were constructed and were used as a reference in scoring aberrationss. Fifteen different aberrations were found in 365 larvae from irradiated populations as compared with 5 different aberrations observed in 356 larvae from control populations, but the mean number of aberrations per larvae did not differ in any of the populations. The quantitative amount of heterozygosity was essentially the same in the irradiated and control populations, but there were three times the variety of chromosomal aberrations found in irradiated populations. It was concluded that chronic low-level radiation from radioactive waste was increasing the variabibity without significantly increasing the frequency. Five different inversions were found in both irradiated and control populations. In the White Oak Creek population frequency of the heterozygous inversions did not change significantly for a three year period and no changes could be attributed to seasonal changes. It was concluded that the three inversions occuring most frequently are endemic to the population of East Tennessee and have been established in the populations for a long time. Results show that chromosomal polymorphism can be maintained in a natural population without superiority of the heterozygous individuals. (BBM)

<154>
Brown, G.N. 1964. Cesium in Liriodendron and Other Woody Species: Organic Bonding Sites. Science, 143(3604), 368-369 (ESD #99)

In trees labeled with cesium 137, the isotope in the sap streams is primarily in the free ionic form. Much ionic cesium 137 also appears to occur in intracellular fluids other than the sap streams. However, a small quantity of cesium 137 forms ionic bonds with organic compounds (probably as salts of carboxylic acids). Even though most of the activity appears in the phloem tissue, some activity is dispersed in much of the sapwood and even in the dead xylem tissue of the heartwood. Some of this cesium 137 is retained, at least temporarily, by the numerous carboxylic groups of the natural plant compounds of cell walls, cytoplasm of living cells, and cell debris of heartwood. (Auth)

<155>
Whittaker, R.H.., N. Cohen, and J.S. Olson 1963. Net Production Relations of Three Tree Species at Oak Ridge, Tennessee. Ecology, 44(4), 806-810 (ESD #100)

An exploratory application of one approach (Whittaker 1961) of the measurement of forest productivity was taken for LIRIODENDRON TULIPIFERA, QUERCUS ALBA, and PINUS ECHINATA stands. Production and biomass relations show trends as the size of woody plants increases from small shrubs to medium-sized trees. As the concentration of biomass and production increases, the fraction of production in foliage and fruits decreases. Fractions of biomass and production in branch growth increase from small to large shrubs but decrease from large shrubs to trees with wide differences between species of a given size. In roots, fractions of biomass and production decrease with wide species differences. Ratios of biomass to current net production and of net shoot production to leaf weight, leaf blade area, and chlorophyll increase. Ratios of net shoot production to estimated volume increment decrease. Various limitations and complexities affect the values, but they permit estimation of forest production from stand data on tree numbers, diameters, heights, and wood increments. (BBM)

<156>
Nelson, D.J. 1964. Interpretation of Radionuclide Uptake from Aquatic Environments. Nuclear Safety, 5(2), 196-199 (ESD #101)

A review and comments are presented for interpretation of radionuclide uptake by organisms from aquatic systems. Specific activities in aquatic organisms are useful in explaining differences in the uptake of radionuclides. The specific activity may be expressed conveniently as microcuries per gram of the same element. Factors and assumptions that must be considered in the use of specific activity data are summarized and discussed in connection with interpretation of radioisotope uptake data. (BBM)

<157>
Crossley, D.A., Jr. 1964, Spring. Biological Elimination of Radionuclides. Nuclear Safety, 5(3), 265-268 (ESD #102)

Patterns of elimination for many radionuclides from humans or laboratory animals are more adequately described by a power function or a series of two or three exponential factors than by a single exponent based on a single biological half-life (or effective half-life). Usually the relations between components of radionuclide elimination and metabolic pools are best determined when they can be verified independently of elimination rates, since various phenomena can lead to complex patterns of elimination. Studies of comparative elimination are important for predicting how a given group of radionuclides may behave in various animal groups and under different environmental situations. When the significance of radionuclide concentrations in environmental samples must be interpreted, information on elimination rates can be invaluable. (KM)

<158>
Olson, J.S. 1964. Gross and Net Production of Terrestrial Vegetation. Journal of Ecology (Supplement), 52, 99-118 (ESD #103)

The relationships between the rates of productivity and the amounts of material (or energy) already accumulated on a given area are discussed with an introduction to modeling and computer simulations. Such models also provide a framework on which to organize empirical information on income and loss-specifically on turnover, or fraction lost per unit time. They should show whether large or small change in accumulated materials follow from a change in certain rates. These methods may also suggest how rapidly (if at all) a given model ecosystem may restore itself towards a steady state (climax) following a specified kind of disturbance. (BBM)

<159>
Nelson, D.J. 1964. Deposition of Strontium in Relation to Morphology of Clam (UNIONIDAE) Shells. Verh. Internat. Verein. Limnol., 15, 893-902 (ESD #104)

The shell structure of several species of freshwater clams is described and the results of an analysis of individual layers of the shells for Sr content are reported. The distribution of Sr in freshwater clam shells was nonhomogeneous and was associated with growth and structure of the shell. Shell structure was redescribed because two distinct nacreous layers were observed instead of the one usually attributed to this group of clam. (KM)

<160>
Patten, B.C. 1964, May 1. The Plankton Community. Science, 144(3618), 556-558 (ESD #105)

An article entitled "Plankton: Optimum Diversity Structure of a Summer Community" by B.C. Patten is criticized on several grounds by Roger W. Bachmann and Patten refutes the charges. Bachmann claims that Patten's model can not be applied to actively growing plankton populations or those undergoing species succession since only the final composition is specified. Bachman further claims that the terms have one meaning in the model and another in the discussion and states that at least one conclusion is incorrect. Patten explains his use of the model, the term in question, and indicates why his conclusions are valid. (KM)

<161>
Kevern, N.R. 1964, September 25. Strontium and Calcium Uptake by the Green Alga, OOCYSTIS ERENOSPHAERIA. Science, 145(3639), 1445-1446 (ESD #106)

The uptake of calcium and strontium by a green unicellular alga cultured in media containing these elements in concentrations found in nature is directly proportional to the concentration in the media. Variation in the concentration of either element has a slight inverse influence on the uptake of the other. The increase of strontium uptake when the calcium concentration is very low indicates that strontium is substituted for calcium when calcium is limited and suggests that the alga requires either element. (Auth)

<162>
Shinn, A.F., G.J. Dodson, and C.L. Corley 1964. Transport of Radioactive Materials by Mud-Dauber Wasps. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 71-73), 109 p. (ESD #107, Part)

SCELIPHRON CEMENTARIUM (Black-and-Yellow mud-dauber wasps) construct nests using radioactive mud while TRYPOXYLON POLITUM (Pipe-Organ mud-dauber wasps) never use radioactive mud for nests. Radioactive mud nests are a hazard to both humans and wasps, causing a significant reduction in successful emergence of wasps, and a higher mortality of wasps from parasites. Failure of the Pipe-Organ mud-dauber to use radioactive mud for nests is not understood. The SCELIPHRON population will tend to decline while the TRYPOXYLON population will hold its level or possibly increase, as more nest site areas become available. The food web involving SCELIPHRON and its spider prey, parasites, and tenants will be altered, as well as that of the metallic-blue dauber, which provisions its cells in part with black widow spiders. (KM)

<163>
Waller, H.D., J.S. Olson, R.M. Anderson, and W.C. Cate 1964. First-Year Budget of Cesium 137 in the Tagged LIRIODENDRON Forest. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 85-86), 249 p. (ESD #107, Part)

About 1/2 of the initial inoculant of a tulip poplar forest system tagged in May, was found in the litter, soil, and smaller root components by October. Almost 2/3 of the Cs 137 in the canopy during the June maximum moved back into woody tissue by autumn. The important paths of transfer of Cs 137 from tagged trees to the forest floor were rain leaching, leaf fall, and passage through the roots. Roots from tagged trees probably contribute about 90% of the total soil burden. (KM)

<164>
Blaylock, B.G., and R.C. Early 1964. Population Genetics and Radiation Effects Studies on CHIRONOMUS TENTANS. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 102-103), 249 p. (ESD #107, Part)

The natural population of CHIRONOMUS TENTANS from White Oak Creek which receives about 230 rads/year from chronic environmental radiation is experiencing newly occurring observations which are eliminated by selection or genetic drift and are not maintained in the gene pool. A relatively high degree of chromosomal polymorphism is also found in this population. The increased mutation rate produced by the chronic irradiation has not reduced the amount of chromosomal polymorphism and consequently, the plasticity of the population has probably not been reduced. (KM)

<165>
Auerbach, S.I., D.J. Nelson, R.C. Early, and N.A. Griffith 1964. Safety Evaluation of Clinch River Fisheries. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 103-104), 249 p. (ESD #107, Part)

Commercial food-fish species were collected and analyzed for their radionuclide content. Fish were also collected for analysis from the Clinch and Tennessee Rivers, downstream from the confluence of the Clinch River. Information was collected on consumption of fish in the local areas. The data will be used to ascertain the intake by humans of radionuclides via the aquatic food chain. (KM)

<166>
Olson, J.S.. A Generalized Compartment Model for Ecosystems. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 108-109), 249 p. (ESD #107, Part)

A framework for studies of landscape contamination may be provided by including transfers between systems in models for transfer of substances within ecosystems. Diverse types of variables can be included as radionuclides and their elements, which together constitute total mass and the energy associated with that mass in various parts of the system. (KM)

<167>
Witherspoon, J.P., Jr., and G.N. Brown 1964. Translocation of Cesium 137 from Seed Into New Growth of Tulip Poplar Seedlings. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 90-91), 249 p. (ESD #107, Part)

Cesium 137 follows pathways similar to those of sugar and other foods stored in tissue, such as cotyledons used to sustain the early growth of seedlings. Transfers of this radionuclide in young seedlings are also rapid, as has been demonstrated for mature trees of this species. (KM)

<168>
Witkamp, M., and M.L. Frank 1964. Microbial Mineralization and Immobilization of Radionuclides. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 92), 249 p. (ESD #107, Part)

Uptake of Cs 134 is proportional to the concentration of Cs 134 in the substrate. Leaching of nuclides from sterile litter is positively correlated with temperature. Increasing temperature also increases microbial immobilization of Cs 134 and decreases the amount of Cs 134 in the leachate. Leaching of Cs 134 from oak litter increases with increasing moisture content. Microbial immobilization of Cs 134 is highest on leaf litter with 25-60% moisture. (KM)

<169>

<169>
Witkamp, M., and M.L. Frank 1964. Microbial Effect on Uptake of Radionuclides by Higher Plants. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 92-93), 249 p. (ESD #107, Part)

Soil microbes affect uptake of radionuclides by higher plants in two ways: by accumulating in microbial tissue the same minerals as utilized by higher plants (immobilization) and by liberating minerals from organic matter or mineral compounds for subsequent plant uptake (mineralization). Microbial flora reduced plant accumulation of P 32 by one-half, increased accumulation and concentration of Cs 137, and increased plant growth. Immobilization of nuclides by soil microbes reduced nuclide content in the soil solution. (KM)

<170>
Waller, H.D., and J.S. Olson 1964. Soil Classification and Survey. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 93), 249 p. (ESD #107, Part)

Soils occurring within the White Oak Creek drainage basin belong to the broad groups of red-yellow podsolic, reddish-brown lateritic, and lithosols. The soils are generally strongly leached, acid in reaction, low in organic matter, and have exchange capacities less than 10 meq/100 g of dry weight. The soils occurring in this area have a wide range of physical and chemical properties. (KM)

<171>
Waller, J.D., J.S. Olson, F.G. Taylor, Jr., R.M. Anderson, and W.C. Cate 1964. Transfer and Distribution of Cesium 137 Within the Forest Floor. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 87-89), 249 p. (ESD #107, Part)

Half of the surface income of Cs 137 was contained within the organic layer of the soil, and more than 80% was contained within the organic layer plus the surface 2 cm of mineral soil. Significant differences in distribution of Cs 137 were noted between the six depths within one foot soil cores, between 20 subplots in the 20 x 25 m tagged plots, and between 10 cores within each 5 x 5 m subplot. The mineral turnover may be as great below ground surface as above ground surface in this forest ecosystem. (KM)

<172>
Waller, H.D., J.S. Olson, R.M. Anderson, and W.C. Cate 1964. Dispersion of Cesium 137 Outside of Tagged Forest. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 89-90), 249 p. (ESD #107, Part)

Dispersion of Cs 137 outside the 20 x 25 m study area by falling leaves from tagged trees was measured at the end of the second growing season. Few leaves fell beyond 10 m from the outside boundry. The amount of Cs 137 transported outside the study area by leaves from tagged trees was 2.67 mCi, representing 5.34 uCi/m2 of study site. About 1/5 of the leaves from tagged trees fall outside the 20 x 25m area, but more than 3/4 of this activity is located within a 10 m zone around the perimeter of the area. (KM)

<173>
Nelson, D.J., S.I. Auerbach, B.G. Blaylock, N.R. Kevern, B.C. Patten, G.M. Rosenthal, R.C. Early, N.A. Griffith, and T. Grizzard 1964. Calcium and Strontium in White Crappie Flesh and Bones. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 95-96), 249 p. (ESD #107, Part)

The calcium and strontium concentrations in flesh and bones are constant throughout the year. The average concentration of strontium in fish flesh is essentially the same as that of river water. There is relatively good agreement between the specific activities of Sr 90 in fish bone and water. For any constant release of Sr 90 to the river, it is possible to predict the consequent Sr 90 content of fish bone. Measurement of Sr 90 in flesh will reflect the environmental concentration at the time the fish is collected. The long biological half life of Sr in fish bone suggests that Sr 90 concentrations in bone reflect the average environmental concentrations during the life time of the fish. (KM)

<174>
Crossley, D.A., Jr., and C.L. Corley 1964. Biological Half-Life for Radiocesium in Aphids. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 74), 249 p. (ESD #107, Part)

Bases of nasturtium twigs inserted in aqueous solutions of Cs 134-labeled cesium chloride were infested with APHIS FABAE and biological half-lives were longer than expected for insects of this size. Current work uses milkweed bugs (ONCOPELTUS FASCIATUS) to pursue differences in size-elimination rate relationships. (KM)

<175>
Crossley, D.A., Jr. 1964. Measurement of Heterotrophic Productivity with Radioactive Tracers. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 74-75), 249 p. (ESD #107, Part)

Data obtained for the plant-insect herbivore-insect predator food chain were used for the estimation of heterotrophic production and energy flow at the herbivore level, by combining information on radiocesium (Cs 137) movement and information on biomasses, respiration rates, and caloric content of plants and insects. (KM)

<176>
Dunaway, P.B., L. Lawrence, J.A. Payne, B.E. Jacobs, J.D. Story, T.P. O'Farrell, and G.D. Martin 1964. Hematology of Native Mammals. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, Radiation Ecology Section, (p. 79-82), 249 p. (ESD #107, Part)

The effects of endogenous and environmental factors on the blood of indigenous species were studied. Age, sex, certain diseases, certain parasites, injuries, confinement, and season govern hematopoietic changes. Species specificity and alterations due to a variety of stress conditions are reflected by serum and plasma protein electrophoretic patterns. Some systematic similarities in serum protein patterns readily apparent. The largest and most consistent change in normal serum patterns is characteristically demonstrated by the albumin which can vary with the season and as the result of numerous stress factors. Normal iodine 131-labeled IUDR retention curves for 3 species of native mammals were established to test the potential of this chemical as a physiological dosimeter. Injected animals with higher rates of metabolism incorporated a greater amount of 131 IUDR and apparently had a higher rate of DNA synthesis. (KM)

<177>
Kevern, N.R., N.A. Griffith, G.M. Rosenthal, Jr., and D.J. Nelson 1964. Uptake and Accumulation of Strontium and Calcium by Algae and Snails. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Divison Annual Progress Report for Period Ending July 31, 1964, (p. 96-101), 249 p. (ESD #107, Part)

The comparative uptake of Sr and Ca in OOCYSTIS EREMOSPHAERIA and PHYSA HETEROSTROPHA, was studied in order to obtain information on the behavior of Sr in aquatic environments, particularly with respect to the comparative effects of Ca and Sr in the environment on Sr uptake. The uptake of Ca by the algae is primarily a function of the media concentrations of Ca, with a slight inverse influence by Sr in the media. A slight relative increase in Ca uptake at very low Ca concentrations indicates an increase in uptake efficiency at limiting levels of Ca, and suggests that Ca is required by the alga. Uptake of Sr is directly proportional to Sr in the media, with an enhancement in uptake at very low media concentrations of Ca, suggesting that Sr was used by the algae in place of Ca when Ca was in short supply. Deposition of Ca and Sr in snail shells depends primarily on the respective concentrations of these elements in the immediate environment. There is a slight negative interaction of environmental Sr on Ca deposition and vice-versa. There is a simple substitution of Sr uptake for that of Ca by snail shell when environmental Ca is deficient. Increased environmental Sr depresses Sr uptake, and increased environmental Ca enhances Sr uptake. (KM)

<178>
Kevern, N.R., N.A. Griffith, and T. Grizzard 1964. Biological Half-Life of Cesium 134 in Carp and Two Aquatic Insects. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 101-102), 249 p. (ESD #107, Part)

Two groups of carp were fed a single dose of organic detritus tagged with Cs 134. One group of 10 fish was held at 12.5 degrees Centigrade and the other group of 5 fish was held at 20.0 degrees Centigrade. An initial rapid elimination of the Cs 134 was followed by further elimination at a reduced rate. The initial deposition in the fish of Cs 134 was 6.79% in the cold water, and 6.57% in warm water. Expressed as the biological half-life, the initial rate function was 11.1 days for carp at 12.5 degrees Centigrade and 6.6 days for carp at 20.0 degrees Centigrade. The second rate was 174 days for carp in cold water and 98.1 days for carp in warm water. Cesium 134 biological half-life in mayfly nymphs was 8.3 days and in midge larvae was 3.5 days. (KM)

<179>
Menhinick, E.F., and G.J. Dodson 1964. Radiation Sensitivity of Insects. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 76), 249 p. (ESD #107, Part)

Five species of insects were irradiated in a Co 60 source at 3 or 30 kR/min, and given total doses of 1 to 512 kR in 100% increments. Radiosensitivity varied among the species and among the different stages in the life cycle of the insect. Crickets were the most sensitive insects examined and ants the most resistant species. Grain beetles, milkweed bugs and roaches had similar, and intermediate mean survival times. (KM)

<180>
Menhinick, E.F., and G.J. Dodson 1964. Metabolism of Crickets. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 76-77), 249 p. (ESD #107, Part)

Crickets (ACHETA DOMESTICA) were used to study the feasibility of simultaneous measurements of different aspects of energy flow (ingestion, defecation, oxygen consumption, and production) as part of a larger study on the extent to which radiation may affect energy requirements and thereby cause changes in community structure. Data were collected on meal consumption, cannibalism, feces, oxygen consumption, standing crop, skins, and death and total production was estimated. (KM)

<181>

<181>
Witherspoon, J.P., Jr. 1964. Radiation Studies on Forest Tree Species. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 66-68), 249 p. (ESD #107, Part)

The effects of fast-neutron exposures and gamma-radiation exposures from both a Cs 137 field source and White Oak Lake Bed were studied using PINUS VIRGINIANA and LIQUIDAMBAR STRACIFLUA. Growth abnormalities and lethality at relatively low total dose and low dose rates were greater than expected and are probably due to a combination of radiation and soil moisture stress. (KM)

<182>
Menhinick, E.F. 1964. Strontium 90-Yttrium 90 Beta Source. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, Radiation Ecology Section, (p. 78-79), 249 p. (ESD #107, Part)

Some of the effects of beta radiation were studied as the ground work for studies on the effect of beta radiation on gamma and radiation on insects. The bremsstrahlung spectrum through 4 mils of aluminum and 3/8 in. of plywood as determined with multichannel analyzer and NaI crystal indicated that most energy was less than 200 keV, and was concentrated around 14 keV. Complete shielding of beta particles is obtained by 0.35 in. of wood or 0.20 in. of glass. Feather analysis and dose rate studies indicated that 5 mils of aluminum shielded out most of the 0.54 MeV Sr 90 and at the same time transmitted a large percentage of the 2.2 MeV Y90 beta rays, which was desirable in order to obtain more uniform tissue doses. A plane source 13 in. in diameter gave uniform surface dose rates from the center up to 1 in. from the edge. (KM)

<183>
Plummer, G.L., D.A. Crossley, Jr., and D.A. Gardiner 1964. Analysis of Growth Responses of Two Sedge Species on White Oak Lake Bed. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 65-66), 249 p. (ESD #107, Part)

CAREX FRANKII and C. VULPINOIDEA on White Oak Lake bed, had longer inflorescences than sedges growing on nearby uncontaminated sites. Various soil factors affect inflorescence length but those influences cannot explain the increased length found in radioactive areas. Further studies are needed to determine whether the observed increase in length of inflorescence is a direct response to radiation, an indirect response, the consequence of some purely chemical aspects of waste disposal, or a combination of these. (KM)

<184>
Witherspoon, J.P., Jr., and F.G. Taylor, Jr. 1964. Vegetation Studies around the HPRR. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 66), 249 p. (ESD #107, Part)

Several species of forest trees growing 10 to 20 m from the Health Physics Research Reactor contained many morphological abnormalities, abnormal apical growth, viability, and leaf production were commonly found among the trees. (KM)

<185>
Patten, B.C. 1964. Effects of Radiation Stress on Interspecific Competition. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 104-108), 249 p. (ESD #107, Part)

Analog computer solutions of competition equations, with and without radiation stress, were generated in order to provide a conceptual basis for understanding effects of radiation on interacting systems. (KM)

<186>
Brown, G.N. 1964. Plant Physiological and Biochemical Phenomena as Affected by Ionizing Radiation. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 68-69), 249 p. (ESD #107, Part)

Base levels of nucleic acids are being established in native forest tree species for use in studies aimed at understanding ionizing radiation, environmental interactions, and possible mechanisms underlying such interactions. Soluable RNA/total RNA ratio of irradiated mimosa seedlings varied considerably from that of the controls and the base compositions showed some differences also. The rate of P 32 incorporation into nucleic acids is an estimate of rate of nucleic acid synthesis and will be used to measure the rate of this synthesis under various conditions of gamma irradiation. (KM)

<187>
Taylor, F.G., Jr. 1964. Nuclear Volume Measurements. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 69-70), 249 p. (ESD #107, Part)

A study was initiated to determine the nuclear volumes, through time, of local tree species, in order to predict radiation sensitivity. The volumetric changes of interphase nuclei for 14 local tree species from January to March indicate that initial spring activity of nucleic acids in shoot apices is earlier in eastern Tennessee than would be anticipated from any morphological changes. (KM)

<188>
Blaylock, B.G., and J.P. Witherspoon, Jr. 1964. Environmental Influences on Responses of Metaphosphate Glass. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 70-71), 249 p. (ESD #107, Part)

The influence of temperature and sunlight on radiation response of Toshiba low-Z glass rods was studied to qualify certain of the uses of glass rod dosimetric radiation ecology studies. Predosed rods faded rapidly when exposed to sunlight for 30 hr. exposed in 6-hr increments at about 10,000 ft-c. Field use of these dosimeters demands shielding that will prevent sunlight from striking the glass and compensation of response to large changes in temperature. (KM)

<189>
Crossley, D.A., Jr., and G.J. Dodson 1964. Radiocesium Accumulation and Feeding by Willow Beetles (CHRYSOMELA KNABI Brown). ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 73-74), 249 p. (ESD #107, Part)

Food consumption rates estimated for third-instar larvae from their radiocesium content and from laboratory estimates of biological half-lives in larvae confirm the previous results on insect food chains. Radiocesium concentrations in samples of other life-history stages of the beetle species were consistent with results obtained in laboratory experiments. Reduction in Cs 137 concentration in pupae probably results from clearance of stored metabolites from the larva immediately prior to pupation. Adult stages were more active than larvae, had more rapid elimination rates, and reached lower equilibrium concentrations of Cs 137. (KM)

<190>
Waller, H.D., J.S. Olson, R.M. Anderson, and W.C. Cate 1964. Transfer of Radiocesium to Untagged Understory Plants in a Tagged Forest. ORNL-3697; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1964, (p. 86), 249 p. (ESD #107, Part)

There are two primary pathways of transfer of Cs 137 from tagged tulip poplar trees to untagged understory. The most direct is the interception of cesium rainout from the canopy and subsequent foliar uptake by the untagged understory. The second pathway is the transfer of the cesium from tagged trees to the forest floor and subsequent root uptake by the understory plants. Foliar absorption is about 1,000 to 10,000 time more important in the transfer than uptake from soil. (KM)

<191>
Witherspoon, J.P. 1964, Autumn. Cycling of Cesium 134 in White Oak Trees. Ecological Monographs, 34, 403-420 (ESD #108)

The cycle of Cs 134 in white oak trees was followed from spring, 1960, to autumn, 1961. Three trees on each of four sites differing in soil type and moisture were each inoculated with 2.0 mCi Cs 134. Redistribution of this radioisotope during the growing season was estimated by sampling from inoculated trees, understory, litter, and soil. With rapid translocation into leaves from initial trunk inoculations in the spring, white oak leaves contained 100,000 to 1,000,000 dpm Cs 134 per g dry weight by early June. This represented a total transfer of about 40 per cent of the original input. Radiocesium transferred from trees via annual leaf fall was approximately two times greater than the quantity exported by rain. A definite pattern of distribution, presumably related to leaching and stem flow, was found under tagged trees, with 19 per cent of the soil radiocesium occurring near the trunk and 80 per cent confined to the area underneath the crown. Total annual loss of this radioisotope from inoculated trees was estimated at 19 per cent of the original inoculation. (CO)

<192>
Baker, E.W., and D.A. Crossley, Jr. 1964, June. A New Species of Mite, FUSOHERECIA LAWRENCEI, from an Artificial Tree-Hole (Acarina: Glycyphagidae). Annals of the Natal Museum, 16, 1-6 (ESD #109)

FUSOHERECIA LAWRENCEI new species, is a small, flat, yellowish-brown mite, pointed oval in outline, with finely punctate, heavily sclerotized integument. It is, in general, similar to F. INCREDIBILIS Vitzhum. The two species may be separated by the setation pattern of the body and legs, and in the shorter aedeagus of F. LAWRENCEI. (Auth)

<193>
Menhinick, E.F. 1964, November. Design of Strontium 90 Sources for Ecological Studies Involving Beta Irradiation. ORNL-TM-997; 20 p. (ESD #110)

Three strontium 90-yttrium 90 sources containing 0.08, 0.8, and 8.0 Ci, respectively, giving surface dose rates of approximately 100, 1,000, and 10,000 R/hr, respectively, have been designed for ecological studies. These sources will consist of Sr 90-labeled SrCl2 mixed with sodium silicate and painted on transite plaques which will then be placed in leak-tested aluminum source holders. These sources will be used for acute and chronic beta irradiations of insects, studies in radiation detection by insects, glass rod dosimetry research, and tissue absorption studies. Sources will be operated by personnel of the Radiation Ecology Section. (Auth)

<194>
Patten, B.C. 1964, November. The Systems Approach in Radiation Ecology. ORNL-TM-1008; 22 p. (ESD #111)

The applications of graph theory and compartment theory to radio ecological problems which concern the relationships between structure and function in coupled ecosystems is described. These two areas of mathematics are being explored to provide a general conceptual basis for unification of a developing program in Systems Ecology at ORNL. (Auth)

<195>
Johnson, R.M. 1964, December. The Herpetofauna of the Oak Ridge Area. ORNL-3653; 26 p. (ESD #112)

The herpetofauna of the Oak Ridge area was investigated (a) to ascertain the kinds of amphibians and reptiles (herptiles) occurring in the area, (b) to evaluate habitat preferences of the herptiles, (c) to evaluate the suitability of the various species populations for ecological investigations, and (d) to prepare a reference collection of herptiles of the area. Collecting was performed by (a) prowling about the various kinds of habitats by day and by night and collecting by hand, (b) walking transects by day and by night and collecting by hand, (c) trapping with hardware-cloth drift fences and funnel traps in terrestrial habitats, (d) using dipnet, funnel traps, and hoop nets in aquatic habitats, and (e) driving roads by day and by night. The most productive method of collecting in terrestrial habitats and streams was hand collecting; in fluvial and pond habitats it was with dipnet, funnel trap, and hoop net. The numbers of monotypic species of herptiles collected are as follows: salamanders, 3; anurans, 2; turtles, 2; lizards, 4; and snakes, 2. The numbers of polytypic species collected are as follows (numbers in parentheses are subspecies represented): salamanders, 4 (4); anurans, 10 (12), turtles, 8 (10); lizards, 1 (1); and snakes, 15 (18). The largest numbers of species and specimens were collected in flood-plain and pond habitats; the least numbers were collected in pine plantations. Herptiles judged as occurring in populations of sufficient size, seasonal availability, and ease of sampling for extensive field and laboratory investigations are as follows: DESMOGNATHUS FUSCUS; HYLA VERSICOLOR; ACRIS CREPITANS; RANA CLAMITANS; R. PALUSTRIS; CHRYSEMYS PICTA; PSEUDEMYS SCRIPTA; NATRIX SEPTEMVITTATA; and N. SIPEDON. A reference collection containing specimens of each species and subspecies collected was prepared and deposited with the Radiation Ecology Section, Health Physics Division. (Auth)

<196>
Patten, B.C. 1965, February. Community Organization and Energy Relationships in Plankton. ORNL-3634; 58 p. (ESD #113)

The objective of this study has been to examine the complex problems of thermodynamics and biological structure of communities of phytoplankton. Quantitative analysis of the energy flux and material that forms the life of a community has been examined by field observations and experiments, laboratory studies, mathematical analysis of energy-depth relationships, and computer simulation models basic to considerations of energy and matter exchange. Although work has not been completed, the approach taken has given new perspective and has reinforced one major premise, ecological communities are adaptive. (BBM)

<197>
Olson, J.S. 1964, Fall. Advances in Radiation Ecology. Nuclear Safety, 6(1), 78-81 (ESD #114)

The aims and scope of radioecology are discussed. Radioecology is an interdisciplinary field that has special interest in photoecology, ecology of ionizing radiation, environmental movement of radioactive nuclides and the use of tracers and radiation in basic and applied studies on the organization and activities of populations and ecosystems. The general review papers presented at the First National Symposium on Radioecology are discussed very briefly. (KM)

<198>
Cosgrove, G.E., T.P. O'Farrell, S.V. Kaye, and D.B. Dunaway 1964, October. Infection of Laboratory-Reared and Wild Cotton Rats with Cat Tapeworm Larvae. Journal of the Tennessee Academy of Science, 39(3), 140-141 (ESD #115)

Both wild and laboratory-bred cotton rats, SIGMODON HISPIDUS, have been found to be intermediate hosts of the cat tapeworm, HYDATIGERA TAENIAEFORMIS, when living or caged in areas subject to contamination by house cat feces. The larval tapeworms encyst in the livers of the cotton rats in varying numbers. It appears that the rate of infection in cotton rats in East Tennessee may depend on the proximity to human habitations with associated house cats. Implantation of radioactive tags in cotton rats led to ease of recovery of the bodies when deaths occurred in large field pens. (Auth)

<199>
Dunaway, P.B., and L.L. Lewis 1965, January. Taxonomic Relation of Erythrocyte Count, Mean Corpuscular Volume, and Body Weight in Mammals. Nature, 205(4970), 481-484 (ESD #116)

An intrafamily relation of erythrocyte number and mean corpuscular volume to body weight is discussed. The number of erythrocytes per mm3 was inversely related to the body weights of the species in each of the families studied from the Oak Ridge area (Soricidae, Sciuridae, Cricetidae and Muridae). Hematocrit percentages for these same families ranged from 39 to 49. There appears to be a tendency for the lightest species of a family to have relatively high hematocrit percentages and for the heaviest species of each family to have relatively low percentages. The effects of altitude on blood apparently vary according to species of animal involved. Latitude may be important in considerations of comparative hematology. (KM)

<200>
Blaylock, B.G. 1965, January. A Method for Preparing Salivary-Gland Chromosomes. Drosophila Information Service, 40, 97 (ESD #117)

A modification of a method used by Keyl and Keyl for CHIRONOMUS salivary chromosomes produces good results with Drosophila. The staining time is short and due to good resolution of the fine bands on a clear background with wide distribution of the chromosomes, the specific regions of the chromosomes may be readily studied. The details of the method are described. (KM)

<201>
Taylor, F.G., Jr. 1965. Nuclear Volume Changes in Southeastern Tree Species Before Spring Growth. Radiation Botany, 5, 61-66 (ESD #118)

The nuclear volume of shoot apex cells of most of 14 local tree species at Oak Ridge, Tennessee, increased before spring growth. Between January and March PINUS STROBUS and P. TAEDA showed the greatest increase in nuclear volumes from 631 u3 + or - 38.49 SE to 1113 u3 + or - 43.12 and from 638 u3 + or - 26.67 to 1026 u3 + or - 23.41 respectively. The nuclei of CORNUS FLORIDA showed no response to approach of spring activity, remaining unchanged from 99 u3 + or - 2.85 to 100 u3 + or - 5.79, while four sspecies of ACER showed increases (45-199 u3 + or - in January to 83-264 u3 in March). (Auth)

<202>
Brown, G.N. 1965, May. Temperature Controlled Growth Rates and Ribonucleic Acid Characteristics in Mimosa Epicotyl Tissue. Plant Physiology, 40(3), 557-561 (ESD #119)

Mimosa seedlings (ALBIZZIA JULIBRISSIN DURAZZINI) were germinated at controlled rates by varying temperature conditions. Quantities of soluble ribonucleic acid (sRNA) per unit dry weight varied between samples, but were not correlated with growth rates. Base compositions of sRNA, however, were correlated with growth rates, particularly the quantities of guanine and uracil. Results suggested a relationship between environmental conditions and differential synthesis of sRNA molecules. Base compositions of total RNA were found to differ from those of sRNA. (Auth)

<203>
Dunaway, P.B., and S.V. Kaye 1962. Effects of Radiation on Mammalian Population Dynamics. Part of Proceedings of the First International Conference on Wildlife Disease held in High View, New York, June 24-28, 1962, (p. 141-151) (ESD #120)

A review of the current work on radiation effects on mammals reveals that radiation can have damaging or lethal effects on the nerous system, gastrointestinal epithelium, hematopoietic tissues, and embroyos, and can cause neoplasms, a reduction in the life span, reduction in litter size, chromosomal aberrations, and gentic mutations. Exposure to cold, fatigue, diet, and copulation can effect the survival rate of irradiated mammals. Ionizing radiation in nature can be considered as a stress factor added to natural environmental stresses already present. The difficulities of studying radiation effects on wild mammal populations are great but the need for this information is pressing. (KM)

<204>

<204>
Van Dyne, G.M., and J.L. Van Horn 1965. Distance Traveled by Sheep on Winter Range. Part of Proceedings of the Annual Meeting of the Western Section of the American Society of Animal Sciences held in Fort Collins, Colorado, July 12-14, 1965. Published in Proc. West. Sect. Amer. Soc. Animal Sci., 16(74), 1-6 (ESD #121)

Distance traveled and elevation climbed by sheep on a foothill winter range in Montana were measured and used to calculate energy expenditure, which was compared to climatic variations and to dietary chemical composition, measured with esophageal fistulated sheep. The band's travel route during 31 days was plotted on aerial photographs. The distance traveled by three wethers in the band was measured for 41 sheep-days with metering devices harnessed to the sheep. The average distance traveled by individual sheep was 1.6 times that measured from aerial photographs for band travel. Wind movement, temperature, and relative humidity were measured winterlong. The calculated distance traveled by sheep in the band averaged winterlong was 7.6 km. Elevation climbed each day, determined from 12.2 m interval contour maps, varied from 85 to 280 m. Energy expenditure for grazing, calculated using Blaxter's constants of .030 and .322 kcal/m respectively for horizontal and vertical movement for a 50 kg sheep, varied from 137 to 406 kcal/day per sheep. The average energy expenditure for grazing, 235 plus or minus 62 kcal/day of which less than 3% was expended for climbing, represents about 20% of the basal metabolic requirement. Dietary samples collected from seven esophageal fistulated ewes grazing in the band were analyzed for crude protein, ether extract, lignin, and cellulose which averaged, respectively, 7.0, 3.1, 14.8, and 41.6% during the winter. Wind movement was the most important climatic variable affecting energy expenditure by the grazing sheep. There was no apparent lag influence of climate on energy expenditure for grazing. (KM)

<205>
Van Dyne, G.M. 1965. Probabilistic Estimates of Range Forage Intake. Part of Proceedings of the Annual Meeting of the Western Section of the American Society of Animal Science, held in Fort Collins, Colorado, July 12-14, 1965. Published in Proc. West. Sect. Amer. Soc. Animal Sci., 16(7), 1-6 (ESD #122)

A method is described for generating a population of forage intake values about the mean value of forage intake so that the nature of the distribution may be examined. This method is applied to data from range nutrition studies in which microdigestion techniques were used to calculate mean forage intake. Daily forage intake (F) may be calculated by the equation: F = (100 x E sub c x E) / (100 x F sub c - F sub c x F sub c), where E is the amount of feces produced per day, E sub c is the percent cellulose content of the feces, F sub c is the percent cellulose content of the diet and M sub c is the percent microdigestion of the dietary cellulose. The means and standard deviations of these four variables are obtained by sampling and these values are assumed to be normally distributed. Correlations between E sub c and M sub c, and E and M sub c may be evaluated because estimates of these three variables are obtained concomitantly from a given group of animals. Estimates of F sub c are usually obtained from a second group of animals that graze with the first group. The mean and distribution of estimates of the forage intake may be obtained by generating values of F calculated with the above equation from independently or dependently selected values of E sub c, E, and M sub c and independently selected values of F sub c. (Auth) (BBM)

<206>
Lewis, L.L., and P.B. Dunaway 1965, June. Techniques for Hematological Studies of Wild Animals. ORNL-3806; 20 p. (ESD #123)

Modern instruments and techniques make possible the utilization of small amounts of blood for red and white blood cell counts, cell size distributions, hemoglobin concentrations, packed cell volumes, mean cell volumes, and electrophoretic separations of plasma protein fractions. Electronic particle counters can be used to enumerate blood cells much faster and more accurately than was heretofore possible. Hemoglobin determinations can be made from the remainder of the suspension of hemolysed blood used for leukocyte counts. Plasma from microhematocrit tubes also can be used for electrophoretic protein separations. These hematological techniques can be utilized in studies of small wild mammals from which only minute quantities of rapidly-clotting blood are available. (Auth)

<207>
Blaylock, B.G., and J.P. Witherspoon, Jr. 1965. Environmental Factors Affecting Glass Rod Dosimetry. Health Physics, 11, 549-552 (ESD #124)

Application of glass-rod dosimetry is increasing in field radiation ecology studies. To qualify certain of these field uses, a study was made on the influence of temperature and sunlight on radiation response (fluorescence) of Toshiba low-Z rods. In a temperature range of 3.5 to 53.5 degrees Centigrade, rods showed no change in response to beta radiation from Cs 137 solutions. The response to Cs 137 gamma rays, however, increased with increasing temperature. A linear expression describing this increase is Y=4.32 + 0.014X, where Y is fluorometer units per rad, and X is temperature (degrees Centigrade). Predosed rods were found to fade (lose fluorescence) exponentially when exposed to sunlight for 30 hr, given in 6-hr increments at about 104 ft-c. Rods lost 37 to 46% of the dose during the first 6-hr exposure. Fading was also related to predose, as high-predosed (5515 fluorometer units) rods had a significantly greater ($P < 0.01$) percentage of fading than low-predosed (396 fluorometer units) rods. The effectiveness of several kinds of shields was studied, and nylon plastic shields painted black were found to prevent fading when tested by 24-day exposures on White Oak Lake bed. (Auth)

<208>
Van Dyne, G.M. 1965, May. A Further Note on Random Locations for Sample Units in Circular Plots. Journal of Range Management, 18(3), 150-151 (ESD #125)

Radii are presented for sample locations for eight different circular sampling areas with or without center areas restricted from sampling. The sampling areas have a maximum radii varying from 25 to 200 feet and the restricted center is calculated at 0, 10 and 20% of the maximum radius. The smaller areas have been especially useful in dense vegetation in pasture and ecological studies in the Southeast. The medium areas were appropriate for investigations on annual and perennial foothill grasslands and the larger areas were useful in studies on salt desert shrubs or other low-growing shrub types wherein distances from the center marker posts can be readily taped. By taking an approximate bearing on the desired direction and by pacing in that direction for the desired distance, personal bias in the choice of location of sampling points is eliminated. (KM)

<209>
Anderson, R.M., B. Barzansky, L.J. Bledsoe, D.A. Crossley, Jr., G.J. Dodson, M.L. Frank, S.V. Kaye, B.C. Moulder, J.S. Olson, L.N. Peters, D.E. Reichle, M.H. Shanks, R.L. Tabor, W.A. Thomas, H.D. Waller, M. Witkamp, and P.B. Whitford 1967. Radionuclide Cycling in Terrestrial Ecosystems. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 79-92), 118 p. (ESD #125, Part, Section)

There was a loss of about one-half of the radiocesium from the forest canopy during each growing season and a corresponding decrease in absolute loss rates. Almost all the radioactivity in the ground vegetation appeared to be due to contamination from rain leaching from the overhanging canopy of tree leaves. Five years of research, including laboratory studies on insect feeding, have clarified many problems related to the animal food chains which depend on live tree foliage or litter. Studies discussed were: 1) accumulation of Cs 137 in soils of the tagged LIRODENDRON forest; 2) microbial immobilization of radionuclides in the field; 3) Cs 137 transfer in terrestrial microcosms; 4) tropic level concentration of Cs 137, Na and K in forest arthropods; 5) body size and bioenergetic relations in forest arthropods; 6) elimination rates of radiocesium by spiders as a function of temperature and body size; 7) radioactive tungsten retention by insects; 8) cycling of Ca 45 by dogwood trees; 9) biomass regression relations for the El Verde Rain Forest in Puerto Rico; and 10) foliar applications of Cs 137 on understory species of mesic forest. (HP)

<210>
Childs, H.E., Jr., and G.E. Cosgrove 1966, October. A Study of Pathological Conditions in Wild Rodents in Radioactive Areas. The American Midland Naturalist, 76(2), 309-324 (ESD #126)

Comparisons were made using wild PEROMYSCUS LEUCOPUS, SIGMODON HISPIDUS, and ORYZOMYS PALUSTRIS from radiocontaminated and uncontaminated sites. The studies included length measurement, body weight, spleen and adrenal weights, gross and microscopic necropsy examination, determination of packed red cell volume and differential leukocyte count, and collection of parasites. No significant differences attributable to exposure to radiation were seen. Many lesions were encountered at necropsy of the animals; but they were usually incidental findings not seriously threatening the health of the host. There was a wide range in hematologic values probably due in part to differing incidental disease and parasite burdens. The presence of CUTEREBRA bot larvae in P. LEUCOPUS led to significant reduction in the hematocrit. There was a high incidence of parasitism in all three species, but associated pathologic changes were not serious in most instances. It appears that diseased animals are rapidly removed from wild populations and are not ordinarily recovered in a study of this nature. The levels of radiation exposure are probably too low to result in somatic effects in exposed animals during their short life in the wild. (Auth)

<211>
Rosenthal, G.M., D.J. Nelson, and D.A. Gardiner 1965, July 3. Deposition of Strontium and Calcium in Snail Shell. Nature, 207(4992), 51-54 (ESD #127)

The relative effect of strontium and calcium concentrations in the environment on their uptake and incorporation into snail shell was demonstrated. Strontium and calcium concentrations were rigidly controlled by assay of the Sr and Ca of all chemicals used. Deposition of both chemicals in the shell of PHYSA HETEROSTROPHA depends primarily on the respective concentrations of these elements in the immediate environment. A slight negative interaction of Sr on Ca deposition and vice versa was noted. A simple substitution of Sr uptake for that of Ca by snail shell occurs when environmental Ca is deficient. Sr uptake increases with increasing environmental Sr concentrations and decreases with increasing environmental Ca concentrations to a certain concentration at which point the opposite behavior is noted. This effect is probably related to some physiological property of the mantle cells, possibly to membrane phenomena or secretory activity. (KM)

<212>
Nelson, D.J. 1965, June. Strontium in Calcite: New Analyses. Public Institute of Marine Science, Texas, 10, 76-79 (ESD #128)

Calcite specimens from the Brush Mineralogical Laboratory, Yale University, were analyzed for Sr and Ca and were considered a reference material to resolve a difference in published values for Sr-Ca ratios in freshwater mollusks. The new analyses showed the earlier published Sr concentrations were high by as much as an order of magnitude. These new data extend the lower range of Sr-Ca ratios in naturally occurring calcium carbonate minerals to 0.0224 Sr atoms per 1000 Ca atoms. (Auth)

<213>

<213>
O'Farrell, T.P. 1965, August 26. The Rabbits of Middleton Island, Alaska. Journal of Mammalogy, 46(3), 525-527 (ESD #129)

The introduction of rabbits (ORYCTOLAGUS CUNICULUS) in 1954 onto Middleton Island is described. The original population consisted of three females and one male. By the summer of 1962 the estimated population was 5000 rabbits. The population may be kept in check by the weather. There is no evidence of vegetation destruction or scarcity of rabbit forage. The role of avian predators is unknown. (KM)

<214>
Brown, G.N., J.W. Curlin, J.S. Olson, G.M. Van Dyne, J.P. Witherspoon, M. Witkamp, R.M. Anderson, W.C. Cate, M.L. Frank, F.G. Taylor, Jr., H.D. Waller, G. Cristofolini, and S. Cristofolini 1965. Processes and Components of Terrestrial Ecosystems. ORNL-3849; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1965, (p. 64-79), 109 p. (ESD #130, Part, Section)

The section includes studies on isotope release from decaying leaves, losses of Cs 137 from the tagged LIRIODENDRON stand, transfer of Cs 137 from trees to forest undercover vegetation, nuclide transfer and microbial respiration, radiocesium movement in THYRIDOPTERYX EPHEMERAEFORMIS feeding on tagged JUNIPERUS VIRGINIANA, biological half-lives of Cs 134 in forest floor arthropods, cesium turnover in forest cryptozoa, forest floor tagging with Cs 137, pilot studies of herbaceous interception of Cs 137 soil and forest site studies of the Oak Ridge reservation, forest management, succession of Oak Ridge vegetation, succession at Copperhill, Tennessee, prediction of weight composition from point samples and a procedures for random locations of sample units in circular plots. (FMM)

<215>
Auerbach, S.I., B.G. Blaylock, N.R. Kevern, D.J. Nelson, B.C. Patten, R.C. Early, N.A. Griffith, M.C. Merlini, and R.L. Iverson 1965. Clinch River and Related Aquatic Studies. ORNL-3849; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1965, (p. 79-88), 109 p. (ESD #130, Part, Section)

This section includes studies on deposition of Sr and Ca in snail shells, microchemical constituents of contemporary and Indian midden clam shells, population genetics and radiation effects studies on CHIRONOMUS TENTANS and DROSOPHILA MELANOGASTER, Cs 134 distribution, transport, and retention in the tissues of the carp (CYPRINUS CARPIO), feeding rate and metabolism of carp in White Oak Lake, chronic low-level radiation effects on carp reproduction, and Sr 90 and primary productivity by plankton from Melton Hill Lake. (FFM)

<216>
Patten, B.C., J.S. Olson, G.M. Van Dyne, and L.J. Bledsoe, Jr. 1965. Theoretical and Systems Ecology. ORNL-3849; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1965, (p. 89-100), 109 p. (ESD #130, Part, Section)

This section includes studies on odd-even relationships in food webs, equilibrium specific activity in two-compartment exchange systems, stationary distribution and turnover of radioactivity in a hypothetical food chain, a digital computer program for compartment model similations of cycling and succession, redistribution of Cs 137 in a LIRIODENDRON forest, Cs 134 leaching from terrestrial microcosms, a model of Cs 134 distribution in the carp, animal-climatic interactions, probabilistic estimates of forage intake, application of some operations research techniques to ecological analysis problems, and information and parameters required for modeling macroecosystems. (FMM)

<217>
Auerbach, S.I., G.N. Brown, D.A. Crossley, Jr., J.W. Curlin, P.B. Dunaway, J.M. Inglis, E.F. Menhinick, J.A. Payne, D.E. Reichle, A.F. Shinn, J.P. Witherspoon, G.J. Dodson, L.L. Lewis, T.P. O'Farrell, M.H. Shanks, J.D. Story, and F.G. Taylor, Jr. 1965. Radiation Effects and Radioactive Waste Area Studies. ORNL-3849; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1965, (p. 45-64), 109 p. (ESD #130, Part, Section)

The section includes vegetation studies around the Health Physics Research Reactor, the effects of Co 60 gamma radiation on potted seedlings of PINUS VIRGINIANA and stem cuttings of POPULUS DELTOIDES, biochemical mechanisms influencing effects of ionizing radiation, seasonal changes in radiosensitivity in cocklebur (XANTHIUM CHINENSE), effects of fast neutron irradiation on uptake of Zn 65 in potted red oak (QUERCUS RUBRA) seedlings, transport of radioactive materials by mud-dauber wasps where a survey of the ORNL area and the general vicinity of the waste disposal area of the adjoining AEC Reservation was conducted to determine the distribution of radioactive mud-dauber nests, radiocesium retention by suctorial insects, namely the bean aphid, APHIS FABAE, and milkweed bugs, ONCOPELTUS FASCIATUS, radiosensitivity of thirteen species of insects and other terrestrial arthropods, radiation profiles of European brown crickets (ACHETA DOMESTICA) and mealworms (TENEBRIO MOLITOR) and of the evergreen bagworm, (THYRIODOPTERYX EPHEMERAEFORMIS), radiosensitivity of immature stages of the giant milkweed bug (ONCOPELTUS FASCIATUS), effects of beta irradiation on cricket nymphs (ACETA DOMESTICA), mealworms (TENEBRIO MOLITOR), American roach nymphs, (PERIPLANETA AMERICANA) and German roach nymphs (BLATTELLA GERMANICA), radiosensitivity of indigenous small mammals and incorporation of 5-131 iodo-2'-deoxyuridine into cotton rats, SIGMODON HISPIDUS, as an aid in interpretation of whole-body retention curves and to measure changes in incorporation following acute radiation of the same species. (FMM)

<218>
Cosgrove, G.E., and T.P. O'Farrell 1965, August 26. Papillomas and Other Lesions in the Stomachs of Pine Mice. Journal of Mammalogy, 46(3), 510 (ESD #131)

Fifty mice (MICROTUS PINETORUM) were captured in uncontaminated environs of Oak Ridge National Laboratory. Nineteen mice had stomach lesions while 31 did not. Gastronomic abnormalities included five cases of gastric squamous papilloma or epithelial hyperplasia, eight cases of gastric submucosal edema, three cases of focal calcification of gastric muscle, and seven cases of acute or chronic gastritis. The cause of the papillary lesions was not determined. (KM)

<219>
Blaylock, B.G. 1965, September 29. Chromosomal Aberrations in a Natural Population of CHIRONOMUS TENTANS Exposed to Chronic Low Level Radiation. Evolution, 19(3), 421-429 (ESD #132)

Salivary chromosomes of CHIRONOMUS TENTANS larvae were analyzed in samples taken from White Oak Creek, an area contaminated with low level radioactive waste, and were compared with samples from two other populations. The amount of chromosomal polymorphism in the irradiated and nonirradiated populations was approximately the same with an average of 0.53 and 0.55 aberration per larva respectively. However, 10 aberrations which occurred at a very low frequency (nine were found only one time) were unique to the irradiated population. It was concluded that the occurrence of new aberrations in the White Oak Creek population was increased by the high background radiation level, and that these new aberrations were rapidly eliminated by selection or genetic drift. (Auth)(CO)

<220>
Witherspoon, J.P., and G.N. Brown 1965. Translocation of Cesium 137 from Parent Trees to Seedlings of LIRIODENDRON TULIPIFERA. Botanical Gazette, 126(3), 181-185 (ESD #133)

Movement of Cs 137 was followed from floral parts of inoculated trees, through seed maturation, and into components of germinated seedlings of yellow poplar (LIRIODENDRON TULIPIFERA L.). Radiocesium concentrations and dry weight in fruit increased during the growing season until early fall, then decreased slightly. During the first three weeks of growth, the cotyledons of germinated seedlings lost about half of their Cs 137 content to other rapidly growing tissues. During the next four weeks, additional radiocesium was translocated into new leaf growth while stem and root levels tended to remain relatively stable. From the seventh to the tenth week of growth, a large influx into roots occurred, and other plant components exhibited a decrease in radiocesium. The data indicated that Cs 137, in both fruit and seedlings (e.g., cotyledons), followed pathways paralleling those of sugars and other translocated organic substances that may be stored in tissues later used to sustain early seedling growth. In addition, the study showed that appreciable quantities of radiocesium, and presumably other alkali metal elements, may be transferred from parent trees to second generation plants. (Auth)

<221>
Van Dyne, G.M., G.F. Payne, and O.O. Thomas 1965, September 7. Chemical Composition of Individual Range Plants from the U.S. Range Station, Miles City, Montana, from 1955 - 1960. ORNL-TM-1279; 24 p. (ESD #134)

In developing and testing complex simulation models for macroecosystems, many data will be needed on chemical constituents in and digestibility of diets consumed by domestic and wild animals. Individual data will be required in order to assess the precision of estimates. The individual data presented herein are previously unpublished information on chemical composition of some important native plants of the Northern Great Plains. Methods of sample collection, preparation, and chemical analyses are described. Chemical constituents reported include crude protein, ether extract, lignin, crude fiber, carotene, total ash, silica, calcium, phosphorus, and nitrogen free extract. The data are identified by the Latin name of the plant, phenological stage at which the plant was sampled, and the date of sampling. Data are presented for 459 samples of the entire current year's growth and for 94 samples collected to represent only the portion of the plant which was grazed by cattle. Graphs are presented in which between year and within year variations in chemical constituents are reported separately for grasses and grasslike plants and for shrubby plants. (Auth)

<222>
Morton, R.J. (Ed.) 1965, October. Status Report No. 5 on Clinch River Studies. ORNL-3721; 149 p. (ESD #135)

The fifth status report of the Clinch River studies is a summary of work in progress from April 26, 1962 to December 4, 1963. Detailed information is given for the following areas of investigation: water sampling and analysis; radioactivity in bottom sediments; biological phases; hydrologic measurements and analyses; and safety evaluations. Separate abstracts have been entered into the data base for each of these sections. (BBM)

<223>

<223>
Morton, R.J. (Ed.) 1965, October. Water Sampling and Analysis. ORNL-3721; Part of Status Report No. 5 on Clinch River Study, (p. 15-27), 149 p. (ESD #135, Part)

The stable inorganic chemical composition of the Clinch and Tennessee Rivers has been fairly constant, except for a wide variation in the suspended sediments and a few other related constituents. The predominant constituent in both rivers is the anion bicarbonate, and the predominant cation is calcium. Turbidity, apparent color, and centrifuged color have a positive correlation with suspended solids. Iron and manganese, and at some stations silica and potassium, vary in the same manner as the suspended material in the water, suggesting that those constituents are present in the water primarily as solid particles. In the Tennessee River, the specific conductance of the water varies directly with the content of the major ionic constituents in the water with the notable exceptions of calcium and bicarbonate. These two constituents are not related to specific conductance in the Clinch River. The suspended sediment content, turbidity, and color of Tennessee River water vary directly with discharge, but this pattern was not appearent in the Clinch River. Little radioactive contamination is introduced into the Clinch River through surface drainage at any place in the Oak Ridge reservation except White Oak Dam and the ORGDP area. (KM)

<224>
Morton, R.J. (Ed.) 1965, October. Radioactivity in Bottom Sediments. ORNL-3721; Part of Status Report No. 5 on Clinch River Study, (p. 28-78), 149 p. (ESD #135, Part)

Two important factors that may influence the deposition and retention of radioactive materials in bottom sediments of the Tennessee River system were identified: annual variations in the radionuclide loads released through White Oak Dam; and channel geometry. Other factors which have been identified include minerology, particle size, water depth, and exchangeable calcium in the sediment. Analysis of sediment cores revealed that there was a general pattern of variation of gross gamma activity with depth of sediment. The variations of sediment activity were very similar to variations in the annual quantities of Cs 137 released through White Oak Dam. A very small fraction of the ruthenium released to the river was in the sediments. Desorption from sediments of cesium, strontium, cobalt and ruthenium is discussed. The overall longitudinal trend in levels of radiation in bottom sediments of the Clinch River is for the levels to increase as the distance downstream from White Oak Creek increases. Radioactivity of sediment in the Clinch River sloughs is within the range of radioactivity in the main river channel and in some places is several times the background radioactivity. Data on gamma count is presented for the two rivers. (KM)

<225>
Morton, R.J. (Ed.) 1965, October. Safety Evaluation Studies. ORNL-3721; Part of Status Report No. 5 on Clinch River Study, (p. 130-137), 149 p. (ESD #135, Part)

Strontium 90 is the most important of the critical radionuclides released to the Clinch River but its concentration is not a threat. There is at present no danger of significant quantities of fission products entering man's diet because of crop irrigation. (KM)

<226>
Morton, R.J. (Ed.) 1965. Biological Phases. ORNL-3721; Part of Status Report No. 5 on Clinch River Study, (p. 89-106), 149 p. (ESD #135, Part)

Data are presented on the quantities of radionuclides in fish which form parts of the food chains leading to man. Ca and Sr concentrations in flesh and bone of white crappie were constant throughout the year. The average concentration of Sr in the flesh was essentially the same as that in the river. The long biological half life of Sr in fish bone suggests that Sr 90 concentrations in the bone of river fish will reflect environmental concentrations during the life time of the fish. The short biological half life of Sr in fish flesh means that fish flesh will quickly reflect any changes in Sr 90 concentration in the environment. The use of radioactive scale rings to study fish movement with respect to radioactive areas was superior to conventional tagging techniques. (KM)

<227>
Morton, R.J. (Ed.) 1965, October. Hydrologic Measurements and Analyses. ORNL-3721; Part of Status Report No. 5 on Clinch River Study, (p. 107-129), 149 p. (ESD #135, Part)

The effects of power waves on dispersion were studied in order to define the influence of power releases from Melton Hill Reservoir on the transport of radionuclides in the river system downstream. The changes in the flow of the Clinch River after the completion of the Melton Hill power station were studied in respect to radionuclide dispersion in order to discover possible means of predicting dispersion and resultant concentrations of contaminants released to the river. (KM)

<228>
McMaster, W.M., and M.D. Waller 1965, May. Geology and Soils of White Oak Creek Basin, Tennessee. ORNL-TM-1108; 35 p. (ESD #136)

Description of the geologic setting, characteristic soils, and general hydrologic characteristics of the geology and soils of the White Oak Creek basin is given. This area has received continuous release of radioactive wastes, and the natural factors affecting movement or retention of the radionuclides released is necessary for an understanding of the manner in which they move through or are stored in the basin. The basin is underlain by four major geologic formations. The two oldest, the Rome Formation and the Consauga Group, are made up of shale, siltstone, sandstone and limestone and are poor water-bearing formations. The two younger formations, Knox Dolomite and Chickamauga Limestone, are the principal water-bearing formations of the basin and discharge from the Knox is the main source of base flow in White Oak Creek. The soils of the basin belong to the red-yellow podzolic, the reddish-brown laterite and lithosol groups. They are strongly leached, low in organic matter, acidic, and generally have exchange capacities of less than 10 milliequivalents per 100 gm of soil. Soil profiles range in depth from 6 inches to about 15 ft in the dolomite and alluvial areas. Textures are from silty loam to plastic clay, and infiltration capacities range from 10 in/hr to less than 0.2 in/hr. Clay minerals present include illite, kaolinite, and montmorillonite. Base saturation ranges from 10 percent to more than 60 percent. (BBM)

<229>
Curlin, J.W. 1965, September 25. Forest Management Plan, AEC Oak Ridge Reservation. ORNL-TM-1317; 46 p. (ESD #137)

Twenty-one thousand acres of the reservation were placed under forest management with the aim of maximizing the yield and quality of timber, and assuring a sustained yield of high quality stumpage that will attract permanent woodusing industries to the area. Information on forest productivity and management data will be gathered for the ecological research program. (KM)

<230>
Van Dyne, G.M. 1965, December. REGRESS - A Multiple Regression and Correlation Program With Graphic Output for Model Evaluation. ORNL-TM-1288; 56 p. (ESD #138)

This general multiple regression and correlation program was written with the intent of being simple and yet flexible. The program will handle up to 60 variables and will give summary statistics on the input variables as well as correlation and regression analyses. Deviations from the model are calculated and a variety of Calcomp plots are available. Options within the program allow reading data from cards or tape, variable format or standard format, names generated or names read in, weighted regression or nonweighted regression, a variety of transgenerations, regression through the origin or not through the origin, plots of each variable against deviations from the model and/or plots of each independent variable against each other independent variable and/or plots of each independent variable against the dependent variable, or plots of the dependent variable with each independent variable with the dependent variable corrected for differences of all other independent variables from their means. The program is written in FORTRAN 63 and is available as a main program, REGRESS1, or as a subroutine REGRESS2. (Auth)

<231>
Payne, J.A. 1965. A Summer Carrion Study of the Baby Pig SUS SCROFA Linnaeus. Ecology, 46(5), 592-602 (ESD #139)

A carrion study of the baby pig, SUS SCROFA LINNAEUS, was conducted during the summers of 1962 and 1963 in a mixed mesophytic hardwood-pine community at Clemson, South Carolina. Six stages of decomposition were delimited for carrion exposed to arthropods: fresh, bloated, active decay, advanced decay, dry, and remains. Five stages were recognized for carrion protected from arthropods: fresh, bloating and decomposition, flaccidity and dehydration, mummy, and desiccation and disintegration. Carrion free of insects decomposed and dried very slowly, retaining its form for many months, while 90% of the carrion open to insects was removed in 6 days. Carrion temperature during the bloated through advanced decay stages differed widely from that of air or soil. A definite ecological succession occurred among the fauna of carrion. Each stage of decay was characterized by a particular group of arthropods, each of which occupied a particular niche. Their activities were influenced by physical properties of carrion, rapidity of putrefaction, time of day, and weather. A total of 522 species representing 3 phyla, 9 classes, 31 orders, 151 families, and 359 genera were collected from decomposing pigs. Four orders of arthropods (Coleoptera, Diptera, Hymenoptera, and Araneida) accounted for 78% of the carrion fauna. Two coleopterous families, Histeridae and Staphylinidae, and three dipterous families, Sarcophagidae, Calliphoridae, and Muscidae, represented 26% of the fauna. (Auth)

<232>
Van Dyne, G.M. 1965. Chemical Composition and Digestibility of Plants from Annual Range and from Pure-Stand Plots. Journal of Range Management, 18(6), 332-337 (ESD #140)

Comparisons were made of within-plant weight distribution, chemical composition by plant part, and total plant digestion by nylon bag technique of mature annual grasses and forbs collected from pure-stand plots and adjacent range. Under the conditions of this experiment it would be erroneous to grow, harvest, and analyze plants from pure-stand plots in order to make inferences about their nutritive value under range conditions. (Auth)

<233>

<233>
Blaylock, B.G. 1966. Chromosomal Polymorphism in Irradiated Natural Populations of CHIRONOMUS. Genetics, 53(1), 131-136 (ESD #141)

Chromosomal polymorphism in a natural population of CHIRONOMUS TENTANS inhabiting a stream contaminated by radioactive waste was compared with a nonirradiated population. Ten inversions and one deletion were found in the irradiated population but not in the control population. The frequencies of three endemic inversions which were found in both populations were not significantly different in the irradiated and nonirradiated populations. It was concluded that in the irradiated population, where an increased frequency of new chromosome aberrations was detected, the frequencies of the endemic inversions were unchanged by the chronic radiation. (Auth)

<234>
Reichle, D.E., and D.A. Crossley, Jr. 1965. Radiocesium Dispersion in a Cryptozoan Food Web. Health Physics, 11, 1375-1384 (ESD #142)

Radiocesium dispersal in a forest floor food web is being studied in a LIRIODENDRON stand previously tagged with Cs 137. Initial studies traced the movement and equilibration of Cs 137 in the forest floor stratum. Subsequently, weekly samples are revealing seasonal shifts in concentration of Cs 137 in available food materials (leaf litter, wood, roots and mosses). Pitfall trap collections form the basis for estimates of Cs 137 equilibrium concentrations in arthropods. Laboratory measurements of biological halflives are being made for radiocesium in the major arthropod species. A preliminary synthesis of these data suggests that radiocesium techniques can be used to provide much detail on structure and function in this food web, but some relationships between animal species remain obscure. (Auth)

<235>
Olson, J.S. 1965. Equations for Cesium Transfer in a LIRIODENDRON Forest. Health Physics, 11, 1385-1392 (ESD #143)

Simple compartment models can simulate the rapid net transfers of cesium from tree boles to foliage and roots, and to the forest environment. Only 2-4 weeks after inoculating 467 mCi into the dominant tulip poplar trees in a 500-square m. plot, the upward flux of Cs 137 to foliage via transpiration was exceeded by losses due to rain leaching and downward translocation via phloem to roots. Fairly high root-soil turnover of cesium (0.003/day) must explain the build-up in soil radioactivity, which is greater than rainout or autumn leaf fall can account for. A model with a matrix of constant fractional coefficients of transfer simulated the observable changes during early months. However, periodically varying coefficients are needed to allow for seasonal rhythms of the forest nuclide cycling and dispersal over a period of years. (Auth)

<236>
Van Dyne, G.M. 1965. Application of Some Operations Research Techniques to Food Chain Analysis Problems. Health Physics, 11, 1511-1519 (ESD #144)

Attributes of species in mixed samples may be predicted from the attributes of the entire sample and from the species composition by weight of the sample. Thus, the relation between the composition of a given chemical as a proportion of the total sample in the Ith mixed sample (C sub i), the chemical content as a percent of the Jth species, plant part, or plant group in the sample (P sub j), and the percent weight of the Jth species, plant part or plant group in the Ith sample (W sub ij) is: C sub i = the sum over j of p sub j and W sub ij where j = 1,2...n species, parts or groups in the sample. Least squares and nonlinear programming routines were compared for the P sub j by minimizing a function Q as Q = the sum over i of (C sub i - the sum over j of P sub j W sub ij) squared subject to 0 = or < P sub j = or < 100 and n = 1,2... n samples. Known P sub j and W sub ij were used to generate C sub i to test these techniques. Variability of P sub j and W sub ij was obtained with random number generators, and known bias was included in some W sub ij values in thiry computer experiments. P sub j, predicted by the above methods from the generated C sub i and W sub ij were compared to P sub j, the true values which were used in generating the data. Both least squares and nonlinear programming gave acceptable P sub j in most instances. Poor estimates of P sub j were found only if P sub j were small and if the corresponding means W sub j were small and of low variability. These techniques were applied sucessfully to data from range nutrition experiments with cattle and sheep to predict the crude protein content of five groups of species in the diets from the botanical composition and the crude protein in the mixed sample. (Auth)

<237>
Witherspoon, J.P. 1965. Radiation Damage to Forest Surrounding an Unshielded Fast Reactor. Health Physics, 11, 1637-1642 (ESD #145)

In May 1964, radiation effects were observed in conifer and hardwood tree species growing within 20 m of the Health Physics Research Reactor. Cumulated fast neutron doses ranged from 265 to 996 rad (tissue dose in air), delivered sporadically over the previous year. During the summer, vegetation damage patterns extended out to 40 m from the reactor. Conifers within this distance exhibited severe growth retardation and needle mortality in areas receiving total cumulated fast neutron doses of between 100 and 250 rad. Site factors such as soil disturbance, moisture stress and poor nutrient status contributed to observed radiation effects. (Auth)

<238>
Auerbach, S.I. 1965. Radionuclide Cycling: Current Status and Future Needs. Health Physics, 11, 1355-1361 (ESD #146)

By definition radionuclide cycling implies recurrent transfers of radioelements between and within ecosystems of the biosphere. The circulation of elements in ecosystems is an important regulatory process as well as a possible boundary condition for characterizing ecosystems. Because of increased recognition of the importance of cycling there has been a considerable increase in biogeochemical studies of terrestrial environments. That the ecologic processes of biogeochemical cycling govern the movement of and are the determinants affecting long-term behavior of long-lived radionuclides, were not recognized sufficiently to merit serious research attention until the late 1950's. Since then, radionuclide cycling has become a recognized facet of radioecological research. The concept currently appears to include four categories of investigation. They are: (1) deductive analyses derived from studies of fallout nuclides in different trophic levels of varying ecosystems, (2) tracer experiments to elucidate links in a food chain and develop data on rate of movement in the chain, (3) studies of rates of turnover of particular radionuclides within a single trophic level and (4) experiments employing tracers to measure the complete cycle in an ecosystem. Current problems such as interpretation of the significance of Sr 90 and Cs 137 levels in selected compartments of arctic ecosystems reinforce the need for more experiments of the fourth category emphasizing simple ecosystems. (Auth)

<239>
Payne, J.A., P.B. Dunaway, G.D. Martin, and J.D. Story 1965, December. Effects of CUTEREBRA ANGUSTIFRONS on Plasma Proteins of PEROMYSCUS LEUCOPUS. The Journal of Parasitology, 51(6), 1004-1008 (ESD #147)

Marked alterations of plasma protein distribution occurred in white-footed mice (PEROMYSCUS LEUCOPUS) infested with botfly (CUTEREBRA ANGUSTIFRONS) larvae. Reductions in the albumin-to-globulin ratio (A/G) of animals infested with botfly larvae were correlated significantly with the number of larvae present. Development of the CUTEREBRA larva in the host was accompanied by progressive depression in the A/G. Correspondingly, recovery in the A/G to the normal values occurred 8 days following loss of the bot. Ingestion of albumin by the bot was proposed as a partial explanation for the reduction in A/G in this type of dipteran parasitism. (Auth)

<240>
Van Dyne, G.M. 1965, December. Data on Chemical and Botanical Composition of Dietary Samples Grazed by Cattle and Sheep. ORNL-TM-1376; 26 p. (ESD #148)

Detailed study of the impact of grazing animals on other components of the ecosystem and modeling of ecosystem phenomena requires knowledge of the chemical and botanical composition of the diets of grazing animals. Data are presented herein on composition of 78 botanical constituents and 8 chemical constituents in 260 mixed forage samples taken from esophageal fistulated cattle and sheep grazing in common on a dry annual range. These data are the basis of several published papers, and some operations research techniques are being applied to the data to predict chemical composition of individual plants and plant parts. Methods of field study, botanical analyses, and chemical analyses are given, and numerical relationships between dietary components are formulated. (Auth)

<241>
Cate, W.C., H.R. DeSelm, W.T. Edwards, W.H. Ellis, G.C. Jones, F.P. Neumann, D.H. Norris, T.P. O'Farrell, J.A. Payne, M.R. Pelton, F.G. Taylor, G.M. Van Dyne, J.A. Wolfe, J.S. Olson (Ed.), G. Cristofolini (Ed.), and S. Cristofolini (Ed.) 1966, February. Oak Ridge, Tennessee, Flora: 1. Preliminary Alphabetic Inventory of Vascular Plants. ORNL-TM-1232; 31 p. (ESD #149)

Over 1500 higher plant taxa contribute to the genetic diversity of woodland and herbaceous ecosystems in Oak Ridge and surrounding Morgan, Roane, Anderson, Knox, and Loudon counties in Eastern Tennessee. This is an initial working checklist, so the number of species and the knowledge of their distributions will presumably be increased in future editions. Notations in the appended list (by county) include representation in: (1) the ORNL Ecology Herbarium; (2) the University of Tennessee Herbarium county maps if not in (1); and (3) additional records, mostly sight records. The Appendix represents an experiment in composition by a Friden Justowriter, from punched paper tape generated by IBM 1401 computer from input of IBM punched cards. These cards furnish a flexible file for continuous revision, for computer listings as needed, and for future rearrangements by sorting in taxonomic order, by ecological role, or by life forms. Numerical codes for order and family in the plant kingdom are adopted from the International Plant Index without implying judgment on the validity of the nomenclature which it accepts for "operating categories." The speed with which additions and corrections have been (or can be) made furnishes an encouraging aid to an orderly progress in compiling regional floras, ecosystem inventories, and international studies such as those on terrestrial productivity and conservation for the International Biological Program. (Auth)

<242>
O'Farrell, T.P., S.I. Auerbach, and P.B. Dunaway 1966, March. Incorporation of a Thymidine Analog by Indigenous Rodents. ORNL-3907; Ph.D. Thesis, University of Tennessee; 176 p. (ESD #150)

The thymidine analog 5-iodo-2-deoxyuridine (IUDR) labeled with iodine 131 was administered to wild rodents, and the activity retained was measured in whole-body counters to test the potential of IUDR 131 as an index to cell proliferation and DNA synthesis. Over 95 per cent of the uCi injected into SIGMODON as labeled IUDR 48IUDR was eliminated within 48 hours. The majority of the retained activity was incorporated into the intestine and presumably was attached to DNA. The whole-body curves apparently were a useful index to cell proliferation and DNA metabolism in the intestines. The rate of cell proliferation, indicated by the activity retained 48 hours postinjection of labeled IUDR, was related to the general metabolism of the animals tested. Animals with higher rates of metabolism had higher rates of cell proliferation and DNA synthesis. Rates of cell proliferation are higher in juveniles than adults within a species. Acute ionizing radiation inversely affected the incorporation of activity after an injection of IUDR 131. (Auth)

<243>
Payne, J.A., and G.E. Cosgrove 1966, January. Tissue Changes Following CUTEREBRA Infestation in Rodents. The American Midland Naturalist, 75(1), 205-213 (ESD #151)

The large subcutaneous cavity that the larva of the botfly, CUTEREBRA ANGUSTIFRONS, produces in PEROMYSCUS LEUCOPUS was studied by histologic preparations on the day of bot emergence and at intervals during the course of healing. The healing and repair of the lesion was very rapid, being nearly complete at 9 days. Occasional complications such as chronic abscess formation or foreign body granuloma occur. A limited study of healing of bot cavities in SCIURUS CAROLINENSIS revealed more extensive tissue involvement and a much slower rate of repair with persistence of purulent exudate. (Auth)

<244>
Crossley, D.A., Jr. 1966. Radioisotope Measurement of Food Consumption by a Leaf Beetle Species, CHRYSOMELA KNABI Brown. Ecology, 47(1), 1-8 (ESD #152)

A field using radioisotopes to estimate consumption of vegetation by insects was evaluated by comparisons with feeding rates measured in the laboratory. The uptake of cesium 137 was investigated for beetle larvae (CHRYSOMELA KNABI Brown) feeding on willows in the White Oak Lake bed, an area contaminated with radioactive waste products. Beetle larvae and adults accumulate cesium 137 from willow leaves and reach steady-state equilibrium concentrations. Information on biological half-lives (elimination rates) for cesium was used to convert the cesium 137 concentrations attained by the beetle larvae into estimates of cesium 137 intake rates. Food intake rates were estimated from radiocesium intake rates, by measuring cesium 137 concentrations in willow leaves. Food intake rates estimated by this method for field areas were 7 to 16 mg dry wt of plant per larva per day. Laboratory measurements of food consumption rates, by comparison, were about 9 to 10 mg/larva per day for larvae of similar size. Influences of temperature on biological half-lives were also studied, but no correction was applied to the field estimates since mean field temperatures were close to those used in laboratory experiments. The good agreement between laboratory and field measurements supports the validity of previous applications to entire communities of plant-feeding insects. The method would be equally useful with predaceous animals as with herbivores. Measurements of food eaten can be converted to energy units by bomb calorimetry. (Auth)

<245>
Payne, J.A., and D.A. Crossley, Jr. 1966, April. Animal Species Associated With Pig Carrion. ORNL-TM-1432; 70 p. (ESD #153)

Following a nuclear attack, carrion remains of domestic animals could pose difficulties for human survival because of public health and sanitation problems associated with carrion. Insects influence the course and rate of decomposition, and radiation effects on insect populations could alter the normal decomposition pattern. A study was made of the animal community in pig carrion, preliminary to experimental research on the influence of radiation and other factors on succession in carrion. A total of 522 animal species representing 3 phyla, 9 classes, 31 orders, 151 families, and 359 genera were found associated with various decomposition stages. A systematic list of all species, their abundance, microhabitat, and food relationships is given. (Auth)

<246>
Brown, G.N., and F.G. Taylor, Jr. 1966. Interaction of Radiation and Photoperiodism in XANTHIUM CHINENSE: Effects of Variation in Time of Radiation With Respect to Photoinduction. Radiation Botany, 6, 145-150 (ESD #154)

Groups of XANTHIUM CHINENSE plants received a dose of 5125 rads Co 60 gamma radiation before, during and after short day photoinduction. Another group of plants received 5125 rads, but was kept on long days. Two groups of non-irradiated control plants were either photoinduced or kept on long days. Flowering was not significantly altered in plants irradiated before photoinduction, was permanently suppressed in plants irradiated during photoinduction, and was temporarily enhanced in plants irradiated after photoinduction. None of the long day plants flowered. Stem elongation and leaf production were enhanced in plants irradiated before, during and after photoinduction. Increases in vegetative growth patterns also were observed in irradiated long day plants. (Auth)

<247>
Patten, B.C. 1966. Equilibrium Specific Activity Relationships in Two-Compartment Exchange Systems. Health Physics, 12, 521-524 (ESD #155)

When an element consisting of a stableisotope and radioisotope equilibrates between two exchanging compartments of a closed system, the individual isotopes may attain equilibrium simultaneously with the total element. However, it is also possible that total element equilibrium may precede equilibria of the radioisotope and stable element, in which case specific activities in the compartments are unequal when the system becomes stationary with respect to the total element. Subsequent equilibration of the stable and radioactive components involves a time lag during which estimates of radioactivity in the compartments will be erroneous if based on the assumption that specific activities are equal because the total element has equilibrated. (Auth)

<248>
Shinn, A.F. 1966. Kiln-Firing as a Technique for Studying Nest-Building Behaviour of Mud-Dauber Wasps. Nature, 210(5031), 112-113 (ESD #156)

Kiln-firing nests gave distinctive colors which were connected with a specific source of mud used in the nest, which allowed an estimate of the flight range of the wasps. Kiln-firing would probably indicate the comparative usages by different species, seasonal charges in nest building activity, and perhaps information about the rate of nest construction. (KM)

<249>
Witkamp, M. 1966. Decomposition of Leaf Litter in Relation to Environment, Microflora, and Microbial Respiration. Ecology, 47(2), 194-201 (ESD #157)

Bacterial and fungal counts, mycelial growth, microbial evolution of CO_2, and substrate moisture and temperature in bags with litter of either mulberry, redbud, white oak, loblolly pine, or beech were measured biweekly over the period November 1960-November 1961 in oak, pine, and maple stands at Oak Ridge, Tennessee. Serial dilution plate method and closed-box technique were effective for measuring microbial densities and microbial respiration respectively. Microbial densities, microbial respiration, and annual weight losses of species declined in the order mulberry, redbud, white oak, pine, beech, and were significantly positively correlated. Stand effects were not significant possibly due to partial exclusion of stand effects in the bags. Microbial densities and moisture conditions of the various leaf species converged with time and their short-term fluctuations decreased indicating homogenation of substrate and stabilization of microbial populations. Microbial respiration was controlled in decreasing order by temperature (T), bacterial density (B), moisture (M/D), and the number of weeks (W) since leaf drop. An effective model for prediction of microbial respiration (C) is $C=46.5 + 3.2T + 26.9\ M/D + 11.4 \log B - 0.6W$. Mean CO_2 production was 0.17 liters/g substrate decomposed. Production was higher for rapidly decomposing leaf species dominated by relatively inefficient bacterial flora than for slowly decaying litter with predominantly more efficient fungi. Loss of weight and respiration were highly correlated with a microbial population estimate, combining bacterial and fungal counts. (Auth)

<250>
Witkamp, M. 1966. Macroflora, Mycoflora, and Soil Relationships in a Pine Plantation. Ecology, 46(2), 238-244 (ESD #158)

Species distribution of the ground cover of a Scots pine stand along the slope of a fixed inland dune closely reflected micro-relief and profile of the soil. Depth of a fine sand deck on coarse sand varied from 0 cm at the bottom to 150 cm at the top of the dune. Corresponding water-holding capacity (WHC) to a depth of 150 cm varied from 459 to 284 liters/m2. Tree height was significantly correlated with WHC. Dependence of litter and humus formation on primary production, and of mycelium growth on litter and humus resulted in significant correlation of these factors and moisture. Mycelium length was significantly correlated with fungal plate counts in January. The annual cycle of mycelium length did not show a peak in autumn as was found in broad leaf forest, presumably a result of differences in nutrient release from the litter. Of the organic mass to a depth of 1 m trees contributed 13%-34%, ground cover + litter + humus 49%-66%, soil organic matter 16%-22%, and fungal mycelium in soil 0.6%-0.9%. Reasons for the low fungal mass may be its ephemeral character, low influx of organic matter into the soil, and presence of much mycelium which was not measured on top of the soil. (Auth)

<251>
Vogel, W.G., and G.M. Van Dyne 1966. Vegetative Responses to Grazing Management on a Foothills Sheep Range. Journal of Range Management, 19(2), 80-85 (ESD #159)

Measurements were made of cover, yield, and vigor of plants at five locations in fenced enclosures and on adjacent range moderately grazed by sheep in fall through spring. Under the conditions of this study, four years of either deferment or moderate grazing did not cause major changes in vegetative cover, but there were improvements in the yield composition and vigor of climax-dominant perennial grasses. (Auth)

<252>
Dunaway, P.B., and G.E. Cosgrove 1966. A Skin Carcinoma in a Cotton Rat. The American Naturalist, 75(2), 535-537 (ESD #160)

A skin neoplasm in the mammary region of a female cotton rat from a natural population was noted during pregnancy. A squamous cell carcinoma was diagnosed histologically 18 days after parturition. There was an associated abscess and marked leukocytosis in this animal. (Auth)

<253>
Van Dyne, G.M. 1966, June. Ecosystems Systems Ecology, and Systems Ecologists. ORNL-3957; 31 p. (ESD #161)

This paper defines and discusses ecosystems, systems ecology, and systems ecologists, in that order. Some properties of ecosystems and the ecosystem concept are given as a basis for defining the area of study called systems ecology. Problems, methods, tools, and approaches of systems ecology are considered in defining tasks, problems, and training of systems ecologists. The interdisciplinary nature of systems ecology research and the importance of computers in this research are considered. Examples of methods, concepts, and applications are drawn from a diverse body of ecological, natural resource management, and mathematical literature, which further illustrate the interdisciplinary nature of systems ecology. Advantages and limitations, with respect to total-ecosystem problems, of research by ecologists in universities, in state and federal experiment stations, and in national laboratories are compared. An example is given wherein, possibly under International Biological Program support, the skills and resources of these three groups of ecologists might be combined for integrated attack on nationally important ecosystem problems. (Auth)

<254>
Nelson, D.J., T.C. Rains, and J.A. Norris 1966. High-Purity Calcium Carbonate in Freshwater Clam Shell. Science, 152(3757), 1368-1370 (ESD #162)

The calcium carbonate in freshwater clam shells is similar in purity to that designated reagent grade. A simple reprecipitation of the shell extract results in a product having less Sr and Mg than reagent grade $CaCO_3$. Clams are harvested commercially, and discarded shells are a high-quality raw material for the production of $CaCO_3$. (Auth)

<255>
Menhinick, E.F. 1966. Strontium 90 Plaques for Beta Radiation Studies. Health Physics, 12, 973-979 (ESD #163)

Strontium 90-Yttrium 90 was chosen for the source in radiation studies because it is essentially a pure beta emitter. Strontium 90 was mixed with sodium silicate and applied in even coats to transite asbestos plaques which were then encapsuled in aluminum containers. Calculating the dose rate and shielding are discussed. (KM)

<256>
Patten, B.C., and R.L. Iverson 1966. Photosynthesis and Uptake of Strontium 85 in Freshwater Plankton. Nature, 211(5044), 96-97 (ESD #164)

Strontium 85 assimilation by natural plankton material is independent of temperature except possibly at abnormally high temperatures. Metabolism apparently does not play a significant part in the uptake of this radioisotope. Assimilation in light is dependent on light intensity. The vertical profile of strontium 85 uptake decreased exponentially with depth which is probably related to the pattern of light extinction. Strontium 85 uptake may be related to primary productivity. (KM)

<257>
Taylor, F.G., Jr. 1966. Predicted Seasonal Radiosensitivty of Southeastern Tree Species. Radiation Botany, 6, 307-311 (ESD #165)

Vegetative shoot apices of 14 tree species at Oak Ridge, Tennessee were studied for 1 year (1964). The average interphase nuclear volumes, estimated interphase chromosome volumes and ratios of volumes in actively growing to dormant plants were determined. Results indicate that the predicted range in sensitivity between species for any month, approximately a 17-fold range, is constant even though the predicted sensitivity of individual species changes with respect to time. (Auth)

<258>
Wisser, H.G., and G.M. Van Dyne 1966. Influence of Number and Spacing of Points on Accuracy and Precision of Basal Cover Estimates. Journal of Range Management, 19(4), 205-211 (ESD #166)

This paper reports a comparison of point techniques for analyzing basal cover of grasslands. A population of 350 line intercept transect records, each recorded to 0.01 ft intervals for 5 ft, was sampled both randomly and systematically with 25, 50, and 100 points (0.01-ft units) per line. Statistical analyses were made to compare point densities, point placements, and their interactions with each other and with 12 plant categories. Comparisons were also made of the various point-sample estimates to the population parameters. Some practical implications from these studies for sampling foothill grasslands are given. To sample sod-forming species, such as needleleaf sedge, random placement of points would be better than systematic placement. To sample the dominant bunchgrasses, systematic placement would be better, especially if the distance between points is greater than the average basal diameter of the plants. To sample plant categories with high basal cover, either of the point placement procedures would suffice. Generally, greater efficiency in sampling would occur with 25 than with more points per line. Basal cover of all species was estimated relatively accurately by both point placements and all point densities. (Auth)

<259>
Witkamp, M. 1966. Rates of Carbon Dioxide Evolution From the Forest Floor. Ecology, 47(3), 492-494 (ESD #167)

Evolution of CO2 from the forest floor measured by the inverted-box method was related to moisture, temperature, and age of the litter, and to CO2 evolution from oak leaves in litter bags measured by the closed-box method. Rates of CO2 evolution measured by the inverted- and closed-box methods did not differ significantly (P greater than 0.2). Respiration rates from bagged oak leaves were significantly correlated (P less than 0.01) with respiration rates from the floor in an oak stand, but not with rates in pine and maple stands. In the oak stand, rates of respiration from the forest floor and from litter bags were highly significantly correlated (P less than 0.01) with temperature, litter age, and moisture in decreasing order of influence. The influence of litter age was much higher in litter bags than in the forest floor. The variability of temperature and moisture in the forest floor was lower than in litter bags. Rates of respiration from the floors of pine, oak, and maple stands were not significantly different (P greater than 0.05). (Auth)

<260>
Patten, B.C. 1966. Systems Ecology: A Course Sequence in Mathematical Ecology. BioScience, 16(9), 593-598 (ESD #168)

The course is based on the ecosystem concept and makes use of systems discipline which are essentially mathematical in nature and require modern computing equipment for effective application. The course is designed to develop: appreciation for the natural affinities between ecology and mathematics; familiarity with the principal techniques of systems analysis which are applicable; and reasonable skill in the use of analog and digital computers. (KM)

<261>
Van Dyne, G.M. 1966. Use of a Vacuum Clipper for Harvesting Herbage. Ecology, 47(4), 624-626 (ESD #169)

A vacuum-clipper for harvesting low-growing herbage is described. Some litter and soil are picked up by this device when harvesting herbage, and equations were developed to predict net herbage weight from gross herbage weight. About 90% of the variation in net herbage weight was accounted for by variations in gross herbage weight under good conditions. The vacuum-clipper increased the speed of fieldwork up to tenfold under difficult working conditions on winter range. The influence was determined of relative variations of clipping time in the field and variations in laboratory separation time upon the optimum ratio of plots clipped to plots separated. In this study, the optimum ratio of plots clipped to plots clipped and separated varied from five to eight. (Auth)

<262>
Culver, D.A., C.E. DePoe, W.A. Griffith, R.L. Iverson, N.R. Kevern, F.G. Lowman, E.C. Neal, D.J. Nelson, B.C. Patten, J.L. Wilhm, G.M. Van Dyne, and M. Witkamp 1966. Radionuclide Cycling in Aquatic Ecosystems. ORNL-4007; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1966, (p. 84-101), 119 p. (ESD #170, Part, Section)

Progress was reported on studies of the uptake and accumulation of radionuclides by aquatic organisms. Results of studies on five species of fish in the Clinch River reported accumulation and concentration levels of several radionuclides and gave an equation for calculation of maintenance metabolism feeding rate of carp. Effect of trophic level on accumulation was not explainable. Periphyton growth, mass and stream bottom area, and radionuclide uptake were reported. Trace elements in plankton and seston on the western coast of Puerto Rico were studied to gain information on patterns and rates of radionuclide immobilization in aquatic systems. Progress on studies under the following headings was reported: cesium and potassium in white crappie and other Clinch River fish, feeding rate of carp in White Oak Lake, effect of trophic level on radionuclide accumulation by fish, radionuclides in periphyton, use of artificial substrata to estimate the productivity of periphyton, estimate of periphyton mass and stream bottom area using P 32, primary productivity measurement, trace elements in plankton, trace elements in seston, transfer of Cs 137, Ru 106 and Co 60 between detritus and benthic macroinvertebrates in microcosms, and accumulation of P 32 by biota and their substrates in a tagged stream. (ST)

<263>
Olson, J.S., B.C. Patten, G.M. Van Dyne, M. Witkamp, G. Cristofolini, V.R.R. Uppuluri, and P.J. Wangersky 1966. Theoretical and Systems Ecology. ORNL-4007; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1966, (p. 102-119), 119 p. (ESD #170, Part, Section)

The area of study defined as systems ecology results from the integration of all living and nonliving factors of the environment. Modeling is used as a supplement to the conventional means of experimentation and analysis in ecological studies. Progress on the inclusion of effects of selection into a deterministic mathematical model of competition between two species was reported. Other models being developed with the aid of computers are considering the effects of energy losses and random disturbances in ecosystems, vegetative succession, Cs 134 kinetics in microcosms, nonlinear programming, computer programs for ecological problems, productivity of an individual species in a mixed population, nutrient availability and seasonal influences on plant growth, optimum sites and predictions of radionuclide movement. Individual papers under the following headings were: a systems philosophy, mathematical modeling of natural populations, ecosystem maintenance and transformation models as Markov processes with absorbing barriers, model simulation of Oak Ridge vegetation successtion, kinetics of Cs 134 in terrestrial microcosms, nonlinear programming in ecology, computer programs for ecological problems, productivity of a planktonic diatom determined from data on mixed populations, growth models for plants, the optimum site problem, and year to year prediction of Cs 137 movement in the tagged forest. (ST)

<264>
Blaylock, B.G., P.B. Dunaway, N.A. Griffith, N.R. Kevern, L.L. Lewis, T.P. O'Farrell, J.A. Payne, and J.D. Story 1966. Responses of Animal Populations to Ionizing Radiation. ORNL-4007; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1966, (p. 45-50), 119 p. (ESD #170, Part, Section)

Responses of laboratory animal populations including mice, rats, shrews, and insects and natural populations of fish and insects to ionizing radiation were reported. Parameters studied were radiation sensitivity, index to radiation damage, reproductive capacity, chromosomal aberrations, and viability of irradiated populations. Progress is reported under the following headings: radiation sensitivity in indigenous small mammals; incorporation of a thymidine analog into indigenous rodents; radiation effects on carp reproduction; population genetics and radiation effects studies. (ST)

<265>
Brown, G.N., J.W. Curlin, F.G. Taylor, Jr., and J.P. Witherspoon 1966. Responses of Plants to Ionizing Radiation. ORNL-4007; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1966, (p. 51-57), 119 p. (ESD #170, Part, Section)

The effects of ionizing radiation on plant growth and mortality, mineral uptake, physiological processes, and plant cell and tissue structure; the modification of damage by environmental stress and genetics; and the production of soil activation products are reported. A study showing the extreme radiosensitivity of conifers to fast neutron radiation was completed this year. Growth and zinc 65 uptake following fast neutron radiation of trees is reported. Studies of radiation dose to roots of potted plants from reactor fast neutrons and soil activation products, effects of fast neutron and gamma radiation on physiological processes (flowering, vegetative growth, and total RNA and DNA content), modification of radiosensitivity by environmental stress (primarily moisture) on clones, and structural anomalies of irradiated plants are in progress. (ST)

<266>
Crossley, D.A., Jr., J.W. Curlin, J.S. Olson, D.E. Reichle, G.M. Van Dyne, M. Witkamp, T. Tamura, G. Cristofolini, S. Cristofolini, R.C. Reynolds, R.M. Anderson, W.C. Cate, G.J. Dodson, M.L. Frank, M.H. Shanks, R.L. Tabor, H.D. Waller, and J.K. West 1966. Radionuclide Cycling in Terrestrial Ecosystems. ORNL-4007; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1966, (p. 58-83), 119 p. (ESD #170, Part, Section)

Radionuclide cycling and other terrestrial ecosystem studies were reported from both field and laboratory observations under twenty separate headings. Progress on studies of Cs 137 cycling following trunk inoculation in 1962 is reported. Separate studies discussed year to year changes in the distribution of Cs 137, foliage biomass and consumption by herbivores, Cs 137 distribution in canopy food chains, and Cs 137 accumulation and equilibration by forest myriapoda in the experimental 500 m2 area of tagged LIRIODENDRON forest. Cs 134 was used to study radionuclide turnover in laboratory and natural populations of isopods, the relation between metabolism and turnover as influenced by temperature, and food consumption and utilization. Radiotracer tags of Rb 86 and P 32 were used to study the trophic efficiency of insect herbivores (chrysomelid beetle) on plants (Indian hemp). Separate laboratory studies utilized the brown cricket to study the efficiency of radioisotope transfer in predator-prey systems and Ru 106 elimination. Two studies used Cs 137 to evaluate transfer (primarily by leaching) of Cs 137 in microcosms and, in another study, the retention and movement of radionuclides in pine forest floor subsystems. In addition, the following studies were reported: regeneration of a denuded landscape by kudzu vine at Copperhill, Tn., contour mapping of a field area in preparation for soil studies in a herbaceous ecosystem, a model of cobalt sorption on natural clays, precision and accuracy of basal cover estimates, value of a vacuum clipper in harvesting herbage, electronic data processing of floristic records and aerial photo survey for forest management. (ST)

<267>
Patten, B.C. 1966. The Biocoenetic Process in An Estuarine Phytoplankton Community. ORNL-3946; 97 p. (ESD #171)

An ecological theory of adaptation at the community level of organization is developed. By adaptation is meant the establishment of optimum relationships between structure and function for community life under existing or expected conditions of environment. An analog computer model of a hypothetical food chain is explored to elucidate how structure-function relationships in coupled systems are determined by the communication net, or pattern of coupling between the parts. Since optimization necessarily implies input of information from the environment which details, in effect, how far off the present state of the system is from an optimum state, there is implicit in the adaptation process a kind of community cognition. To give emphasis to this aspect etymologically, the process of community adaptation is referred to as biocoenesis. An annual cycle of structure-function relationships in phytoplankton of the York River, Virginia, is described, with particular emphasis on aspects that relate to system adaptability. (Auth)

<268>
Morton, R.J. (Ed.) 1966. Status Report No. 6 on Clinch River Study. ORNL-3941; 82 p. (ESD #172)

This report is the sixth in a series conducted as a cooperative project in the Oak Ridge National Laboratory. This project was designed to study radionuclides released through White Oak Creek, and with their dispersion, detection, and distribution downstream in the Clinch and Tennessee Rivers. The effects of Melton Hill Dam, begun soon after the study, were taken into consideration. Special reports are presented on features of the overall program, water sampling and analysis, radionuclides in bottom sediments, biological samples, hydrologic measurements and analyses, safety evaluations, and computer simulation of the fate of radioactive wastes in streams. Each report has been entered separately in the data base. (BBM)

<269>
Morton, R.J. (Ed.) 1966, November. Hydrologic Measurements and Analysis. ORNL-3941; Part of Status Report No. 6 on Clinch River Study, (p. 42-58), 82 p. (ESD #172, Part)

A diffusion study of the effects of Melton Hill Dam under winter conditions was done in 1964 for comparison with similar dye diffusion studies under summer conditions. The minimum dilution factor at CRM 14.4 for power release patterns is much less in winter than in summer. The time of arrival of peak concentrations at Clinch River Mile (CRM) 14.4 may be predicted using analytical techniques developed especially for the Clinch River by the TVA. Difficulties have been encountered in predicting peak concentration at CRM 5.5 due to conditions at Watts Bar Dam and Reservoir. The reduction in concentration in peaks resulting from the release of dye during weekday shutdowns averaged about 3.17 for both summer and winter conditions. (KM)

<270>
Morton, R.J. (Ed.) 1966. Biological Phases. ORNL-3941; Part of Status Report No. 6 on Clinch River Study, (p. 35-41), 82 p. (ESD #172, Part)

Collection and analysis of fish and other aquatic organisms were carried out during the Clinch River Study. Data on radiation exposures were turned over to the Subcommittee on Safety Evaluation. The Subcommittee on Aquatic Biology gave its opinions regarding desirable activities for a continuing program of biological monitoring in the creek and river system and the need for additional research studies by sampling and analysis of biota in surface waters. Periodic monitoring of fish is advisable. Investigations should be continued as feasible for further insight regarding biological effects of radioactive contaminants in the river system. (KM)

<271>
Morton, R.J. (Ed.) 1966, November. Safety Evaluation Studies. ORNL-3941; Part of Status Report No. 6 on Clinch River Study, (p. 59-62), 82 p. (ESD #172, Part)

The Subcommittee on Safety Evaluation gave its opinions and recommendations regarding a monitoring program and additional research based on data from various groups in the Clinch River Study. Routine environmental monitoring should be devoted to surveillance of the current and critical pathways of exposure, especially the ingestion of river water and fish. The radiation intensity of contaminated water and bottom sediment should be included. The future use of the Clinch River and Tennessee River as sources of water for supplemental crop irrigation should be investigated. The routine monitoring program should include comparison of gross beta analyses of daily samples and of monthly composite samples. The uncertainties regarding fish and irrigated crops as potential causes of radiation exposure should be investigated. (KM)

<272>
Morton, R.J. (Ed.) 1966. Radionuclides in Bottom Sediments. ORNL-3941; Part of Status Report No. 6 on Clinch River Study, (p. 29-34), 82 p. (ESD #172, Part)

The distribution and behavior of radionuclides in the river systems were studied to answer questions and provide reassurance regarding the possibility that large and hazardous amounts of radioactive materials might be accumulated and retained at the river bottom. Radionuclide concentrations in sediments varied widely, making monitoring of the radionuclides in bottom sediments in the Clinch and Tennessee Rivers advisable as long as radioactive materials are released into the Clinch River and for a limited time thereafter. (KM)

<273>

<273>
Morton, R.J. (Ed.) 1966. Computer Simulations of the Fate of Radioactive Wastes in Streams. ORNL-3941; Part of Status Report No. 6 on Clinch River Study, (p. 63-72), 82 p. (ESD #172, Part)

A digital computer was used in the design of a mathematical model which was developed as a stochastic process and simulates the physical processes and interactions of stream flow, dilution, mixing, nuclear decay, uptake and release from benthic deposits, water withdrawal at use points, and water treatment. The most important information derived from the model was that the mean concentrations at the critical points are only slightly affected by a wide range of pollutant inputs and flows, provided the mean inputs are constant. (KM)

<274>
Morton, R.J. (Ed.) 1966, November. Features of the Overall Program. ORNL-3941; Part of a Status Report No. 6 on Clinch River Study, (p. 1-17), 82 p. (ESD #172, Part)

The research aspects of the study were concerned mainly with the radionuclides released through White Oak Creek, and with their dispersion, dilution, and distribution downstream in the Clinch and Tennessee Rivers. The effects of the Melton Hill Dam, begun soon after the study, were taken into consideration. This study is the first integrated comprehensive study of the dispersion and fate of radionuclides in a complicated river system where cooperative agencies having such a wide variety of special competencies had jointly brought them to bear on these complex problems. Mass-balance analyses were utilized to a greater extent than is usual in a river study. Many undisturbed cores of bottom sediments on the river bed were of radionuclides, and a technique was devised by which outside limits of the amounts of radionuclides tied up in the bromass of the stream and stream bed were estimated. A theory of movement of radionuclides in a stream subject to pulsating power releases was developed and confirmed. (KM)

<275>
Morton, R.J. (Ed.) 1966, November. Water Sampling and Analysis. ORNL-3941; Part of Status Report No. 6 on Clinch River Study, (p. 18-28), 82 p. (ESD #172, Part)

Water samples collected over a period of two years from White Oak Creek, the Clinch River, and the Tennessee River were examined for mutual correlations between the radionuclides and for correlations of the radionuclides with stable-chemical constituents in the water. Results are given for various water sampling stations. A sophisticated system of collecting water samples was recommended for use in the Clinch River where changes in flow conditions occurred due to hydroelectric operations at Melton Hill Dam. The sampling equipment was fully automated so that water samples would be continuously collected in volumes proportional to the flow. (KM)

<276>
Olson, J.S. 1966, Fall. Progress in Radiation Ecology: Radionuclide Movement in Major Environments. Nuclear Safety, 8(1), 53-58 (ESD #173)

Several recent meetings and papers extended the information on cycling and levels of radionuclides in terrestrial, freshwater, and marine enviornments. Prior information in this field was brought together conveniently in the First National Symposium on Radioecology in 1961. One trend in ecological analysis is toward further testing of mathematical models for transfers between parts of a complex ecological system by using equations and analog or digital computer simulations like those which have proved useful in the health physics and physiology of internal dose. Dietary sources of contamination for man are frequently at least as important as sources of contamination from drinking water and air. In assessing hazards, concentration factors based on stable elements could be used more widely than is done at present. Such factors may give rise to conservative estimates of permissible release for elements whose half-life is short or whose transfer through environmental networks is slow. (Auth)

<277>
Witkamp, M. 1966, Fall. Biological Concentrations of Cesium 137 and Strontium 90 in Arctic Food Chains. Nuclear Safety, 8(1), 58-62 (ESD #174)

Efficient foliar sorption of fallout minerals and their transfer without much dissipation along the Arctic food chain from lichen via caribou and reindeer to human inhabitants of inland communities lead to body burdens of cesium 137 and presumably of strontium 90 that are several times higher than those of the rest of the world population. Reasons for these higher than average body burdens are not high fallout levels but rather the unique ecological conditions of the closed and marginal economies of vegetation, fauna, and man in the Arctic environment. (Auth)

<278>
Blaylock, B.G. 1966. Cytogenic Study of a Natural Population of CHIRONOMUS Inhabiting an Area Contaminated by Radioactive Waste. Part of Proceedings of a Symposium on Radioactive Wastes into Seas, Oceans and Surface Water held in Vienna, Austria, 1966, (p. 835-846) (ESD #175)

The aquatic larvae of CHIRONOMUS TENTANS, one of the midges, inhabit the radioactive bottom sediments of White Oak Lake and White Oak Creek in large numbers. This aquatic habitat has received varying quantities of radioactive waste released from the Oak Ridge National Laboratory sicne 1943. Dosimetric measurements and calculations based on radionuclide content of the bottom sediments indicate that these larvae were receiving 230 rad/yr. We estimate that 130 generations have been exposed to this or greater dose rates for the past 22 yr. During the past 5 years, the incidence of chromosomal aberrations in the salivary gland chromosomes of larvae collected seasonally from the radioactive and control habitats was measured. Chromosomal polymorphism is prevalent in C. TENTANS in this locality and six endemic inversion heterozygotes were found in all populations. Three of these inversions occurred at relatively high frequencies (0.09-0.22), but these frequencies did not fluctuate seasonally nor change significantly in the irradiated populations for 5 years (1960-1965). Also, the frequencies of endemic inversions in the irradiated populations were not significantly different from a control population. In addition to the six endemic inversions found in all populations, ten inversions and one deletion were observed only once in 755 larvae from the radioactive habitat while no additional aberrations were observed in 714 larvae from the control habitats. We concluded that the ionizing radiation from the radioactive waste was increasing the frequency of new chromosomal aberrations in the White Oak Lake and White Oak Creek populations, but these new aberrations were eliminated by selection. Also, this level of chronic radiation, which was capable of producing a detectable increase of new chromosomal aberrations, has not affected the fitness of the population by producing a change in the frequencies of the endemic inversions. (Auth)

<279>
Reichle, D.E. 1966. Some Pselaphid Beetles with Boreal Affinities and Their Distributions Along the Postglacial Fringe. Systematic Zoology, 15(4), 330-344 (ESD #176)

Many species of relict boreal insects reside along the postglacial border in central and eastern United States in scattered series of sphagnum bogs. The distributional patterns of these insects are often influenced to a considerable extent by climatic factors and may reflect past climatic conditions, especially if the species involved are restricted by specific microclimatic requirements and are themselves incapable of active dispersal beyond these limits. Over 20 species of pselaphid beetles with boreal affinities are characteristic bog inhabitants. The range of each species is correlated with glacial processes and the contemporary distribution of bog plants. Included among the factors discussed affecting their distribution are glacial influences, ecological limits, and species dispersal potentials. None of the true bog pselaphids are known beyond the limits of Wisconsin glaciation, except for the Wisconsin driftless area and New Jersey breaches paralleled by bog plant distributions. The specificity of most species to these relict boreal habitats bespeaks their value as indicators of biotic displacement. (Auth)

<280>
Tanner, J.T. 1966, Late Summer. Effects of Population Density on Growth Rates of Animal Populations. Ecology, 47(5), 733-745 (ESD #177)

The growth rate of a population at time t is defined as the change in numbers per unit population at that time per time period. The rate usually changes with time as the population increases or decreases. The objective of this study was to determine whether the growth rate of animal populations is or is not a function of the population density. In most mathematical models of populations whose changes resemble those of actual populations, the growth rate is a decreasing function of density, meaning that as the population increases the growth rate decreases and vice versa. Records of actual populations can be use to test the relation between growth rate and density by calculating correlation coefficients for these two characteristics. The methods of doing this are described and the limitations on the data are explained. The records of 111 different populations representing 71 species were analyzed by these methods. Of the 71 species, 7 were eliminated from further analysis because their census records were not significantly different from a series of random numbers, 47 had correlation coefficients that were negative and significantly different from zero, 16 had coefficients not significantly different from zero (all but one of these estimated coefficients were negative), and one, the world's human population, had a positive coefficient significantly different from zero. There were no differences between taxonomic groups (insects, other invertebrates, fish, birds, mammals). The primary conclusion is that in most animal species a population's growth rate is a decreasing function of density. This explains the relative stability of animal populations, which never continue to increase at rates their fertility would allow, and rarely decrease to extinction. Tentative conclusions are presented regarding the processes regulating population numbers. Populations of herbivorous insects at low and moderate levels are regulated by disease, parasites, and predators causing mortality that is an increasing function of density. Favorable conditions may allow an increase in insect numbers so rapid that the population temporarily escapes regulation by its enemies. Nonterritorial species of vertebrates are normally controlled by predation and, when that fails, by competition; in both cases juvenile individuals are most affected. In territorial vertebrates competition for suitable territories determines the the size of the breeding population. Populations of vertebrate species (excepting man) are in general regulated by the production of adult individuals being a decreasing function of population density. (BBM)

<281>
Kevern, N.R., J.L. Wilhm, and G.M. Van Dyne 1966, October. Use of Artifical Substrata to Estimate the Productivity of Periphyton. Limnology and Oceanography, 11(4), 499-502 (ESD #178)

Plexiglas plates were placed in laboratory streams and in a spring and removed at 2- to 4-day intervals to determine the increase in standing crop of periphyton. The instantaneous growth rate, calculated from the growth curve of periphyton on plates in the streams, was 0.51 gm/m2/day as compared to an estimate of 0.60 gm/m2/day obtained by oxygen measurements for growth of periphyton on the stream bottom. The average growth rate of periphyton on plates in the streams over a single exposure period was 0.31 gm/m2/day. Under the conditions of this experiment, the instantaneous growth rate was a better estimate of productivity than the average growth rate. (Auth)

<282>
Kevern, N.R. 1966. Feeding Rate of Carp Estimated by a Radioisotope Method. Transactions of the American Fisheries Society, 95(4), 363-371 (ESD #179)

The feeding rate was estimated for yearling carp living in a small lake contaminated with low-level radioactive wastes. The amount of cesium 137 that must be ingested to maintain the equilibrium body burden of the carp was calculated from measured values for body burden, biological elimination rates, and assimilation factors. The radioiostope was ingested by the fish as an integral part of its food items. The amount of food consumed was estimated by measuring the concentration of cesium 137 in the food items. An age and growth study and the weight-length relationship are given for the carp. The estimate of the average daily food intake was 5.36 g wet weight (3.9% of mean body weight) consisting of 2.4 g detritus and 1.6 g algae for maintenance, and 0.82 g detritus and 0.54 g algae for growth. On an energy basis, 3.7 kcal were consumed for maintenance and 1.3 kcal for growth. Net and gross food conversion factors were 3.18 and 12.55, respectively, and the ecological growth efficiency was 0.08. (Auth)

<283>
Brown, G.N., and F.G. Taylor, Jr. 1966. Zinc 65 Distribution and Radiosensitivity of Growth and Zinc 65 Uptake in Red Oak Seedlings. Radiation Botany, 6, 519-524 (ESD #180)

External fast neutron irradiation of red oak seedlings (QUERCUS RUBRA L.) inhibited primary and secondary stem growth, root growth, and new leaf development. An initial stimulation of zinc 65 uptake was observed following irradiation, but ceased to be significant 22 days post irradiation. Retardation of zinc 65 uptake was found several weeks following exposure of seedlings to 1000 rad. Physiological explanations for growth inhibition and both stimulation and inhibition of zinc 65 uptkae are discussed. At the end of a growing season, zinc 65 was most highly concentrated in secondary roots, followed by primary roots, stems and leaves in decreasing order: 91, 7.7, 0.83 and 0.42 per cent of the total. (Auth)

<284>
Witkamp, M., M.L. Frank, and J.L. Shoopman 1966. Accumulation and Biota in a Pioneer Ecosystem of Kudzu Vine at Copperhill, Tennessee. Journal of Applied Ecology, 3, 383-391 (ESD #181)

Masses of vegetation, litter and humus and their contents of carbon and nitrogen; population densities of bacteria, fungi and arthropods; and respiration rates, moisture contents and pH of litter and soil were measured at four stations at different stages of development in a pioneer vegetation of kudzu (PUERARIA LOBATA) on denuded soil at Copperhill, Tennessee. In 1955 kudzu was planted on a cultivated strip. By August 1960 the vine had produced 550 g of dry matter per m2 on the strip and had spread 30 m away from it. Subsequent measurements in August of 1962 and 1964 showed that further growth was checked, presumably by immobilization of up to 80 percent of the cycling phosphorus and nitrogen in litter and humus which accumulated to equivalent of 0.8-1.1 standing crops per year. Microbial densities and respiration increased at a higher rate (percent per year) than their litter and humus substrate. This sugggests (1) that the physical environment of the microflora improved, and (2) that microbial immobilization of phosphorus and nitrogen was largely responsible for the fall in the rate of expansion of kudzu. Planted kudzu grew and expanded in the harsh microclimate of a denuded landscape and regenerated soil and biota. For continued succession, mineralization or phosphorus additions seem necessary. (Auth)

<285>
Van Dyne, G.M. 1966. Application and Integration of Multiple Linear Regression and Linear Programming in Renewable Resource Analyses. Journal of Range Management, 19(6), 356-362 (ESD #182)

Preliminary results are presented for formulating quantitatively the influence of site factors on various nutrient production measures and using these relationships in linear programming models to determine the optimum protein production on a foothill range. Site characteristics for optimum protein production were constrained to fall within the range of variables measured, and were constrained to satisfy certain inherent relationships known about these variables. This example shows a useful application of an operations research technique to resource evaluation problems. (Auth)

<286>
Payne, J.A., G.D. Martin, J.D. Story, and G.E. Cosgrove 1967. Electrophoresis as an Aid in Detecting Pathological Conditions in Wild Mammals. Bulletin of Wildlife Disease Association, 3, 21-22 (ESD #183)

Changes in the electrophoretic distribution of plasma proteins were noted in wild animals with a variety of parasitic and infectious diseases. This technique may be useful in screening for disease before death or sacrifice of animals. (Auth)

<287>
Blaylock, B.G. 1967, January. A Population Cage for Counting Adult DROSOPHILA Populations. Drosophila Information Service, 42, 113-114 (ESD #184)

A small population cage, made of acrylic plastic, that will hold about 1000 flies has been used successfully in competition experiments. The total adult population can be counted and transferred with minimum effort to another cage. (KM)

<288>
Dunaway, P.B., J.A. Payne, L.L. Lewis, and J.D. Story 1967. Incidence and Effects of CUTEREBRA in PEROMYSCUS. Journal of Mammalogy, 48(1), 38-51 (ESD #185)

PEROMYSCUS LEUCOPUS is the favored host for CUTEREBRA ANGUSTIFRONS on the AEC Reservation near Oak Ridge, Tennessee. PEROMYSCUS NUTTALLI is a host of C. ANGUSTIFRONS also, but no other cricetid (5 species, greater than 4000 captures) was infested. Percentages of infestation in P. LEUCOPUS during 1958-1964 ranged from 19 to 33% per year; the overall average per year was 25%. In general, the infestation period in P. LEUCOPUS is June-December, the greatest percentages occurring in summer. Infested mice were found in certain nonforested areas, as well as in forested areas. Eighty-one per cent of the mice carried one bot, 16% had two bots and 3% had three bots; 87% of the larvae were located in the inguinal region. There was no difference in percentage of infestation between sexes. Erythrocyte count, hematocrit percentage and hemoglobin concentration were consistently lower in infested mice, and total leucocyte number was greater. The infestation period for P. leucopus in this area is about 3 months longer than in southern Canada and northern U. S. Consequently, hematological effects caused by CUTEREBRA myiasis are present for a considerably longer time in P. LEUCOPUS populations in this area than in the areas farther north. (Auth)

<289>
Brown, G.N., and F.G. Taylor, Jr. 1967. Interaction of Radiation and Photoperiodism in XANTHIUM PENSYLVANICUM. Radiation Botany, 7, 67-72 (ESD #186)

Two groups of XANTHIUM PENSYLVANICUM plants received a dose of 1927 rad cobalt 60 gamma radiation during either the dark or light period of short day photoinduction. Another group of plants was photoinduced but not irradiated. Vegetative growth was initially stimulated in both groups of irradiated plants, but later responses were not observed. Both pistillate and staminate flowering were inhibited in both groups of irradiated plants, but pistillate flowering was inhibited to a greater extent. Staminate and pistillate development were retarded in both groups of irradiated plants with the greatest inhibition occurring in plants irradiated during the light period. Results are interpreted as responses to radiation-induced changes in nucleic acid and growth hormone metabolism. (Auth)

<290>
Nelson, D.J. 1966. The Prediction of Strontium 90 Uptake in Fish using Data on Specific Activities and Biological Half Lives. Part of Proceedings of a Symposium on Radioecological Concentration Processes held in Stockholm, Sweden, April 25-29, 1966. Pergamon Press, Oxford, England, (p. 845-851) (ESD #187)

White crappies (POMOXIS ANNULARIS) were collected monthly from the Clinch River and flesh and bone samples were analysed for calcium and strontium. Bone samples were analysed for strontium 90. Four additional species of fish were sampled on a limited basis for comparison. The objective of the research was to determine whether the uptake of strontium 90 by fish could be predicted on the basis of stable strontium concentrations in river water and fish tissue. A good agreement was observed between the specific activity of strontium 90 in water and white crappie bone, indicating that it is possible to predict strontium 90 concentrations in fish when the specific activity of the water is known. The specific activity approach with strontium 90 is considered superior to the use of strontium 90-calcium ratios. This was illustrated by the fact that among five species of Clinch River fish, differences in either the calcium or strontium concentrations would affect the accuracy of predictions based on calcium concentrations. The biological half-life of strontium in white crappie flesh ranged from 12 to 48 minutes, showing that fish flesh will reflect quickly changes in the environmental strontium 90 concentrations. (Auth)

<291>
Witkamp, M., and D.A. Crossley, Jr. 1966. The Role of Arthropods and Microflora in Breakdown of White Oak Litter. Pedobiologia. Bd., 6, 293-303 (ESD #188)

The effects of soil arthropods on leaf litter breakdown were estimated in field experiments utilizing naphthalene to reduce or exclude arthropod populations. Weight loss and radioactive cesium loss by decaying oak leaf litter were measured with litterbag and gravimetric methods. Periodic applications of 100 g of naphthalene per m(E-2) reduced arthropod populations to 20% of controls, increased bacterial populations on the leaves up to six fold, and tended to reduce microbial populations of the sub-soil, but generally did not affect CO2 evolution from litter plus soil. Litter in treated plots retained about 55% of its weight after one year, compared to 40% in control plots. Radiocesium loss rates also were reduced in treated plots. These results are consistent with the hypothesis that the gross effects of soil arthropods include fragmentaation of leaf litter, thus exposing a greater surface area to microbial attack and leaching. (Auth)

<292>

<292>
Cowser, K.E., S.V. Kaye, P.S. Rohwer, W.S. Snyder, and E.G. Struxness 1967, March. Dose-Estimation Studies Related to Proposed Construction of an Atlantic-Pacific Interoceanic Canal with Nuclear Explosives: Phase I. ORNL-4101; 210 p. (ESD #189)

This report presents information obtained by ORNL in Phase I of dose-estimation studies to evaluate the radiological-safety feasibility of excavating an Atlantic-Pacific interoceanic canal with nuclear explosives. The information includes (1) methods for estimating external and internal dose equivalents, for quantifying the transfer of radionuclides through critical exposure pathways, and for identifying the radionuclides likely to be critical; (2) criteria for evaluating the radiological safety of the operation; and (3) lists of radionuclides arranged according to the dose commitment that results from exposure to a unit quantity of each radionuclide. Equations to estimate external and internal radiation dose commitments were developed which account for production, venting, and movement of radionuclides in environmental exposure pathways. A compartment model for representing movement of radionuclides in the tropical environment was designed with coupled compartments having income and loss fluxes controlling the inventory of radionuclides which may have inputs to man. The specific-activity concept for estimating the allowable radionuclide concentrations in the environment was evaluated in a way that reveals its limitations, considering the time-dependent relative importance of radioactive half-life, biological half-time, and biological growth. Criteria for evaluating radiological safety were developed from the recommendations of recognized authorities which might reasonably apply in an operation of this magnitude, taking account of the principle of balancing the possible benefits against the potential risks. (Auth)

<293>
Waller, H.D., and J.S. Olson 1967. Prompt Transfer of Cesium 137 to the Soils of a Tagged LIRIODENDRON Forest. Ecology, 48(1), 16-25 (ESD #190)

An inventory of total cesium 137 distribution in a 500-m2 tagged tulip poplar (LIRIODENDRON TULIPIFERA) forest at the Oak Ridge National Laboratory showed transfer from trees to soil during the first growing season. About one-third of the maximum amount of radiocesium found in the tree canopy during June was transferred to the forest floor and soil; the remainder moved back into woody tissue (stem and roots) before leaf fall. Losses of radiocesium from the foliage and stems into the plot area through litterfall (55 uCi/m2) and rain leaching (13 uCi/m2) accounted for almost 8% (68 uCi/m2) of total cesium 137 (934 uCi/m2) introduced into tree boles. However, soil (including roots) and litter sampling at the end of the growing season indicated a much larger quantity (414 uCi/m2 or 45% of initial input) already in the surface 30cm layer of mineral soil. Of the total cesium 137 activity found within the mineral soil layer, about half can be physically associated with the tagged trees through removal of roots from soil samples and cumulative measurement of surface income at time of soil collection. Much of the remainder can be accounted for by contact exchange, root exudation, root death, and leaching of roots by soil solution. (Auth)

<294>
Van Dyne, G.M., and I. Thorsteinsson 1966. Intra-Seasonal Changes in the Height Growth of Plants in Response to Nitrogen and Phosphorus. Part of Proceedings of the 10th International Grasslands Congress, Finland, 1966, (p. 926-929) (ESD #191)

The residual influences of nitrogen and phosphorus fertilizers on plant heights in early spring, maximum rate of growth, plant heights at the time of maximum growth rate, and maximum plant height were examined. Height growth of AGROPYRON SPICATUM, STIPA COMATA, and OXYTROPIS SERECIA were related to the effects of fertilizers on production and basal cover and to soil moisture content. As compared to no fertilizer, nitrogen, but not phosphorus, caused grasses to attain their greatest growth rates while they were shorter, which was earlier in the spring when there was a high soil moisture content. (Auth)

<295>
Curlin, J.W. 1967. Clonal Differences in Yield Response of POPULUS DELTOIDES to Nitrogen Fertilization. Soil Science Society of America Proceedings, 31(2), 276-279 (ESD #192)

Trees propagated from cuttings of 22 clones of POPULUS DELTOIDES were grown under unfertilized and nitrogen-fertilized conditions. Large increases in growth resulted from fertilization. A strong clone/ fertilizer interaction was observed for diameter, height, and volume growth. Wood specific gravity was reduced by fertilization but no interaction between clones and fertilizers was noted for that character after 2 years. The presence of the genotype-environment interaction indicated that it would be unwise to select eastern cottonwood from a nutritional environment other than the one in which it will ultimately grow. Frequently a clone which performed poorly under unfertilized conditions excelled when fertilized and in several instances the reverse was true. This suggests the possibility that selection can be made specifically for fertilizer response in tree improvement programs. Caution should be exercised when interpreting fertilizer response of experimental populations which might contain genetic bias. (Auth)

<296>
Reichle, D.E. 1967. The Temperature and Humidity Relations of Some Bog Pselaphid Beetles. Ecology, 48(2), 208-215 (ESD #193)

Of the many microclimatic variables, temperature and moisture exert a considerable influence upon the numbers and kinds of arthropods found in particular habitats. Experimental temperature and humidity gradients permitted determinations of the responses of five bog-inhabiting species of pselaphid beetles to these factors. Significant differences were found between species with respect to their temperature preferenda and preferred temperature ranges: BYTHINOPSIS TYCHOIDES, 21.5 plus or minus 0.81, 25.9-15.3 degrees centimeter; DECARTHRON DEFECTUM, 28.5 plus or minus 0.55, 31.4-24.0; PSELAPHUS ULKEI, 19.5 plus or minus 0.86, 24.7-13.0; REICHENBACHIA BOREALIS, 21.9 plus or minus 0.99, 26.2-14.4;RYBAXIS CLAVATA, 28.3 plus or minus 0.41, 29.9-25.1. Species reactions were correlated with the natural environmental conditions of their microhabitats and the predilection of "index" species for unique microhabitats within the bog sere. The consistent response of all species toward saturated humidities (95-100% relative humidity) was paralleled by the near-saturated humidities of the interstices of moss microhabitats. Temperature stratification within moss microhabitats and differential species responses to temperature are postulated as mechanisms restricting certain species to different seral stages and isolating sympatric species in similar habitats. (Auth)

<297>
Taylor, F.G., Jr. 1967. SPIRANTHES OVALIS Lindl. Present in Tennessee. Castanea, 32, 99-101 (ESD #194)

SPIRANTHES OVALIS was collected for the first time in Tennessee in Roane County in a study area dominated by second growth LIRIODENDRON TULIPIFERA. S. OVALIS is limited in this mesophytic forest to an area of deep sinkholes in terrain of the Knox dolomite. LYCOPODIUM FLABELLIFORME, a new species to the reported flora of the Atomic Energy Commission's Oak Ridge Reservation, is a recent invader in a 1948 loblolly plantation on sites which 25 years ago were cultivated fields. (KM)

<298>
Reichle, D.F. 1967, Late Spring. Radioisotope Turnover and Energy Flow in Terrestrial Isopod Populations. Ecology, 48(3), 351-366 (ESD #195)

Radiocesium turnover rates in terrestrial isopod populations were used to measure food consumption and metabolism under natural and laboratory-simulated field conditions. Four old-field and forest species were studied: ARMADILLIDIUM VULGARE (Latreille), ARMADILLIDIUM NASATUM Budde-Lund, CYLISTICUS CONVEXUS (DeGeer), and METOPONORTHUS PRUINOSUS (Brandt). Uptake, body burden equilibria, and elimination rates for cesium 134 were related to environmental temperature (Q10 equivalent or equal to 2). Dietary supplements of stable sodium, potassium, and cesium salts produced no effect upon cesium 134 elimination rates. Assimilation fractions from food were 60 to 64% for digestible dry matter, 70 to 73% for caloric, intake, and 70 to 87% for radiocesium. Body equilibrium concentrations and biological half-lives of radiocesium in each species permitted estimates of food consumption comparable to gravimetric determinations. Food intake varied between different species and ranged from 1.5 to 3.5% of dry body weight per day. Bomb calorimetry and respirometry measurements were used to partition the total energy budgets, caloric inputs required for maintenance, production, and growth were determined. Radiocesium elimination rates were correlated with the metabolic rates of individual species, and radionuclide turnover rates in tagged individuals were demonstrated to be a practicable means of determining the activity and metabolism of species in their natural habitats. (Auth)

<299>
Van Dyne, G.M., and W.G. Vogel 1967. Relation of SELAGINELLA DENSA to Site, Grazing, and Climate. Ecology, 48(3), 438-444 (ESD #196)

SELAGINELLA DENSA, small clubmoss, is an important component of central Montana foothill grasslands. In an area where it occupied 10-20% of the soil surface, above-ground biomass was 42-101 gram per m2. Soils growing S. DENSA were shallower, more rocky or gravelly, but less sandy, than soils without this species. High levels of fertility, shading, and mulch reduced, but additional water increased, its cover. Contrary to other reports, we found a greater decrease in cover on areas grazed intensively than on areas protected for 4 years. Cover on moderately grazed sites or on adjacent protected areas did not change. (Auth)

<300>
O'Farrell, T.P., and P.B. Dunaway 1967. Incorporation and Tissue Distribution of a Thymidine Analog in the Cotton Rat SIGMODON HISPIDUS. Comparative Biochemistry and Physiology, 22, 435-450 (ESD #197)

The incorporation and tissue distribution of the thymidine analog iodine 131-labeled 5-iodo-2'-deoxyuridine (iodine 131-labeled IUDR) and its catabolic product, radioiodine, were determined for the cotton rat, SIGMODON HISPIDUS. Over 95 per cent of the labeled IUDR was eliminated within 48 hours postinjection, and the majority of the retained activity was incorporated into the intestines, presumably by attachment to DNA. Activity in the gut largely determined the shape of the whole-body curves; therefore, the whole-body curves were a useful index to cell proliferation in this tissue. The half-life of SIGMODON intestinal cells was approximately 60 hours. More than 99 per cent of the radioiodine released during the metabolism of the labeled IUDR was excreted within 48 hours postinjection. Activity retained as iodine or iodide was concentrated on and in the skin-hair, where it had a long biological half-life. Cotton rats differed from laboratory rats and mice in that a greater quantity (0.4 per cent) of the initial activity was retained as iodine or iodide in the prostate gland and the seminal vesicle-coagulation gland. (Auth)

<301>
Roti Roti, J.L., and S.V. Kaye 1967. Calibration of Strontium 90 Plus Yttrium 90 Plaques for Irradiating Insects. ORNL-TM-1921; 22 p. (ESD #198)

Calibration dose-rate measurements have been made above two 34 centimeter diameter plane-disk sources containing approximately 75 mCi and 750 mCi of strontium 90 + yttrium 90, respectively. The contact dose rate in the center of the 75 mCi source was 656 rads per hour and the measured dose rate at contact in the center of the 750 mCi source was 4950 rads per hour. The data presented in this report are intended to be useful in planning the design of irradiation experiments with insects, in choosing desirable dose rates, and in estimating total doses. (Auth)

<302>
Shinn, A.F. 1967. Freshwater Fish in a Nuclear Disaster. Part of Proceedings of Commercial Fish Farming Conference held at Texas A & M University, College Station, Texas, February 1-2, 1967, (p. 51-55) (ESD #199)

Fallout contamination will probably not severely limit either fish production or consumption. Cesium 137 will be quickly absorbed on the bottom of most ponds. Strontium 90 can be removed from the flesh by simple short-time immersion in clear water. Iodine 131 decays to a safe level in 30 days. (KM)

<303>
Ciesla, W.M., J.C. Bell, Jr., and J.W. Curlin 1967. Color Photos and the Southern Pine Beetle. Journal of the American Society of Photogrammetry, 33(8), 883-888 (ESD #200)

Fifty-acre plots superimposed on color aerial photographs taken at a scale of 1:3960 were evaluated as a sampling unit for estimating the level of southern pine beetle infestations. Two color films were evaluated: Anscochrome D200, and Ektachrome Infrared Aero. Data from the photographs and subsequent field checks were analysed in accordance with procedures developed for analysing equivalent data taken from operation recorder surveys. This provided estimates of the number of infested areas and number of trees actively infested by the southern pine beetle with 90 per cent confidence limits. Ektachrome Infrared Aero film was superior to Anscochrome D200 because it was capable of discriminating between pines and hardwoods and had the ability to penetrate haze resulting in clearer imagery. Costs of photographic surveys conducted over three outbreak areas in 1966 ranged between $0.0055 and $0.0190 per acre depending upon the size of the area surveyed. These costs compared favorably with the cost of operation recorder surveys. (Auth)

<304>
Thomas, W.A., S.I. Auerbach, and J.S. Olson 1967, August. Accumulation and Cycling of Calcium by Flowering Dogwood Trees. ORNL-TM-1910; Ph.D. Thesis, University of Minnesota; 153 p. (ESD #201)

Distribution of calcium in flowering dogwood trees and major pathways of calcium circulation in the tree-soil system were studied to evaluate the function of this common understory species in the cycling of an essential element. The accumulation of calcium by various plant organs is documented and the rate of calcium circulation in the tree-soil system is determined. Accumulation of calcium in dogwood leaves permits a high "calcium pumping efficiency" of 71% (calcium lost from the tree by leaf fall as percentage of calcium in nonfoliar organs). Mineral soils under dogwoods had significantly greater concentrations of exchangeable calcium than did soil not under dogwood trees. Dogwood is probably most beneficial in limiting movement of nutrients (particularly calcium) through the soil profile, thus keeping them in the rooting zone of other species. (KM)

<305>
Witkamp, M., and M.L. Frank 1967. Retention and Loss of Cesium 137 by Components of the Groundcover in a Pine (PINUS VIRGINIANA L.) Stand. Health Physics, 13, 985-990 (ESD #202)

Retention, accumulation, and loss of cesium 137 by lichen, moss, needle litter, and plant rosettes were measured in a laboratory experiment. Cesium 137 was added to these forest floor components for 3 months in simulated rain, after which they were leached out with rainwater for 5 weeks. Accumulation was proportional to cesium 137 input. Retention increased in the order plant rosettes (72%) less than lichen or needles less than moss (96%). Biological uptake, as indicated by differences in retention between live and dead components, accounted for only 4-8% of the total retention. Underlying soil reduced retention by needles and lichen about one-third and one-half, respectively. Loss of accumulated cesium 137 was more rapid from dead plants than from live ones. Resulting half-times varied between 0.8 and 2.4 years. The calculated cesium 137 retention by the entire forest floor was 93%. (Auth)

<306>
Witkamp, M. 1967. Assessment of Microbial Immobilization of Mineral Elements. Soil Biology, 7, 36-37 (ESD #203)

A methodology to assess microbial immobilization of a number of elements in soil and leaf litter is reported. The method quantifies the effect of the microflora on the readily available fraction of mineral elements in litter, humus, and the soil under specified conditions. Maximum net immobilization on rewetted substrate incubated under simulated field conditions may serve as an arbitrary measure for the impact of the microflora on mineral cycling in natural systems. (KM)

<307>
Witkamp, M. 1964. Environmental Influences on Microbial Populations and Activity of the Forest Floor. Part of Proceedings of the 8th International Congress of Soil Science, Volume 8 held in Bucharest, Romania, 1964. Publishing House of the Academy of the Socialist Republic of Romania, (p. 647-654) (ESD #204)

Quantitative relationships of microflora and microbial activity are established with other factors and with rats of litter breakdown based on some data from European and American forests. In a given climate, substrate is the main controlling factor for microbial population. Bacterial counts are the best index for mean microbial activity. Microbial activity at any given time can be successfully predicted on the basis of bacterial density, temperature, moisture and litter age. (Auth) (KM)

<308>
Crossley, D.A., Jr., and M. Witkamp 1964. Effects of Pesticides on Biota and Breakdown of Forest Litter. Part of Proceedings of the 8th International Congress of Soil Science, Volume 8 held in Bucharest, Romaia, 1964. Publishing House of the Academy of the Socialist Republic of Romania, (p. 647-654) (ESD #205)

Naphthalene was used to separate the effects of soil fauna and microflora in the breakdown of oak leaves. Microarthropods fragment the leaf material and mix it with soil, but bacteria and fungi are responsible for the actual decay. To separate these different effects an insecticide was used to reduce arthropod populations in the litter. The resulting changes in litter fauna and microflora produced changes in rates of weight loss and radiocesium loss from the decayed litter. After a preliminary experiment naphthalene was selected as a suitable insecticide because it was highly effective against arthropods and affected the dieldrin, or chordane. The litter fauna has a pronounced influence on the rate of breakdown and the release of nutrient minerals from forest litter. Killing of the arthropods presumably stimulated the early microflora on the surface of the leaves, where as a gradual increase of microflora, occurred on normally decomposing litter. (Auth)

<309>
Edwards, N.T., and G.M. Van Dyne 1967, December. Metabolism of Herbicides in Ecosystems: A Review. ORNL-TM-2042; 34 p. (ESD #206)

The need for a better understanding of the fate of some of the commonly used herbicides in ecosystems prompted a general review of the literature, with emphasis on 2,4-D and 2,4,5T, to sumarize research which has been conducted. Based on a selected but representative sample of the diverse literature on herbicides, research seems to have centered around (1) effects of herbicides on animals, (2) degradation of herbicides by soil microorganisms and the effects of herbicides on soil microorganism activity, (3) behavior of herbicides within the plants, and (4) persistence of herbicides and their effect on succeeding plant growth. This report presents (a) abstracts of publications under the headings listed above, (b) a brief discussion of the types of toxic action of some of the commonly used herbicides, (c) and chemical structural formulas for the most common herbicides. This review suggests there is need for research on the movement and degradation of herbicides in ecosystems with special emphasis on (i) transfer of herbicides from sprayed plants to animals which may feed on these plants under natural conditions, and (ii) further consideration of sublethal effects on nontarget organisms. (Auth)

<310>
Patten, B.C., and M. Witkamp 1967. Systems Analysis of Cesium 134 Kinetics in Terrestrial Microcosms. Ecology, 48(5), 814-824 (ESD #207)

Laboratory experiments were conducted to determine patterns and rates of cesium 134 exchange in microecosystems composed of different combinations of radioactive leaf litter, soil, microflora, millipedes, and aqueous leachate. Rate constants were determined by fitting models to data with an analog computer. Simulations with the models permitted comparisons of different microcosms in terms of time to radiocesium equilibrium, steady state concentrations, concentration factors, input and output fluxes, turnover rates, and stability. Rate constants varied with different compartment combinations, indicating both qualitative and quantitative differences in the cesium exchange patterns within different systems. This result is generalized transfers of energy and matter in ecosystems are functions of networks which define intercompartmental interactions; internal coupling should be considered a significant variable in investigations of ecosystem processes. Points of particular interest derived from the computer simulations are (1) organism concentration factors for a material may vary in different systems, depending upon how the organism is coupled to other compartments; (2) total flux of a material in a steady state system may vary considerably from that in another system which receives identical input; (3) material turnover within compartments and in the system as a whole tends to increase as more compartments are added; and (4) stability of material concentration does not appear to increase with system complexity. (Auth)

<311>

<311>
Neal, E.C., B.C. Patten, and C.E. DePoe 1967. Periphyton Growth on Artificial Substrates in a Radioactively Contaminated Lake. Ecology, 48(6), 918-924 (ESD #208)

Periphyton colonization, biomass development and radionuclide accumulation were studied by suspending polyethylene tape vertically for up to 9 weeks in a radioactively contaminated lake. After 2 weeks biomass growth was nearly complete on the upper tape sections, but full development on the deeper sections took longer. Maximum biomass occurred at 25.4-50.8 centimeters (6-20 in.) depth. Bacterial colonization and slime formation went unobserved. Blue-greens were the initial algal dominants, succeeded by diatoms and filamentous greens. Species succession continued beyond biomass equilibrium, with blue-greens tending to maintain importance in the deeper zones and greens developing best in the upper, lighted regions. Animals were minor constituents. Radioisotope concentrations equilibrated rapidly in both the artificial substrates and the periphyton biomass. Zinc 65 was concentrated highly by the polyethylene tape, cesium 137 moderately, and cobalt 60 and ruthenium 106 only slightly or not at all. Ambient concentrations of zinc 65 in water and periphyton were below detection. The other isotopes contributed about equally (ca. 10-20 disintegrations per minute per milligram) to biomass radioactivity. Biomass activity-densities of ruthenium 106 and cesium 137 increased slightly with depth; this pattern was pronounced for cobalt 60. Factors considered to account for observed vertical distributions include: different radioisotope concentrations in surface and deep water; a hyperbolic rather than linear relationship between activity-density and biomass; and, in the case of cobalt 60, concentration by blue-green algae as an essential element, or by microbiota for use in cobalamin synthesis. (Auth)

<312>
Thomas, W.A. 1968. Calcium Content of MYCODIPLOSIS ALTERNATA (Diptera: Cecidomyiidae) Galls. Annals of the Entomological Society of America, 61(1), 234-235 (ESD #209)

Galls on CORNUS FLORIDA which had been tagged with calcium 45 were analyed to determine their effect on the distribution of weight, stable calcium and calcium 45 in the branches as part of an investigation of cycling of calcium by this understory tree species. Twigs supporting the galls had a significantly greater concentration of stable calcium and a nonstatistically different concentration of calcium 45 compared with galls. These differences were due to higher concentrations of stable and radioactive calcium in twigs than in all other branches combined. The specific activity was not significantly greater in galls than in branches or twigs. There were no significant differences in stable calcium or calcium 45 concentrations between parasitized and unparasited twigs of the same size. (KM)

<313>
Van Dyne, G.M., and P.T. Haug 1968, January. Variables Affecting in vitro Rumen Fermentation Studies in Forage Evaluation: An Annotated Bibliography. ORNL-TM-1973; 73 p. (ESD #210)

A bibliography was prepared with a review of literature through 1966 that examined methods and interpretations of in vitro evaluations of forage as well as sources of variation in these evaluations. These errors or variables appear to be four major types: (1) variations in microbial populations due to the diet of the lost animal, animal-to-animal differences, and inoculum processing differences; (2) variations due to different storage, grinding, and processing techniques in sample preparation; (3) differences attributable to inoculum (sample ratio, buffer, and nutrient medium); and (4) procedural variations such as length of fermentation, criteria of digestibility, and laboratory errors. Nine procedures from the literature are recommended which, if applied, could decrease variation in results by 50%. Two hundred and twenty five references, with abstracts, are included. A permuted title index provides a keyword index. (BBM)

<314>
Thomas, W.A. 1967. Dye and Calcium Ascent in Dogwood Trees. Plant Physiology, 42(12), 1800-1802 (ESD #211)

As part of an investigation of cycling of calcium by flowering dogwood trees, experiments were conducted to determine the pattern of the transpiration stream and the short-term distribution of stem inoculated calcium. Dye in stem-inoculated trees was confined to xylem and ascended dextrally in a narrow channel traversing about 90 percent of stem circumference every meter. Dye moved basipetally in approximately the same pattern as it moved acropetally. Uptake of dye was slower when the sun was obscured by clouds then when trees were in direct sunlight. Calcium 47 did not move primarily by mass flow as the dye apparently did. Calcium transport from xylem to phloem in the tagged dogwoods was demonstrated by presence of calcium 47 in bark above the stem segment from which all bark had been removed. Calcium 47 content of xylem, bark, and total stem decreased exponentially with increasing height in the stem. (KM)

<315>
Baker, C.E., P.B. Dunaway, and S.I. Auerbach 1968. Measurement of Metabolism in Cotton Rats by Retention of Cesium 134. ORNL-TM-2069; 48 p. (ESD #212)

Biological half-lives (T sub b) of cesium 134 were compared with resting metabolism measurements of cotton rats maintained at 5 degrees, 15 degrees, and 25 degrees C in an endeavor to develop a technique for determining respiration rates of animals in the field. Average T sub b values of the experimental groups were 6.3 days at 5 degrees C, 6.9 days at 15 degrees C, and 8.1 days at 25 degrees C; oxygen consumption measurements (cubic centimeters per hour per gram) averaged 3.2, 2.3, and 1.5, respectively. Regression and correlation analysis performed on the data of the individual animals indicated a linear relationship between T sub b of cesium 134 and resting metabolism. Although cesium 134 retention correlated well with oxygen consumption, it apparently did not correlate with body weight. Further investigations of 24-hour oxygen consuption measurements made over a wider range of metabolic rates (i.e., both above and below thermoneutrality) and consideration of certain factors which promote elimination of cesium are necessary to validate the apparent relationship between cesium 134 retention and general metabolism. (Auth)

<316>
Dunaway, P.B. 1968, January. Life History and Population Aspects of the Eastern Harvest Mouse. The American Midland Naturalist, 79, 48-67 (ESD #213)

REITHRODONTOMYS HUMULIS in the Oak Ridge, Tennessee, area is found mainly in certain habitats dominated by grasses and other herbaceous plants characteristic of early vegetational succession. Populations seldom are dense, but on a 4 ha, old-field area, trapping success ranged from about 4 to 18 individuals per 100 trap nights for 18 consecutive months. This population on the old-field area disappeared during severely cold weather in February-March of 1960, but a few individuals survived on a radioactive area. More females than males were captured in the periods June-November 1958 and May-November 1959, whereas more males were caught from December 1959 to February 1960. However, the sex ratio was about equal over a period of a year or more. The reproductive season extended from about late spring to late fall, but breeding occurred during winters of some years. Litter sizes ranged from 1-8 (av. 3.4). Cannibalism and abandonment of litters were characteristic of newly caught females. Average weights for females during reproductive periods were consistently greater than average weights of males, but even during nonreproductive periods females weighed as much or more than males. Weights of trapped individuals ranged from 3-17 g. Mortality of nestlings appeared to be severe, but survival after leaving the nests seemed to be relatively long. Huddling was common during cold weather. Territoriality seems poorly developed. Some individuals occupied relatively restricted ranges for periods of several months, but other mice shifted their activities from one part of an area to another. Ranges of the mice were less during the colder months than during the warmer months. Only heterosexual pairs of mice were ever trapped together, and these captures usually occurred during breeding periods. Erythrocyte count and mean corpuscular volume in the harvest mouse were not significantly different from the measurements for larger mice, but hemoglobin concentration and oxygen consumption were greater than in the larger mice.

<317>
Nelson, D.J. 1967. Microchemical Constituents in Contemporary and Pre-Columbian Clamshells. Part of Cushing, E.J. and Wright, H.E., Jr. (Eds.), Proceedings of the 7th Congress of the International Association for Quaternary Research Symposium on Quaternary Paleoecology, Vol. 7. Yale University Press, New Haven, Connecticut, (p. 185-204) (ESD #214)

A heterogeneous distribution of strontium, barium, and manganese within eight species of freshwater clamshells is related to annual growth and shell structure. Strontium and barium concentrations in the inner laminar layers of contemporary clamshells are similar to concentrations in the outer peripheral layers during the first several years of a clam's life. The most recently deposited laminar layers of older clams contain larger quantities of strontium and barium in six species and smaller quantities in two species. Concentrations of manganese increase annually in both the nacreous layers, but the laminar layers contain higher concentrations. Sodium and magnesium concentrations are relatively constant throughout the shells. There are inherent differences in the trace-element composition of clamshells of different species. Shells of ELLIPTIO CRASSIDENS from an Indian midden 1,000 to 2,000 years old contain concentrations of strontium, barium, and manganese 50 to 100% higher than in contemporary shells. The increased levels of these elements are related neither to recent man-made changes in the river nor to diagenesis. It is suggested that destruction of forests by an agricultural economy resulted in reduced concentrations of carbon dioxide in the soil and consequently in reduced rates of dissolution of alkaline earth carbonates from the soil matrix. These findings may have important implications for study of geochemical relationships between terrestrial and freshwater environments as well as for the geochemistry of the oceans. (Auth)

<318>
Cate, W.C., W.M. Ciesla, E.L. Norman, E.H. Rosenbalm, and J.W. Curlin 1967. Forest Management. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 117-118) 118 p. (ESD #215, Part, Section)

Southern pine beetle control dominated the forest management. In cooperation with the University of Georgia School of Forestry, work has begun on the development of a computerized system of optimum cut allocation using linear programming techniques. (HP)

<319>
Olson, J.S., and B.C. Patten 1967. Theoretical and Systems Ecology. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 111-116), 118 p. (ESD #215, Part, Section)

Subjects in theoretical and systems ecology include: 1) the system identification problem; 2) the radiant energy budget of a deciduous forest; 3) an initial model for energy flow in LIRIODENDRON forest; 4) vertical periphyton growth; and 5) rates of geochemical denudation of the continents. (HP)

<320>
Curlin, J.W., D.J. Nelson, T. Grizzard, F.L. Norman, F.G. Taylor, Jr., C.H. Abner, F.H. Boyett, E.E.C. Clebsch, W.F. Johnson, B.R. Fish, T. Tamura, and W.M. Snyder 1967. Watershed Aquatic Habitat Interactions. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 102-110), 118 p. (ESD #215, Part, Section)

A program was initiated that unifies the terrestrial, aquatic, and environmental studies in an effort to gain further understanding of the relationship between land and water. Walker Branch Watershed facility was described. Concentration and transport of suspended and dissolved material by river water was discussed. (HP)

<321>
Blaylock, B.G., C.E. DePoe, W.A. Griffith, W.R. Kevern, E.C. Neal, D.J. Nelson, B.C. Patten, J.R. Reed, and J.L. Wilhm 1967. Radionuclide Cycling in Aquatic Ecosystems. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 93-101), 118 p. (ESD #215, Part, Section)

Several different types of experiments were used to clarify the respective roles of fish flesh and blood in Sr uptake and turnover. Cesium and potassium were studied in aquatic food chains. Other studies include: 1) radiation effects on carp reproduction, 2) periphyton growth and radionuclide accumulation and 3) community structure and function of benthic macroinvertebrates in a constant temperature spring. (HP)

<322>
Baker, C.E., B.G. Blaylock, D.A. Crossley, Jr., G.J. Dodson, P.B. Dunaway, J.T. Kitchings, C. Koh, L.L. Lewis, C.M. McConnell, M.P. Miller, D.E. Reichle, J.D. Story, and L.E. Tucker 1967. Responses of Animal Populations to Ionizing Radiation. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 63-71), 118 p. (ESD #215, Part, Section)

Radiation effects in blood and radionuclide excretion in indigenous small mammals, and radiation effects in insects, fish and arthropods were research subjects. Radiation responses in peripheral blood of 4 species of indigenous rodents were measured after whole-body irradiation. Erthyrocyte number, hematocrit percentage, and hemoglobin concentrations were consistently lower than controls in the 60-rad rats for the first 11 days; these values also were lower than controls in the 200-rad animals for the first 4 days, but were slightly higher than controls from day 5 to day 13. The correlation between cesium retention and general metabolism in the cotton rat was tested in a laboratory study. Loss rates of Fe 59 at 25 C were determined in 7 species of native rodents in an effort to establish a suitable index of radiation damage in erythropoietic tissues and hemoglobin synthesis in free-ranging animals. The postirradiation survival of brown crickets in a grassland habitat was analyzed and compared with the results of laboratory experiments. Life history radiation sensitivity of bagworms was studied. Experiments with chironomids, DROSOPHILA, and mosquitofish showed that the exposure to ionizing radiation can influence the outcome of competition between closely related species. For Ru 106, Co 60, and Cs 137, concentration factors always increased during progression along the soil-vegetation-arthropod food chain. (HP)

<323>
Fraley, L., Jr., H.L. Ragsdale, F.G. Taylor, Jr., J.P. Witherspoon, and D.R. Johnson 1967. Responses of Plants to Ionizing Radiation. ORNL-4168; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1967, (p. 72-78), 118 p. (ESD #215, Part, Section)

Five studies on responses of plants to ionizing radiation are reviewed. They are: 1) radiosensitivity of forest tree species to acute fast-neutron radiation; 2) genetic modification of radiosensitivity dosimetry in forests around the HPRR; 3) effects of internal emitters on native plant species; and 4) radionuclide uptake as a measure of radiation stress in single-component microcosms. (HP)

<324>
Kaye, S.V., and D.A. Crossley, Jr. 1968. Radiotungsten Retention by Two Insect Species. Health Physics, 14, 162-165 (ESD #216)

Twenty adults of the brown cricket ACHETA DOMESTICUS and 10 adults of the large milkweed bug, ONCOPELTUS FASCIATUS, were tagged with radiotungsten and counted for radioactivity periodically for 2 days. For ONCOPELTUS, the interceptof the least-squares estimate with the ordinate is 99.9%, which suggests complete absorption of ingested radiotungsten from the drinking water. For ACHETA, absorption was apparently slightly less. Biological half-times were of 58 hours and 48 hours were computed for ONCOPELTUS and ACHETA respectively. In both insect species, the distribution of biological half-times for individual insects was found to be strongly skewed to the right. Biological elimination coefficients, however, have a symmetrical distribution. Radiotungsten accumulation and retention patterns for these two insect species show some similarities with radiocesium. (KM)

<325>
Curlin, J.W., and J.P. Witherspoon 1968. Components and Estimates of Dose to Roots of Potted Plants Exposed to Fast Neutron Radiation. Health Physics, 14, 167-168 (ESD #217)

Thermal neutron fluence increased rapidly between the face of the soil and the 5 cm layer. The quantity of activation products from soil minerals followed a trend similiar to that of the thermal neutron distribution. Four radionuclides were indentified as the major contributors of the induced gamma activity: manganese 56, chromium 51, hafnium 181, and zirconium 95-and niobium 95. Activity of these nuclides followed the same general trend as the thermal neutron fluences. The dose to the center of the soil mass from activation products was only 1.1 percent of the total dose. Fission gamma rays from the reactor accounted for most of the gamma radiation dose but this component was only 2.8 percent of the total dose. Thermal neutron dose was very small while the dose from neutrons with energies greater than or equal to kev accounted for 96 percent of the total dose. (KM)

<326>
Kaye, S.V., and D.J. Nelson 1968. Analysis of Specific Activity Concept as Related to Environmental Concentration of Radionuclides. Nuclear Safety, 9(10), 53-58 (ESD #218)

The specific-activity technique is reviewed and evaluated for estimating potential hazards to man from consuming food or water derived from radioactivity-contaminated aquatic environments. Pertinent literature on past applications of this technique is discussed, and the findings are interpreted. A specific-activity model proposed by the National Academy of Sciences-National Research Council is evaluated with an analysis of the time-dependent parameters (biological half-time, physical half-life, and biological growth) to determine the sensitivity of the calculated maximum allowable specific activity of radioactivity in the aquatic environment to changes in the parameters. In all cases the guidance given by the specific-activity approach is conservative. The major restriction on application of the specific-activity models appears to be incomplete mixing and differing biological availability between the radioisotope and the stable-isotope analog. (Auth)

<327>
Van Dyne, G.M. 1968, January. Prediction by Nonlinear Programming of Relative Chemical Composition of Dietary Botanical Components. Journal of Range Management, 21(1), 37-46, 60 (ESD #219)

Nonlinear programming and matrix methods of analysis were used to predict relative chemical composition, energy values, and cellulose digestion coefficients for dietary botanical components. These methods provided data that would be difficult or impossible to obtain by direct experimental techniques. Estimates of chemical composition are presented for plant groups, plant parts, and individual species in the diets of cattle and sheep grazing together in early, middle, and late summer on annual range. These results illustrate the usefulness of, and the need for, training more resource scientists in systems analysis and computer techniques for biological problems. (Auth)

<328>
Crossley, D.A., Jr., (Reviewer) 1967, Autumn. Methods for Insect Ecology. Ecology, 48(6), 1057 (ESD #220)

T.R.E. Southwood's book entitled "Ecological Methods with Particular Reference to the Study of Insect Populations" (Barnes and Noble, New York, 1966), is a comprehensive manual of techniques for studying the ecology of insects. The importance of careful experimental design is emphasized. The subjects discussed include: dispersion of insect populations and the statistics used in describing them; sampling theory; mathematical models for insect distributions; methods of absolute population estimates; methods for description and analysis of population size changes; and methods for measurement of community diversity and of energy flow. (KM)

<329>
Van Dyne, G.M., R.G. Wright, and J.F. Dollar 1968. Influence of Site Factors on Vegetation Productivity: A Review and Summarization of Models, Data, and References. ORNL-TM-1974; 238 p. (ESD #221)

The foundation for the development of complex but realistic simulation models is laid. Mathematical models are reviewed which have been used in predicting vegetation productivity as a function of edaphic, climatic, and physiographic parameters and information on types of site variables of vegetation productivity for individual species productivity are presented in a tabular manner. Individual plot data on dependent productivity measurements and independent site factors were located, collected and prepared for computer analysis. A preliminary bibliography of site factor studies is provided. (KM)

<330>

<330>
Dunaway, P.B., G.E. Cosgrove, and J.D. Story 1968, January. Capillaria and Trypanosoma Infestations in MICROTUS OCHROGASTER. Part of Proceedings of the Copenhagen Conference on Ecosystems held in Copenhagen, Denmark, 1967, (p. 271-288) (ESD #222)

Blood samples were taken from ten praire voles from Putnam County, Tennessee two weeks before receiving acute gamma irradiation doses ranging from 520-1270 rad. Four of the animals died after irridiation, one of which was necropsied and found to be infested with CAPILLARIA. The disease was probably present before irrdiation and was unrelated to it. The six surving M. OCHROGASTER were killed 30 days postirradiation. CAPILLARIA infestations were severe in three individuals, slight in two and nonexistent in three. TRYPASOSOMA sp. were found in each of the smears obtained from seven of the animals. No animal was free from both infestations. There were no statistically different blood values among the CAPILLARIA-infested animals, but of the four with severe infestations, three had the lowest erythrocyte counts of all specimens. The animals were somewhat radioresistant in comparison with certain species of indigenous rodents tested. (KM)

<331>
Witherspoon, J.P. 1968. Effects of Internal Cesium 137 Radiation on Seeds of LIRIODENDRON TULIPIFERA. Radiation Botany, 8, 45-48 (ESD #223)

Mature LIRIODENDRON TULIPIFERA (tulip poplar) seeds were collected from cesium 137-tagged and control trees in October 1965. After stratification, all seeds were planted in flats under greenhouse conditions. Germination of controls was almost 2 times that of tagged seeds. Analysis of seed production, however, showed that control trees produced 2 to 3 times more filled ovules than tagged trees, thus accounting for germination differences. Lower seed production might be related to internal radiation from cesium 137 during floral development and seed formation. (Auth)

<332>
Taylor, F.G., Jr. 1968. Some Effects of Acute Gamma Radiation in Giant Sequoia Seedlings. Radiation Botany, 8, 67-70 (ESD #224)

Actively growing Giant Sequoia seedlings (SEQUOIA GIGANTEA (Lindl.) Deene.) received acute gamma radiation from a cobalt 60 source at various dose rates ranging from 42 to 1119 rad/24 hr. While maximum radiation levels (697 and 1119 rad) proved to be sublethal, growth of primary stems was inhibited 28 percent by 134 days postirradiation. Microscopic examination of foliar tissues receiving from 346 to 1119 rad revealed abnormal development of the vascular strand as the result of a reduction of elements per xylem row, extensive development of transfusion tissues, and increased cell wall thickness of some tracheids. Double or twin resin ducts also were observed in leaves receiving 697 rad. (Auth)

<333>
Olson, J.S. 1965. Use of Tracer Techniques for the Study of Biogeochemical Cycles. Part of Proceedings of the Copenhagen Conference on Ecosystems, 1967, Copenhagen, Denmark (ESD #225)

Radioactive tracers are very useful in studying the speed at which elements are transported through the ecosystem and in what quantities. Cesium 134 and cesium 137 are ideally suited for long-term experiments on the pathways and general rates of alkali metals through the ecosystem after ions leave the foliage. Tagged studies using LIRIODENRON showed that foliage concentrations of cesium reached a maximum in June, and decreased throughout the summer. The decrease was considerably greater than that actually accounted for by rain leaching, premature leaf fall or insect feeding. A very important withdrawal of cesium from foliage to branches, the tree boles and roots had occurred. A matrix notion is used to describe the characteristics of transfer in space of tagged chemicals. (KM)

<334>
Gore, A.J.P., and J.S. Olson 1968. Preliminary Models for Accumulation of Organic Matter in an ERIOPHORUM/CALLUNA Ecosystem. Aquilo, Service Botanica, 6, 297-313 (ESD #226)

A clipping experiment was conducted which measured accumulation of living and standing dead plant material. These studies and others provided estimates of rates of transfer of organic matter between the major compartments of a bog ecosystem. Complete removal of above-ground parts required five years of recovery. At this time, accumulation of living and standing dead plant materials was 320 g/m2 for ERIOPHORUM VAGINATUM and 510 g/m2 for the total higher plant community. Simple algebraic expressions and computer simulation were used to show the consequences of net changes resulting from a shifting balance of income minus loss in each of a series of coupled compartments. Refinements in the modeling should include separation of the several live plant species and their parts into different compartments and allow for seasonal variation in net primary production. (BBM)

<335>
Rohwer, P.S., and S.V. Kaye 1968.
Age-Dependent Models for Estimating Internal Dose in Feasibility Evaluations of Plowshare Events. ORNL-2229; 36 p. (ESD #227)

This report presents age-dependent models which are used in the INREM computer code for calculating the radiation dose resulting from inhalation or ingestion of radionuclides. Use of age-dependent models in feasibility studies permits identification of the critical segment of the population and provides the guidance necessary for planning of remedial action. Results of example dose calculations are presented for tritium and iodine 131 to illustrate use of the INREM code. The radionuclide input used for the tritium example is based on estimated concentrations released to air after combustion of natural gas stored in the Project Ketch reservoir. The idoine 131 example illustrates the influence of the age-dependent parameters in the dose model upon the resulting dose estimates. A computer code called EXREM is being tested for external dose calculations and will be reported in a future progress report. (Auth)

<336>
Van Dyne, G.M. 1968, June. Secondary Succession in Abandoned Cultivated Fields: An Annotated Bibliography. ORNL-TM-2104; 70 p. (ESD #228)

A bibliography of 120 references is presented as preliminary work for a comprehensive review and analysis of old-field succession. Abstracts of important papers and a computer generated index of keywords from titles of the articles are included. Much of the past work has been descriptive. More quantitative studes of ecosystems as a unit are needed. (BBM)

<337>
Reichle, D.E., and D.A. Crossley, Jr. 1968. Investigation on Heterotrophic Productivity in Forest Insect Communities. Part of Petrusewicz, K. (Ed.), Proceedings of a Symposium on Secondary Productivity of Terrestrial Ecosystems held in Warsaw, Poland, 1967, (p. 563-587) (ESD #229)

A multidisciplinary approach and radioisotope techniques were employed to elucidate the cesium 137 movement through the ecosystem with objectives of measuring rates of cycling, determining standing radiocesium distribution and transfer rates in foodchains and other components, and deriving information for predicting the behavior of this hazardous radionuclide in entire landscapes. The area under study is a small part of a rich LIRIODENDRON forest. The rate of bioelimination of cesium 137 is a function of the general metabolic rate of the insect and doubles with 10 degree increase in temperature over the range 8 degrees to 28 degrees. The size of insect species can be the basis of cesium turnover rates provided certain restrictions are applied. Highest cesium 137 levels were found in the leaf-eating herbivores. There is a general decrease in cesium 137 content during movement along food chains with herbivorous insects (except sap feeders) having the highest concentrations, omnivores intermediate concentrations, and predators the lowest concentrations per unit weight. Based on calculations of standing crop and leaf area consumed by insects the total primary production was estimated to be 360 g/m2 and 1.64 x 10(E+3) kcal/m2 calculating from consumption rates and observed consumption gives a standing crop of canopy herbivores on LIRIODENDRON between the limits of 40 and 120 mg/m2. (KM)

<338>
Williams, E.C., Jr., and D.E. Reichle 1968. Radioactive Tracers in the Study of Energy Turnover by a Grazing Insect (CHRYSOCHUS AURATUS Fab., COLEOPTERA CHRYSOMELIDAE). Oikos, 19(1), 10-18 (ESD #230)

Radioisotope tags of rubidium 86 and phosphorus 32 were used to measure food consumption by the chrysomelid beetle CHRYSOCHUS AURATUS feeding upon the old field herb APOCYNUM CANNABINUM. The elimination of isotope by beetles which had fed upon tagged plants was used to estimate the rates of food consumption. For individuals at isotopic equilibrium with their food base, isotope input (I) equals the biological turnover of isotope: I = kQ sub eM/a, where k is the turnover rate of isotope, Q sub e is the equilibrium concentration of isotope in the beetles, M is mass (mg dry wt), and a is the assimilation coefficient for the particular radioisotope. If the radioisotope concentration of the food base is known, input also can be expressed as food consumed. Turnover rates (k) were calculated from biological half-lives (T sub b), where k = 0.693/T sub b. The biological half-life of rubidium 86 in CHRYSOCHUS was one day, while that of phosphorus 32 was 7.5 days in females and 10.2 days in males. The calorific value of APOCYNUM leaves was 4625 calories per gram dry weight (5640 calories per gram ash-free weight); that of CHRYSOCHUS was 5227 calories per gram dry weight (5337 calories per gram ash-free weight). Individuals consumed 56.8% (15.9 milligrams) of their dry body weight in food per day. Of the ingested foliage, 43% of the ash-free dry matter was digested, 56% of the energy assimilated, and 71% of the ash content assimilated. The calorific value (calories per gram) of digested food was 1.17 times greater than that consumed. Beetles assimilated 87% of the rubidium 86 and 74% of the phosphorus 32 present in food. Ranking of turnover times showed CHRYSOCHUS to be most conservative in its expenditure of food energy and dry matter, followed by mineral constituents. (Auth)

<339>

<339>
Auerbach, S.I., E.A. Bardill, B.G. Blaylock, P.G. Bruno, J.L. Cooley, G.E. Cosgrove, G.J. Dodson, P.B. Dunaway, N.A. Griffith, A.M. Jenkins, R.G. Jordan, S.V. Kaye, R.I. Van Hook, J.T. Kitchings, P.G. Koehler, H.P. Landreth, M.P. Miller, M.J. Mitchell, E. Oertel, D.L. Willis, R.V. O'Neill, D.E. Reichle, A.F. Shinn, J.D. Story, C.E. Styron, and L.E. Tucker 1970, January. Responses of Animal Populations to Ionizing Radiation. ORNL-4446; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1969, (p. 41-65), 162 p. (ESD #230, Part, Section)

Laboratory, field, and systems analysis approaches were employed to measure genetic, cytologic, individual, and population effects of acute and/or chronic radiation on vertebrates and invertebrates. Parameters investigated include tissue damage, changes in radionuclide incorporation rates, radiation profiles, survivorship, fecundity, chromosomal aberrations, metabolism, food consumption, energy flow, competition, temperature, and RBE. Field studies with fallout simulant and Cs 137 were conducted. Animals studied include invertebrates, rodents, and honeybees. Separate sections include: open-field dosimetry; application of LiF crystals in ecological radiation dosimetry; effect of chronic beta radiation of FOLSOMIA sp. (Collembola); simulated fallout radiation effects on earthworm populations; mammal studies in field enclosures; honeybee irradiation studies; applications of correlation matrices to investigations of community dynamics; effect of temperature and radiation stress on the survivorship of isopods; population genetics and radiation effects studies; effects of chronic gamma radiation on snail reproduction; radiation sensitivity and temperature effects in GAMBUSIA; radiation effects on carp reproduction; radiosensitivity of the newt NOTOPHTHLAMUS VIRIDESCENS; comparative radiosensitivity of vertebrates; and incorporation of Fe 59 in mammals. (CO)

<340>
Thomas, W.A. 1968. Calcium Distribution in Leaves: Autoradiography Versus Chemical Analysis. International Journal of Applied Radiation and Isotopes, 19, 544-545 (ESD #231)

Autoradiography of leaves collected in July from CORNUS FLORIDA which had been stem inoculated with calcium 45 in early May show apparent accumulation of radiocalcium in the petiole, midrib and primary lateral veins. Distribution of a radioisotope as revealed by autoradiograms can be altered (from no apparent radioactivity to uniform distribution throughout) by varying film exposure time and developing procedures. This technique used alone may not indicate when the stable element is concentrated on a total leaf basis. (KM)

<341>
Auerbach, S.I., D.A. Crossley, Jr., and A.F. Shinn 1967. Postattack Insect Problems. Part of Proceedings of the Symposium on Postattack Recovery from Nuclear War, held in Fort Monroe, Virginia, November 6-9, 1967, (p. 137-142) (ESD #232)

It has been postulated that insect plagues would be one of the major consequences of a nuclear attack because while insects are relatively radioresistant their chief predators, birds, are not. Little is known about beta-dose sensitivity of insects and investigations are needed in this area. The radiosensitivity and response of insects should be known for their whole life cycle because sensitivity to ionizing radiation may vary by a factor of 100 or more over the life cycle. Another area where study is needed is the problem of the interaction of radiation damage and other environmental stresses. Because of the importance of pollinating insects to food production studies on the radiosensitivity of the honey bee are necessary. (KM)

<342>
Kaye, S.V., and P.S. Rohwer 1968. Estimating External Dose in Feasibility Evaluations of Plowshare Events for April 1, 1968 to June 30, 1968. ORNL-TM-2249; 18 p. (ESD #233)

A brief description is given of the EXREM computer code for calculating dose equivalent rates and dose equivalents from external beta and gamma sources of radioactivity which might result from nuclear engineering detonations. Three modes of external exposure are considered: 1) submersion in contaminated air, 2) submersion in contaminated water, and 3) exposure above a contaminated surface. This code will handle up to 25 releases of radioactivity involving up to 250 radionuclides and two locations for each mode of exposure. The machine output from a sample problem is shown in the Appendix. (Auth)

<343>
Turner, W.D., S.V. Kaye, and P.S. Rohwer 1968. EXREM and INREM Computer Codes for Estimating Radiation Doses to Populations from Construction of a Sea-Level Canal with Nuclear Explosives. K-1752; 193 p. (ESD #234)

EXREM is a computer code to estimate the dose equivalent rate and the total dose equivalent from both beta and gamma radiation resulting from submersion in contaminated water, submersion in contaminated air, and exposure to a contaminated surface. There can be more than one environmental release, and exposure can begin at any time after the first release. INREM is a computer code to estimate the cumulative dose equivalent to body organs resulting from a continuous intake. The organ parameters are dependent on the age of the individual, and the intake is a function of post-detonation time and the individual's age. Although the codes were specifically written to estimate doses to populations from construction of a sea-level canal, they may be useful in other dose-estimation studies involving releases of radioactive materials to the environment. (Auth)

<344>
Patten, B.C., and G.M. Van Dyne 1968. Factorial Productivity Experiments in a Shallow Estuary: Energetics of Individual Plankton Species in Mixed Populations. Limnology and Oceanography, 13(2), 309-314 (ESD #235)

A nonlinear programming method is described for estimating productivity parameters of individual plankton populations from data on mixed species water samples. The method is flexible in yielding average values over a treatment set established by experimental design. Specimen data on in situ populations of SKELETONEMA COSTATUM are examined for illustration. Changes in estimated energy-processing characteristics of this diatom during a summer succession in the York River, Virginia, indicated a wide range of physiological states available to the species. Computed values of its productive output per individual were related inversely to corresponding values for other species. Various usages of the technique are discussed. (Auth)

<345>
Nelson, D.J., (Reviewer) 1966. Ecology and the Industrial Society. Health Physics, 12, 1507-1508 (ESD #236)

Ecology and the Industrial Society, edited by G. T. Goodman, R. W. Edwards, and J. M. Lambert, Wiley, New York, New York, 1965, is the British Ecological Society Symposium No. 5. The 15 papers in the symposium embrace pollution of air, freshwater, marine and terrestrial environments. Within these areas the following subjects are included: disposal of radioactive wastes to sea, radioactive isotopes in freshwater, aquatic environments, toxicities of pesticides, pesticides in terrestrial environments, ecology of groups of organisms occupying particular habitats or substrates, land dereliction, plant tolerance to heavy metals, and pollution control. (KM)

<346>
Kitchings, J.T., P.B. Dunaway, J.D. Story, and L.F. Tucker 1968. Use of Radioiron Iron 59 as an Index to Hemopoietic Damage Caused by Ionizing Radiation. Journal of the Tennessee Academy of Science, 43(3), 85-87 (ESD #237)

Elimination rates (lambda sub b) and biological half-lives (T sub b) of radioiron (iron 59) in seven species of wild rodents ranged from ORYZOMYS PALUSTRIS (lambda sub b = 0.18%, T sub b = 385) to REITHRODONTOMYS HUMULIS (lambda sub b) = 0.50%, T sub b = 137). No significant difference in retention of iron 59 was noted after injections of 0.475 uCi or 0.110 uCi. The animals were exposed to ionizing radiation on the one hundred-fourteenth day of the experiment. One group (400 rad) exhibited no decrease in iron retention with the exception of radiosensitive rice rats, while in the other group (doses approaching the lethal dose 50/30) all species except the house mouse showed a marked decrease in retention. It is believed that the normal mechanism involved in the return of hemoglobin disintegration products, notably released iron, to the hemopoietic system is impaired. A discussion of renal elimination of the released iron is presented. (Auth)

<347>
Curlin, J.W., and D.J. Nelson 1968. Walker Branch Watershed Project: Objectives, Facilities, and Ecological Characteristics. ORNL-TM-2271; 106 p. (ESD #238)

One of the most serious environmental problems facing the eastern U. S. is that of water quality and stream pollution. Small experimental watersheds which define practical ecosystems provide a means for studying the effects of man-caused disturbances on water quality. Walker Branch Watershed, a 241-acre forested catchment basin, has been established to provide data on baseline values for unpolluted natural waters, contribute knowledge of cycling and loss of chemical elements in natural systems, and enable construction of empirical models with which to predict the ecological effects of man's activities. This report outlines the objectives of the project, describes the facility and summarizes the ecological characteristics of the watershed. (Auth)

<348>
Blair, W.F., S.I. Auerbach, D.M. Gates, R.F. Inger, and B.H. Ketchum 1968. The Importance of Ecology and the Study of Ecosystems. Part of Joint House-Senate Colloqium, National Policy for the Environment, (p. 154-158) (ESD #239)

The case for ecology is presented within the basic thesis that the time has come when we must make choices among various fields of science as a matter of public policy. Ecology has a high social merit as it deals with topics that are highly significant in terms of human welfare. Ecology by its very nature envelops many different scientific fields and its contribution to the development of science is the synthesis of information from many sources into concepts of inceasing generality. Many major national problems can be studied through the study of ecology and ecosystems. (KM)

<349>
Dahlman, R.C., and S.I. Auerbach 1968, November. Preliminary Estimation of Erosion and Radiocesium Redistribution in a Fescue Meadow. ORNL-TM-2343; 24 p. (ESD #240)

The potential radioactivity redistribution was evaluted for observed and hypothetical conditions of precipitation prior to application of a fallout simulant to fescue vegetation. Estimates from this analysis are compared with those of the radionuclide movement experiment from Area 0807 and also compared with predictions of erosion using the Wischmeier and Smith soil-loss equation. Based on observed erosion loss as a function of different precipitation events, approximately .06 percent of the Cs 137 contaminant will move from each contaminated area annually, and the input to the natural drainage system will be less than 2 mCi from 4 100 m2 plots. This estimate is one-fortieth of other independent predictions and measurements because the dense fescue vegetation and sod of the simulant-plots greatly reduce erosion and mineral element loss in runoff. (Auth)

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<350>
Patten, B.C. 1967. Ecological Systems Analysis and Water Quality. Part of Proceedings of Third Annual Symposium on Water Resources Research, Systems Approach to Water Quality in the Great Lakes held at the Ohio State University Water Resources Center, September, 1967 (p. 37-45) (ESD #241)

The current thinking in systems ecology in reviewed by way of illustrating how systems analysis techniques are beginning to be used in redefining and exploring ecological problems. The topics covered include: linear dynamic systems the optimum diversity problem, network problems and the relation of these topics to aquatic systems and water quality. (KM)

<351>
Witkamp, M. 1967. Accumulation of Cesium 137 by TRICHODERMA VIRIDE Relative to Cesium 137 in Soil Organic Matter and Soil Sclution. Soil Science, 106(4), 309-311 (ESD #242)

An attempt was made to quantify some of the relationships between the concentrations of a mineral element in a common soil fungus, in natural solid organic substances, and in the surrounding solution. Cesium 137 concentration of the mycelia is a function of both the concentration and the availability of cesium 137 in the substrate. Cesium 137 concentration in mycelium without direct contact with the solid donor substrate can be directly related to the cesium 137 concentrations in the surrounding liquid medium. Concentrations of cesium 137 in mycelia on solid substrate were invariably higher than those in mycelium from liquid. Mineral concentrations in mycelia in direct and indirect contact with the donor substrate can be calculated and predicated in terms of the concentration, solubility, and availability of the mineral in the substrate. (KM)

<352>
Goolsby, M. 1968, September. How Does Nuclear Radiation Affect Honey Bees?. American Bee Journal, 108(9), 352-353 (ESD #243)

Results of laboratory irradiation experiments indicate that bees are definitely affected at lower levels of radiation. Length of life of bees ranged from 9.9 days for those irradiated with 15,000 rads and 8.0 days for those irradiated at 5,000. Reduction in temperature greatly affected and increased the life span in bees. Either gamma or neutron irradiation of 5,000 rads reduced bees by about 21%. Irradiation of a field test group to 5,000 rads cobalt 60 gamma radiation produced different results. By 14 days the flight activity as indicated by counts using the Gary funnel and daily weight of pollen collected dropped rapidly to zero while that of the control group stayed about the same. Within 21 days the irradiated hives were completely eliminated as functional units. Only a few bees remained alive, and these few could not carry out the usual activity of honey bees. (KM)

<353>
Dahlman, R.C. 1968. Root Production and Turnover of Carbon in the Root-Soil Matrix of a Grassland Ecosystem. Part of Ghilarov, M.S. (Ed.), Proceedings of International Symposium on Methods of Productivity Studies in Root Systems and Rhizosphere Organisms held in USSR, August 28-September 12, 1968. USSR Academy of Sciences, Nauka Publishing House, Leningrad, USSR, (p. 11-21) (ESD #244)

Root production and turnover parameters have been determined for native tall grass prairie in Central United States. The measured annual increment of ash free root organic matter was at least 450 grams per m2 for the 0 to 75 cm root system compared with at least 460 grams per m2 shoot production. Average annual turnover of the root system was estimated as 110 and 590 years for topsoil and subsoil respectively. Labeling the plants of the ecosystem with carbon 14 helped to investigate in situ transfer of carbon from roots to soil humus. A maximum of 85% of the assimilated label was translocated to the root system of mature plants. Radiocarbon disappearance from roots of the 0 to 25 cm horizon followed a linear trend which suggested root system turnover every 4 years. Maximum cumulative transfer of carbon 14 from the roots to the soil was observed 10 to 14 months after the roots were tagged when 45% of the carbon 14 lost from roots was recovered in humus. The initial carbon 14 humus products were rapidly decomposed, and after 26 months only 9% of the radiocarbon root loss was present. Both rapid transfer from roots to soil and the large fraction of decay products which disappeared as CO2 indicate a rather short residence time for most organic materials in these parts of the carbon cycle. (Auth)

<354>
Olson, J.S. 1968. Distribution and Radiocesium Transfers of Roots in a Tagged Mesophytic Appalachian Forest in Tennessee. Part of Ghilarov, M.S. (Ed.), Proceedings of International Symposium on Methods Productivity Studies in Root Systems and Rhizosphere Organisms held in USSR, August 28-September 12, 1968. USSR Academy of Sciences, Nauka Publishing House, Leningrad, USSR, (p. 133-139) (ESD #245)

Cesium 137 tagged in dominant LIRIODENDRON TULIPIFERA trees in a mesophytic forest at Oak Ridge National Laboratory was rapidly translocated to roots and other parts of the ecosystem. The tracer aided estimation of root biomass and trends of distribution and root activity with depth. Very fine roots separated by flotation were highest at the surface and diminished by a factor of 0.5 with each 2.9 centimeter depth. Manually separated roots (mostly 1-15 millimeters) were highest in the 2.5-5 centimeters layer and diminished by a factor of 0.5 with about 7 centimeters depth. Compartment models treating simultaneous incomes and losses for major parts of the tagged forest suggested a turnover fraction near 0.3% of the root cesium per day. (Auth)

<355>
Styron, C.E. 1968. Operation and Maintenance of the Madison Research, Inc. Thermoluminescent Dosimetry System. ORNL-CF-68-11-56; 25 p. (ESD #246)

This report provides users of a Madison Research, Inc. thermoluminescent dosimetry system with a brief schedule for routine operation of the system, and a discussion of operation, calibration, and maintenance sufficient for an understanding of the system's operation. The report does not deal exhaustively with the theory of thermoluminescence. A selected bibliography is provided for that purpose. (Auth)

<356>
Cristofolini, G., and S.M. Cristofolini 1967. Phytosociological Study on Some LIRIODENDRON TULIPIFERA L. Forests of Tennessee, USA. Giornale Botanics Italiano, 101(6), 317-346 (Translation) (ESD #247)

This research is based on a set of phytosociological relevees listing the species associated with tulip tree dominated forests and on a number of ecological observations of these forests. The analysis of the phytosociological table has been performed with the aid of CDC-1604 digital computer. A table of relevees, diagrams of stratification and life-form spectra and diagrams of distribution in classes present are given and discussed. LIRIODENDRON-dominated stands on Knox dolomite in the lower elevations of Eastern Tennessee are floristically homogeneous and perhaps constitute an association in the sense of European phytosociologists. Structure and life form spectra show that it is a form intermediate between the northern broadleaved forest and the evergreen tropical forest, with a particular abundance in geophytes. According to the ecological analysis of the flora it is mesic-submesic vegetation. Distribution of tree species in the various layers suggests succession toward a mixed broadleaved forest dominated by oaks and hickories. On the basis of a phytosociological analysis it is supposed that in these conditions LIRIODENDRON does not form climax communities even though trees can live several hundred years and can reproduce in gaps. The vegetation studied represents a transitory LIRIODENDRON-dominated stage of the Appalachian regional oak forest. (Auth) (JC)

<357>
Kaye, S.V. 1968. Distribution and Retention of Orally Administered Radiotungsten in the Rat. Health Physics, 15, 399-417 (ESD #248)

Two complementary experiments were performed to estimate the retention and gross distribution of radioisotopes of tungsten in the rat. The first experiment involved the measurement of tungsten 187 in urine, feces, blood, plasma, GI tract, and residual carcass of 24 rats over a 3 day period. The second experiment involved the distribution and retention of tungsten 185 in major organs of 70 rats over periods of up to 254 days. The radiotungsten was administered by gavage in 1 milliliter of tungstate solution at pH 8 to adult Wistar rats. Urinary and fecal excretion each accounted for approximately 40% of the administered dose after 24 hours. Long-term studies of tungsten 185 disclosed that after 100 days, greater than 99% of the total body burden (about 0.4% of the administered dose) was retained in bone with a biological half-time of 1100 days for the slowest component of a three-component elimination curve. This half-time appears to be longer than previous studies have reported, indicating that bone may be the primary site of damage from long-term retention of tungsten 181 and tungsten 185. Elimination from soft tissues was relatively rapid with highest concentrations during the first week in the following tissues: spleen, hair, kidney, uterus, prostate, and ovary. (Auth)

<358>
Menhinick, E.F., and D.A. Crossley, Jr. 1968. A comparison of Radiation Profiles of ACHETA DOMESTICUS and TENEBRIO MOLITOR. Annals of the Entomological Society of America, 61(6), 1359-1365 (ESD #249)

Radiation-induced mortality was investigated for developmental stages of house crickets, ACHETA DOMESTICUS (L.), and yellow mealworms, TENEBRIO MOLITOR L. Insects were exposed to gamma rays from a cobalt 60 source at rates of 3 or 30 kiloroentgens (kR) per minute and given total exposures of 1-512 kilorentgens in 100% increments. Postirradiation temperature was 28 degrees centigrade. Effects were expressed as differences in mean and median life expectancy. In general there was a decline in radiosensitivity with age, although there were exceptions. ACHETA was unusually radiosensitive, with life expectancy of all stages severely shortened by exposure to 4 kiloroentgens. TENEBRIO pupae and adults exhibited a survival plateau, with similar life expectancies following exposures from 8 to 32 or 64 kiloroentgens. Some incrase in life expectancy appeared following low exposure doses of radiation. (Auth)

<359>
Crossley, D.A., Jr., D.E. Reichle, and M.P. Hoglund 1969, January. Transient Behavior of Radioisotopes in Insect Food Chains. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 97-98), 160 p. (ESD #250, Part)

Equations are presented to predict the equilibrium levels of isotope in successive trophic levels and of the intervals elapsed between peak concentrations. The transient behavior analysis described results in biological turnover rate estimates for radioisotopes in entire trophic levels composed of many separate species populations. Similiar applications may be made in predicting the movement and fate of nutrient elements and other environmental pollutants in food chains. (KM)

<360>
O'Neill, R.V., and C.E. Styron 1969, January. Applications of Compartment Modeling to Population Dynamics. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division ANNUAL Progress Report for Period Ending July 31, 1968, (p. 140-142), 160 p. (ESD #250, Part)

Measured population statistics on Collembola were used in a compartment modeling technique to extrapolate results for a longer period of time than data were taken. Parameters which limit the population's ability to increase in the field were incorporated into the model to simulate natural effects. The parameters included self inhibition, sinusoidal temperature function, food availability function and a predator function. The study described demonstrates the practical application of modeling for preliminary but quantitative predictions of potential population increase under natural populations. (KM)

<361>
O'Neill, R.V. 1969, January. Indirect Estimation of Energy Fluxes in Animal Food Webs. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 138-140), 160 p. (ESD #250, Part)

The probability that a predator will feed upon one prey rather than another is directly proportional to the standing crop of that prey. Predation is also dependent on factors such as prey preference and defense mechanisms that can be combined in a single parameter that expresses the relative frequency or ratio in which the various prey are consumed when they are available in equal standing crops. An equation is presented which expresses the fraction of the total diet of a predator composed of a given species. At steady state the total energy income must equal energy loss and energy flux from prey to predator. An equation is presented to represent the energy loss for each non terminal compartment. (KM)

<362>
Kelly, J.M., and P.A. Opstrup 1969, January. Seasonal Changes in Roots, Tops, and Dead Biomass of ANDROPOGON and FESTUCA Fields. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 112-113), 160 p. (ESD #250, Part)

Minimal limits on net production from biomass change in FESTUCA and ANDROPOGON old field communities are closer estimates of total community net production than most values found in the literature. Estimation of input to and loss from standing dead biomass for the present year is confounded by previous year's standing dead material in both communities and a new technique needs to be developed to better quantify both income and loss for age classes in this compartment. Since input and decomposition of litter are balanced, amounts are relatively stabilized in both communities. Total live community biomass is increasing in the FESTUCA ELATIOR community, while total biomass has stabilized in the ANDROPOGON VIRGINICUS community. No increase in root biomass occurred of a proportional magnitude below 20 cm compared with the great seasonal changes of roots in the top 20 cm. Due to an unusually wet July, the expected summer depression in FESTUCA production did not occur. (KM)

<363>
Reed, J.R., Jr., and N.A. Griffith 1969, January. Radiotungsten Uptake and Elimination in Black Bullheads (ICTALURUS MELAS). ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 122), 160 p. (ESD #250, Part)

The average whole body uptake of tungsten 187 from water reached a maximum level after four days. An initial rapid loss of 24 percent of the activity by excretion in six hours was followed by a longer, linear component with a biological half-life of 2.75 days. After seven days of excretion, the bullheads retained 13 percent of the initial radiotungsten activity. A single feeding experiment showed that 71 percent of the initial activity was eliminated initially and the remaining 29 percent was eliminated in seven days. (KM)

<364>
Stanhill, G. 1969, January. A New Instrument for the Aerodynamic Measurement of Water Vapor Flux from and Carbon Dioxide Flux to Undisturbed Vegetation Under Field Conditions. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 113-114), 160 p. (ESD #250, Part)

An equation is derived which serves as the basis for a simple field instrument capable of measuring the fluxes of water vapor and carbon dioxide above undisturbed vegetation. The instrument is being tested in the field and measurements are being compared with independent estimates of water loss and dry matter increment. (HP)

<365>
Thomas, W.A. 1969, January. Behavior of Curium in Plants. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 104-105), 160 p. (ESD #250, Part)

The ability of FESTUCA ARUNDINACEA and PHASEOLUS VULGARIS var. Giant Stringless, to absorb and transport curium was studied by growing the plants in media containing Cm 242. Grass did not contain activity in excess of that in control samples. Bean plants exhibited significant activity in foliage and stem tissues. Plants probably can not introduce hazardous quantities of curium into food chains which lead to man unless foliage becomes contaminated after a large scale release of this element to the atmosphere. (KM)

<366>
Curlin, J.W., D.J. Nelson, T. Grizzard, F.G. Taylor, Jr., L.W. Peters, W.A. Thomas, Jr., T. Tamura, W.P. Bonner, C.H. Abner, W.F. Johnson, J.H. Burris, W.M. Snyder, R.H. Moneymaker, and G. Stanhill 1969, January. Walker Branch Watershed Project. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 127-137), 160 p. (ESD #250, Part)

The project is designed to evaluate the impact of man's use or misuse of the landscape upon water quality and biotic productivity of the water which flows from that landscape. Data is being compiled on precipitation, stream flow, mineral income, mineral loss, water movement, vegetational characteristics, soil characteristics, and stream ecology. (KM)

<367>
Hoffman, G.R. 1969, January. Computer Simulation of Phosphorus Cycling in a Douglas Fir Forest Ecosystem in Western Washington. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 145-146), 160 p. (ESD #250, Part)

A recent simulation study on cycling of phosphorus in a douglas fir forest indicated that although losses of P from compartments slowed considerably, steady state was never attained. Changes in nutrient cycling with successional changes of the habitat were not considered but work is currently being done on a computer simulation of forest succession and nutrient cycling changes concurrent with successional changes maybe worked out for certain Douglas fir regions. (KM)

<368>
Cate, W.C., E.H. Rosenbalm, J.W. Curlin, and G.L. Gilreath 1969, January. Forest Management. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 160), 160 p. (ESD #250, Part)

Compatibility between the forest management program and the ecological research program has exceeded expectations. A long term timber sale contract culminated the five year effort of TVA to attract a stable, progressive integrated wood-using production plant in the area. Although activity of DENDROCTONUS FRONTALIS (southern pine beetle) increased, control measures have been effective. (KM)

<369>
Patten, B.C., N.A. Griffith, S.A. Rucker, and D.J. Nelson 1969, January. Aquarium Experiments. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 124), 160 p. (ESD #250, Part)

Experiments on radionuclide cycling in simple aquaria ecosystems provided results which differed from results observed in biological half-life experiments with acutely tagged organisms. The early excretory patterns do not show rapid loss rates, which are usually associated with the passage of food through the gut. A much higher fraction of the isotope is associated with the component having a long biological half life. The single long-term component observed in excretion curves is quantitatively the most important. (KM)

<370>
Kolehmainen, S.E. 1969, January. White Oak Lake Studies. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 117-118), 160 p. (ESD #250, Part)

The body burdens of cesium 137, ruthenium 106, and cobalt 60 were determined in bluegill, redear, warmouth, largemouth bass, goldfish and gizzard shad with emphasis on comparative methabolism of cesium 137 and potassium in bluegills. There was no significant trophic level increase in the cesium 137 concentrations from 1965, although largemouth bass had a slightly higher concentration than the other species. Concentrations of cesium 137 varied among a few individual bluegills by a greater factor than the variation among all species. Most of the cesium 137 in the bluegills is associated with the long component of the half-live curves. The half-life of potassium 42 in bluegills held at 22 degrees C was about 16 days. Bluegills fed cesium 137-tagged chironomids assimilated about 70 percent of the ingested radionuclide. (KM)

<371>

<371>
Reed, J.R., Jr., N.A. Griffith, and C.H. Courtney 1969, January. Uptake and Excretion of Cobalt 60 by Black Bullheads (ICTALURUS MELAS). ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 118-122), 160 p. (ESD #250, Part)

In studies of cobalt 60 uptake from water, near maximum levels of activity were reached in one day. Following the initial rapid uptake, the whole-body activity increased slowly to a maximum after three days and remained nearly constant. Individual tissues varied in their uptake rates and in the amount of radiocobalt accumulated. The gills, gut, and stomach had the most rapid uptake; liver, bone and flesh had low uptake. Studies of whole-body elimination and tissue excretion of cobalt 60 indicated that the rate of initialelimination of cobalt 60 varied with the form of uptake. Fish that received radiocobalt via the water lost 28 percent of the initial activity the first day of excretion while fish receiving radiocobalt in a single feeding lost 95.5 percent of the initial activity during the first day of excretion. The gills, gut, and stomach lost activity rapidly during the first day of excretion and with the exception of the kidneys and blood which retained high activity, other tissues eliminated radiocobalt steadily over a 32 days excretion period. The kidney retained more cobalt per gram than any other tissue examined and in an equilibrium situation might constitute a major sink for cobalt. (KM)

<372>
Nelson, D.J., and C.R. Malone 1969, January. Feedings Rates of Snails Determined with Cobalt 60. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 122-124), 160 p. (ESD #250, Part)

Tagging food with cobalt 60 and then allowing snails to eat the food for a short time is a suitable technique for the indirect determination of food consumption rates in a nonequilibrium situation. The biological half-life in GONIOBASIS is relatively long, (320 days) that the equilibrium equation ordinarily used to measure feeding rates would be applicable only in situations where the snails had been exposed to cobalt 60 their entire lives. (KM)

<373>
Witkamp, M., M.L. Frank, and V. Merchant 1969, January. Transfer of Cesium 137, Manganese 54, and Phosphorus 32 in Terrestrial Microcosms. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annualy Progress Report for Period Ending July 31, 1968, (p. 114-115), 160 p. (ESD #250, Part)

Rye grass was used as the producer, grasshoppers as consumers, and natural microflora as decomposers. Increased light and temperature enhanced consumption by grasshopper more than it did the growth of grass. The subsequent decrease in standing crop resulted in significantly less cesium 137 and manganese 54 in grass at higher than lower light and temperature values. Fertilizer increased cesium 137 and manganese 54 accumulation in grass significantly without greatly influencing isotope content of the grasshoppers. Increased light and temperature also decreased rates of isotope accumulation in grass sooner than at lower light and temperature values. Rye grass grown at deficient nutrient concentrations on glass fiber with tap water accumulated significantly more phosphorus 32 than when grown on glass fiber with Knop's nutrient solution. Rye grass on substrate deficient in nutrients accumulated more phosphorus 32 when competing for food with dense microbial populations. Analog computer simulation of consumer-decomposer microcosms showed that the effect of a compartment on mineral transfer into antoher compartment was not related to the accumulation of minerals in the first compartment and that there was a rapid exchange of isotope back and forth between two compartments of various systems. (KM)

<374>
Olson, J.S., and R.B. Williams 1969, January. Ford Foundation Report on Systems Ecology. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for period Ending July, 31, 1968, (p. 142-143), 160 p. (ESD #250, Part)

The Ford Foundation is supporting a study which will summarize available data on the state of selected ecosystems, use compartment model analyses or simulations to infer consequences that are implied by a given set of assumptions, and explore future applications and potential use of model methodology. A knowledge of transfer coefficients between compartments and of the factors which control transfer coefficients is essential for the analysis of ecostems but most current research in quantitative ecology does not contain the data needed to compute transfer coefficients. (KM)

<375>
Patten, B.C., S.A. Rucker, and J. Standaert 1969, January. White Oak Lake Periphyton. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 125), 160 p. (ESD #250, Part)

Organic matter has a relatively more uniform vertical distribution than the inorganic. The ash/ash-free ratio increases in the time series, particularly in the upper water layers. A generally linear relation exists between chlorophyll a concentration and ash-free dry weight. (KM)

<376>
Olson, J.S., J.D. Ovington, and P. Sollins 1969, January. Estimated Biomass of Leaf, Branch, Bole, and Roots of Tropical Lower Montane Rain Forest, El Verdue, Puerto Rico. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 158-159), 160 p. (ESD #250, Part)

Analysis of forest growth was carried out according to steps similiar to those of FORSTAN. Individual species show irregularities in local distribution which have indicator value for local variations in the environment. There is a remarkable consistency in trend among many species and areas in proportions of major plant parts. Such relations should be very helpful in carrying the analysis of tropical woodlands toward further understanding of production rates. (KM)

<377>
Dahlman, R.C., J.S. Olson, and K. Doxtader 1969, January. Nitrogen Equations of Grassland and Dune Soils. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 146-149), 160 p. (ESD #250, Part)

A review is presented of the current knowledge on accumulations and equilibria as influenced by climate. A modification of an existing equation is suggested to give a more general expression encompassing changes in the nitrogen accumulation through time or its depletion under conditions of cultivation. Additional modifications could be made to account for any significant soil forming factors besides climate and time and for stochastic variation which is not merely an artifact of sampling. An analysis of the nitrogen cycle of a native grassland in Missouri indicates that the major portion of nitrogen is present in the soil humus. Transfer rates, residence time, and the interrelationships among different components may contribute greatly to the economy of the ecosystem. New production is supported by the available nitrogen pool, much of which arises from the rapid turnover of fresh biological materials. Under steady-state conditions microorganisms probably maintain the available nitrogen pool at a relatively constant level. (KM)

<378>
Opstrup, P.A. 1969, January. Dry Weight Rank Method for Grassland Studies. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual ROGRESS Report for Period Ending July 31, 1968, (p. 150-153), 160 p. (ESD #250, Part)

The computer program, RANKER, is based on the premise that a more precise estimate overall of the total biomass of an area may be obtained by ranking a large number of plots rather than by ranking and clipping a smaller number. This requires a sufficient number of sampled plots to get a good estimation of the correlation between observed values and predicated values. This method reduces the amount of laboratory work and allows for the optimum usage of time for obtaining the largest representative sample possible. (KM)

<379>
Olson, J.S., and A.J.P. Gore 1969, January. Model of Peat, Standing Dead, and Live Organic Contributions to Subarctic Blanket Bog. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 153-156), 160 p. (ESD #250, Part)

The formulae and the means of obtaining and calculating the necessary information for their use are given for the system variables and ecological examples of compartments of the model. The ecological compartments considered include: solar energy, primary production, green plants, dead organic matter, substrate, animals, and respiration and gas loss. (KM)

<380>
Clebsch, E.E.C., A.M. Craig, Jr., H. Vardis, and A.W. Freeman 1969, January. FORSTAN: A Computer Program for Estimating Forest Stand Dry Weight and Mineral Content. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 156-158), 160 p. (ESD #250, Part)

FORSTAN uses detailed sample data from tree boles, branches, and leaves to predict parameters such as total mineral content, dry weight, height, volume, etc. of felled trees on which a minimum amount of data has been taken. Derived estimating equations are then used to find these same parameters for forest stands from measurement of the breast height diameter of the individual trees. FORSTAN has six main subroutines: dry, weight, branch weight, bole weight, weight-height, growth, and mineral. (KM)

<381>
Witkamp, M., and M.L. Frank 1969, January. Accumulation of Cesium 137 by a Soil Fungus Relative to Cesium 137 in Organic Debris and in Soil Solution. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 97), 160 p. (ESD #250, Part)

An experiment was designed to quantify the relationships between cesium 137 accumulation in TRICHODERMA VIRIDE and cesium 137 concentrations in various solid litter components and their surrounding solutions. Accumulation of cesium 137 in soil fungi without direct contact with solid donor substrate may be expected to be proportional to cesium 137 concentration in the soil solution. For fungi in direct contact with solid substrate, concentration appears to be proportional to cesium 137 availability in the substrate, where availability is a function of the decomposability of the substrate and the concentration and leachability of the cesium 137 in it. (KM)

<382>
Reichle, D.E., M.H. Shanks, and D.A. Crossley, Jr. 1969, January. Calcium, Potassium, and Sodium Content of Forest Floor Arthropods. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 98-99), 160 p. (ESD #250, Part)

Calcium composition of species was highly variable. High calcium contents were associated with high ash composition and species characterized by well developed exoskeletons. The potassium frequency curve was positively skewed, due to occurrence of a few relatively high value for several of the diplopod species. Potassium and sodium concentrations were consistent within and among major taxonomic categories. Whole-body concentrations of certain alkali metals, such as cesium and potassium, decrease in arthropods with increase in tropic level. Seasonal changes in nutrient content of species also occurred. (KM)

<383>
Dahlman, R.C. 1969, January. Preliminary Estimation of Erosion and Radiocesium Redistribution in a Fescue Meadow. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division GNNUAL Progress Report for Period Ending July 31, 1968, (p. 108-111), 160 p. (ESD #250, Part)

Agreement between observed and predicted erosion loss is reasonably good considering that the soil-loss model used was derived for cultivated systems and the simulant plots approach the lower limits for which the model is applicable. Correlation between predicted and observed erosion from both simulant and small plots was better when predicted erosion was compared with the maximum expected assuming extreme conditions of rainfall erosevity. For normal conditions, the Wischmeier and Smith model over estimates erosion from a heavily vegetated sod. The management factor term of their model needs downward revision because of the overriding influence of dense vegetation in reducing erosion. (KM)

<384>
Dahlman, R.C. 1969, January. Distribution of Radiocesium Assimilated by Fescue Foliage. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 105-108), 160 p. (ESD #250, Part)

Foliar assimilation of radiocesium and subsequent redistribution to other parts of fescue plants was determined during vegetation and flowering phases of the growth cycle. Significant quantities of foliar-assimilated radiocesium were promptly redistributed to different plant parts, about 20 percent to the root system in five days and then 20% to the flower structures as they emerged from the sheath 15 days after labeling. At floral maturity the content in inflorescence increased to 45% of the total present in the plant. Redistribution of radiocesium from roots to inflorescence accounted for approximately half the initial burden in the flowering organs. Subsequent radiocesium increases in the inflorescence were the result of continuing transport from the foliage. Initially, radiocesium moved from shoots to seminal roots; then after four days nearly all the basepetal movement was to the nodal roots. Transfer from seminal to nodal roots corresponded to cessation of seminal root growth. (KM)

<385>
Kowal, N.E. 1969, January. Ingestion Rate of Pine-Mor Detritus by an Oribatid Mite (CULTRORIBULA JUNCTA). ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 102-104), 160 p. (ESD #250, Part)

The radioactivity of individual microarthropod feeding upon calcium 45-tagged pine needles and natural pine mor, in small containers, was counted in order to investigate the feasibility of using radioactive tracers in food web dynamics studies. The standard radionuclide tracer techniques used were suited to the problem. Data gathered on the accumulation of calcium 45 by the saprovorous oribated mite C. JUNCTA allow the calculation of a crude estimate of its ingestion rate. A very low ingestion rate of pine needles compared with that of natural pine mor suggests that pine needles required considerable decomposition by fungi before they are eaten by microarthropods. The tagged needles were primarily first year needles, not yet ready to fall, and probably contributed to the low ingestion rate. (KM)

<386>
O'Neill, R.V., and G.J. Dodson 1969, January. Prey Preferences of a Forest Centipede. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 99-100), 160 p. (ESD #250, Part)

A decided preference of centipedes for crickets and various larvae was demonstrated, with isopods, wood roaches, large spiders, and large centipedes forming the rest of the diet. Annelid worms would probably be eaten if they were exposed and discovered, but this would be infrequent under natural conditions. Termites may be eaten on rare occasions. (KM)

<387>
Reichle, D.E., C.A. Edwards, and M.H. Shanks 1969, January. Effects of Pesticides on Soil Invetebrate Populations. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 101-102), 160 p. (ESD #250, Part)

A techniques is described which employs a soil fumigant (dichloropropence), an insecticide (aldrin) and an earthworm extractant (formalin) for exclusion of various segments of the soil biota. This technique can provide controlled populations of soil invertebrates for studies of their roles in breakdown of organic detritus by manipulating microarthropods, earthworms, and flora of soil systems. (KM)

<388>
Dunaway, P.B., J.D. Story, C.E. Baker, J.T. Kitchings, L.E. Tucker, and J.W. Gooch, Jr. 1969, January. Incorporation of Cesium 134 by Cotton Rats. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 72-74), 160 p. (ESD #250, Part)

Uptake and excretion rates of cesium 137 adsorbed from the simulant and from contaminated vegetation by cotton rats were measured. The method of exposure, acute versus chronic ingestion, influences metabolic kinetics of cesium 134 in cotton rats under laboratory conditions. Cesium half-life is shorter in animals receiving acute inputs because less cesium is incorporated in compartments with slow uptake and long retention times. (KM)

<389>
Reichle, D.E., and R.V. O'Neill 1969, January. Effects of Acute Gamma Radiation on Cricket Respiration. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annuals Progress Report for Period Ending July 31, 1968, (p. 74-75), 160 p. (ESD #250, Part)

The hypothesis of Menhinick that low doses of gamma radiation increased the life span by reducing the respiration rate, was tested by measuring oxygen consumption of crickets exposed to radiation doses corresponding to those used by Menhinick. Oxygen consumption was not reduced at lower compared with higher radiation doses. The increased life expectancy seen at low dose levels can not be explained by reduction in respiration rate alone. (KM)

<390>
Blaylock, B.G., and M.F. Miller 1959, January. Population Genetics and Radiation Effects Studies. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 78-81), 160 p. (ESD #250, Part)

Chromosome aberrations were not detected in the salivary gland chromosomes of 150 CHIRONOMUS larvae whose progenitors had received a dose of 2000 rads in the fourth instar larval stage. Forty one percent of the progency of irradiated males mated with nonirradiated females contained at least one chromosome aberration. Experiments using DROSOPHILA indicated that levels of radiation that have no apparent effect on a population will produce a drastic effect, such as the elimination of the population, when the population is exposed to a stress such as competition. Additional data is provided for GAMBUSIA AFFINIS which supports the hypothesis that the exposure to chronic environmental radiation is acting as an environmental stress on the population by increasing the mortality of the embryos, but it also increases genetic variability, which speeds up the rate of evolution and allows the population to adjust to the stress. (KM)

<391>
Witherspoon, J.P., and M.L. McPhail 1969, January. Mineral Uptake by Irradiated Plants. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 85), 160 p. (ESD #250, Part)

Cuttings of Eastern cottonwood (POPULUS DELTOIDES) were exposed to acute sublethal radiation levels. Up to 31 hours, total uptake rates of irradiated plants exceeded those of controls, but after this time control plant uptake rates were greatest. Damage to mineral transfer mechanisms, unrelated to growth rate, was induced by sublethal radiation exposures, and repair occurred after one week. Exposure to acute sublethal radiation levels can have an appreciable effect upon the mineral economy of plants, especially in the case of plants growing on sites of low fertility. (KM)

<392>
Witherspoon, J.P., and F.G. Taylor, Jr. 1969, January. Genetic Modification of Growth and Radiosensitivity of POPULUS DELTOIDES. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 85-87), 160 p. (ESD #250, Part)

Clones of P. DELTOIDES representing 30 genotypes from seven states varied significantly in shoot height, shoot weight, and number of stems, and leaf and root emergence. Leaf and root emergence and callus formation were delayed about two weeks by gamma radiation treatment. (KM)

<393>
Ragsdale, H.L. 1969, January. Effects of Biotic Complexity and Fast-Neutron Radiation on Cycling of Radionuclides in Microcosms. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 87-90), 160 p. (ESD #250, Part)

Aquatic microcosms consisting of various combinations of physical components (soil, water, and container surface) and biological components (PHYSA HETEROSTROPHA, NAJAS FLEXILIS, and ELODEA CANADENSIS) were used to determine the effect of increased biotic complexity on mineral cycling parameters. The stability of mineral cycling parameters was tested by stressing selected complexity levels with sublethal doses of fast-neutron radiation. Cycling parameters for different elements (cesium 137 and cobalt 60) were dissimiliar in less complex systems and converged toward similarity as complexity increased. Microcosm components had one or more mineral cycling roles, some of which changed with complexity levels. Increased functional complexity had the greatest effect on mineral cycling, although an increase in unifunctional species modified the mineral cycling parameters. Ecosystem stability was related to the sensitivity of the biological interactions and not necessarily to the sensitivity of the organisms. On the basis of mineral cycling parameters, the simpler microcosms were less stable than the complex ones to a moderate radiation stress (100 rads) but more stable than complex systems when subjected to an extreme stress (100 rads). (KM)

<394>
Olson, J.S., L.N. Peters, and R.M. Anderson 1969, January. Seasonal Shoot Growth in a Tagged LIRIODENDRON Forest. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 91-92), 160 p. (ESD #250, Part)

The cumulative growth of leaves, twigs, and buds plus stipules through the growing seasons of 1964-1967 is discussed. During a major increase in weevils in 1965, foliage development decreased while twig growth increased. In 1966, early season suppression of growth was even more severe than before but recovery of leaf growth continued after the main period of leaf consumption. Twig growth was lower than in preceding years. In 1967, many features of the seasonal growth were intermediate in character between those of 1964 and 1966. Although weevil consumption was high, high midsummer rainfall may have started a recovery process. (KM)

<395>
Olson, J.S., L.N. Peters, and R.M. Anderson 1969. Rainfall Transfers from Liriodendron Forest Canopy. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 92-94), 160 p. (ESD #250, Part)

Quantities of cesium 137 leached from tree canopies decline markedly in the years after tagging in the years 1962-1964. In early summer 1965 and in 1967 leaching increased relative to the preceding year. The 1967 increase may have been due to the unprecedented high summer rainfall in that year. (KM)

<396>
Witkamp, M., and M.L. Frank 1969, January. Microbiology of Forest Soil. ORNL-4316; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1968, (p. 97), 160 p. (ESD #250, Part)

Daily cycles in CO_2 evolution from soil primarily parallel the daily temperature cycle but at night, during temperature inversions in the soil profile, a second maximum may occur. Periods of rapid CO_2 generation at the surface during the afternoon may cause a downward diffusion of CO_2 into deeper layers, from where it may escape again during the night. (KM)

<397>
Reichle, D.E. 1968. Relation of Body Size to Food Intake, Oxygen Consumption, and Trace Element Metabolism in Forest Floor Arthropods. Ecology, 49(3), 538-541 (ESD #251)

Food intake and respiratory heat loss are the major pathways of energy flow through animal communities. In certain cases flow rates can be estimated for the total population from selected measurements of individual species. Metabolic parameters (Y) of arthropods from the floor of a LIRIODENDRON TULIPIFERA forest were correlated with size (X) of species: $Y = aX^{(E+b)}$. This power function relationship is similar to the "active surface area" hypothesis of animal metabolism. The species examined ranged in size from 2.1 milligrams to 1.6 grams live weight, and spanned a diversity of food habits and taxonomic categories. Food consumption was proportional to the 0.68 power of body weight. Metabolism ul O_2/hr varied with the 0.84 power of body weight, while metabolic rate ul O_2/g/hr was inversely proportional ($b = -0.16$) to body size. Within closely related species, cesium 137 turnover rates were closely correlated with metabolic rates. These rates varied with temperature and followed a Q sub 10 of approximately two. By applying appropriate temperature corrections, body size relations can be used to estimate food intake and metabolism of species in their natural habitats. Radiotracers also may permit measurement of temporal fluctuations in metabolism resulting from activity in the field. (Auth)

<398>
Thomas, W.A. 1968. Decomposition of Loblolly Pine Needles With and Without Addition of Dogwood Leaves. Ecology, 49(3), 568-571 (ESD #252)

Weight losses of decomposing loblolly pine (PINUS TAEDA) needles were measured in two series of litter bags: (a) without deciduous leaves and (b) with addition of dogwood (CORNUS FLORIDA) leaves. First-year decomposition rates of needles in the two types of litter did not differ significantly. Loss of needle weight averaged 44% after 1 year in litter. Total number of animals extracted during the year from the 26 litter bags containing mixed litter (11,211) surpassed that from the 26 samples of needles alone (6,458). Collembola (springtails), Acarina (mites), Diptera (flies), and Hymenoptera (ants) apparently made the greatest faunal contribution to litter breakdown. Populations in mixed litter in excess of those in needles alone evidently were confined to dogwood leaves and did not aid in needle decomposition. (Auth)

<399>
Kerlin, T.W. 1968, October. An Introduction to the Methods of Systems Analysis. NEUT-3028-1; 31 p. (ESD #253)

The potential advantages of modern systems analysis for studying ecosystems are discussed. The term, systems analysis, is defined as the dynamic behavior of a system. Basic matrix operations required in systems analysis are outlined. Three ways of characterizing system dynamics, namely transient response, frequency response, and eigenvalue location are considered. The sensitivity of the computed dynamic behavior to changes in the coefficients in the system equations may be used to relate performance uncertainty to uncertainties in the coefficients and to aid in deciding on ways to improve on the dynamics of an unacceptable system. Systems analysis can also aid in the interpretation of experiments. (FMM)

<400>
Van Dyne, G.M., F.M. Glass, and P.A. Opstrup 1968. Development and Use of Capacitance Meters to Measure Standing Crop of Herbaceous Vegetation. ORNL-TM-2247; 52 p. (ESD #254)

Three capacitance meters were developed and tested for measuring standing crops of herbaceous vegetation. Various independent variables were tested in equations to predict herbage yield. For our third and best capacitance meter we utilized the capacitance reading and estimated percent standing dead vegetation in the plot, and the squares of these, in a four-variable multiple regression prediction equation. We also developed an equation to show the optimum ratio of plots to be read only as compared to plots to be clipped. This optimum ratio equation considers the multiple correlation in the prediction equation and costs for locating a plot in the field, for making field readings, and for laboratory efforts. We compare results of use of our meter with those reported in the literature and compare use of capacitance meters in agronomic vs. ecological studies. (Auth)

<401>
Norman, E.L., and J.W. Curlin 1968. A Linear Programming Model for Forest Production Control at AEC Oak Ridge Reservation. ORNL-4349; 48 p. (ESD #255)

A mathematical model is presented which annually optimizes the cutting schedule in two arbitrarily selected compartments on the Oak Ridge Reservation. Yield equations were developed for three major timber types of that area. A comparative site index study was undertaken so that a measure of site quality could be used as an independent variable in the yield equations. The objective function was maximized over one cutting period, i.e., a period of twelve years. Over this period, selected management alternatives were proposed and evaluated subject to various management restrictions. The model selects for cutting those alternatives which maximize the value of the residual stand discounted to the present. The limitations and utility of the model are discussed. The manner in which information from this model can aid the forester in maximizing forest income is shown. (Auth)

<402>
Ragsdale, H.L., J.P. Witherspoon, and D.J. Nelson 1968, December. The Effects of Biotic Complexity and Fast Neutron Radiation on Cesium 137 and Cobalt 60 Kinetics in Aquatic Microcosms. ORNL-4318; Ph.D. Thesis, University of Tennessee, 174 p. (ESD #256)

Aquatic microcosms consisting of various combinations of physical components (soil, water, and container surface) and biological components (PHYSA HETEROSTROPHA, NAJAS FLEXILIS, and ELODEA CANADENSIS) were used to determine the effect of increased biotic complexity on mineral cycling parameters. The stability of mineral cycling parameters was tested by stressing selected complexity levels with sublethal and lethal doses of fast neutron radiation. Cycling parameters for different elements were dissimilar in less complex systems but converged toward similarity as complexity increased. Microcosm components had one or more mineral cycling roles, some of which changed with complexity levels. Increased functional complexity had the greatest effect on mineral cycling. Ecosystem stability was related to the sensitivity of the biological interactions and not necessarily to the sensitivity of the organisms. On the basis of mineral cycling parameters, the simpler microcosms were less stable than the complex ones when subjected to a moderate radiation stress, but more stable than complex systems when subjected to an extreme stress. (KM)

<403>
Reichle, D.E., M.H. Shanks, and D.A. Crossley, Jr. 1969, January. Calcium, Potassium, and Sodium Content of Forest Floor Arthropods. Annals of the Entomological Society of America, 62(1), 57-62. (ESD #257)

Whole-body nutrient composition of calcium, potassium, and sodium is documented for 37 species of forest floor arthropods. Sodium concentrations averaging 4.6 mg Na/g ash-free dry weight, and potassium concentrations averaging 6.2 mg K/g ash-free dry weight were relatively consistent within and among major taxonomic categories. Calcium content varied from 0.3 to 509.8 mg Ca/g ash-free dry weight, with highest values associated with Diplopoda and related species possessing highly calcified exoskeletons. Within-species variation in chemical composition often exceeded seasonal fluctuations, although several species exhibited significant temporal changes in whole-body nutrient composition of calcium, potassium, and sodium. (Auth)

<404>
Buckner, M. R. 1968, December. A Study of the Application of System Identification Techniques in the Analysis of Nuclear Reactor Dynamics (Thesis). NEUT-3028-2; M.Sc. Thesis, University of Tennessee, 112 p. (ESD #258)

A study was made of the parameter space approach to system indentification. The coefficients appearing in a mathematical model of the system are determined by adjusting them in such a manner as to minimize the difference between the predicted and experimental system response. The minimization is performed according to an optimization scheme known as the steepest descent procedure. A computer code was written for the IBM 7040 which performs the calculations described above. The method was applied to several test problems to determine its applicability and limitations. The uniqueness of converged-to coefficients is very important, and it was found that certain rules must be followed in selecting the adjustable coefficients so as to assure their unique determination. Also, a good initial estimate of the coefficients is required since the steepest descent procedure does not always give the global minimum. Test problems show that the method performs its function, but the optimization scheme is very slow "moving" near the minimum point. The test problems substantiate the uniqueness principles, but full verification will require test problems on systems of higher order and more adjustable parameters. This is not possible at present due to the excessive running time requirements of the optimization calculations. (Auth)

<405>

<405>
Dunaway, P.B. 1969. Perfect Polydactylism in Hind Feet of a Gray Squirrel. The American Midland Naturalist, 81(1), 244-247 (ESD #259)

An adult gray squirrel from an isolated natural population had seven toes and nine plantar tubercles on each hind foot. The extra digits were articulated with supernumerary cuneiforms and appeared to have been functional. Polydactylism in wild adult rodents is probably a rare anomaly. (Auth)

<406>
Patten, B.C. 1968. Mathematical Models of Plankton Production. Internationale Revue der Gesamten Hydrobiologie, 53(3), 357-408 (ESD #260)

A review is given of the variety of plankton models which have been generated, identifying main trends, and analyzing the models in context of the different classes that may be distinguished. Emphasis is placed on the development of systems thinking in the evolution of productivity models and the qualitative logical aspects of mathematical formulations usually not stressed due to quantitative tradition in plankton science. Models were classified loosely into two groups, those viewing productivity as a function of time and those treating it in relation to depth. Plankton models are not strong mathematically and errors are numerous through the literature. However, good rapport exists between theoretical models and empirical observations. (BBM)

<407>
Blaylock, B.G. 1969. The Fecundity of a GAMBUSIA AFFINIS AFFINIS Population Exposed to Chronic Environmental Radiation. Radiation Research, 37(1), 108-117 (ESD #261)

The fecundity of GAMBUSIA AFFINIS AFFINIS, the common mosquito fish, that has inhabited a lake contaminated with radioactive waste for over one hundred generations, was compared with a control population. The calculated dose rate from the bottom sediments to the GAMBUSIA population in this contaminated environment was 10.9 rads per day. A significantly larger brood size occurred in the irradiated than in the nonirradiated population, although significantly more dead embryos and abnormalities were observed in the irradiated broods. These results suggest that an increased fecundity is a means by which a natural population of organisms having a relatively short life cycle and producing a large number of progeny can adjust rapidly to an increased mortality caused by radiation. (Auth)

<408>
Bledsoe, L.J., and G.M. Van Dyne 1969. Evaluation of a Digital Computer Method for Analysis of Compartmental Models of Ecological Systems. ORNL-TM-2414; 64 p. (ESD #262)

This report presents results of development and testing of a FORTRAN program for exploration and analysis of data from experiments in which the system may be depicted by a compartmental mode. Both real and artificial data were used to check for rate and type of convergence toward the minimum sum of squares of deviations of observed from predicted data values for each compartment. Data with known degree and kind of error were generated to simulate various degrees of noise encountered in real biological data. Results of these computer studies are presented in graphic and tabular form, limitations of the program are discussed, and program and subroutine listings with directions for use are given in appendices. (Auth)

<409>
Dahlman, R.C., and C.L. Kucera 1968, Autumn. Tagging Native Grassland Vegetation with Carbon 14. Ecology, 49(6), 1199-1203 (ESD #263)

Techniques using a plastic tent to contain C 14-labeled CO_2 gas over herbaceous vegetation were effective for applying a tracer to Missouri tallgrass prairie. The grasses incorporated 67 to 41 microcuries of C 14/m2 from a single exposure to 151 microcuries of C 14/m2 for 6 hr on clipped and unclipped areas, respectively. Regenerated shoots, which had been clipped 6 weeks earlier, possessed 8 times higher specific activity than unclipped shoots (0.134 vs. 0.017 microcuries/g of carbon in foliage biomass). The root systems of both areas possessed over 50% and the roots of mature vegetation as much as 85% of the assimilated C 14 remaining in the plant biomass 8 weeks after tagging, thus illustrating the tendency for food reserves to accumulate in underground storage organs late in the growing season. Specific activities in the root systems were similar (0.02 vs. 0.016 microcuries/g C) for both revegetated and mature areas and were adequate for study of later translocation, transfer to soil, and in situ decomposition of organic material in soil. (Auth)

<410>
Nelson, D.J. 1967. Ecological Behavior of Radionuclides in the Clinch and Tennessee Rivers. Part of Proceedings of the Reservoir Fishery Resources Symposium held in Athens, Georgia, April 5-7, 1967, (p. 169-187) (ESD #264)

Biological investigations in connection with the Clinch River Study sought to determine the uptake and turnover of radionuclides in biota, the effect of biota in redistributing radioactivity, and the effect of ionizing radiation on aquatic organisms. Conventional fish tagging studies were conducted with the Clinch River fish, and, in addition, movements of smallmouth buffalo were studied by use of radionuclides deposited in their scales. Scale radioactivity, detected by autoradiography, provided a continuum of information with respect to the movement of fish into and out of areas contaminated with radionuclides. The white crappie was selected for intensive study because the tagging survey showed that it did not migrate far in the river, and therefore its exposure to radioactive waste releases could be estimated more closely. A good agreement was observed between the specific activity of strontium 90 in water and fish tissue which showed that strontium 90 concentrations in fish may be predicted for constant releases of strontium 90 to the river. Freshwater clams were also good indicators for strontium 90 in river water. Clams are relatively immobile on the river bottom, and the concentration of strontium 90 in their shells was directly proportional to the concentration of strontium 90 in river water to which they were exposed. The effects of radiation on aquatic organisms were studied by examination of the salivary gland chromosomes of CHIRONOMUS TENTANS larvae in an effort to detect chromosomal aberrations which might be attributed to radiation exposures. Induced aberrations were observed, but these were eliminated from the population by natural selection. Hence, no permanent radiation damage to the population has occurred. Estimates of radionuclides incorporated in the biomass of fish, clams, and insects living in the river suggest that activities of aquatic organisms are not important as vectors of radioactivity nor will organisms contain a significant quantity of radioactivity. These results suggest that the greatest hazard to man from a contaminated environment will result from the consumption of contaminated food and water. (Auth)

<411>
O'Conner, J.S., and B.C. Patten 1969. Mathematical Models of Plankton Productivity. CONF-670456; Part of Proceedings of a Symposium on Reservoir Fishery Resources held in Athens, Georgia, April 5-7, 1967, (p. 207-228), 576 p. (ESD #265)

Published mathematical models of plankton productivity in several marine and freshwater environments are reviewed. Existing models are inevitably lacking somewhat in generality, realism, or precision - each of which is a desirable attribute of models. An attempt is made to categorize plankton models by these attributes of emphasize that the type of utility of each model is determined somewhat by its degrees of precision, realism, and generality. A graphic representation of the references containing plankton models illustrates the evolutionary modifications and extensions of earlier models if the later reference explicity acknowledges antecedent models by citing them. (Auth)

<412>
Blaylock, B.G. 1969. Effects of Ionizing Radiation on Interspecific Competition. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 61-67), 774 p. (ESD #266)

The effect of acute and chronic radiation on competition was studied in laboratory populations of the sibling species DROSOPHILA MELANOGASTER and DROSOPHILA SIMULANS which are similar both morphologically and genetically. DROSOPHILA SIMULANS was the superior species for thirty weeks in the control populations, but was eliminated by D. MELANOGASTER when the populations were exposed to a chronic dose of 4.3 rads per hour. After an acute dose of 2000 rads, D. MELANOGASTER was the superior species for approximately 12 weeks; however, the reverse was true when the populations were exposed to 10,000 rads. DROSOPHILA MELANOGASTER was eliminated by D. SIMULANS by the end of six weeks. The frequency of irradiated D. MELANOGASTER or irradiated D. SIMULANS (2000 rads) decreased rapidly when placed in competition with non-irradiated flies of the opposite species. Under these conditions, irradiated D. MELANOGASTER recovered after six weeks, but irradiated D. SIMULANS never recovered and was eliminated in one population after 24 weeks. Population size was affected by the exposure to acute and chronic radiation, but most of the populations recovered after six weeks. The populations receiving 10,000 rads were the exceptions; they required twelve weeks to recover. This was attributed to the effects of radiation on the reproductive capabilities of these species. After nine weeks of competition the populations having the largest average size were the ones that received an acute dose of 2000 rads. (Auth)

<413>

<413>
Witherspoon, J.P. 1969. Radiosensitivity of Forest Tree Species to Acute Fast Neutron Radiation. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 120-126), 774 p. (ESD #267)

For the past two years studies on the response of experimental plant populations to fast neutron radiation have been in progress at ORNL. These studies employed potted forest tree species which were subjected to acute fast neutron radiation and then maintained in greenhouse or growth chamber facilities for observations. Responses in terms of growth, morphological, or mortality criteria were measured for locally important tree species. This information is compared with data on effects of other types of ionizing radiation. In addition, methods of predicting radiosensitivity, such as chromosome volume comparisons, were evaluated for fast neutron radiation. Acute fast neutron doses of 400 to 1500 rads inhibited shoot growth of deciduous species tested by at least 85% under optimal environmental conditions. This may be compared with 6000 to 8500 rads of gamma radiation necessary to produce the same effect. With mortality as a biological end point, fast neutron irradiations were 3 to 4 times more effective than gamma radiation in the case of woody tree species. (Auth)

<414>
Dunaway, P.B., L.L. Lewis, J.D. Story, J.A. Payne, and J.M. Inglis 1969. Radiation Effects in the Soricidae, Cricetidae, and Muridae. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 173-184), 774 p. (ESD #268)

Effects of acute, cobalt 60 gamma irradiation under controlled conditions in the laboratory were compared in six species of rodents in the Cricetidae, two species in the Muridae, and two species of shrews in the Soricidae. Estimates of LD 50/30 for these ten species ranged from 525 to 1069 rads. The most radioresistant species (two species of PEROMYSCUS) and the most radiosensitive species (ORYZOMYS PALUSTRIS) were cricetids. Average survival times of decedents at highest radiation doses (1560-2060 rads) were longer among cricetids (5.6-8.1 days) than in murids (4.4-5.1 days) or soricides (3.5-4.3 days), and interspecific variation was manifested within families. Survival times were longer and LD 50 estimates were greater in RF-strain, female MUS MUSCULUS caged alone, than in females caged in groups of five or in males caged either singly or in groups. At high doses, weight losses were rapid and severe in all species, but at lower doses considerable interspecific differences were seen in time of onset and magnitude of weight changes. Other symptoms of radiation damage were conjunctivitis, ataxia, diarrhea, passiveness, cessation of feeding, aggressiveness, and pelage "graying." (Auth)

<415>
Reed, J.R., and D.J. Nelson 1969. Radiostrontium Uptake in Blood and Flesh in Bluegills (LEPOMIS MACROCHIRUS). CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 226-233), 774 p. (ESD #269)

The rapid initial uptake of radiostrontium by bluegills (LEPOMIS MACROCHIRUS) was attributed to a quickly exchanged strontium pool in flesh and blood. Two percent of the strontium pool in blood consisted of a component having a biological half-life of 2 hours. Another 1% of the blood strontium exchanged in 35 days and 97% was contained in a component with a long, undetermined biological half-life. Strontium in blood contributed less than 0.09% to the strontium in flesh. At least three compartments of strontium metabolism were identified in flesh. One percent of the strontium in flesh was turned over with a biological half-life of about 2 hours while 9% was turned over with a half-life of 9 days. The remaining 90% of strontium in flesh had a long but undetermined half-life. Uptake of strontium in the quickly exchanged strontium pool was directly proportional to the strontium concentration in test solutions in the range from 0.3 to 300 parts per billion strontium. At 3000 and 30,000 parts per billion strontium, bluegills took up more strontium than at the lower concentrations indicating an inability to discriminate against strontium at abnormally high environmental concentrations. (Auth)

<416>
Nelson, D.J. 1969. Cesium, Cesium 137, and Potassium Concentrations in White Crappie and other Clinch River Fish. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 240-248), 774 p. (ESD #270)

Potassium concentrations in white crappie were relatively constant throughtout the year and the average of all specimens was 3.48 milligrams per gram fresh weight. Other species, including drum, white bass, channel catfish, and bluegill, contained similar potassium concentrations and the potassium content of fish was considered a conservative property. Cesium concentrations in the white crappie flesh were about 0.8 x 10(E-2) micrograms per gram fresh weight from May through July, and during the remainder of the year varied from 1.0 x 10(E-2) to 1.6 x 10(E-2) micrograms per gram. In addition to varying seasonally, the cesium content of different species ranged from 0.344 x 10(E-2) micrograms per gram in bluegill to 1.60 x 10(E-2) in white bass. Concentration factors for potassium were from 2500 to 2700, while those for cesium were from 140 to 640. The average specific activity of cesium 137 in white crappie flesh was about the same as the average specific activity in Clinch River water. These results showed that specific activities of cesium 137 may be used to predict cesium 137 concentrations in fish for chronic releases of cesium 137 to surface streams. The variable cesium content and the constant potassium content of fish vitiates application of cesium 137 to potassium ratios for predictive purposes. (Auth)

<417>
Witkamp, M., and M.L. Frank 1969. Cesium 137 Kinetics in Terrestrial Microcosms. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 635-643), 774 p. (ESD #271)

Transfer of cesium 137 among compartments of terrestrial microcosms was studied using microcosms of increasing complexity. By adding one compartment at a time the role of each compartment in the kinetics of such systems can be evaluated. The results show that microbes, millipedes, snails and green plants significantly affect the cesium 137 kinetics of the investigated microcosms, and that the effect of a compartment on mineral turnover relative to the mineral content of that compartment may vary by two orders of magnitude. In an eight-compartment model, initial cesium 137 dissipated from leaf litter to microflora, millipedes, snails, green plants, sand, soil organic matter and soil leachate. Millipedes and snails reached equilibria and highest concentrations within a month. In contrast there was a steady accumulation of cesium 137 in sand, soil organic matter, and soil leachate. Analog computer simulations of the cesium 137 kinetics of various systems provided new insight in pathways and rates of turnover and stressed the importance of close contact of the investigator with both the experiment and the simulations. (Auth)

<418>
Dahlman, R.C., and C.L. Kucera 1969. Carbon 14 Cycling in the Root and Soil Components of a Prairie Ecosystem. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 652-660), 774 p. (ESD #272)

Tall grasses of a central Missouri native prairie were labeled with Carbon 14-labeled CO2 in polyethylene enclosures during late summer in order to study carbon transfer from foliage to the roots and from roots to soil organic matter. Six-week-old regenerated foliage assimilated six to eight times more of the radiocarbon than foliage which was approaching maturity. Approximately 60 and 85 percent of the assimilated label was translocated to the root system in regenerated and mature plants respectively. Similar quantities of radiocarbon were present in roots collected from both mature and regenerated areas because of differential translocation processes. Over a two-year period, carbon 14 disappearance from the 0-10 inch depth of the root system followed a linear trend as described by the regression $Y = 27.1 - 0.52X$, where Y is radioactivity and X is time in months. This relationship suggests that the root system undergoes turnover approximately every four years. Roots deeper in the profile exhibited a slower rate of carbon 14 disappearance, and a near-equilibrium condition between loss to the soil and input from translocation was approached. Maximum cumulative transfer of carbon 14 from the roots to the soil was observed 10 to 14 months after assimilation of the label when approximately 45% of the cumulative carbon 14 loss from roots was present in the soil organic matter. Fourteen to 26 months later the carbon 14 present in the soil decreased to 9% of the cumulative loss from roots, indicating that most of the early decay products were rapidly decomposed by the soil microbes. Both the rapid transfer from roots to soil and the large fraction of decay products which disappeared as CO2 indicate a rather short residence time for most organic materials in these parts of the carbon cycle. (Auth)

<419>
Thomas, W.A. 1969. Cycling of Calcium 45 by Dogwood Trees. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 661-664), 774 p. (ESD #273)

Twelve flowering dogwood (CORNUS FLORIDA L.) trees, stem-inoculated with calcium 45 in early May, retained only 27% plus or minus 3% of inoculum in woody tissues (stem 11, branches 15, roots 1) at the end of the growing season. Losses (as percentage of inoculum) were by leaf fall (64), foliar leaching (6), stemflow (less than 1), and insect damage (3). Rapid turnover of inoculated calcium (73% plus or minus 3) by these trees within a single growing season adds to the evidence that this species is a nutritionally beneficial component of forest communities. (Auth)

<420>
Reichle, D.E., and D.A. Crossley, Jr. 1969. Trophic Level Concentrations of Cesium 137, Sodium, and Potassium in Forest Arthropods. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 678-686), 774 p. (ESD #274)

In a forest ecosystem experimentally tagged with cesium 137, the trophic dynamic aspects of arthropod food chains are being investigated using radiotracer techniques. Cesium 137 concentrations in organisms in isotopic equilibrium with food have shown progressive reduction during dispersion through food chains, although the fractional transfer between food and consumer increased with each successive trophic level. The distribution of other alkali metals in arthropod food chains varied from that of cesium. Potassium concentrations in primary consumers (saprovores) were a factor of 3.5 higher than in detritus, although they decreased (similar to cesium 137) by a factor of 0.5 from primary consumers to predators. Sodium concentrations in primary consumers increased by a factor of 17 above leaf litter, and by an additional factor of 1.5 in predators. There were no significant differences in cesium 137 to potassium ratios between arthropod trophic levels. Changing elemental composition of litter during decay, nutrient availability and assimilation efficiency by arthropods, and biological half-lives of each element were parameters affecting absolute concentrations and cesium 137 to potassium ratios in each trophic level. (Auth)

<421>
Crossley, D.A., Jr. 1969. Comparative Movement of Ruthenium 106, Cobalt 60, and Cesium 137 in Arthropod Food Chains. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 687-695), 774 p. (ESD #275)

The behavior of radiocesium in food chains has been relatively well documented in results of environmental studies and tracer experiments, but little information is available on food chain behavior of ruthenium 106. New data from a waste disposal site (White Oak Lake bed) permit comparison of ruthenium 106 and cobalt 60 with the distribution of cesium 137 along a terrestrial food chain consisting of soil, herbaceous vegetation, herbivorous arthropods, and predaceous arthropods. Vegetation accumulated ruthenium and cobalt more efficiently than cesium (concentration factors of 0.06 vs 0.02). Herbivores also accumulated relatively more ruthenium 106 and cobalt 60 concentrations in herbivores and predators were similar. These distributions indicate that ruthenium 106 has a greater food chain mobility than does cesium 137 and cobalt 60, with an increase in concentration of ruthenium 106 in herbivore to predator transfers. Turnover rates (biological half-lives) for ruthenium 106 and cobalt 60 were compared with cesium 134 turnover rate in one insect species (ACHETA DOMESTICUS L.), and results are reasonably consistent with the data obtained from White Oak Lake bed. (Auth)

<422>
Kaye, S.V., and S.J. Ball 1969. Systems Analysis of a Coupled Compartment Model for Radionuclide Transfer in a Tropical Environment. CONF-670503; Part of Nelson, D.J., and Evans, F.C., (Eds.), Proceedings of Second National Symposium on Radioecology held in Ann Arbor, Michigan, May 15-17, 1967, (p. 731-739), 774 p. (ESD #276)

The bioenvironmental feasibility study for construction of a sea-level canal in Central America with nuclear devices requires prediction of the movement of radionuclides in a tropical environment and estimation of the possible radiation doses to indigenous man. Large complex environments can be schematically simplified if represented by coupled compartment diagrams which contain critical pathways leading to man. Since actual field data are not yet available for constructing such diagrams, a preliminary diagram was constructed which has enough flexibility for future modification and necessary expansions after on-site data become available. Such preliminary diagrams are useful because they can be used for computer sensitivity analyses using frequency response techniques when linear differential equations with constant coefficients are specified in the model. The SFR-3 digital computer code was used to determine the sensitivity of the various environmental transfer coefficients of a banana plantation to the concentration of radioactivity in the bananas which would be eaten by man. This code also provides an estimate of the integrated concentration of radioactivity in bananas resulting from a fallout pulse input to the system and the magnitude and time of the peak concentration, all of which are directly related to the internal dose received by man. (Auth)

<423>
Auerbach, S.I. 1969, March. Progress Report in Post Attack Ecology. ORNL-TM-2466; 60 p. (ESD #277)

A summary is presented on the progress in research on postattack ecology which is concerned with the interim and long-term environmental consequences of a nuclear attack. The program is particularly concerned with the effects of fallout and residual radiation on insects, rodents and native and crop plants. Emphasis is being placed on the use of strontium 90 tagged particles for the study of beta radiation effects on plants and animals under laboratory-controlled or field-simulated conditions. Cesium 137 tagged particles are being utilized in a field facility in which 4 plots each 1000 square feet are being contaminated with approximately 2.2 Ci of cesium 137 on silica sand particles which in turn will be spread over the plots at a load of 25 grams per square foot. Research progress in four projects is reported: (1) the effects of external beta radiation on higher plants, (2) uptake and excretion of cesium 134 from fallout simulant by rodents (cotton rats), (3) effects of beta and gamma radiation on SINELLA CIRVOSETA, (4) honey bee irradiation studies. (KM)

<424>
Styron, C.E. 1969, March. Effects of Beta and Gamma Radiation on SINELLA CURVISETA (Collembola). ORNL-TM-2466; Part of Auerbach, S.I., Progress Report in Postattack Ecology, (p. 40-46), 60 p. (ESD #277, Part)

Survival and feeding of adult Collembola were reduced by all doses of beta or gamma radiaction. Day-old eggs showed the greatest sensitivity to radiation and are the critical stage in the response of the population to ionizing radiation. Juveniles were more sensitive than adults to gamma as well as beta radiation. Survival rates for irradiated adults suggest a relative biological effectiveness (RE) of 0.497 for Sr 90-Y 90 beta radiation. The RBE value 0.931 for eggs indicates that they have comparatively little protection from beta radiation. The greatest fluctuations in population numbers resulted from changes in fecundity rates and egg mortality. (KM)

<425>
Shinn, A.F. 1969, March. Honeybee Irradiation Studies. ORNL-TM-2466; Part of Auerbach, S.I., Progress Report in Postattack Ecology, (p. 47-49), 60 p. (ESD #277, Part)

The effect of various doses of ionizing radiation on the pollinating behavior of colonies of honeybees was studies in order to assess the consequences for postattach recovery of fruit and vegetable agriculture and general wild landscape. The longevity of lab-caged bees and the daily pollen collection by irradiated colonies of bees in the field were investigated. All irradiated colonies were eliminated as functional social units within 2 weeks. Pollen collection by irradiated bees was significantly reduced within 1 week following irradiation. (KM)

<426>
Witherspoon, J.P., and F.G. Taylor, Jr. 1969, March. Effects of External Beta Radiation on Higher Plants. ORNL-TM-2466; Part of Auerbach, S.I., Progress Report in Postattack Ecology, (p. 2-17), 60 p. (ESD #277, Part)

Particle application to 3 species of plants indicated that contact exposure in all cases killed the plant part contacted while other plant organs survived with varying degrees of biological damage depending upon distance from the contaminated area of the plant. Beta doses above 338 rads from cylinders prevented growth of white pine shoot buds exposed inside the cylinders. In red oak trees total doses exceeding 1500 rads were sufficient to kill apical buds. Growth of shoots was severly impaired at doses in the range of 500 to 750 rads. (KM)

<427>
Kitchings, J.T., P.B. Dunaway, J.D. Story, and L.E. Tucker 1969, March. Uptake and Excretion of Cesium 134 from Fallout Simulant and Vegetaion by Cotton Rats. ORNL-TM-2466; Part of Auerbach, S.I., Progress Report in Postattack Ecology, (p. 18-39), 60 p. (ESD #277, Part)

Cesium 134 Tagged simulants with varying in vitro nuclide solubilities were analyzed with respect to absorbabilites of the Cs 134 by the gastrointestinal tracts of SIGMODON HISPIDUS. The type of ingestion, acute (simulant) is chronic (vegetation), influenced the metabolic kinetics of Cs 134 in cotton rats under laboratory conditions. The Cs biological half life was shorter in animals receiving a single dose of simulant because less Cs was incorporated in compartments with slow uptake and long retention times. (KM)

<428>
Baker, C.E., and P.B. Dunaway 1969. Retention of Cesium 134 as an Index to Metabolism in the Cotton Rat (SIGMODON HISPIDUS). Health Physics, 16, 227-230 (ESD #278)

Biological half-lives T sub b of cesium 134 were compared with resting metabolism measurements of cotton rats maintained at 5, 15, and 25 degrees C in an endeavor to develop a technique for determining respiration rates of animals in the field. Average (T sub b) values of the experimental groups were 6.3 days at 5 degrees, 6.9 days at 15 degrees, and 8.1 days at 25 degrees; oxygen consumption measurements (cubic centimeters per hour per gram) averaged 3.2, 2.3 and 1.5, respectively. Regression and correlation analysis performed on the data of the individual animals revealed a strong linear relationship between T sub b of cesium 134 and resting metabolism. Although cesium 134 retention correlated well with oxygen consumption, it could not be shown to correlate with body weight. Further investigations of 24 hour oxygen consumption measurements made over a wider range of metabolic rates (i.e. both above and below thermoneutrality) and consideration of certain factors which promote elimination of cesium are necessary to validate the apparent relationship between cesium 134 retention and general metabolism. (Auth)

<429>
Kaye, S.V., P.S. Rohwer, K.E. Cowser, and W.S. Snyder 1969. Predicting Radiation Dose Equivalents for Populations. I. Dose Models and Methods of Application. BioScience, 19(3), 238-241 (ESD #279)

The information essential for developing a model to estimate dose to a population may be divided into five categories: inventory of radionuclides produced and fractions released to the environment; environmental dilution or concentration factors; intake and/or exposure time factors; biological parameters and habits characterizing the exposed population; and dose estimation equations. Internal radiation doses are estimated with a computer code called INREM, and the external radiation doses are calculated with a computer code known as EXREM. The best possible input for estimating potential radiation doses and the calculation of the desired estimates of doses are discussed. A generalized model for internal dose, the INREM model, and the EXREM model are briefly described for external dose. (KM)

<430>
Whitford, P.B. 1968. Foliar Application of Cesium 137 on Understory Species of Mesic Forest. Radiation Botany, 8, 509-518 (ESD #280)

Foliar application to the understory in a LIRIODENDRON forest of 35 uCi/m2 of cesium 137 diluted in 11/m2 water showed 18 per cent retention of the isotope on foliage after 2 hours, 9, 8 and 7 per cent after 2, 4, and 6 weeks; the major part of the applied solution dripped onto the litter layer. Approximately 22 centimeters of rain during the test period accounted for most of the reduction in isotope in the foliage, as well as for transfer through the litter to the top 5 centimeters of soil (23 per cent of application) by the end of the sixth week. Less than 4 per cent was absorbed and translocated to stem and roots. Differences between species are probably related to leaf surface structure, mass per area ratio, and leaf orientation. (Auth)

<431>
O'Neill, R.V. 1969. Indirect Estimation of Energy Fluxes in Animal Food Webs. Journal of Theoretical Biology, 22, 284-290 (ESD #281)

A new technique for estimating energy fluxes in food webs is developed, based upon the probability of predator-prey interactions. It circumvents direct measurement of energy fluxes and rate functions by utilizing a parameter w sub ij for weighting prey preference. This parameter can be simply measured for most food webs, and offers a more utilitarian approach to quantifying energy flow in complex ecosystems. (Auth)

<432>
Witkamp, M. 1968. External Factors Influencing Mineralization and Immobilization of Some Radionuclides from Tree Litter. SM-106-26; Part of Proceedings of a Symposium on Isotopes and Radiation in Soil Organic-Matter Studies held in Vienna, Austria, 1968, (p. 231-241) (ESD #282)

Kinetics of mineral elements in forest litter are being studied at Oak Ridge National Laboratory using radiotracer techniques. Special emphasis is placed on the cycling of long-lived fallout nuclides because of their potential health hazard in the food chain to animals and man. Data are being obtained from in vitro, microcosm, and field experiments and their interpretation is helped by systems analysis and analog computer simulation of mineral flow. The results indicate that during the usual microbial bloom of newly incubated litter, loss of minerals by leaching may be reduced by as much as 50% as a result of their immobilization in microbial tissue. Only on the most rapidly decomposing litters will initial mineralization prevail over immobilization. After the bloom, release of accumulated minerals from the declining population and from the decaying substrate results in net mineralization which is proportional to the weight loss of the substrate. In general, rates of mineral turnover are positively related to concentration and availability of the nuclides, and to environmental factors which enhance microbial development (substrate, temperature, moisture). Faunal consumption of litter also enhances mineral turnover by exposing cell contents. Faunal consumption of microbial mass results in decreased immobilization of nuclides. Under favorable conditions, net and gross microbial immobilization by the microflora may amount to 22% and 61%, respectively, of the initial quantity of cesium 137 in the litter. Leaching (excess rain) releases only a few per cent of the immobilized nuclides but freezing, drying, and burning may result in almost complete release. Much of the remineralized nuclide is immediately reabsorbed by the substrate, in particular by charred leaves. Burning also releases minerals to the atmosphere in smoke or by volatilization. In field experiments on the forest floor, rates of mineral turnover vary greatly in time as a result of changes in weather conditions. Consequently periods of net immobilization in the forest are short and the average per cent net immobilization is lower than that found in the laboratory. Thus, even though the microbial and faunal compartments are relatively small as compared with other litter compartments, their role in mineral kinetics is appreciable because of high rates of turnover. (Auth)

<433>
Olson, J.S. 1968. Eolian Transport. Part of Fairbridge, R.W. (Ed.), Encyclopedia of Geomorphology. Reinhold Publishing Company, New York, New York, (p. 309-312) (ESD #283)

Wind erosion, sand transport, sand deposits, nutrient additions to ecosystems, and dust and loess transport and deposition are briefly described. The factors effecting these processes, the results of these processes and the theoretical aspects of each are included. (KM)

<434>
Witkamp, M., and B. Barzansky 1968. Microbial Immobilization of Cesium 137 in Forest Litter. Oikos, 19(2), 392-395 (ESD #284)

Significant microbial immobilization of mineral elements in the forest floor was demonstrated by exposing decaying and sterile LIRIODENDRON leaves with cesium 137 in untagged forest floor and by exposing similar leaves without cesium 137 in a forest floor tagged with the isotope. Net immobilization on the tagged leaves was 7% of the initial cesium 137 content. Immobilization of cesium 137 from the forest floor more than doubled the accumulation of cesium 137 by the exposed leaves. (Auth)

<435>
Rohwer, P.S., and S.V. Kaye 1969. Predicting Radiation Dose Equivalents for Populations, II. Results Obtained with Dose Models. BioScience, 19(4), 326-330 (ESD #285)

Application of the dose models to the radionuclide production and venting estimates provided dose estimates used to arrange the radionuclides in descending order of importance for each mode of exposure. The modes of exposure considered were: submersion in contaminated air, submersion in contaminated water, exposure to a contaminated surface and ingestion and inhalation of contaminated air, water and food. The potential dose for each element was estimated for each mode of exposure by summing the potential dose of its radioisotopes. The elements were then arranged in descending order of the summed percentage contribution of their radioactive isotopes to the total potential dose in each mode of exposure. Evaluation of exposures to populations requires that dose estimates be made for all age groups or subgroups identifiable by factors influencing dose within the populations. The doses to individuals in the population and to the critical population groups must be evaluated in terms of the permissible dose limits recommended by recognized authorities. (KM)

<436>
Crossley, D.A., Jr., and D.E. Reichle 1969. Analysis of Transient Behavior of Radioisotopes in Insect Food Chains. BioScience, 19(4), 341-343 (ESD #286)

Analysis of the transient concentrations of tracer in different organisms can be used to obtain in situ measurements of transfer rates and materials between food and consumer organisms in intact ecosystems. A model is presented which describes transient behavior of radioisotopes with illustrations of its application with laboratory and field data. (KM)

<437>
Taylor, F.G., Jr. 1969. Oak Ridge, Tennessee Flora: 2. Spring Flowering Dates. University of Tennessee Arboretum Society Bulletin, 4(1), 13-19 (ESD #287)

The easliest observed flowering dates of specimens found on typical sites in the Oak Ridge reservation are recorded. The species are arranged alphabetically by month. Woody species are differentiated from herbaceous species. Between February and May the earliest observed flowering dates of 171 species were recorded. The majority of species were herbaceous. The month of Arpil contained the greatest number of species and the greatest family diversity. (KM)

<438>
Snyder, W.M., and J.W. Curlin 1969, April. Walker Branch Watershed Project: Hydrologic Analysis and Data Processing. ORNL-4392; 63 p. (ESD #288)

The various steps in processing data from continuously recording instruments on the Walker Branch Watershed are described. Processing includes all steps beginning with conversion of raw data from instrument tapes to computer- compatible forms and ending with summaries or analyses which provide input data for mathematical models of watershed ecosystems. Initial emphasis is on processing of recorded rainfall and stream-flow records. Also included are basic tabulations of rainfall and runoff which will form continuous sequential inventories of the water resources of the subwatersheds. With development of processing and analytical methods, inventories and analyses of long-term effects of base-flow on water yield of the streams will be added. Chemical, biological and mineralogical inputs-outputs of the streams will be included. (BBM)

<439>
Dahlman, R.C., J.S. Olson, and K. Dortader 1969. The Nitrogen Economy of Grassland and Dune Soils. Part of Proceedings of the Biology and Ecology of Nitrogen Conference held at University of California, Davis, California, November 28-December 1, 1967, (p. 54-82) (ESD #289)

A preliminary model of a nitrogen cycle was presented for a native grassland ecosystem. Quantitative inventory and transfer rates are suggested for several compartments. On the basis of incomplete data, it was concluded that appreciable nitrogen was returned to the available nitrogen pool by means of shoot and root organic turnover. Mineralized nitrogen from these sources would nearly satisfy the minimal nutritional demand by higher plants. Enumeration of the nitrogen inventory and transformation of microorganisms was incomplete or at best a first-order-of-magnitude estimate because the cycling parameters are very difficult to measure in the field. Further progress in system analysis of the nitrogen cycle requires additional field experiments concerning microbial transformations. Perhaps an outcome of the International Biological Program's planning meeting on nitrogen processes will be the design of investigations that consider all aspects of the nitrogen cycle quantitatively and simultaneously. (Auth)

<440>
Van Hook, R.I., Jr., and D.A. Crossley, Jr. 1969. Assimilation and Biological Turnover of Cesium 134, Iodine 131, and Chromium 51 in Brown Crickets, ACHETA DOMESTICUS (L.). Health Physics, 16, 463-467 (ESD #290)

Understanding of radionuclide accumulation by insects requires careful assessment of assimilation and turnover rates. In separate experiments, three radionuclides (cesium 134, iodine 131 or chromium 51) were fed to adult brown crickets for a 24 hour period. The insects were then transferred to nonradioactive food and their whole-body retention measured at 1 hour intervals. The retention of each radionuclide can be described by a sum of two exponential functions, a shorter one related to loss of unassimilated radionuclide from the gut and a longer one describing excretion of assimilated radionuclide from tissues. The shorter components had similar rates (half-time = about 4 hours) for all three radionuclides, indicating that they were a measure of gut clearance time. Chromium had the lowest assimilation (6%) and cesium the highest (65%). Assimilated cesium 134 and chromium 51 were eliminated at moderate rates (biological half-lives of 62 and 83 hours, respectively) but assimilated iodine 131 was stored rather than excreted. (Auth)

<441>
DeSelm, H.R., P.B. Whitford, and J.S. Olson 1969. The Barrens of the Oak Ridge Area, Tennessee. The American Midland Naturalist, 81(2), 315-330 (ESD #291)

Old field, thicket and barren (prairie-like) vegetation have been sampled on 14 small areas over limestone near Oak Ridge, Tennessee. Fields are characterized by high percentages of annual, grass, introduced, and weed taxa. They are floristically most similar to and presumably related successionally to Juniper-dominated thickets. Barren samples cover a wide site range, but only the dry forms will persist because of droughty soils. Floristically these last areas are most strongly related to other Southern Barren vegetation and certain areas in the Central Basin of Tennessee and "cedar barrens" of southern Ohio. (Auth)

<442>

<442>
Jacobson, K.B., J.B. Murphy, and P.B. Dunaway 1969. Phylogenetic Relationships of Rodents on the Basis of Isoenzymes of Lactate Dehydrogenase. Comparative Biochemistry and Physiology, 28, 1135-1144 (ESD #292)

The isoenzymes of lactate dehydrogenase (LDH) were compared in twenty-two rodents. LDH sub 1 of three electrophoretic mobilities and LDH sub 5 of four mobilities were found. Erythrocytes of the more primative classes contained several LDH isoenzymes whereas in most of the Cricetidae and Muridae only LDH sub 5 was found. Distribution of LDH isoenzymes varied widely in the kidney, but no prominent differences were observed in the heart, liver and skeletal muscles. MERIONES UNGUICULATUS (Mongolian gerbil) was found to have a sixth LDH isoenzyme in both kidney and heart. The evolutionary development and genetic control of isoenzyme patterns is discussed. (Auth)

<443>
O'Farrell, T.P., and P.B. Dunaway 1969. Effects of Acute Ionizing Radiation on Incorportation of Iodine 131-Labeled IUDR by Cotton Rats, SIGMODON HISPIDUS. Radiation Research, 38(1), 109-124 (ESD #293)

Acute gamma irradiation affected the incorpration of the thymidine analog iodine 131-labeled 5-iodo-2'-deoxyuridine (iodine 131-labeled IUDR) by cotton rats, SIGMODON HISPIDUS. Absorbed doses of 100, 500, and 1000 rads administered 24 hours before injection depressed whole-body measurements of radioactivity retained at 48 hours postinjection to 76%, 38%, and 28%, respectively, of control values. The greatest depression of total activity retained within tissues occurred in the intestines, where activity levels were reduced to 47%, 18%, and 1.5% of control values. Since the data included responses from maximum incorporation in controls to minimum incorporation in animals irradiated at 1000 rads, a regression of activity remaining in the intestines as a function of total body burden was calculated to interpolate responses at intermediate dose levels. The in vivo measurements were a useful index to radiation insult at doses below 1000 rads. The method described should serve as a valuable adjunct to other techniques for measuring the effects of ionizing radiation in free-ranging mammals at dose levels that are too low to induce gross pathological responses or death. At the highest dose, activity accumulated in the excretory pathways and the gastrointestinal contents; the latter may have been due to a delayed emptying syndrome of the tract. (Auth)

<444>
Kelly, J.M., P.A. Opstrup, J.S. Olson, S.I. Auerbach, and G.M. Van Dyne 1969, June. Models of Seasonal Primary Productivity in Eastern Tennessee FESTUCA and ANDROPOGON Ecosystems. ORNL-4310; M.Sc. Thesis, University of Tennessee, 305 p. (ESD #294)

Three purposes of the study were: (1) to test various sampling and mathematical techniques in the analysis of grasslands typical of eastern Tennessee, (2) to explore the feasibility of increasing efficiency in future investigations, and (3) to use computer models for theoretical estimation of gross and net production and for mathematical description of transfer coefficients or functions in grasslands. Possitive changes in live biomass during phenologically appropriate periods were summed, giving 101 and 892 g/m2 as the first empirical estimates of cumulative annual oven dry organic production for FESTUCA and ANDROPOGON communities. Trends in standing dead above-ground vegetation differ: the maximum for FESTUCA (408 g/m2) came in early summer, near time of flowering, while that for ANDROPOGON (806 g/m2) ocurred just after frost killed most of the live tops. Detached litter on the ground remained low and comparatively constant: near 114 and 181 g/m2, respectively. High apparent daily mean production rates approximated by biomass changes varied seasonally: 1.21 to 3.29 g/m2 (for intervals March 1 to April 27 and April 27 to May 15) for the FESTUCA community, and 1.05 to 3.34 g/m2 (March 10 to June 7 and June 7 to August 7) for the more mixed ANDROPOGON community. Declining biomass change for later dates presumably reflected increased losses as the mass of live and dead "compartments" increased, as well as declining carbon assimilation rates. A 7-compartment model was designed in order to simulate plausible redistribution of biomass through major parts of the system. From the model, gross production was estimated to be at least 1145 g/m2/yr for the ANDROPOGON and 1220 g/m2/yr for the FESTUCA communities (probably higher). The net primary production in the FESTUCA community was estimated to be in the plausible range from 921 g/m2 to 1115 g/m2 as compared with adjusted clipping estimates of 992 g/m2. For the ANDROPOGON community the range was estimated to be from 853 g/m2 to 1060 g/m2 compared with 892 g/m2 calculated from the clipped data. (KM)

<445>
Styron, C.E. 1969, June. Operation and Maintenance of the Beckman Omega Data Reduction Systems. ORNL-CF-69-6-9; 188 p. (ESD #295)

This report provides users of the Beckman OMEGA Data Reduction System with instructions and examples for the tyro, a reference manual for the expert, and a library of "de-bugged" programs frequently used in biological research. The report does not deal exhaustively with the mathematics and statistics supporting the computer programs. It is assumed that the user has sufficient background in these areas to avoid errors such as application of inappropriate statistical tests. (Auth)

<446>
Henhinick, E.F., and D.A. Crossley, Jr. 1969. Radiation Sensitivity of Twelve Species of Arthropods. Annals of the Entomological Society of America, 62(4), 711-717 (ESD #296)

Eleven species of insects and 1 species of isopod were exposed to gamma radiation from cobalt 60 with total doses ranging from 1 to 512 kiloroentgens (kR) in 100% increments. Insects were irradiated and maintained under comparable conditions at 28 degrees C. Mean and median life expectancy were estimated for each dose level. Life expectancy was significantly lowered for all species by exposure to 8 kiloroentgens or more. Most species were affected by 4 kiloroentgens. Exposure to 1 or 2 kiloroentgens generally had no effect. Of the species tested the American cockroach, PERIPLANETA AMERICANA (L.), was the most sensitive to radiation; the black carpet beetle, ATTAGENUS PICEUS (Olivier) was the least sensitive. Correlations between radiation sensitivity and taxonomic grouping were poor. However, within insect orders size appeared to be a good basis for estimating mortality response to irradiation. Large species were found to be more sensitive to irradiation than smaller species. (Auth)

<447>
Nelson, D.J., N.R. Kevern, J.L. Wilhm, and W.A. Griffith 1969. Estimates of Periphyton Mass and Stream Botton Area Using Phosphorus 32. Water Research, 3, 367-373 (ESD #297)

The standing crop of periphyton and actual surface area in a 100-m section of a small stream were estimated by applying material balance techniques to an experimental phosphorus 32 release. About 75 per cent of the introduced phosphorus 32 was retained initially by periphyton in the study section. Based on the quantity of phosphorus 32 in periphyton samples, per milligram and per cm2, the total standing crop of periphyton and the bottom area of the section were estimated as 1.5 kilogram and 560 m2, respectively. (Auth)

<448>
Kitchings, J.T., P.B. Dunaway, and J.D. Story 1969. Uptake and Excretion of Cesium 134 from Fallout Simulant and Vegetation by Cotton Rats. Health Physics, 17, 265-277 (ESD #298)

Cesium 134 tagged simulants with varying in virto nuclide solubilities were analyzed with respect to absorbabilities of the Cs 134 by the gastrointestinal tract of cotton rats, SIGMODON HISPIDUS. Analysis of fecal material showed a rapid increase in radioactivity until the 42nd hr postadministration. Complete passage of the particulate matter was assumed to have occurred by the 66th hr. The elimination coefficients and biological half-lives of the Cs 134 absorbed from the various simulants were: (1) 0.76 percent/hr, 3.79 days; (2) 1.16 percent/hr, 2.50 days; (3) 1.46 percent/ hr, 1.98 days. The second experimental phase was to establish uptake rates and equilibrium levels for Cs 134 in laboratory-born and wild-trapped cotton rats under chronic ingestion conditions, using Cs 134 tagged lettuce as simulated contaminated vegetation, and to determine retention curves for Cs 134 following termination of the chronic ingestion regimen. The Cs 134 uptake for both groups appeared to be a multicomponent curve. While the rate increase of both groups was not different, the amount of Cs 134 absorbed by the wild-trapped and laboratory-born groups showed a significant difference by the 64 hr. Retention curves, using the equilibrium levels as 100 percent incorporated Cs 134, broke down into two components. Serial sacrifices were made during both the uptake and excretion phases of the experiment, and eight tissues were analyzed for Cs 134. Accumulation and loss of Cs 134 was slowest in muscle. It appears that the type of material ingested and the method of ingestion, acute (simulant particles) vs. chronic (vegetation), influenced the metabolic kinetics of Cs 134 in cotton rats under laboratory conditions. Presumably, the cesium biological half-life was shorter in animals receiving a single dose of simulant because less cesium was incorporated in systemic compartments with slow uptake and long retention times. (Auth)

<449>
Thomas, W.A. 1969, Spring. Accumulation and Cycling of Calcium by Dogwood Trees. Ecological Monographs, 39, 101-120 (ESD #299)

The accumulation of calcium by various plant organs is documented and the rate of calcium circulation in the tree-soil system is determined. Calcium concentration as percentage of dry weight and root/top ratios for both weight and calcium of dogwood trees from sites with significantly different concentrations of exchangeable soil calcium did not differ significantly between sites. Calcium concentration and root/top ratios of seedlings significantly exceeded those of larger trees, and seedlings returned a greater percentage of the total tree calcium to the forest floor in leaves than did the larger trees. Calcium content per leaf increased during the growing season 1 to 2.8% of dry weight just before abscission, when leaves contained 17% of the weight and 43% of the calcium in entire trees from 9 to 28 years old. Precipitation during the growing season removed 10% of the maximum amount of stable calcium in leaves; this quantity equals 8% of total calcium contributed to litter by foliar leachate plus leaf fall. Calcium content of inflorescence and fruits increased until abscission. Reproductive organs can account for a large fraction of the annual contribution to litter by trees growing in the open (39% if weight and 79% of calcium). Dogwoods contributed 1.8% of the total above-ground calcium in an 18 year-old loblolly pine plantation but only 0.2% of total aboveground weight. Dogwood trees function as "pumps" which keep calcium in circulation through the biologically-active upper layers of soil. (KM)

<450>

<450>
Auerbach, S.I., and S. Warren 1969. Medical and Ecological Effects of Nuclear Weapons. Part of Wigner, E.P. (Ed.), Survival and the Bomb: Methods of Civil Defense. Indiana University Press, Bloomington, Indiana, (p.126-147) (ESD #300)

The preceeding chapter in the book described the effects of nuclear explosions in terms of physical quantities, such as overpressure, radiation intensity, and potential for igniting fires. This chapter tells what the effect of a certain overpressure of a certain amount of radioactivity is on man animals, and plants, and what the effect of large fires would be on fields and forests. It considers effects in the near future and also long-range effects. Although methods are not described in detail for mitigating the effects of nuclear explosions on man and animals, a number of useful hints in that direction are given. In particular, it describes the medical problems in the absence of an extensive shelter system, and the alleviation of these problems by the availability of different types of shelters. (BBM)

<451>
Sandberg, G.R., J.S. Olson, and E.C. Clebsch 1969, September. Internal Distribution and Loss from Roots by Leaching of Cesium 137 Inoculated into LIRIODENDRON TULIPIFERA L. Seedlings Grown in Sand Culture (Thesis). ORNL-TM-2660; M.S. Thesis, University of Tennessee, 68 p. (ESD #301)

Two-year-old tulip poplar seedlings were grown in heavily fertilized sand culture. Each seedling was inoculated with 1.5 microcuries of cesium 137 and harvested at certain periods during the growing season. The subsequent distribution of cesium 137 in the plant, including the roots, was studied and was compared with the amount of cesium 137 lost from the root system by leaching with two rates of application of water. Dead roots were periodically collected, and the contribution of cesium 137 to the leachate from the death of roots was estimated. Approximately 32 percent of the inoculated cesium 137 was leached from the plants; root death accounted for one-fourth of this loss. The remaining 75 percent of the loss is credited to exudation and possibly sloughing off of cells from the root cap. Exudation of cesium 137 did not increase with movement of cesium 137 to the roots during the growing season or to increased rates of water used to leach cesium 137 from the roots. (Auth)

<452>
Williams, R.B. 1969. A Table of Mean Effective Temperatures for the Metabolism of Biological Systems Subjected to Sinusoidal Cycles in Temperature. Journal of Theoretical Biology, 24, 240-245 (ESD #302)

In developing a mathematical model of the production and decay of needle rush, JUNCUS ROEMERIANUS, a general solution was achieved to the problem of superimposing variation in metabolic rate in response to the seasonal temperature cycle upon the system under study without changing the previously determined average annual metabolic rate. The general solution may be of assistance to others in the mathematical simulation of ecosystem dynamics. A table is presented of the mean effective temperatures for rates controlled by a constant Q10 and a sinusoidal cycle in temperature in which the minimum temperature is 0 degrees C. (KM)

<453>
Reichle, D.E. 1969. Lethal Effects of Gamma Radiation on Eggs and Larvae of the Bagworm, THYRIDOPTERYX EPHEMERAEFORMIS. Annals of the Entomological Society of America, 62(5), 1113-1117 (ESD #303)

Eggs and larvae of THYRIDOPTERYX EPHEMERAEFORMIS (Haworth) (LEPIDOPTERA: PSYCHIDAE) were gamma irradiated in a cobalt 60 source to establish a profile of radiation sensitivity for different ages and stages of development. One-day-postdiapause eggs were the most radiosensitive (lethal dose 50/20 = 417 rad) life stage examined; the lethal dose 50 progressively increased during embryonic development to 14,790 rad for 8-day eggs. Immediately preceding hatching (12 days), eggs were also quite radiosensitive (lethal dose 50/20 = 1905 rad). Larvae showed no significant response with respect to age or size; the mean lethal dose 50/20 for size classes ranging from 0.12 to 90.16 milligrams dry weight was 10,633 rad. Lower doses of ionizing radiation (3200 rad) showed a significant (phosphorus less than 0.05) 12% increase in percent hatching of 8-day-old eggs. Radiation doses to eggs at a level one-half that required to produce significant larval mortality were found to interfere with case-building behavior of young larvae. (Auth)

<454>
Thomas, W.A. (Reviewer) 1969, August 4. Book Review: Our Environment from Sea to Shining Sea: A Report on the American Environment, Our National Heritage. Journal of the American Medical Association, 209(5), 775-776 (ESD #304)

A critical review is given for this book by the President's Council on Recreation and Natural Beauty, Washington, D. C. The publication provides extensive information about what can be done to alleviate our environmental ills. Many examples are cited of how cooperation between citizen groups and government provided the impetus to overcome specific environmental problems. A valuable list is provided of pertinent literature and private and public governmental organizations which can help maintain and improve environmental quality. (KM)

<455>
Malone, C.R., and M.B. Swartout 1969. Size, Mass, and Caloric Content of Particulate Organic Matter in Old-Field and Forest Soils. Ecology, 50(3), 395-399 (ESD #305)

Particulate organic matter of various size fractions larger than 44 u in diameter was extracted from old-field and forest soils by flotation in aqueous solutions of magnesium sulfate. Extracted ash-free organic material comprised about 0.6% of the dry weight of both soils and from 15-20% of all the organic matter present in the soils. Particulate organic matter less than 44 u in size accounted for 70% of the organic matter, the remaining 10-15% being water soluble. In the old-field soil, a direct relationship existed between caloric values and particle sizes with the exception of particles between 44-105 u in size. Relationships between size and energy content of organic particles in the forest soil were not as clearcut, since several smaller size components in the upper 10 centimeters of the soil had greater caloric contents than larger sizes. The data are discussed in relation to decomposition processes and heterotrophic production in soil ecosystems. (Auth)

<456>
Edwards, C.A., D.E. Reichle, and D.A. Crossley, Jr. 1969. Experimental Manipulation of Soil Invertebrate Populations for Trophic Studies. Ecology, 50(3), 495-498 (ESD #306)

The experimental application of pesticides is developed for manipulation of populations of soil microarthropods, earthworms, and flora to provide controlled populations of soil invertebrates for studies of their role in litter and soil turnover. The technique employs a soil fumigant (dichloropropene,D-D), an insecticide (aldrin), and an earthworm extractant (formalin) for elimination of various biotic groups. D-D fumigation effectively eliminated earthworms, and reduced microarthropod populations by 98.3%. With periodic application of aldrin to fumigated soil, recolonization by microarthropods was held to 6.5% of control densities after 8 months. Formalin extraction of earthworms remained 80% efficient 6 months after treatment, and showed no significant effect upon soil microarthropod densities. This report presents the methods of treatment, subsequent population changes, and rates of recolonization of soil by specific invertebrate groups. (Auth)

<457>
Blaylock, B.G., and P.G. Koehler 1969. Terminal Chromosome Rearrangements in CHIRONOMUS RIPARIUS. The American Midland Naturalist, 103(933), 547-551 (ESD #307)

The frequency of the occurrence of radiation-induced terminal rearrangements, including both inversions and translocations, in C. RIPARIUS, challenges the accepted hypothesis that broken ends of chromosomes fuse only with other broken ends. This hypothesis is based on studies with DROSOPHILA MELANOGASTER and should probably not be applied to all organisms. (KM)

<458>
Witkamp, M. 1969. Environmental Effects on Microbial Turnover of Some Mineral Elements. Part I. Abiotic Factors. Soil Biology and Biochemistry, 1, 167-176 (ESD #308)

The effects of some abiotic environmental factors on mineral cycling in leaf-litter and in artificial media were measured using radionuclides. Leaching and microbial immobilization of various elements increased in the order cobalt less than iron less than calcium = strontium less than cesium and were proportional to their concentrations. The microbial accumulation of cobalt was curtailed as a result of cobalt poisoning when there was more than 1000 parts per million $CoCl_2$ in the substrate; and the microbial accumulation of cesium was greatly increased in a potassium-deficient substrate. The acidity of the substrate did not affect the uptake of cesium but the uptake of cobalt was lowest around neutrality. Leaching of cesium from litter increased with the rate of leaching but leaching efficiency was highest at a rate equivalent to 50 centimeters of precipitation per year. Immobilization of cesium at 20% leaf moisture was nil. Over the range from 60 to 200% leaf moisture, immobilization was significant and rather constant. Raising litter temperature from 2 degrees C to 50 degrees C increased leaching of cobalt by 40% and of cesium by 3 to 6 times. Immobilization of cesium in oak litter increased with increasing temperature. Freezing (and drying) mobilized over 95% of the cesium and over 85% of the cobalt in microbial tissue, but only one third of the cesium in decaying litter was mobilized as a result of resorption onto the litter. Resorption was even greater (approximately 85%) onto charred leaves after fire, and raised the cesium concentration per unit weight by a factor of four. (Auth)

<459>
Witkamp, M., and M.L. Frank 1969. Loss of Weight, Cobalt 60, and Cesium 137 from Tree Litter in Three Subsystems of a Watershed. Environmental Science and Technology, 3(11), 1195-1198 (ESD #309)

Losses of weight, cobalt 60, and cesium 137 from alder, sycamore, and oak leaves exposed for one year in a forest, a pond, and a brook, were exponential. Loss coefficients increased in the order: weight less that cobalt 60 less than cesium 137 at the ratio 1:1.9:4.1. For species loss, coefficients increased in the order: alder less than sycamore less than oak at the ratio 1:2.7:4.6. The effects of site, species, and substance were highly significant (P=0.1%), and without significant interaction (P=10%). Differences between weight a d minerals appear to be controlled primarily by leachability, differences between species by microbial breakdown rates, and those between sites by rates of leaching and mechanical abrasion. (Auth)

<460>
Thomas, W.A., and D.G. Jacobs 1969. Curium Behavior in Plants and Soil. Soil Science, 108(4), 305-307 (ESD #310)

Young bean plants (PHASEOLUS VULGARIS Var. Giant Stringless) and tall fescue (FESTUCA ARUNDINACEA) were grown in media tagged with curium 242 in order to assess the potential danger of curium to man through agronomic sources. Translocation of curium to foliage is so limited that introduction of hazardous quantities of curium 242 into food chains by plants is unlikely unless foliage becomes contaminated after a release of the element to the atmosphere. Should this occur, the affinity for curium of bone, liver and the gastrointestinal tract of any animals in the food chain between plant and man would reduce the quantity that might be ingested by man. (KM)

<461>
Peters, L.N., J.S. Olson, and R.M. Anderson 1969. Eight-Year Summary of Plant-Soil Data on Cesium 137 in a Tagged Appalachian Forest Dominated by LIRIODENDRON TULIPIFERA. ORNL-TM-2737; 235 p. (ESD #311)

A long-term tracer experiment using cesium 137 was initiated May 20-23, 1962. The experimental site was located on the AEC Reservation, Oak Ridge, Tennessee, in a forest dominated by tulip poplar (LIRIODENDRON TULIPIFERA). The trees in an area of 20-25 meters were tagged with 464 mCi of cesium 137. In the autumn immediately after inoculation, approximately 63 percent had transferred to the ground (0-30 Ci, including litter) inside and outside the tagged area. Rainfall accounted for 4 percent of total ground burden and litter fall about 12 percent; therefore, roots must have contributed approximately 84 percent of the cesium concentration in the soil. Almost all of the cesium was immediately bound within the soil. By 1967 the total amount accumulated in the soil and litter was 96% (plus or minus 5% S.E.) of initial inoculum. Continuous sampling of canopy parts has indicated a relatively steady decline of cesium 137 concentration in leaves. There is no evidence of recycling of cesium 137 from roots. Numerous data have been collected since the tagging of the forest. This report constitutes a depository of data on amounts and rates of transfer of cesium 137 in the tulip poplar forest. (Auth)

<462>
Kolehmainen, S.E., and D.J. Nelson 1969, December. The Balances of Cesium 137, Stable Cesium, and the Feeding Rates of Bluegill (LEPOMIS MACROCHIRUS Raf.) in White Oak Lake. ORNL-4445; Ph.D. Thesis, University of Tennessee, 114 p. (ESD #312)

The concentration of cesium 137, stable cesium and potassium and the specific activities of cesium 137 were determined in seven species of fish in White Oak Lake, a small radioactively contaminated lake in Oak Ridge, Tennessee, during a period from June 1967 to January of 1969. The intake of cesium 137 was used to calculate the feeding rates of bluegill at different times of the year. The concentration of cesium 137 in bluegill and other species of fish as well as in the food of bluegill was analyzed gamma-spectrometrically. The concentration of cesium 137 in bluegill increased by a factor of four in fish from 1 to 70 grams, but the concentration of stable cesium decreased somewhat with increasing fish size. In bluegill above 70 grams the concentration of cesium 137 was in a steady state with a considerable seasonal cycling, and the concentration of stable cesium in large bluegill had a seasonal cycling similar to that of cesium 137. Concentrations of potassium also decreased slightly with increasing fish size, but the concentration of potassium did not fluctuate seasonally. The excretion rates of cesium and potassium were determined by biological half-life studies using cesium 137 and potassium 42. The biological half-life of cesium 137 increased with the increasing size of bluegill. There were no significant differences in the long component of the biological half-life of cesium 137 among fish that were close to equilibrium with cesium 137 and fish that received a single feeding of cesium 137. The short component of the biological half-life of cesium 137 was 8 days and the long component 190 days at 15 degrees C. The biological half-life of potassium consisted of only one component which was 40 days at 15 degrees C. The assimilation of cesium 137 increased with fish size and it varied for different types of food from 3% to 70%. The assimilation of potassium was almost complete for all types of food. The intakes of cesium 137, stable cesium, and potassium in bluegill were calculated for a nonequilibrium state considering the growth of the fish, the seasonal cycling of the concentration and the excretion rates. Feeding rates were calculated on the basis of the daily cesium 137 intake, the concentration of cesium 137 in bluegill's food, and the assimilation percentage of cesium 137 for different food items. The feeding rate of bluegill was in a positive relationship with the temperature of water, but the correlation was not complete. The daily meal was at a minimum, 0.8% of body weight, in February increasing rapidly during May to a maximum 3.2% in June whereafter it decreased gradually towards the winter. The annual mean of the feeding rates of bluegill calculated on the basis of stable cesium and potassium balances agreed well with the mean of feeding rates calculated by the cesium 137 balance. The concentration of cesium 137 was highest in golden shiner and lowest in redear sunfish while the concentration of stable cesium was highest in goldfish and lowest in bluegill. The concentration of potassium varied only slightly among different species of fish. There were no consistent relationships between cesium 137, stable cesium, and potassium concentrations in different species of fish in White Oak Lake. The specific activity of cesium 137 in different fish species varied from one to two and a half times that of water. (Auth)

<463>
Cosgrove, G.E., P.B. Dunaway, and J.D. Story 1969, July. Malignant Tumors Associated with Subcutaneously Implanted Cobalt 60 Radioactive Wires in PEROMYSCUS MANICULATUS. Bulletin of Wildlife Disease Association, 5, 311-315 (ESD #313)

Three adult female mice were used to assess the effects of radioactive tracking techniques used to study the range and activity patterns of small mammals. One mouse died in 15 months with no tumor present and two mice developed tumors and hematologic abnormalities. Caution should be exercised in interpreting data from animals containing radioactive tags for long periods of time. (KM)

<464>
Dahlman, R.C., S.I. Auerbach, and P.B. Dunaway 1969. Behavior of Cesium 137-Tagged Particles in a Fescue Meadow. SM-117/72; Part of Proceedings of a Symposium on Environmental Contamination by Radioactive Materials held in Vienna, Austria, March 24-25, 1969, (p. 153-165) (ESD #314)

Enclosures of tall fescue (FESTUCA ARUNDINACEA), 0.01 hectare in area, were contaminated at the rate of 25 g/ft2 using artificial fallout (cesium 137 fused to 88-177 um silica sand, approximately 100 uCi/g, 15% leachable in water) to study the effects of closein fallout on a grass system. Investigations of radiation effects, intercompartmental cycling of radiocesium and secondary movements of the simulant particles in soil and litter have been in progress since midsummer, 1968. Plant community response (yield, seed production and species composition), small mammal physiology (hemopoietic and gut effects) and insect population dynamics are being studied following exposure to chronic, internal-external, beta-gamma radiation. Sand particles intercepted by grass blades were readily dislodged by light wind, and maximum retention time was approximately 10 days. The simulant was readily trapped in the leaf axils where it remained for 4 weeks until washed off by rain. There was significant transfer (15%) of cesium 137 from simulant to vegetation. Vacuum and brush cleaned vegetation initially contained 1.32 uCi/g (living parts) and 4.62 uCi/g (dead parts). Early incorporation into foliage was largely by contact assimilation because appreciable uptake had occurred before the simulant had reached the soil. Two loss rates were evident in the subsequent decrease of cesium 137 in living foliage. The fast component, which began 8 days after contamination and continued for 4 weeks, was described by the linear regression Y = 1.64-0.04X where Y and X are uCi cesium 137/g foliage and days, respectively. The slower loss rate commenced 4 weeks after contamination and its regression was Y = 0.61 -0.003X. Only 0.12 uCi of cesium 137 (0.006% of that present) was carried from the tagged areas in one runoff event. This agreed remarkably well with that predicted from a simple model based on characteristics of simulant and soil, and on rainfall-runoff relationships. (Auth)

<465>
Taylor, F.G., Jr. 1969. Phenological Records of Vascular Plants at Oak Ridge, Tennessee. ORNL-IBP-69-1; 46 p. (ESD #315)

Date of first flowering for 225 vascular plant species has been recorded during the spring seasons from 1963 to 1969 at Oak Ridge, Tennessee. Sixty species were woody, whereas 165 were classified as herbaceous. This array was comprised of 164 genera representing 70 families. The woody taxa contained observations on 48 genera from 28 families, and the herbaceous plants consisted of 116 genera from 42 families. More species were observed to flower in April than in any other month. Twenty woody species flowered during that month in contrast to 77 herbaceous species. This total represented 52 genera among the herbaceous plants and 17 among the woody plants. These observations are intended to call attention to date of first flowering, and in many cases illustrate the variation observed within a seven year period. Since vegetative growth usually diminishes with the onset of the reproductive life cycle, knowledge concerning date of flowering would be especially valuable in analysis of ecosystems and in biomass estimations. (Auth)

<466>
Witherspoon, J.P., and F.G. Taylor, Jr. 1969. Retention of a Fallout Simulant Containing Cesium 134 by Pine and Oak Trees. Health Physics, 17, 825-829 (ESD #316)

Small white pine (PINUS STROBUS) and red oak (QUERCUS RUBRA) trees were contaminated in the field with a fallout simulant consisting of 88-175 u dia. quartz particles containing cesium 134. Whole plants were harvested at intervals up to 33 days after application of the simulant, and the cesium 134 retention by each species was determined. The initial fraction of the simulant retained by foliage was higher in the oaks (0.35) than in the pines (0.24). However, after 1 hour, the broad leaved oaks had lost 90.5% of the initial cesium 134 concentrations while the pines had lost only about 10%. These early retention differences are related to the effects of wind on the two distinct foliage types. Effective half-lives were calculated for both species at intervals of 0-1 day, 1-7 days and 7-33 days. For pine trees these values were 0.25, 4.53 and 20.66 days, respectively. For oaks they were 0.12, 1.41 and 24.86 days. Loss of particles (cesium 134) was due, primarily, to the weathering action of wind and rain during the study. The effects of wind and the first rain following contamination accounted for a large percentage of the total radionuclide loss during the study. (Auth)

<467>

<467>
Witherspoon, J.P., and F.G. Taylor, Jr. 1969. Radiation-Induced Anatomical Modifications in Forest Trees. Journal of the Tennessee Academy of Science, 44(4), 118-124 (ESD #317)

Aberrant stem and foilage samples were collected from several forest tree species irradiated by fast neutron or cobalt 60 gamma sources. Common gross morphological abnormalities such as fused stems, alterations of size and shape of leaves and necrosis in meristematic regions were examined microscopically. These frequently-reported changes in plant growth habit were described by effect of radiation on internal structure. Probable effects of these tissue changes on the physiological function of organs are discussed. Of particular significance were anomalies in vascular tissues of foilage which could affect the transport of both mineral and food substances. (Auth)

<468>
Witkamp, M. 1969. Environmental Effects on Microbial Turnover of Some Mineral Elements. Part II. Biotic Factors. Soil Biology and Biochemistry, 1, 177-184 (ESD #318)

Some effects of biotic factors (forest floor, microflora, litter fauna) on mineral cycling on artificial and natural substrates were measured using radionuclides. Leaching and immobilization of cesium 134 in the leaves of four species of tree were positively related. During the first weeks of decay all species except mulberry showed net immobilization. In fresh litter of tulip poplar, rates of leaching of cesium 137 and microbial activity, as well as immobilization of cesium 137, were higher than in one-year-old litter. Mixing of litter with cesium 137 and litter without cesium 137 did not affect cesium 137 movement. Concentration factors for cesium of several representative soil organisms in vitro and in fungal fruiting bodies in the field which derived their cesium from the substrate varied from less than 0.1 to 80. The maximum concentration of cesium 134 and cobalt 60 by TRICHODERMA VIRIDE in shaken cultures occurred after about 5 days. A change from net immobilization to net mineralization of cesium 137 by the natural flora of tulip poplar leaves occurred after 10 days of growth. Presumably ageing of microbial tissue increased release of minerals more than it did uptake, which resulted in reduced immobilization in time. Mineral accumulation by long-lived fungal fruiting bodies and mycelium, however, continued for several weeks. Five millipedes on 1 gram of entire white oak leaves tagged with cesium 134 accumulated in 18 days 9% of the initial cesium 134 in their tissue; reduced microbial immobilization from 24 to 11% of the initial cesium 134, presumably by reducing mycelium growth; and increased leaching from 26 to 30% of the initial cesium 134 as a result of leaf fragmentation. It was concluded that biotic as well as abiotic factors greatly affect mineral turnover by the microflora. Further knowledge of such effects may open ways to control the mineral kinetics in the environment. (Auth)

<469>
Malone, C.R., and D.J. Nelson 1969, Summer. Feeding Rates of Freshwater Snails (GONIOBASIS CLAVAEFORMIS) Determined with Cobalt 60. Ecology, 50(4), 728-730 (ESD #319)

A short-term radionuclide method was developed for estimating feeding rates of snails inhabiting freshwater streams. Snails were allowed to feed for 1 hr upon the surfaces of rocks previously soaked in a Co 60 solution. Organic detritus and aufwuchs were scraped from the rocks and assayed to determine radioactivity. When the dpm of Co 60/mg of food were known, the quantity of biomass ingested by the snails could be calculated by determining the radioactivity in the snails. Feeding rates varied both diurnally and monthly, suggesting periodicity in feeding activities and interactions with environmental factors. (Auth)

<470>
Baskerville, G., F.C. Dean, L.J. Bledsoe, N.B. Gove, S.V. Kaye, J.S. Olson, R.V. O'Neill, N.F. Sollins, P. Sollins, and R.B. Williams 1970, January. Systems Ecology. ORNL-4446; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1969, (p. 153-162), 162 p. (ESD #320, Part, Section)

Ecosystem modeling and analysis aimed at predictive functions are reported under the following titles: pertinence of recent ecological literature to the modeling of ecosystems; biogeochemical ecology research collection; parameter identification in systems ecology; numerical methods in systems ecology; CSS: a versatile compartment system simulation program; a stochastic model of feeding in a forest centipede; a model for Cedar Bog Lake, Minnesota; analysis of the change-in-ratio model for estimating population abundance; and systems analysis of balsam fir forests. (CO)

<471>
Anderson, R.M., C.E. Baker, F.S. Brinkley, E.E.C. Clebsch, R.C. Dahlman, G.J. Dodson, P.B. Dunaway, N.T. Edwards, C.W. Francis, M.L. Frank, M.P. Hoglund, M.J. Kelly, J.F. McBrayer, C.R. Malone, V. Merchant, B.C. Moulder, D.J. Nelson, J.S. Olson, R.V. O'Neill, P.A. Opstrup, L.N. Peters, D.E. Reichle, G.R. Sandberg, M.H. Shanks, J.D. Sheedy, G. Stanhill, M.B. Swartout, T. Tamura, W.A. Thomas, R.I. Van Hook, F.W. Waman, and M. Witkamp 1970, January. Radionuclide Cycling in Terrestrial Ecosystems. ORNL-4446; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1969, (p. 76-112), 162 p. (ESD #320, Part, Section)

Emphases are on elucidating the structure and mechanism in ecological organization, and distribution and flux of radionuclides in ecological systems, and on the use of radionuclide methods and computer simulation in model development. Titles are: trends in canopy content of Cs 137 in tagged LIRIODENDRON TULIPIFERA trees; seasonal pattern and components of litterfall in LIRIODENDRON forest tagged with Cs 137; distribution and loss of Cs 137 from roots by leaching of LIRIODENDRON TULIPIFERA L. seedlings grown in sand culture; the accumulation of Cs 137 in the soils of a tagged LIRIODENDRON forest; distribution of Cs 137 in soil of a tagged LIRIODENDRON forest; population density and biomass of soil microinvertebrates in the Cs 137-tagged LIRIODENDRON forest; seasonal density and biomass of forest floor invertebrates; seasonal energy budgets for forest spider populations; secondary production of bagworms on different host plants; biological turnover of radionuclides; a model for Cs 137 movement in a forest floor community; respiration rates of ACHETA DOMESTICA acclimated to a fluctuating daily temperature regime; accumulation of Cs 144 by hickory and Co 60 by black gum seedlings; decomposition and loss of Cs 137, Ce 144, and Co 60 from leaves of LIRIODENDRON TULIPIFERA, CARYA TOMENTOSA, and NYSSA SYLVATICA; interaction between grass communities; hydrological balance of a fescue field; behavior of Cs 137 fallout simulant in a fescue meadow; compartment model of seasonal change in roots, tops, and dead biomass of ANDROPOGON and FESTUCA fields; short-term effects of cover management on decomposition processes in grassland soil; pesticide-induced responses in organic matter decomposition in a grassland; toxicity of fescue extract to soil bacteria; characterization of particulate organic matter in old-field and forest soils; temperature dependence of Ca 47, K 42, and Na 22 turnover in arthropods; kinetics of Cs 137 and Mn 54 in sand-grass-grasshopper systems; an energy budget for wolf spiders, LYCOSA RABIDA Walckenaer; energy dynamics of a terrestrial snail, MESODON THYROIDUS Say; avoidance of dead grass cover by pine mice; and investigation of the concept of using radionuclides for metabolic measurements in small mammals. (CO)

<472>
Brown, E., J.R. Gammon, N.A. Griffith, S.E. Kolehmainen, B. Martinedes, C. Marvin, R.H. Monheimer, D.J. Nelson, J.R. Reed, S.A. Rucker, and D.L. Willis 1970, January. Radionuclide Cycling in Aquatic Ecosystems. ORNL-4446; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1969, (p. 113-136), 162 p. (ESD #320, Part, Section)

Radionuclide movement in rivers and lakes, particularly White Oak Lake was studied. Progress is reported under the following titles: radiotungsten studies; radionuclide excretion studies; radionuclide uptake and retention in the newt (NOTOPHTHALMUS VIRIDESCENS); determination of feeding rates in Trichoptera using Co 60; the role of aerobic microbes in the cycling of sulfur in an aquatic ecosystem; mineral kinetics in microcosms; and White Oak Lake studies. (CO)

<473>
Harris, W.F., C.E. Macklin, S. Suzuki, F.G. Taylor, Jr., J.P. Witherspoon, and W.A. Thomas 1970, January. Responses of Plants to Ionizing Radiation. ORNL-4446; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1969, (p. 66-75), 162 p. (ESD #320, Part, Section)

Radiation effects on higher plants (primarily trees) were studied as well as fallout retention and dosimetry studies. Progress is reported under the following subtitles: retention of a fallout simulant by pine and oak trees; beta dosimetry of Sr 90-Y 90 sources; effects of external beta radiation on higher plants; mineral uptake by irradiated plants; ecological responses of trees to fast-neutron radiation and reduced light intensities; and decomposition of irradiated persimmon leaves. (CO)

<474>
Abner, C.H., W.P. Bonner, J.W. Curlin, E.R. Eastwood, J.W. Elwood, M.L. Frank, N.A. Griffith, D.F. Grigal, T. Grizzard, M. Heath, W.F. Johnson, D.J. Nelson, L.N. Peters, W.M. Snyder, W.J. Selvidge, G. Stanhill, T. Tamura, J.L. Thompson, W.A. Thomas, and M. Witkamp 1970, January. Watershed Aquatic Habitat Interactions. ORNL-4446; Part of Auerbach, S.I., et al, Health Physics Division Annual Progress Report for Period Ending July 31, 1969, (p. 137-152), 162 p. (ESD #320, Part, Section)

The Walker Branch watershed project is designed to measure ecological impacts in relation to natural resource management. The systhesis of an empirical watershed model to relate the various compartments is based on the input-output sequence of chemicals and water throughout. Meteorologicals inputs, dry particulate matter, stream water chemicals, biomass, soil water, leaf decomposition, and standing crop of periphytic algae have been quantified. (CO)

<475>

<475>
Kowal, N.E. 1969. Effect of Leaching on Pine Litter Decomposition Rate. Ecology, 50(4), 739-740 (ESD #321)

Leached pine needles have a much higher decomposition rate than unleached ones. Under laboratory conditions, the measurement of carbon dioxide production yields a close estimate of decomposition rate as measured by weight loss. (Auth)

<476>
Blaylock, B.G., and T.J. Mitchell 1969. The Effect of Temperature on the Dose Response of GAMBUSIA AFFINIS AFFINIS from two Natural Populations. Radiation Research, 40(3) 503-511 (ESD #322)

The radiation resistance of the common mosquito fish, GAMBUSIA AFFINIS AFFINIS, from two natural populations was compared by establishing lethal dose 50/30 for each population. One population had been exposed to chronic environmental radiation of approximately 10 rads per day for over 100 generations, while the other population was exposed only to natural background radiation. The lethal dose 50/30 for each population were ascertained at environmental temperatures of 20, 25, or 30 degrees C. A statistical analysis of the data based on a modified form of a logistic dose response model showed no significant difference in radiation response between the two populations. However, as the temperature increased above 20 degrees C, the sensitivity of GAMBUSIA to radiation increased. Differences of only 5 degrees C changed significantly the lethal dose 50/30 of each population. (Auth)

<477>
Kowal, N.E. 1969, April. Ingestion Rate of a Pine-Mor Oribatid Mite. The American Midland Naturalist, 81(2), 595-598 (ESD #323)

An accumulation model was fitted to calcium 45 uptake data of CULTRORIBULA JUNETA feeding on undecomposed pine needles and on natural pine mor. The resulting crude estimates of ingestion rates are 0.3 and 1.1 ug mor/mite/day. (Auth)

<478>
Reichle, D.E. 1969. Distribution and Abundance of Bog-Inhabiting Pselaphid Beetles. Illinois State Academy of Science, 62(3), 233-264 (ESD #324)

The distribution and abundance of pselaphid beetle populations in a relict sphagnum bog are related to microhabitat varibles and the ecology of each species. In northern Illinois, eleven pselaphid species with boreal affinities exhibited distributional patterns related to stages in the bog sere. Each successional stage was characeterized by unique moss species and microclimatological conditions comprising the microhabitats: the sphagnum mat, ericaceous shrubs, tamarack forest, and a swamp forest ecotone. Physical preferenda and predator-prey relations appeared to isolate sympatric beetle populations. Seasonal shifts in population between stages were affected by changing microclimate. Early successional stages were dominated by boreal species, where highest densities were attained with maximum development of the moss substratum. (Auth)

<479>
Kaye, S.V., and P.S. Rohwer 1969. Methods of Estimating Population Exposures from Plowshare Applications. Part of Proceedings of a Symposium on Public Health Aspects of Peaceful Uses of Nuclear Explosives, held in Las Vegas, Nevada, April 7-11, 1969, (p. 550-584) (ESD #325)

When estimating doses to populations it is necessary to divide the total population into groups that have parameters of similar type and magnitude in order to identify critical population groups. Age groups constitute the most basic and generally useful way of dividing the total population for estimating dose. Models for estimating dose, particularly the internal dose from inhalation and ingestion of radioactivity, should be written as a function of age. The importance of considering age-dependency is emphasized by the fact that some of the internal dose parameters change by as much as a factor of ten for some radionuclides when comparing a one year old with an adult. A computer code called INREM has been written which can consider all internal dose parameters as a function of age. The major limitation in using this computer code for all radionuclides is the paucity of age-dependent imput data for many radionuclides. Tritium, iodine, cesium, and strontium have been studied in detail with INREM and the results and interpretations are discussed. Another code, EXREM, computes the external dose rates and cumulative doses from both beta particles and gamma photons from submersion in a radioactive cloud, submersion in contaminated water and exposure above a contaminated land surface. This code can consider up to 25 Plowshare detonations and a variety of combinations for calculating doses and dose rates in relation to a detonation schedule. The importance of using both INREM and EXREM to estimate the total dose to a population group is stressed. (Auth)

<480>
Witkamp, M., and M.L. Frank 1969. Evolution of Carbon Dioxide from Litter, Humus, and Subsoil of a Pine Stand. Pedobiologia, 9, 358-365 (ESD #326)

Evolution of CO2 from the floor of a pine stand was calculated from the rate of CO2 increase in air before and after passage over profile sections of different depth. The contribution of a profile layer to total respiration was calculated as the difference between CO2 evolution from profiles with and without that layer. Concentrations of CO2 were measured for a 24-hour period using slow air flow (approximately 1 cm/min) over the floor, automatic sample selection, and infrared gas analysis. The resulting curves for CO2 evolution rates of litter, humus, and subsoil showed that the daily cycle of CO2 evolution from litter was highly correlated with the temperature cycle. During periods of high CO2 production and temperature in the afternoon some CO2 2 from litter appeared to diffuse downward into the humus, and to block CO2 evolution from the subsoil. During the night the accumulated CO2 in subsoil and humus appeared to move to the surface possibly aided by low CO2 evolution and temperatures in the litter. Downward movement of some CO2 during the day and enhanced upward movement at night resulted in a rather constant rate of CO2 evolution from the entire profile over the 24-hour period. During this time, litter, humus, and subsoil contributed 28, 16, and 56% of total soil respiration, respectively. Respiration by roots which occurred in the subsoil only appeared to account for not more than 50% of the total soil respiration. The method of measuring yields rates of CO2 evolution that agree with the annual input of organic matter to the floor. (Auth)

<481>
Reichle, D.E., P.B. Dunaway, and D.J. Nelson 1970. Turnover and Concentration of Radionuclides in Food Chains. Nuclear Safety, 11(1), 43-45 (ESD #327)

Proliferation of nuclear technology and concern for radioactivity in the biosphere demand more sophisticated evaluations of future nuclear installations and procedures. Adequate analyses of radionuclide dispersion in the environment will require more substantial bioenvironmental information than is presently available. Frequently information known for one ecological system (e.g., Artic tundra) will not be applicable to other ecosystems (e.G., temperate or tropical forests). Only with sufficient ecological data can predictive models be developed that will enable assessment of the environmental consequences of radioactive contamination. A simple source-pathway-receptor model, analogous to the ecological food chain, requires pathway indentification, data on assimilation by each link (organism) in the pathway, and determination of the biological turnover of each radionuclide. For acute releases of radioactivity to the environment, evaluation of these variables is needed to predict time-dependent concentrations of radioactivity in organisms. For chronic releases, concentration factors alone will often suffice. The biological concentration and turnover of radionuclides by animals are summarized in this paper. Data are presented for use in environmental models and correlation with species characteristics (e.g., body size) that allow estimation of absolute values for many different animal groups based on existing experimental data. (Auth)

<482>
Moulder, B.C., D.E. Reichle, and S.I. Auerbach 1970, January. Significance of Spider Predation in the Energy Dynamics of Forest Floor Arthropod Communities (Thesis). ORNL-4452; Ph.D. Thesis, University of Tennessee, 170 p. (ESD #328)

Field and laboratory radioisotope techniques were used in the present study in conjunction with more conventional ecological methods to quantify the energy drain upon prey populations by spiders in a detritus food web. Weekly collections from pitfall traps located within a cesium 137 tagged forest plot provided estimates of radiocesium equilibrium body burdens of spiders and potential prey throughout the year. Annaul mean population density of spiders equalled 126 individuals per square meter. Population density peaks occurred in fall, early winter, and summer. Mean biomass for the year equalled 43 mg dry wt. per meter squared, with early winter and spring maxima. A comparison with other major predator groups, centipedes and beetles, revealed that spiders ranked first in importance in terms of population density and biomass, but were second to centipedes in terms of calories respired per square meter. Spiders killed an equivalent of 2.08 kcal prey tissue/m2/year and ingested 1.68 kcal/m2/year. Respiratory energy loss equalled 1.23 kcal/m2/year. In terms of energy drain on the cryptozoan community, medium sized spiders were most important. Population efficiencies calculated from seasonal energy budget for spiders were in close agreement with values reported in literature by several authors for predator trophic levels. Calculated efficiencies were: (1) intake efficiency, 73-96 percent; (2) assimilation efficiency, 90-99 percent; (3) respiration efficiency, 58-96 percent; (4) respiration/assimilation, 63-106 percent; (5) ecological growth efficiency, -5-34 percent; (6) tissue growth efficiency, -4-37 percent. (BBM)

<483>
Hull, N.C., J.J. Beauchamp, and D.E. Reichle 1970. PITFALL 1: A general Purpose Data Processing Program for Environmental Data. ORNL-IBP-70-2; 67 p. (ESD #329)

PITFALL I is designed to enable the individual researcher to participate in the processing and analysis of complicated data sets requiring storage, recall, summarization and basic statistical analysis. Although originally developed for handling extensive environmental data, the programs' flexibilities lend them applicable to situations where recovery and recombination of data in three-dimensional arrays (e.g., attribution evaluation for species in time and space) are needed. The problem for which PITFALL I originally was developed is described in the report. In addition, sections on statistics and data processing are included. (Auth)

<484>
Witkamp, M. 1969. Cycles of Temperature and Carbon Dioxide Evolution from Litter and Soil. Ecology, 50(5), 922-924 (ESD #330)

Periodic measurement of CO2 evolution from various biotopes reveal a daily cycle in soil respiration with a predawn minimum and an afternoon maximum that parallels the daily temperature cycle. A second maximum occasionally occurs between midnight and dawn when soil temperatures exceed temperature of the surface air. This predawn flush may result from thermal convection of CO2-rich subsurface air to the surface. The time of measurment must be considered for comparisons of rates of CO2 evolution from different sites, and measurements should be made over a 24-hour period for estimates of daily CO2 evolution. (Auth)

<485>
Thomas, W.A. (Reviewer) 1969. Book Review: The Conquest of Nature. Technology and Its Consequences, Man, Machine, and Milieu. Ecology, 50(5), 942 (ESD #331)

A critical review is given for the R. J. Forbes book (Praeger, New York, 1968). The global implications of western technology is discussed in the book under three sections. "Man and Machine" traces the evolution of the present technological order. "Machine and Milieu" concentrates on the environmental changes wrought by technology. "Milieu and Man" discussed man and his environment as influenced by culture. Thomas' main objection to the book is its paucity of literature citations. (KM)

<486>
McBrayer, J.F., D.E. Reichle, and S.I. Auerbach 1970. Trophic Level Delineation of Forest Soil Microinvertebrates. ORNL-TM-2847; 47 p. (ESD #332)

This study provides basic information on the food chain relationships of the important, but poorly known, microfauna of soils. Trophic transfers were studied in a soil population from a forest ecosystem previously tagged with cesium 137 and also in laboratory microcosm cultures where the detrital input was experimentally tagged with cesium 137. Trophic level position of the fauna was identified on the basis of four parameters: (1) the rate of radionuclide uptake by a population, (2) the final equilibrium concentration of radionuclide attained by the population, (3) initial temporal delays in uptake of the radionuclide, and (4) the presence or absence of a concentration spike in the uptake pattern. Relative trophic positions were identified for twenty-eight taxa of soil invertebrates in the phyla Annelida and Arthropoda. (Auth)

<487>
Thomas, W.A., (Reviewer) 1969, December 15. Pesticides. Journal of the American Medical Association, 210, (page not given) (ESD #333)

A review is given for the 1968 Rochester Conference on Toxicity publication, Chemical Fallout: Current Research on Persistent Pesticides by Morton W. Miller and George C. Berg and published by Charles C. Thomas, Springfield, Illinois, 1969. The reviewer-reported proceedings are well organized and well indexed. (BBM)

<488>
Johnson, W.F., and W.R. Miller 1970. Walker Branch Watershed Project Proportional Water Sampler Design Report and Operating Manual. ORNL-TM-2839; 21 p. (ESD #334)

An automatic sampler was designed and constructed to withdraw samples of water from flowing outdoor streams. The volume of sample withdrawn is automatically in volumetric proportion to the stream flow rate. These samples are collected and combined as a large composite sample for laboratory analysis. The frequency of sampling can be adjusted manually. The sampler system will also automatically switch to a fast sampling mode such as during a storm whenever the rate of increase of the stream flow rate exceeds a preset value. In this mode the system collects individual samples in volumetric proportion to the stream flow rate in up to 250 bottles, each 250 milliliter capacity, at a rate of up to four individual samples per minute. These samples are not combined. (Auth)

<489>
Reichle, D.E. 1969. Measurement of Elemental Assimilation by Animals from Radioisotope Retention Patterns. Ecology, 50(6), 1102-1104 (ESD #335)

Measurements of nutrient assimilation by animals from dietary inputs often are based upon chemical analyses of food and feces. Therefore, those budgets of the difference between nutrient values of food consumed and feces produced provide an estimate of the digestive assimilation of nutrients--equivalent to metabolizable energy in energy balance calculations (Harris 1966)--if it can be assumed that intestinal secretion of nutrients is not a significant source of error. Although this experimental approach is reasonable for those animals where urinary and digestive products are distinct, e.g., mammals (Petrusewicz 1967), it cannot be applied to those organisms where metabolic and digestive products are intimately mixed in feces. In the latter case, assimilation measurements are biased by the organism's turnover of materials through normal excretory and secretory processes. Fecal analyses on insects and other invertebrates describe only net assimilation--equivalent to apparent digestible energy (Harris 1966)--and do not reflect true digestive efficiency as often implied in the literature. (Auth)

<490>
Crossley, D.A., Jr., and R.I. Van Hook, Jr. 1970. Energy Assimilation by the House Cricket, ACHETA DOMESTICUS, Measured with Radioactive Chromium 51. Annals of the Entomological Society of America, 63(2), 512-515 (ESD #336)

A radioisotope method for determining energy assimilation for energy flow studies is discussed. Concentrations of radioactive chromium 51 in food and feces, along with caloric measurements on these materials, were used to estimate energy assimilation independent of intake-defecation budgets. Adult house crickets, ACHETA DOMESTICUS (L.) (Orthoptera: Gryllidae), were allowed to feed on chromium 51-tagged food for 24 hours and then were transferred to nonradioactive food. Their feces were collected at hourly intervals for the next 24 hours. Regression analysis was used to estimate radiochromium in the gut at the time of their transfer to a nonradioactive food. The data on these crickets yielded an estimate of 65% for energy assimilation efficiency. Gravimetric determination of energy assimilation efficiency was 63%, based on intake-defecation budgets. (Auth)

<491>
Van Hook, R.I., Jr., D.E. Reichle, and S.I. Auerbach 1970, March. Energy and Nutrient Dynamics of Predator and Prey Arthropod Populations in a Grassland Ecosystem. ORNL-4509; Ph.D. Thesis, Clemson University, 110 p. (ESD #337)

Population dynamics, energy budgets and nutrient concentrations were used to develop a compartment model for evaluating energy flow and nutrient fluxes in the arthropod components: herbivores - MELANOPLUS SANGUINIPES G. and B., CONOCEPHALUS FASCIATUS (De Geer) and the Homoptera-Hemiptera; omnivore - PTERONEMOBIUS FASCIATUS (De Geer); and the predator - LYCOSA spp. of an eastern Tennessee grassland ecosystem. Weekly estimates of arthropod density and biomass, and monthly estimates of standing crop biomass of the vegetation were made during the 1968-69 growing season. Supporting studies included: 1) determination of calorific equivalents, 2) measurements of arthropod metabolism, 3) determination of whole-body concentrations of sodium, calcium, and potassium, 4) estimation of biological turnover rates of these nutrients using radioactive analogs and 5) field studies of arthropod feeding habits and food consumption. Total net primary production of the grassland ecosystem was 1274 kcal/m2; 89% of this total was grass species (FESTUCA ARUNDINACEA Schreb. and ANDROPOGON VIRGINICUS L.) and 11% of green forbs. Herbivorous and omnivorous insects consumed 9.6% (122.9 kcal/m2) of net primary production. Annual net secondary production by the insect community was 32.05 kcal/m2. Predators (LYCOSA spp.) consumed 21% of net secondary production. Total net tertiary production by spiders was 2.26 kcal/m2. Total annual energy flow through arthropods was 75.6 kcal/m2. Herbivorous species accounted for 79.8% of this total, the omnivore 12.2% and the predators 8.1%. Whole-body concentrations of sodium increased with higher trophic position in the food chain: vegetation (0.43 milligrams per gram ash free dry weight), prey (1.18 mg/g ash free dry weight) and predators (1.94 mg/g ash free dry weight). Calcium concentrations decreased from vegetation (5.82 mg/g ash free dry weight) to prey (0.85 mg/g ash free dry weight), and remained constant from prey to predators (0.88 mg/g ash free dry weight). Potassium concentrations were much higher in vegetation (14.28 mg/g ash free dry weight) than in either the prey (1.87 mg/g ash free dry weight) or predators (1.96 mg/g ash free dry weight), which were essentially the same. (Auth)

<492>
O'Neill, R.V. 1970. Pathway Analysis: A Preliminary Application of Systems Ecology to Nuclear Facility Safety Evaluation. ORNL-CF-70-3-25; 25 p. (ESD #338)

To improve predictions of internal dose equivalents resulting from releases at nuclear facilities, it would be useful to estimate the quantity of nuclides ingested by man after passage through environmental food chains. Computer simulations, using a compartment model approach, have been useful in other attempts to trace nuclides through environmental systems. This report illustrates a preliminary attempt to apply simulation techniques to the behavior of released fission products in human food chains. A hypothetical example is developed to demonstrate an application of the approach and to point out deficiencies in the proposed computer model. On the basis of this preliminary work, directions can be suggested for further development. (Auth)

<493>
Baskerville, G.L. 1970, April. Testing the Uniformity of Variance in Arithmetic and Logarithmic Units of a Y-Variable for Classes of an X-Variable. ORNL-IBP-70-1; 38 p. (ESD #339)

A FORTRAN IV computer program was designed to aid users' judgment of the homogeneity of variance around regressions for data untransformed and transformed by logarithms, as in allometric relations of organism mass on diameter and/or height (length). A great majority of tests on such relations are shown elsewhere to favor log-log transformation. Therefore it is important that regressions based on the logarithms be applied to data with an appropriate correction (included here) to avoid bias, which commonly tends to underestimate the expected value of the untransformed value of Y for a given value of X. This would underestimate sums of many such values, e.g., for the total mass, growth, or chemical inventory of a forest stand. Program listing, description, output tables, and Calcomp plotted graphs should help lead the user through a series of decisions about data analysis which is natural and statistically useful for this and other inferences which recur many times in analysis of productivity data for the International Biological Program. (Auth)

<494>
Wilhm, J.L. 1970. Transfer of Radioisotopes Between Detritus and Benthic Macroinvertebrates in Laboratory Microecosystems. Health Physics, 18, 277-284 (ESD #340)

The transfer of Ru 106, Cs 137 and Co 60 between detritus or algae and benthic macroinvertebrates was studied in laboratory microcosms. Detritus or algae containing radioisotopes was collected from a lake which serves as a settling basin for partially decontaminated waste water, and invertebrates were taken from a constant temperature spring. Four species of detritus feeders, each with a different feeding mechanism, and one carnivorous species were studied. Microecosystems were established in 201 Erlenmeyer flasks and two systems each were sacrificed after specified time periods. Mean initial activity in picocuries/ash-free g in whole detritus was 2.88 x 10(E+4) for Ru 106, 6630 for Cs 137 and 6870 for Co 60, while these values in SPIROGYRA were 1.35 x 10(E+5), 4930, and 6.21 x 10(E+4), respectively. Radioisotopes were present in intermediate concentrations in pulverized detritus. When whole detritus was used, activity of all three radioisotopes was greater in LIMNODRILUS HOFFMEISTERI than in STICTOCHIRONOMUS ANNULURUS. When pulverized detritus or algae was used as a source of nourishment, the reverse was true. PHYSA HETEROSTROPHA was intermediate between LIMNODRILUS and STICTOCHIRONOMUS in activity. Peak concentrations of the radioisotopes in detritus feeders were reached by day 3, while the carnivore PROCLADIUS had a delayed uptake and increased in activity until day 14. Ru 106 was detected in all life stages and exuviae of STICTOCHIRONOMUS, and Cs 137 and Co 60 were detected only in larvae. Activity of Ru 106 in adults was 1/3 less than in larvae. (Auth)

<495>
Thomas, W.A. 1970. Decomposition of Irradiated Persimmon Leaves. Radiation Botany, 10, 7-10 (ESD #341)

The decomposition rate of leaves from neutron-gamma irradiated persimmon (DIOPYROS VIRGINIANA) trees did not differ significantly from that of nonirradiated leaves during the first 28 weeks in litter. Beginning in early May and extending through summer into autumn, the irradiated leaves decomposed faster than did the controls (P is less than 0.025). First-year weight loss from irradiated leaves, 62% plus or minus 2%, exceeded that from nonirradiated foliage, 48% plus or minus 3%. No differences existed in water-soluble losses from the two types of litter. The coarser texture of aberrant areas on irradiated leaves did not retard the rate of weight loss from those leaves. It is possible that convolutions in wrinkled areas of the irradiated foliage afforded concealment and a more favorable environment for decomposers. (Auth)

<496>
Kitchings, J.T., P.B. Dunaway, and J.D. Story 1970. Blood Changes in Irradiated Cotton Rats and Rice Rats. Radiation Research, 42(2), 331-352 (ESD #342)

Response of the peripheral blood after irradiation was measured in two species of wild rodents, the radiation-resistant cotton rat (SIGMODON HISPIDUS) and the radiosensitive rice rat (ORYZOMYS PALUSTRIS). Blood samples were taken before exposure to 200 or 600 rads and then at periodic intervals after irradiation. Erythrocyte counts, hemoglobin concentrations, and hematocrit percentages were unchanged for the cotton rats at both dose levels and for the rice rats receiving 200 rads. However, rice rats receiving 600 rads developed a severe normocytic anemia by the 13th day after irradiation and died before the 15th day postirradiation. Leukopenia developed in both species and was dose-dependent within each species. Leukocyte counts in the cotton rats receiving 200 rads were less reduced and recovered to normal levels faster than in the group exposed to 600 rads. Similar patterns were noted for the rich rats, but recovery was slower and preirradiation levels were not reached within 30 days. Patterns of reduction and recovery for total leukocyte count were primarily a reflection of the response of the small lymphocytes. Recovery of the leukocytes in a group of cotton rats parasitized with a blood parasite of the genus HEPATOZOON and receiving 600 rads resembled the recovery pattern for nonparasitized animals receiving only 200 rads. A significant reduction in serum albumin and a corresponding rise in the Beta-globulin fraction of the rice rats receiving 600 rads were noted on the 11th day postirradiation. No significant alteration was apparent in the composition of cotton rats after both doses or rice rats receiving 200 rads. (Auth)

<497>
Malone, C.R., and B.G. Blaylock 1970, April. Toxicity of Insecticide Formulations to Carp Embryos Reared in Vitro. The Journal of Wildlife Management, 34, 460-463 (ESD #343)

Carp (CYPRINUS CARPIO) eggs stripped and fertilized in vitro were subjected to commercial formulations of DDT, chlordane, dieldrin, endrin, diazinon, and Guthion at concentrations of 0.001, 0.01, 0.10, 1.0, 5.0, and 10.0 part per million active ingredients. None of the chemicals significantly affected embryo viability at concentrations < 1 part per million, but all six resulted in about 50-100 percent mortality at 5 parts per million. Chlordane at concentration of < 1 part per million stimulated embryo development and reduced incubation time by about one-third. (Auth)

<498>
O'Neill, R.V., and C.E. Styron 1970, April. Applications of Compartment Modeling Techniques to Collembola Population Studies. The American Midland Naturalist, 83(2), 489-495 (ESD #344)

Data from a study of radiation effects on a collembolan are used to illustrate a general method for applying compartment-modeling techniques to animal population dynamics. The population is divided into compartments which represent arbitrary age groups. Numbers of individuals in the compartments at a particular time are defined by a system of difference equations. Field conditions can be simulated by imposing realistic limiting functions on the basic model. Results from the collembola study demonstrate the great potential of the technique for dealing with ecological problems. (Auth)

<499>
Stanhill, G. 1970. Some Results of Helicopter Measurements of the Albedo of Different Land Surfaces. Solar Energy, 13, 59-66 (ESD #345)

Two series of albedo measurements are reported in which observations were made from a helicopter hovering above the surface of eight different types of land cover. One series, above a mixed hardwood forest in East Tennessee, consisted of 20 measurements repeated at three different stages of vegetative development. The second series, in Israel, included five types of mountain vegetation and two examples of coastal plain land cover. Five replicate observations were made over each type and the measurements were repeated on six occasions. The results showed mean values of albedo to range from a minimum of 0.11, for the hardwood forest, to a maximum of 0.42 for bare sand dunes. The size of the albedo was inversely related to the height of the vegetation canopy, presumably because of the greater opportunities for the reabsorption of reflected radiation within deep canopies. Other results also support the view that the spatial arrangement of the canopy was more important than the optical properties of individual elements in determining the overall reflectivity. Albedo differences between replicate plots of the same vegetation type or between replicate sites within one plot were considerable. The average coefficient of variation was 18 percent and the variability ranged from surface to surface and season to season. By contrast, the seasonal variation in albedo values was much smaller. (Auth)

<500>
Thomas, W.A. 1970. Retention of Calcium 45 by Dogwood Trees. Plant Physiology, 45, 510-511 (ESD #346)

The amounts of calcium 45 available for transport from woody tissue to foliage during three growing seasons after stem inoculation of dogwood (CORNUS FLORIDA) are reported. The results are discussed in the light of the hypothesis that xylem functions as an ion exchange column for calcium. The calcium 45 contained in foliage during the 2nd and 3rd growing seasons had to be transported in xylem when growth commenced in the spring, 12 and 24 months after stem inoculation. Upward movement of the calcium 45 by exchange reactions in the stem and branches can account for the supply of radiocalcium. The relatively constant percentage contribution of xylem to total stem radiocalcium during successive seasons suggests replacement of calcium 45 from lower levels in the stem. (KM)

<501>
Malone, C.R. 1970, December. Short-Term Effects of Chemical and Mechanical Cover Management on Decomposition Processes in a Grassland Soil. Journal of Applied Ecology, 7, 591-601 (ESD #347)

The effects of chemical and mechanical cover control on processes of organic matter decomposition in grassland (FESTUCA ARUNDINACEA) soil were studied in a randomized plot experiment during the 1968 growing season. Treatments consisted of plots mowed and raked bi-weekly, plots mowed and sprayed with dalapon towith Dalapon (2,2 dichloro-proprionic acid) to kill shoots and roots, and unmowed plots sprayed with dalapon. Saprophytic mites were unaffected by cover manipulations, but densities of soil Apterygota and predatory-parasitic mites appeared suppressed by high and low extremes of soil temperature and moisture, respectively, which occurred in denuded plots. In plots upon which fescue had been killed, regardless of whether the dead cover was removed, densities of soil bacteria increased, corresponding to enhanced rates of organic matter decomposition. Evidence was found that living fescue produces toxic substances, explaining in part the proliferation of bacteria whenever the vegetation was killed. This suggests that a factor of primary importance in the responses of soil organic matter decomposition to cover management is the presence or absence of vegetation types which produce bacterial-inhibiting compounds. If such plants are eliminated by management techniques, decay of organic matter might be greatly accelerated, possibly hastening mineralization of soil. (Auth)

<502>
Bledsoe, L.J., and J.S. Olson 1970, July. COMSYS1: A Stepwise Compartmental Simulation Program. ORNL-TM-2413; 70 p. (ESD #348)

This report aims to help persons having only a slight acquaintance with calculus and the FORTRAN programming language to analyze the behavior of a system of interconnected compartments, using COMSYS1 and related computer programs. The following sections include (2) an introduction to compartment models, (3) the case of continuous flow between compartments, and (4) the case actually simulated in this program as a sequence of calculations in steps controlled by the user, accounting for simultaneous incomes and losses. Practical use is aided by directions on setting up input data and optional subroutines which permit nonlinear systems to be specified (sections 5-6), peripheral programs to aid in problem setup and analysis (7-8), FORTRAN program listings (9), examples (10), and a FORTRAN IV version using disc storage instead of magnetic tapes (Appendix D). Appendix A includes sections 6-8, Appendix B gives the program listing for COMSYS1 (section 9), and examples of three different systems can be found in Appendix C (section 10).

<503>
Baker, C.E., P.B. Dunaway, and S.I. Auerbach 1970, July. Relationship of Cesium 137 and Iron 59 Elimination Rates to Metabolic Rates of Small Rodents. ORNL-4568; Ph.D. Thesis, University of Tennessee, 113 p. (ESD #349)

Elimination of cesium 137 and iron 59 by wild small rodents was measured in the laboratory and field to determine whether excretion rates of these nuclides are influenced directly by general metabolic rates. A double-tagging method was employed, isotopes were administered intraperitoneally, and attention was focused on final-component elimination of each isotope. Cotton rats (SIGMODON HISPIDUS), harvest mice (REITHRODONTOMYS HUMULIS), and white-footed mice (PEROMYSCUS LEUCOPUS) were used in laboratory investigations, and cotton rats and white-footed mice were employed in field experiments. Both species in field studies eliminated iron 59 more rapidly than laboratory animals, but only cotton rats excreted the isotope faster in winter than in spring. No differences were found between cesium 137 seasonal excretion rates of either species. There was a striking difference between species in rate of cesium 137 turnover, with PEROMYSCUS excreting the isotope about twice as fast as SIGMODON. Long-component biological half-times (T sub b) of iron 59 for SIGMODON were 108 days in winter, 144 days in spring, and 176 to 242 days in the laboratory; for PEROMYSCUS, these values were 50 days in winter, 47 days in spring, and 289 days in the laboratory. Biological half-times of iron 59 in REITHRODONTOMYS ranged from 121 to 178 days at different laboratory treatment levels. The T sub b values for long-component cesium 137 elimination for SIGMODON were 7.5 days in winter, 7.9 days in spring, and 7.7 to 8.6 days at different treatment levels in the laboratory; in PEROMYSCUS, values were 3.4 days in winter, 3.6 days in spring, and 3.5 days in the laboratory. Biological half-times of cesium 137 in laboratory REITHRODONTOMYS ranged from 3.5 to 3.9 days. Daily average CO_2 production rates (cc/hr/g; 29 degrees centigrade, 745 mm Hg) for cotton rats ranged from 1.55 to 2.62; for harvest mice, 4.53 to 7.67; and averaged 3.73 for white-footed mice. Mean hourly CO_2 production rates were plotted to obtain daily metabolic cycles for individuals. Long-component intercept values of cesium 137, which indicated the level of incorporation or rate of initial-component excretion, exhibited a strong correlation with CO_2 production within species. Based on this relationship, equations were derived to predict metabolism from Y-axis intercept values. These equations have potential use in estimating metabolism of rodents in the field for energy flow measurements. Although iron 59 elimination appeared to correlate with metabolic rates in the field, laboratory experiments failed to demonstrate a predictable relationship between excretion of this nuclide and general metabolism. Iron 59 was associated primarily with the blood, and the physiology of this tissue presumably controlled whole-body excretion of the isotope. (Auth)

<504>
Nelson, D.J. 1969, December. The Stream Ecosystem: Terrestrial-Lotic Community Interactions. Part of Proceedings of AAAS Symposium on The Stream Ecosystem held in Boston, Massachusetts, December 19, 1969, (p. 14-19), 42 p. (ESD #350)

A review is presented on sources of materials carried in streams, the effect of geologic type, time dependency of inputs to streams, and the movement of some specific ions into water courses. (KM)

<505>
Witkamp, M., and M.L. Frank 1970. Effects of Temperature, Rainfall, and Fauna on Transfer of Cesium 137, Potassium, Magnesium, and Mass in Consumer-Decomposer Microcosms. Ecology, 51(2), 465-474 (ESD #351)

Microcosms containing leaf litter, sand, and three, six, or nine millipedes were incubated for 14 weeks at either 5 degrees, 15 degrees, or 25 degrees centigrade under three rates of simulated rainfall. Effects of temperature, rate of leaching, and millipede density on transfer of cesium 137, potassium, magnesium, and mass and on evolution of CO2 were analyzed statistically and by analog computer simulation. Loss rates from litter increased in the order: Mg less than mass less than cesium 137 less than potassium; the effects of the three environmental variables on transfer also increased in the same order. Transfer of Mg was primarily to humus; mass to CO2; cesium 137 to sand; and potassium to leachate. Loss rates of Mg and mass, evolution of CO2, and transfers of cesium 137 were all influenced primarily by temperature and secondarily by millipede density. Only potassium was affected more by leaching than by millipedes. Production of CO2 showed a Q10 of approximately 2, but mineral transfer did not double at each 10 degrees centigrade increase because of significant temperature-moisture interaction. Computer simulation showed that pathways and rate coefficients for transfer of cesium 137 were identical whether it originated from litter or soil, that the major pathways were from litter to soil and from litter via millipedes to soil, and that about 7% of the initial leaf cesium 137 was easily leached from litter and transferred to soil and leachate during the first month. At higher temperatures, drying and rewetting cycles of the litter appeared to shift the litter to soil transfer of cesium 137 from the millipede ingestion-excretion pathway to that effected by microbial immobilization-mineralization cycles. (Auth)

<506>
Nelson, D.J. 1970. Measurement and Sampling of Outputs From Watersheds. Part of Reichle, D.E. (Ed.), Analysis of Temperate Forest Ecosystems, Vol. 1 of Ecological Studies, Analysis and Synthesis. Springer-Verlag, New York, New York, (p. 257-267) (ESD #352)

The output of water from watersheds via stream discharge is measured readily and routinely either in natural control sections or through the use of artificial control structures. A portion of the discharge stream must be sampled to determine quantitatively the output of materials carried by the water. Sampling methods include continuous proportional samples, continuous nonproportional samples and grab samples. The sampling method chosen will depend on the objectives of the research and the facilities available. Separation of suspended materials into components may be accomplished either by centrifugation or by filtration. (KM)

<507>
Curlin, J.W. 1970. Models of the Hydrologic Cycle. Part of Reichle, D.E. (Ed.), Analysis of Temperate Forest Ecosystems, Vol. 1 of Ecological Studies, Analysis and Synthesis. Springer-Verlag, New York, New York, (p. 268-285) (ESD #353)

The state of the art of modeling hydrologic systems is reviewed. The study of hydrologic processes uses historical data collected from natural phenomena. These processes are more or less stochastic and are nonpure, random, and nonstationary. In recent years unit-hydrography theory has been extended to the development of conceptual models which describe the stream response system. The ultimate objective of ecologists is to relate the intricacies of the hydrologic system to that of the adjacent terrestrial system in such a manner that a total ecosystem model evolves. (BBM)

<508>
Edwards, C.A., D.E. Reichle, and D.A. Crossley, Jr. 1970. The Role of Soil Invertebrates in Turnover of Organic Matter and Nutrients. Part of Reichle, D.E. (Ed.), Ecological Studies, Analysis and Synthesis, Vol. 1. Spring-Verlag, Berlin, Germany, (p. 147-172) (ESD #354)

The breakdown of litter, woody materials and root is discussed. There is considerable evidence that litter decomposes at a rate directly related to the number of invertebrate animals in the litter and underlying soil. Methods of studying litter breakdown by soil populations are discussed. Radioactive tracer methods can be used to provide information on feeding habits in the field and to reveal food chains. Methods of measuring assimilation are given and the respiration rates of some major soil invertebrate groups are summarized. Detritus-feeding invertebrates and their predators redistribute and transfer nutrients in soil, and the chemical composition of the various species must be estimated before the movement of nutrients through food chains can be determined. While it is recognized that the soil microflora and microfauna may account for as much as 90% of the total energy flow, invertebrate populations contribute significantly through litter fragmentation, mixing with soil, and creation of suitable fecal substrates for the microbiota as well as adding energy turnover themselves. Ultimate understanding of the role and importance of soil invertebrates cannot be realized until the interactions and synergistic effects of soil populations are know. (PMM)

<509>
Peters, L.N., D.F. Grigal, J.W. Curlin, and W.J. Selvidge 1970, August. Walker Branch Watershed Project: Chemical, Physical and Morphological Properties of the Soils of Walker Branch Watershed. ORNL-TM-2968; 96 p. (ESD #355)

Chemical and physical properties of typical soils of Walker Branch Watershed are summarized. Five Bodine and Fullerton and one Claiborne, Linside, and Tarklin soil profiles were sampled. Bodine and Fullerton soils occupy most of the area of the watershed. Both these soils are very cherty, infertile and permeable. Fullerton has about twice as much clay in the B horizon as does Bodine (51 percent versus 28 percent), and thus slightly higher cation exchange capacity. The chert content in the lower horizons is higher in Bodine (45 percent) than Fullerton (20 percent). The similarities of these soils, however, override the small differences noted. Both Bodine and Fullerton soils are acidic (pH 4.2-4.6) and low in exchangeable bases, N and P. Thus relatively thin A1 horizons have moderate base saturation (25 percent) whereas the lower A and B horizons are approximately 10 and 7 percent respectively. Because of the high chert content of all the soils on the watershed, the hydraulic conductivity determinations are susceptible to significant errors. The Bodine and Fullerton soils are very permeable and are very well drained. The minor soil series on the watershed show widely different characteristics compared with the Bodine and Fullerton soils. The colluvial origin of the Linside soil is apparent in the relatively high sand and chert contents in the lower horizons. The fragipan indicated in the profile description of the Tarklin soil is also indicated by the higher bulk density in the lower horizon of that soil. Claiborne is morphologically similar to Bodine and Fullerton soils but chemically similar to Linside and Tarklin soils. It is more acid than the latter two but has a moderate base saturation. The three soils are cherty, moderately fertile, and permeable. Their proximity to the stream makes them important for their ability to supply moisture to mesophytic and raparian vegetation, and their possible influence on the quality of water flowing in the stream. The soils of Walker Branch Watershed can be described as very cherty, infertile, and very permeable. They are ill suited to agriculture, and as such, are characteristic of many forested soils through the Ridge and Valley Physiographic Province. (Auth) (BBM)

<510>
Olson, J.S. 1970. Carbon Cycles and Temperate Woodlands. Part of Reichle, D.E. (Ed.), Analysis of Temperate Forest Ecosystems, Vol. 1 of Ecological Studies, Analysis and Synthesis. Springer-Verlag, New ork, New York, (p. 226-241) (ESD #356)

Studies are summarized that suggest a relatively greater role for forests in the world's cycles of carbon than has been assumed previously. The assumptions upon which such a broad generalization are based require study. The importance of relating large-scale dependence between all living matter, the whole atmosphere, oceans and land add to the many economic reasons which motivate us to understand and regulate the productivity of particular ecosystems. A research program will usually involve three aims: description, prediction and control. Hence, systems analysis requires more than modeling related to the most important aim of the movement. (BBM)

<511>
Thomas, W.A. 1970. Energy Turnover by Dogwood CORNUS FLORIDA L. Trees. Oikos, 21(1), 71-75 (ESD #357)

Dogwood (CORNUS FLORIDA L.) trees 13 to 18 years old lost 17% of total tree weight and 16% of their energy content by leaf fall. The weighted caloric equivalent of woody tissues averaged 4.56 kcal/g ovendry (4.68 kcal/g ash-free); that of foliage at time of abscission was 4.19 kcal/g ovendry (4.59 kcal/g ash-free). Weight loss significantly exceeded energy loss from decomposing leaves during the first 26 weeks in litter. The caloric value of different tree components varied greatly, ranging from 4.19 to 4.92 kcal/g ovendry and from 4.59 to 5.38 kcal/g on the ash-free basis. (Auth)

<512>
Wilhm, J.L. 1970, July. Some Aspects of Structure and Function of Benthic Macroinvertebrate Populations in a Spring. The American Midland Naturalist, 84(1), 20-35 (ESD #358)

Structure and function of populations of benthic macroinvertebrates in an open-water area and a vegetation-choked area of a spring were examined. Although more species were collected from the vegetated area, more individuals were taken from the open area. STICTOCHIRONOMUS ANNULICRUS and LIMNODRILUS sp. comprised 93% of the individuals and of the biomass in the open area, and 78% of the individuals and 73% of the biomass in the vegetation. Although STICTOCHIRONOMUS and LIMNODRILUS were similar in numbers, they were considerably different in biomass/individual and therefore in total biomass. Species diversity was analyzed with the index, mean d=minus the summation of n sub i/n log base 2 of n sub i/n where i goes from 1 to s. Species diversity was less in the open area of the spring than in the vegetation-choked area. In the open area, d increased from May through August when numbers of individuals were used and decreased when biomass units were used. NASTURTIUM OFFICINALE was important in influencing the structure of the benthic community, but was unimportant as a source of energy. Mean monthly standing crop of algae in the entire spring was 3500 kcal, while detritus averaged 15,900 kcal. Mean standing crop of benthic herbivores was 3800 kcal. The size of the benthic community was probably limited by space but not by food. Caloric content of fourth-instar STICTOCHIRONOMUS larvae was 5.50 kcal/ash-free g and respiratory rate was 0.765 ml O2/ash-free g per hr. Caloric content of LIMNODRILUS was 5.61 kcal/ash-free g and respiratory rate was 0.810 O2/ash-free g per hr. Benthic macroinvertebrate respiration was almost 25% of community respiration in the open area and less than 2% in vegetation. (Auth)

<513>
O'Neill, R.V., J.M. Hett, and N.F. Sollins 1970, October. A Preliminary Bibliography of Mathematical Modeling in Ecology. ORNL-IBP-70-3; 87 p. (ESD #359)

The techniques of mathematical modeling are expected to play a major role in the synthesis of data from the Deciduous Forest Biome Project. To facilitate the application of these techniques, this preliminary bibliography will present a number of studies which have been reported in the literature. These studies can be of value both as an introduction to the methodology and, in many cases, initial hypotheses for process functions could be formulated from the work reported. Although the annotations have been kept to a minimum, an attempt was made to call the readers attention to articles of particular interest. (Auth)

<514>
O'Neill, R.V., and D.E. Reichle 1970, October. Urban Infestation by the Millipede, OXIDUS GRACILIS (Koch). Journal of the Tennessee Academy of Science, 45, 114-115 (ESD #360)

An unusual aggregation of millipedes, OXIDUS GRACILIS (Koch) occurred during the spring and summer of 1968 and three previous years at homes in Lenoir City, Tennessee. We hypothesize that these large numbers were due to exceptional breeding conditions and that the urban infestations were attributable to known physiological and behavioral traits of the millipedes. (Auth)

<515>
Witherspoon, J.P., and F.G. Taylor, Jr. 1970. Interception and Retention of a Simulated Fallout by Agricultural Plants. Health Physics, 19, 493-499 (ESD #361)

Five species of agricultural plants were contaminated in the field with two particle size ranges of a quartz fallout simulant containing Rubidium 86. Initial fallout interception and retention of particles up to 8 weeks was determined. Loss of fallout from foliage due to the weathering action of wind and rain (weathering half-lives) and loss due to weathering plus radiological decay (effective half-lives) were determined for all species. The initial interception of smaller particles (44-88 micron dia.) by foliage was 2.5 times that of larger particles (88-175 micron dia.). Particle interception was correlated with leaf area and varied between species by a factor of 65 in terms of micronCi Rubidium 86/g foliage. After rapid initial losses of fallout (67% lost the first week after deposition), differences in retention rates between species became non-significant. Retention times of the two particle size ranges were also found to be similar. (Auth)

<516>
Witherspoon, J.P., and A.K. Corney 1970. Differential and Combined Effects of Beta, Gamma and Fast Neutron Irradiation of Soybean Seedlings. Radiation Botany, 10, 429-435 (ESD #362)

Young soybean (GLYCINE MAX, L., Dare variety) seedlings were acutely irradiated with various doses of Sr 90-Y 90 beta rays, Co 60 gamma rays and fission neutrons. The radiation types were given in combination as well as singly. Biological effects were evaluated on the basis of apical meristem mortality, dry weight and height. The dose necessary to produce a 50 percent effect were calculated, and RBE values were derived. Gamma and beta radiation were essentially equally effective in producing a 50 percent effect on apical meristem mortality, height and shoot weight, respectively. The effects of combined radiation types were not directly additive. With beta doses of 1500 rads, a 10 percent increment of gamma or fast neutron doses gave greater effects than were expected. (Auth)

<517>
Harris, W.F., J.P. Witherspoon, and J.S. Olson 1970, November. Ecological Aspects of Responses of LIRIODENDRON TULIPIFERA L. and ACER SACCHARINUM L. to Fast Neutron Radiation and Reduced Light (Thesis). ORNL-4610; 202 p. (ESD #363)

Seedlings of shade-tolerant silver maple and shade-intolerant yellow poplar were given acute fast neutron doses ranging to 500 rads as dormancy was breaking. The seedlings were maintained in three light environments: 100, 50, and 25% of full sunlight. Natural terminal bud death was found to vary considerably between yellow poplar (8%) and silver maple (28%) measured one year postirradiation. Net percent terminal bud mortality, however, ranged to 90% in yellow poplar and 60% in silver maple. Shade leaf development in reduced light decreased the effect of radiation on photosynthetic capacity. As light intensity was reduced, the effect of radiation was increased. Net photosynthetic capacity of irradiated trees was reduced to levels one-third that of control silver maple seedlings. No treatment effects on dark respiration rates were observed. As a consequence of reduced photosynthetic capacity, root production was decreased in the more radiosensitive yellow poplar. Reduced photosynthetic capacity not only decreased biomass production, but also the concentration of certain storage carbohydrates. Transpiration rates were altered by the treatments. The relative ability to tolerate shade exhibited by yellow poplar and silver maple was apparent. Tolerance, as a species characteristic (or assemblage of characteristics), was sensitive to alterations following radiation damage, particularly in the relatively more radiosensitive yellow poplar. (KM)

<518>

<518>
Cooley, J.L., and D.J. Nelson 1970, November. Effects of Chronic Irradiation and Temperature on Populations of the Aquatic Snail PHYSA HETEROSTROPHA. ORNL-4612; Ph.D. Thesis, University of Tennessee, 71 p. (ESD #364)

Three separate, but related, studies were conducted to determine the effects of chronic irradiation and temperature on laboratory and natural populations of the aquatic snail PHYSA HETEROSTROPHA. In the laboratory, at 25 C, dose rates of chronic gamma irradiation of 1, 2, 5, 10, and 25 rads/hr caused a significant descrase in the fecundity of snails. A dose rate of 25 rads/hr would cause extinction of a population in one generation; 10 rads/hr, in one or two generations. Dose rates of 1, 2, and 5 rads/hr would not lead to an immediate extinction; the reduction in fecundity increased with increasing dose rate. The percentage of eggs hatching was decreased by all dose rates except 1 rad/hr. Dose rates of 10 and 25 rads/hr significantly increased growth. The life span of adult snails was shortened significantly by all dose rates except 1 rad/hr. Laboratory populations were exposed to dose rates of 1, 2, and 5 rads/hr at 15 C. Only a dose rate of 5 rads/hr significantly decreased fecundity. Hatching of eggs was significantly decreased by dose rates of 2 and 5 rads/hr. The effects of chronic irradiation on snail populations were determined to be greater at the higher temperature of 25 C. A temperature of 25 C, as compared with 15 C, caused a significant increase in the fecundity of laboratory populations. Temperature elevation did not have an effect on the hatching of eggs. The elevated temperature was judged to be non-detrimental to snail populations for the conditions of this laboratory study.

<519>
O'Farrell, T.P., and P.B. Dunaway 1970. Cell Proliferation as a Function of Metabolism in Three Species of Native Rodent. Comparative Biochemistry and Physiology, 36, 811-815 (ESD #365)

Incorporation of the thymidine analog 5-(131)iodo-2'-deoxyuridine ((131)IUDR) was measured in vivo in cotton rats, SIGMODON HISPIDUS, white-footed mice, PEROMYSCUS LEUCOPUS and pine voles, MICROTUS (PITYMYS) PINETORUM. The percentage of initial activity retained per 10 g of body weight 48 hr post-injection of 1 uc of (131) IUDR was used as an index to cell proliferation in the intestinal epithelium. The values were: SIGMODON male 0.22, female 0.26; PEROMYSCUS male 0.68, female 1.00; MICROTUS male 1.40, female 1.50. When measurements of (131)IUDR retention were plotted as a function of average oxygen consumption for these species the resulting regression equation indicated that for every 1 ml increase in oxygen consumption there was a doubling in cell proliferation. Animals tested which had high rates of metabolism likewise had high rates of cell proliferation. (Auth)

<520>
Thomas, W.A. 1970, August. Weight and Calcium Losses from Decomposing Tree Leaves on Land and in Water. Journal of Applied Ecology, 7, 237-241 (ESD #366)

The losses of weight and calcium from decomposing leaves of red maple (ACER RUBRUM), tuliptree (LIRIODENDRON TULIPIFERA) and white oak (QUERCUS ALBA) proceeded at much greater rates in a perennial stream than they did on land. Complete decomposition of ACER leaves in water required less than 24 weeks, while that of LIRIODENDRON and QUERCUS both required less than 44 weeks. First-year losses on land also varied among species: from ACER, 55% of weight and 45% of calcium; from LIRIODENDRON, 44% of weight and 38% of calcium; and from QUERCUS, 33% of weight and 35% of calcium. Constant leaching and scouring of leaves by bottom sediments probably accounted for the greater loss rates in water. Variation in weight and calcium losses among samples in the stream far exceeded the variation among samples on land. Weight losses from leaves that had partially decomposed on land sharply increased when they were placed in the stream 9 months after abscission, showing that allochthonous material may influence stream chemistry by inputs throughout the entire year. The losses of weight and calcium from the leaves did not significantly differ at the 0.05 probability level in either environment; this suggests that the estimate of weight loss from decomposing deciduous leaves may also serve as an adequate index of the rate of calcium release.

<521>
Auerbach, S.I. 1970. Ecological Considerations in Siting Nuclear Power Plants: The Problem of Long-Term Biotic Effects. Part of Foreman, H. (Ed.), Nuclear Power and the Public. University of Minnesota Press, (p. 29-44) (ESD #367)

The risk of long-term biotic effects of nuclear power plants is recognized as one associated with radioactivity. This paper examines some of the evidence which bears on the long-term, low-level effects of chronic ionizing radiation upon organisms within the natural environment. The data should be evaluated in terms of the doses likely to be received by organisms in the environment as a result of releases at or below the maximum permissible concentration (MPC). Since all MPC's are derived for internal exposure to man, a question arises relating to exposure of natural populations submerged in water (MPC sub w). An acute dose of 100 rads is the lower limit that can be expected to produce mortality in a number of organisms. Acute doses greater than 100 rads will produce an effect proportional to the dose. Under chronic doses, the effect is much less marked than for acute doses. Conclusions from studies cited indicated that any significant increase in radiation levels is detrimental from the genetic point of view. In man, genetic anomalies are not reparable in an individual, but in the marine environment we are concerned with populations and not individuals and genetic damage is reparable by natural selection. Most data shows that the dose necessary to evoke an unequivocally detectable biological response is considerably above that resulting from MPC's in the environment. If MPC sub w levels of radionuclides have an effect on biota living in the vicinity of nuclear power stations, these effects will be essentially undetectable. Other factors changing in the environment may modify the habitat to the extent that with current methodologies it will be extremely difficult to demonstrate effects that might result from low-levels of radioactivity. (BBM)

<522>
Kaye, S.V., and P.S. Rohwer 1970, December. Dose Estimation Studies Related to Proposed Construction of an Atlantic Pacific Interoceanic Canal with Nuclear Explosives: Phase III. ORNL-4579; 145 p. (ESD #368)

The final report is given on the Bioenvironmental Radiological Safety-Feasibility Study of a sea-level canal excavated with nuclear explosives. Potential doses to indigenous populations in eastern Panama and northwestern Colombia were estimated for a combination of hypothetical exposures to radiation. The studies attempted to determine when it might be appropriate for the evacuated populations to reenter the area. The only modes of exposure considered were external exposure to a contaminated land surface and internal exposure from the ingestion of four types of contaminated foods and beverages. Parameters in the internal dose models were adjusted to differentiate five age groups and nine reference organs on the basis of diet and estimates of time and age dependent concentrations of radioactivity in dietary items. Estimates of potential external doses were based on 170 radionuclides; only 31 radionuclides were considered in detail for the estimation of potential internal doses, with an approximate estimate of total dose from the radionuclides not included in the list of 31. Estimates of potential total doses were assessed in terms of radiation safety criteria recommended for members of the public by recognized authorities. Basic criteria were: annual dose limit for the total body of 0.17 rem/year and a genetic dose limit of 5 rems/30 years. Assessments based on somatic doses suggest reentry may be appropriate 8-10 yrs after the last detonation. Children less than 5 yrs of age at the time of reentry may be the critical age group among the groups for which doses were estimated. Assessments based on genetic dose appear to be less limiting, suggesting that reentry may be possible within months following the last detonation. These assessments are based on comparisons with the total doses allowed under the radiation safety criteria. (BBM)

<523>
Kolehmainen, S.E. 1969. Daily Feeding Rates of Bluegill Determined by Radioisotopic Method. Part of Proceedings of the 23rd Annual Conference of the Southeastern Association of Game and Fish Commissioners, 1969, (p. 422-430) (ESD #369)

The feeding rate of bluegills was estimated using the radioisotopic method. In the calculations of cesium 137 intake all possible factors affecting the body burden and the intake of cesium 137 were taken into consideration, such as the growth of fish, the fluctuation of cesium 137 concentration in fish, the relationship between the excretion rates of cesium and the temperature, the composition of bluegills' diet, the concentration of cesium 137 in different food items of bluegills, and the percentage of cesium 137 absorption for different food items of bluegills. A bluegill's daily food consumption was .0263 g food/g of fish which gives a daily meal of 2.63% of the body weight. There was a positive relationship between the daily meal of bluegill and the daily temperature of water. The daily meal was at a minimum (0.83% of the body weight) in February and increased slowly during March and April. During May the daily meal increased rapidly towards a maximum (3.24%) in June after which there was a gradual decrease until February. The main daily meal for the whole year was 1.75% of the body weight. (KM)

<524>
Frank, M.L., and B.G. Blaylock 1971, May. Effects of Acute Ionizing Radiation on Carp (CYPRINUS CARPIO L.) Embryos. ORNL-TM-3346; 48 p. (ESD #370)

CYPRINUS CARPIO Linnaeus embryos were exposed to acute ionizing radiation (500 to 16,000 rads) at different intervals of time following fertilization of eggs. Descriptions and photomicrographs of developmental stages of controls were used to evaluate teratogenic effects of radiation on embryos. Changes in development and hatchability showed radiosensitivity decreased as development increased after organogenesis, but sensitivity of early stages did not decrease in chronological order. Stages in decreasing order of sensitivity were newly fertilized egg, early gastrulation, early cleavage, and post organogenesis. Radiosensitivity of early stages was influenced by the regulative ability of the blastodisc and cellular activity at the time of irradiation. Responses for C. CARPIO were in general agreement with those for other teleosts. (Auth)

<525>
Strock, W.G., Jr. 1970, December. Forest Management Plan, AEC Oak Ridge Reservation: 1970 - 1975. ORNL-TM-3175; 28 p. (ESD #371)

The forest management program for the AEC Oak Ridge Reservation has been revised for 1970-1975. The program is designed to yield high quality timber and an area for long-term ecological research. Twenty-five research areas total 2410 acres and 22,751 acres are forested. Silviculture policies and practices, timber sales policy, timber stand improvement and insect, disease, and fire control measures are detailed for the current five year program. (BBM)

<526>
O'Neill, R.V. 1970, December. An Introduction to the Numerical Solution of Differential Equations in Ecosystem Models. ORNL-IBP-70-4; 29 p. (ESD #372)

Four of the available numerical solution methods for differential equations are evaluated relative to their potential use in ecosystem models. A simplified energy flow model is used to point out potential problems in applying the methods, and a number of criteria are applied to the techniques in an effort to achieve a better understanding of each method. (Auth)

<527>
Auerbach, S.I., and P.B. Dunaway 1970, December. Progress Report in Postattack Ecology. ORNL-TM-2983; 129 p. (ESD #373)

Laboratory and field studies have been underway for two years at ORNL on movement of fallout simulant and Cs 137 through plants, animals, soils, and water. Gamma and beta doses to organisms varied with time and location. Simulant interception, retention, and weathering on plants varied with simulant size, species, and weather. Cs 137 transfers to fescue and cotton rats are reported. Radiation effects in animals depended on species, life stage, fertility rates, dose rate, and dose. (Auth)

<528>
Cosgrove, G.E., J.D. Story, and P.B. Dunaway 1970, October. Subcutaneous Fat Necrosis in Captive BLARINA Shrews. Journal of Wildlife Diseases, 6, 516-517 (ESD #374)

Four shrews, BLARINA BREVICAUDA, in a colony of twenty under study in the comparative mammalian radiobiology program showed marked enlargement and discoloration of the dorsal and abdominal subcutaneous fat bodies. The cause of the fat necrosis could not be determined. (BBM)

<529>
Thomas, W.A., (Reviewer) 1970, November-December. Book Review: Environmental Contamination by Radioactive Materials. Nuclear Safety, 11(6), 492 (ESD #375)

A review is given for the book, "Environmental Contamination by Radioactive Materials", (UNIPUB Inc., 650 First Avenue, New York, New York). The book presents sixty-two papers on a variety of topics including: sources of radionuclides in the environment; mechanisms of transfer of radionuclides from the environment through food and water to man; radiation protection standards and criteria; monitoring programs; emergency situations; and administrative responsibilities for protection of the public from this type of risk. (KM)

<530>
Chapman, D., and R.V. O'Neill 1970, December. Ecology and Resource Economics. An Integration and Application of Theory to Environmental Dilemmas. ORNL-4641; 38 p. (ESD #376)

We use a hierarchical classificatory schema to develop the concept of a functional system linking relevant knowledge in economics and ecology. The concept is itself positivistic, but useful for normative purposes. To illustrate a functional system, power production is described within a matrix of (a) five energy sources, (b) six stages of production and distribution, and (c) interactions with ecosystems and nonmarket costs. These nonmarket costs are the basis for expecting substantial divergence between social and market equilibria; consequences of this divergence include brownouts, siting controversies, and pollution. The theory of expected utility maximization is used to suggest that the expected costs of outcomes exceed the costs of expected outcomes. We conclude with the suggestion that this research may serve as an introduction to a comprehensive analysis of power production and public policy. (Auth)

<531>
Curlin, J.W. 1970. Nutrient Cycling as a Factor in Site Productivity and Forest Fertilization. Part of Youngberg, C.T. and Davey, C.B. (Eds.), Proceedings of the Third North American Forest Soils Conference on Tree Growth and Forest Soils held at North Carolina State University, Raleigh, North Carolina, August, 1968. Oregon State University Press, Corvallis, Oregon, (p. 313-325) (ESD #377)

The nutrient cycle has been discussed only in terms of single tree values and relative transfer rates within the biotic phase. The mineral cycle in a forest ecosystem is complex, involving many interactions between both biotic and abiotic components. The absolute quantities and rate of cycling per unit area depend directly on species composition, stand density, stocking, age, and prior cultural treatment - indirectly they depend on all of the factors that make up the "site." In the early stages of stand development, herbaceous vegetation and understory species can profoundly influence mineral cycling. As the stand matures, understory vegetation plays a less important role, except in some park-type forest communities. (Auth)

<532>
Auerbach, S.I. 1971, January-February. Ecological Considerations in Siting Nuclear Power Plants: The Long-Term Biotic Effects Problem. Nuclear Safety, 12(1), 25-34 (ESD #378)

One of the current concerns over the increasing installation of nuclear power stations is the potential impact of radioactive waste releases on local ecosystems. In particular, the question has been raised whether waste releases at maximum permissible concentration (MPC) levels would cause ecological problems due to the radioactivity. Hypothetical annual submersion dose rates from water assumed to be maintained at the occupational MPC x 1/30 were calculated for organisms living continuously in these waters. These hypothetical doses are used as a basis for comparisons in a variety of ecological studies of low doses of ionizing radiation and are analyzed and evaluated in terms of detectability of biological effects at MPC levels. Present knowledge based on these and similar studies of the ecological effects of low-level chronic doses, such as could result from routine reactor releases under current standards, guidelines, and operational experience, indicates that any possible biological effects would be undetectable. Although the data in support of this contention are limited, they consistently point to this conclusion. (Auth)

<533>
Stanhill, G. 1969. A Simple Instrument for the Field Measurement of Turbulent Diffusion Flux. Journal of Applied Meteorology, 8(4), 509-513 (ESD #379)

A new instrument is described which enables integrated values of water and carbon dioxide flux to be obtained under field conditions. The principle of operation is the Thornthwaite-Holzman equation for turbulent diffusion under adiabatic conditions, but a simple adaption would allow automatic correction for nondiabatic conditions. The instrument is simple and designed for continuous unattended operation under difficult field conditions, where integrated flux values are required over long time intervals. Preliminary tests under such conditions show satisfactory agreement with an independent estimate of evapotranspiration from autumn fields of tall grasses and sedges. (Auth)

<534>
Cristofolini, G. 1970. Biomass and Productivity of the Herb Layer in a Forest Ecosystem. Giornale Botanico Italiano, 104, 1-34 (ESD #380)

Dry weight and field estimates were correlated for all species (or genera) using a thoroughly empirical procedure. The resulting correlations permit the drawing of a diagram for each species where individual correlated points, the least square line, the confidence interval P sub 0.05 for individual measurements and the confidence interval P sub 0.05 for the line as a whole are plotted. Such diagrams permit the prediction, with a known degree of accuracy, of the dry weight of any given plant or population of these species on the basis of field estimates. A discussion of the models of transformation applied to the original independent variable(s) to obtain the correlated variable x demonstrates a logical connection between the transformation required and the habitus of the various species, because direction of growth, density of leaves and stems, etc., condition the way in which the basic parameters must be treated in order to obtain a distribution which is linear with respect to that of the biomass. From these models it can now be foreseen which transformation would be required for any plant species on the basis of its habitus, thus reducing trials, errors and waste of time to a minimum. Estimated biomass equals about 1/5 of the canopy green biomass in the same stand. About 1/5 of the chlorophyllian tissues of the ecosystem appears to be located in the herb layer. (Auth) (KM)

<535>
Auerbach, S.I., D.J. Nelson, S.V. Kaye, D.E. Reichle, and C.C. Coutant 1971. Ecological Considerations in Reactor Power Plant Siting. IAEA-SM-146/53; Part of Proceedings of a Symposium on Environmental Aspects of Nuclear Power Stations held in Vienna, Austria, 1971, (p. 805-802) (ESD #381)

This paper discusses four ecological considerations which bear on the location of nuclear power plants. These are: (1) long-term effects of the released radionuclides on the environment, especially on maintenance of the ecological balance; (2) environmental fate of radionuclides, including their foodchain dynamics and potential to build-up at different ecological levels; (3) ecological pathways by which radionuclides may expose human population groups; and (4) influences of the discharge of waste heat into the aquatic environment. Present knowledge of the ecological effects of low-level chronic doses such as could result from reactor releases under current standards, guidelines and operational experience, indicates that any possible effects would be undetectable. While the data in support of this contention are limited, they consistently point to this conclusion. Food chains are the major mechanism of radionuclide transport to man; consequently, potential radiation exposure is closely related to the nature of the ecological process. Limited data are available for some aspects of the biological uptake and transport of radionuclides in environmental cycles, especially those cycles having food chains leading to man. Such data, in sufficient quantities, could provide the basis for development of meaningful models of radionuclide transport to man. Thermal modifications, both direct and indirect, have an important bearing on future siting and design of nuclear power plants. In addition to the ecological problems which may result from the direct discharge of heated water, at least three other problems indirectly related to thermal discharge merit further analysis and study: (1) Consumptive use of water in cooling towers may result in a concentration of chemicals, including radionuclides, in the release water; (2) Subtle ecological interactions influenced by small temperature changes leading to the demise of a population through predation, or metabolic acclimation and the consequent expansion of aquatic population; (3) Synergistic interactions between temperature, nutrient content of the water and radionuclide content may modify the uptake and turnover parameters for certain radionuclides and thereby affect food chain transport. (Auth)

<536>
Shinn, A.F. 1970. The Use of Municipal-Waste Compost for Growing White Dutch Clover on Calcareous Clay Soil in Tennessee. Compost Science, 11, 13-15 (ESD #382)

Municipal compost made of the mixed refuse was applied to an area filled with miscellany broken concrete and asphalt paving, junk metal, wood, bricks and gravel covered with a one-to-five inch thickness of a calcareous clay soil which could not support a crop of clover with normal cultural practices. The compost clearly promoted a much better yield of clover in spite of several factors that militated against a good clover crop. (KM)

<537>
Coutant, C.C. 1970. Biological Aspects of Thermal Pollution. I. Entrainment and Discharge Canal Effects. CRC Critical Reviews in Environmental Control, 1(3), 341-381 (ESD #383)

Control of environmental effects of waste heat requires recognition that discrete biological processes are affected by each step in the cooling process, from water flow in the condensers to heat dispersion in the receiving water. Some disposal methods produce greater effects than others at particular sites. Available field and laboratory information suggests that these effects may be predicted and suitable cooling systems chosen to minimize detrimental effects. This article concentrates on two sites for biological effects in the cooling sequence: (1) condensers and outlet piping, and (2) discharge canals. Results of ecological field studies at power plants are emphasized.

<538>
Curlin, J.W. 1971. Legal Systems and Ecosystems. Student Lawyer Journal, 6(4), 4-8 (ESD #384)

Law is at the interface of science and society and will play an increasingly important part in resolving current environmental problems and in avoiding potential problems. The legal system needs careful evaluation and rethinking of some of the 12th century doctrines on which environmental cases are often decided. Modifications of the rules of evidence may be required to permit the acceptance and recognition of the validity of inconclusive or in precise scientific data. Another area of needed judicial concern is "standing to sell". Consideration needs to be given to shifting the burdens of responsibility to proponents of new technology and altered land use rather than relying on the evolution of harm under the traditional nuisance doctrine. (KM)

<539>
Auerbach, S.I. (Ed.) 1971, February. Ecological Sciences Division Annual Progress Report for Period Ending July 31, 1970. ORNL-4634; 141 p. (ESD #385)

The Annual Report for 1970 presents work done in the Environmental Sciences Division for the year ending 1970. Sections of the report summarize work performed in the following fields: (1) responses of animal populations to ionizing radiation; (2) radionuclide cycling in terrestrial ecosystems with emphasis on mathematical models of ecosystem function; (3) the Biogeochemical Ecology Information Center; (4) responses of plants to ionizing radiation; (5) systems ecology; (6) watershed aquatic habitat interactions; (7) forest management; and (8) radionuclide cycling in aquatic systems. Individual reports are given for specific projects within the major study areas. (BBM)

<540>
Bousfield, E.L., and J.W. Elwood 1971. A New GAMMARUS (Crustacea: Amphipods) from Tennessee. The American Midland Naturalist, 85(1), 247-253 (ESD #386)

GAMMARUS BREVIRAMUS is newly described and new records of G. minus Say are given from tributaries of the Clinch River system of eastern Tennessee. The discovery of G. BREVIRAMUS reinforces the belief that the east central portion of the U.S., south of the limits of Pleistocene Glaciation and inland from the limits of post-Palaeozoic marine transgressions, will prove rich in undescribed epigean GAMMARUS species. (KM)

<541>
Witkamp, M. 1970. Aspects of Soil Microflora in a Gamma-Irradiated Rain Forest. TID-24270; Part of Odum, H.T. and Pigeon, R.F. (Eds.), A Tropical Rain Forest, A Study of Irradiation and Ecology at El Verde, Puerto Rico, 1970, (p. F-29 - F-33) (ESD #387)

Microbial densities and activity were measured just before and after 3 months of irradiation and again 7 and 13 months after the period of irradiation. Comparisons of rock-shielded and exposed sites along a transect from 3 to 140 m from the radiation source showed no direct radiation effects on the microflora. In December 1964, before irradiation, rates of CO_2 evolution increased with increasing distance from the source. In April, immediately after irradiation, the freshly fallen litter increased organic matter, moisture content, bacterial density, CO_2 evolution, and O_2 uptake in the defoliated area within 20 m from the source. Maximum microbial activity at that time was located near the periphery of the defoliated area because of the usual microbial bloom on freshly fallen litter. Seven months later, in November, breakdown rates and population densities were still higher in the defoliated area than in the forest with leaves remaining. The bloom had passed, and maximum activity was located in the highest accumulation of litter just around the source. One year after irradiation bacterial densities and activities in the defoliated area had dropped below those in the forest with leaves remaining, presumably as a result of substrate exhaustion and lack of additional litter deposition. In November rates of CO_2 evolution in litter of the manually defoliated North Cut Center were considerably higher than in the Radiation Center. Microbial densities and CO_2 evolution in cloud-forest samples from El Toro (1075 m) and evolution of CO_2 on East Peak (1030 m) were significantly lower than in the rain forest. (Auth)

<542>
Blaylock, B.G., and N.A. Griffith 1971, January. A Laboratory Technique for Spawning Carp. The Progressive Fish-Culturist, 33(1), 48-50 (ESD #388)

A technique for breeding carp, CYPRINUS CARPIO, artificially has been developed. With this technique, the hatchability of carp eggs is a good biological test that has many advantages. Besides the short development time, the different embryonic stages are plainly visible. Another advantage is that several thousand eggs can be obtained from one fish. However, having a good biological end point that is easily scored, such as the hatching of the egg, is probably the chief advantage. (Auth) (KM)

<543>
Witkamp, M. 1970. Mineral Retention by Epiphyllic Organisms. TID-24270; Part of Odum, H.T. and Pigeon, R.F. (Eds.), A Tropical Rain Forest, A Study of Irradiation and Ecology at El Verde, Puerto Rico, 1970, (p. H-177 - H-179) (ESD #389)

Leaf surfaces with epiphylls dipped in nuclide solutions retained from 6 to 1726 ppm of the nuclide. Nuclide retention decreased in the order Cs greater than Mn greater than P greater than Mn greater than Sr. It is argued that retention by epiphylls of minerals from precipitation may be a significant process in the mineral cycle of rain forests. (Auth)

<544>
O'Neill, R.V. 1971. Tracer Kinetics in Total Ecosystems: A Systems Analysis Approach. IAEA-SM-142a/45; Part of Proceedings of a Symposium on Nuclear Techniques in Environmental Pollution held in Vienna, Austria, (p. 693-705) (ESD #390)

Systems analysis provides holistic methods well-suited to the study of complicated natural systems. However, application of available techniques has been limited by two factors: the difficulty of translating engineering techniques into an appropriate environmental context and the problem of quantifying a large systems model. The paper addresses itself to these difficulties by examining the use of parameter identification techniques for quantifying ecosystem models with data from large-scale tracer experiments. Parameter identification is used by the systems analyst to fit dynamic models to data from complex systems. A number of these techniques are available for analog, hybrid and digital computers. The methods differ significantly in their use of computer time and other characteristics. The general approach of these techniques and a few of the available methods are discussed. Particular attention is paid to modifications and refinements which could be useful in fitting environmental data. Tracer methodology applied to total systems, combined with refined techniques of analysis could provide a new approach to pollution stuides. Although the initial predictive capability might be limited, the models could be useful in managing the release of pollutants to the environment. The need for new approaches, such as that proposed here, is expected to increase as environmental degradation continues to adversely affect the quality of life. (Auth)

<545>
Ulrikson, G.U., and W.G. Stockdale 1971. Survey of Thermal Research Programs Sponsored by Federal, State, and Private Agencies. ORNL-4645; 56 p. (ESD #391)

A survey was made of state and federal agencies and those colleges and universities with known programs in the field of ecology or oceanography. The projects are divided into 9 main categories: productive uses; bio-effects; limnological effects; combination and general; cooling towers; modeling; surveys-ecological; surveys-temperature and physical; and surveys-general. In each category the title of the projects, the location of investigator(s), sponsor, and duration are listed. Each project is numbered for cross-indexing with alphabetical listing of all investigators with addresses in a concluding section. (KM)

<546>
Nelson, D.J. 1971. The Specific Activity Concept Applied to Aquatic Ecosystems. Part of Proceedings of a Symposium on Nuclear Techniques in Environmental Pollution held in Vienna, Austria, 1971, (p. 735-746) (ESD #392)

The specific activity concept is useful for predicting, a priori, the quantitative behavior of radionuclides in the environment. In contrast, data from radiotracer releases are principally useful for interpreting environmental pathways of inorganic elements. We have used specific activity studies to quantify the complete material balance in aquatic organisms. Radionuclide concentrations (pCi/g of organism) may require the use of specific activities for interpretation of biophysical phenomena. Analyses show that the stable Cs content of fish flesh varies with fish size, as does the stable Sr content of clam shells. For instance, a clam shell containing 220 ppm Sr and 100 pCi Sr 90/g of shell is ecologically equivalent to a shell containing 550 ppm Sr and 250 pCi Sr 90/g of shell. This paper uses numerous examples from research at Oak Ridge National Laboratory (ORNL) to illustrate and explain the proper interpretation of data with respect to environmental radioactivity. Our studies have shown that for any meaningful interpretation of concentrations, pCi/g of organism, it is advisable to analyze for stable elements of the radionuclides being determined. Application of specific activities at ORNL has been particularly useful for research in aquatic environments where this concept appears to have most validity, as opposed to terrestrial systems, for predicting and interpreting radionuclide behavior in ecosystems. (Auth) (BBM)

<547>
O'Neill, R.V. 1971. A Stochastic Model of Energy Flow in Predator Compartments of an Ecosystem. Part of Patil, G.P. (Ed.), Statistical Ecology, Vol. 3. Populations, Ecosystems, and Systems Analysis, (p. 107-121) (ESD #393)

A Monte Carlo simulation model has been devised to describe the energy dynamics of a predator. The caloric pool of a randomly selected individual is decreased by respiration until a hunger threshold is reached. At this point, several probability functions are used to decide which species of prey will be consumed and during which hours. The assimilated portion of that prey is added to the predator compartment and respiration continues. The model is illustrated with data on a centipede, OTOCRYPTOPS SEXSPINOSUS, and demonstrates that an entire energy budget can be generated along with estimates of variance. Applications of the model to analysis of sensitivity and components of variance are briefly discussed. (Auth)

<548>
Blaylock, B.G., and N.A. Griffith 1971. Effects of Acute Beta and Gamma Radiation on Developing Embryos of Carp (CYPRINUS CARPIO). Radiation Research, 46(1), 99-104 (ESD #394)

The effects of acute beta and gamma radiation on developing CYPRINUS CARPIO eggs were measured by the percentage of eggs that hatched. Eggs were exposed to various doses of beta and gamma radiation from external sources 30 min. after fertilization. LD50 doses established by a probit analysis were 500.5 rads for beta and 601.3 rads for gamma radiation. The one-cell stage of the developing carp eggs, which is supposed to be the most sensitive stage of development, was relatively resistant to both acute beta and gamma radiation. (KM)

<549>
Mankin, J.B., and A.A. Brooks 1971. Numerical Methods for Ecosystems Analysis. ORNL-IBP-71-1; 99 p. (ESD #395)

In order to aid ecologists in understanding numerical analysis and scientific applications of computers, some basic elements of numerical analysis are presented. It is intended to provide an introduction to numerical techniques to the ecologist who is unfamiliar with computing and to provide practical hints and a reference to existing programs and their use to those ecologists who are moderately familiar with computing. Chapters on interpolation, integration, linear and nonlinear algebraic equations, eigensystems, linear and nonlinear ordinary differential equations, partial differential equations, and sensitivity analysis are included. Emphasis is placed on practical applications and the difficulties encountered in numerical computation. (Auth)

<550>
Blaylock, B.G. 1971, March. The Production of Chromosome Aberration in CHIRONOMUS RIPARIUS (Diptera: Chironomidae) By Tritiated Water. The Canadian Entomologist, 103(3), 448-453 (ESD #396)

CHIRONOMUS RIPARIUS was used to determine whether an increased frequency of chromosome aberrations could be detected in the progeny of an aquatic organism reared in tritiated water (HTO). An increased frequency was detected in larvae whose progenitors had developed either in 250 or 500 mCi/ml of HTO (2500 to 5000 times MPC for occupational exposure). The radiosensitivity of C. RIPARIUS to acute gamma radiation was determined and compared with the results obtained with tritiated water. The frequency of aberrations produced by incorporated tritium was approximately the same as the frequency produced by an equivalent dose of chronic gamma irradiation. (Auth)

<551>
O'Neill, R.V. 1971, June. Examples of Ecological Transfer Matrices. ORNL-IBP-71-3; 26 p. (ESD #397)

Available literature has been surveyed for data to quantify linear, constant-coefficient models of ecological systems. In all, 23 papers were located with a total of 66 transfer matrices. The ecological systems range from 2 to 17 state variables and cover a wide spectrum of terrestrial and aquatic systems. The matrices are documented in this report for their heuristic value and to provide a preliminary data base for the development and testing of new mathematical analysis techniques. (Auth)

<552>
Coutant, C.C. 1970. Biological Limitations on the Use of Waste Heat in Aquaculture. Part of Proceedings of a Conference on Beneficial Uses of Thermal Discharges held by the New York State Department of Environmental Conservation, 1970, (p. 51-61) (ESD #398)

Although warmer water generally stimulates growth of aquatic organisms, the easy availability of warmed power station coolant does not necessarily assure success of aquaculture. Certain biological limitations must be carefully considered, such as 1) the complex relationships among temperature, food utilization and growth, 2) metabolic and food waste products and their effects on the receiving water (compared to the effects of heat above), 3) uptake of radionuclides by cultured species (and acceptance as for human food), and 4) tolerances of organisms to biocides and temperature changes caused by variations in plant operation. Some of these biological limitations may inflict severe economic ones as well, and thus affect the feasibility of aquaculture projects. Assistance in planning can be obtained from established fields of salmon and trout culture, radioecology, and thermal ecology. (Auth)

<553>
O'Neill, R.V. 1971. Systems Approaches to the Study of Forest Floor Arthropods. Part of Systems Analysis and Simulation in Ecology, Vol. 1. Academic Press, Inc., New York, New York (p. 441-447) (ESD #399)

Techniques of mathematics and systems analysis are applied to actual prediction of ecological phenomena related to forest floor arthropods. Extensive examples are used to demonstrate how the methods can be used to solve real problems. The logical steps needed to construct a preliminary working model of an entire cryptozoan system are followed in detail. The discussion emphasizes the balance which must be achieved between elegance of mathematical tools and empirical knowledge. (KM)

<554>
Crossley, D.A., Jr., D.E. Reichle, and C.A. Edwards 1971. Intake and Turnover of Radioactive Cesium by Earthworms (Lumbricidae). Pedobiologia, 11(1), 71-76 (ESD #400)

Assimilation and excretion of radioactive cesium was measured in three species of earthworms, OCTOLASIUM LACTEUM, EISENIA HORTENSIS, and LUMBRICUS TERRESTRIS. Assimilation of radioactive cesium from leaf litter ranged from 11.6% to 28.5% of the ingested tracer. O. LACTEUM did not assimilate any radiocesium from tagged soil. Retention of radioactivity by earthworms feeding upon leaf litter is described as a two-component retention system, consisting of nonassimilated and assimilated radioisotope. Gut clearance time and rate of soil throughput were calculated, based on the shorter component of retention.

<555>
Reeves, M. 1971, July. A Code for Linear Modeling of An Ecosystem. ORNL-IBP-71-2; 22 p. (ESD #401)

A computer code is presented for the purpose of solving linear ecosystem models. The general solution of such models is developed in terms of the eigenvalues and eigenvectors of the matrix of internal flow coefficients and integrals of time-dependent external forcing functions. Numerical methods used to obtain these quantities are mentioned. A thorough discussion of the input and output is given, including variable lists, formats, and control cards, together with an example. Plots and equations are given for all currently available forcing functions. (Auth)

<556>
Coutant, C.C. 1971. Thermal Pollution - Biological Effects. Journal Water Pollution Control Federation, 43(6), 1292-1334 (ESD #402)

This article reviews the 1970 literature on thermal effects on aquatic organisms. The review is organized into the following discussion areas: site studies; geographic or seasonal distribution of organisms; resistance; reproduction; growth and development; morphology; performance; selection of temperature range by organisms; physiology; synergism; disease; primary production; waste assimilation; and beneficial uses of thermal pollution. (KM)

<557>
Reichle, D.E., D.J. Nelson, and P.B. Dunaway 1971. Biological Concentration and Turnover of Radionuclides in Food Chains: A Bibliography. ORNL-NSIC-2492; 42 p. (ESD #403)

A bibliography is presented for a parallel publication in Nuclear Safety, 11(1) entitled Turnover and Concentration of Radionuclides in Food Chains. Literature cited for invertebrates, fish, and mammals was condensed from several hundred publications. The references include those papers judged scientifically credible and pertinent. The effective date of the literature survey did not extend beyond 1969, however manuscripts in press during 1969 and published in 1970 have been included. (KM)

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<558>
Reichle, D.E., and R.I. Van Hook, Jr. 1971. Effect of Temperature and Radiation Stresses on the Survivorship of Isopods: ARMADILLIDIUM VULGARE and CYLISTICUS CONVEXUS. Radiation Research, 46(3), 588-600 (ESD #404)

Gamma radiation affects many metabolic processes whose rates are temperature-dependent in poikilothermic organisms. Laboratory experiments were designed to test the effects of temperature, cobalt 60 radiation, and their interactions on the survivorship of isopods-ARMADILLIDIUM VULGARE and CYLISTICUS CONVEXUS. A central composite rotatable design with dose and temperature as independent variables was used to construct three-dimensional response surfaces described by quadratic polynomial equations. Temperature treatments ranged between 12.9 and 27.1 degrees C; radiation doses were between 8.3 and 19.7 kilorads. The response surfaces (survivorship) varied through time (from 0 to 60 days) both within and between species. Both temperature and dose became significant ($P < 0.05$) in the equation for isopod survival during the 60-day observation period. However, temperature effects became significant 10 to 20 days later than those of radiation dose for both species. The LD 50/30 for A. VULGARE and C. CONVEXUS wer not significantly different at 16.9 kilorads. (Auth)

<559>
Ovington, J.D., and J.S. Olson 1970. Biomass and Chemical Content of El Verde Lower Montane Rain Forest Plants. TID-24270; Part of Odum, H.T. and Pigeon, R.F. (Eds.), A Tropical Rain Forest, A Study of Irradiation and Ecology at El Verde Puerto Rico, 1970, Chapter H-2, (p. H-53 - H-57) (ESD #405)

The nondestructive estimation of the biomass and the nutrient inventory in the El Verde forest was based on sample weighing and analysis of over 100 trees and regressions that separately treated three goupings of dicotyledon trees and palms. Logarithm of height (for palms), diameter at 1.3 meters (for minor trees), and diameter and height jointly (for major trees and shrubs) were the predictors used for logarithms of tree mass. Resulting regressions were used with the corrected preirradiation stand data from the Waterways Experiment Station to give estimates averaging 32,492, 20,919, and 26,928 grams per m2 (= metric tons per km2) for the Radiation Center, the South Control Center, and the North Cut Center, respectively; 10 times these numbers gives kilograms per hectare. Nonpalm trees and shrubs included four components: leaves, branches, boles, and roots greater than 0.5 centimeters in diameter, which (for the three centers averaged together) were estimated as 788, 3677, 15,345, and 6480 grams per m2, respectively. Corresponding estimates for the Radiation Center (1018, 6017, 29,364, and 12,422 grams per m2) were highest for nine subtotal areas; these figures may be exaggerated (especially for foliage) because of extrapolation of regressions to size classes larger than those represented by sample trees. These estimates may approximate the natural rain forest condition more closely than the average figures, which are affected by former harvesting of large trees. Nutrient content was calculated for the Radiation Center with results for leaves, which have relatively rapid turnover, in grams per square meter as follows: potassium, 6.2; calcium, 5.6; magnesium, 2.0; sodium, 11.8; and phosphorus, 0.7. Corresponding figures for branches plus boles are about 46, 84, 32, 70, and 4 grams per m2, respectively. A diagram for major overstory (one CYRILLA tree, DACRYODES, TABEBUIA) and understory (PALICOUREA) species shows these providing most of the inventory in this subplot. (Auth)

<560>
Funderlic, R.E., and M.T. Heath 1971. Linear Compartmental Analysis of Ecosystems. ORNL-IBP-71-4; 50 p. (ESD #406)

The concept of a linear compartment model is discussed with particular reference to ecosystems. The dynamics of such a model is described by a system of differential equations and the resulting matrix of coefficients is analyzed to yield information about the stability and recovery time of the system. (Auth)

<561>
Sollins, P. (Ed.), and R.M. Anderson (Ed.) 1971. Dry-Weight and Other Data for Trees and Woody Shrubs of the Southeastern United States. ORNL-IBP-71-6; 80 p. (ESD #407)

Tables of dry weight and other data are provided for approximately 900 trees, saplings, and seedlings (43 total species) and about 100 individuals of woody shrubs (13 species). Data available for at least some individuals include bole diameter (at breast height, ground level, and base of crown), tree height; dry weight of leaves, branches, bole, and roots; crown width and height; leaf surface area; bark thickness; age; and annual radial increment. The data are summarized by species and size class. Regression equations based on these data will be published elsewhere.

<562>
Grigal, D.F., and J.E. Hubbard 1971. SOGGY: An Empirical Evapotranspiration Model for Forest Soils. Part of Proceedings of the Summer Computer Simulation Conference held in Boston Massachusetts, July 19-21, 1971, (p. 795-800) (ESD #408)

A digital computer model was developed to simulate plant-soil-water relations observed in a deciduous forest. Features of the model include (1) use of mathematical expressions relating moisture-tension in the soil, (2) treatment of surface and subsurface soils as separate compartments, (3) movement of water between surface and subsurface as differences in moisture tension develop, and (4) evapotranspiration from soils as a function of potential evapotranspiration and moisture tension. The model has been tested on a limited basis. Combined with long-term meteorological records, it is being used to simulate hydrologic records and periods of moisture stress. (Auth)

<563>
Francis, C.W., and D.F. Grigal 1971. A Rapid and Simple Procedure Using Strontium 85 for Determining Cation Exchange Capacities of Soil and Clays. Soil Science, 112(1), 17-21 (ESD #409)

Cation exchange capacity of soils and clays can be rapidly and easily determined radiometrically using strontium 85. Samples are saturated with a tagged strontium solution (either unbuffered SrCl2 or buffered Sr(OAc)2) of known normality. The nonadsorbed strontium is washed from the sample and the activity of the absorbed stronium 85 in the sample is determined directly. All steps of the procedure are carried out with the sample in the same test tubes and extraction of the absorbed strontium is not necessary. The method gives good replication and is particularly well suited for small clay samples (less than 50 milligrams) and for routine determinations. (Auth)

<564>
Sollins, P. 1971. CSS: A Computer Program for Modeling Ecological Systems. ORNL-IBP-71-5; 66 p. (ESD #410)

CSS is a digital computer program developed to allow ecologists with minimal training in mathematics and computer programming to construct and test a wide variety of ecosystem models. Nonlinear and time-dependent functions are permitted for transfers between storage components; however, the models must be predominantly continuous. Sources and sinks may be defined. Concepts necessary for program use are discussed, including preparation of program input and interpretation of program output. Two test cases and a listing of the program are provided.

<565>
Edwards, N.T., R.I. Van Hook, Jr., and F. Rau 1971, November. Portable System for Continuous Analysis of Environmental Carbon Dioxide. ORNL-IBP-71-7; 25 p. (ESD #411)

An automatic portable carbon dioxide (CO_2) monitoring system based on an infrared absorption analyzer is described. The system is designed to supply continuous data via strip chart (analog) and/or punched paper tape (digital) from ten separate sampling points. Air flow through each sampling unit is continuous, and analysis of flow data can be performed at variable time periods for variable time durations. The instrument is equipped with both a low (0-1000 parts per million) and high (0-3000 per million) CO_2 range selector for handling a diversity of natural environmental concentrations of CO_2. In a pilot experiment involving CO_2 evolution from in situ decomposing litter, rates determined by infrared analysis compared favorably with total CO_2 collected in a train of bottles containing potassium hydroxide (KOH). Evolution from a forest floor determined by the analyzer system was 7100 milligrams of CO_2/m2/day compared with a value of 6600 milligrams of CO_2/m2/day by the "CO_2 train" method. A complete operating procedure for the system is included. (Auth)

<566>
Malone, C.R. 1971. Responses of Soil Microorganisms to Non-Selective Vegetation Control in a Fescue Meadow. Soil Biology and Biochemistry, 3, 127-131 (ESD #412)

Control of fescue meadow vegetation with a non-selective herbicide containing sodium cacodylate as the principal active ingredient increased the numbers of soil bacteria and decreased the numbers of fungi. Both effects were short term and failed to persist throughout the growing season. Results of laboratory experiments were similar to those obtained from the field study, suggesting that the effects of non-selective vegetation control on the soil microorganisms were caused primarily by the herbicide rather than secondarily by death of the vegetation. (Auth)

<567>
Elwood, J.W. 1971. Ecological Aspects of Tritium Behavior in the Environment. Nuclear Safety, 12(4), 326-337 (ESD #413)

A rapidly expanding nuclear power economy has resulted in increased public concern over releases of radionuclides to the environment. Review of available literature on tritium, one of the radionuclides released to the environment at nuclear power reactors and fuel-repocessing plants, indicates that tritium can be taken in by plants and animals and organically bound, regardless of the means of exposure. However, there appears to be no concentration factor relative to hydrogen at any level of food chains analyzed to date. Isotope effects apparently do not significantly alter tritium behavior compared with that of stable hydrogen (H1) in natural ecosystems. Turnover times of tritium in coupled ecosystem compartments are dependent on climate, hydrological, and meteorological factors and thus are site specific for each ecosystem. Half-times are much longer in a desert ecosystem compared with those in a tropical rain forest. The total ecosystem will have a half-time of retention at least as long as the compartment with the longest half-time. Tritium body burden is dependent on the pathways of exposure; tissue-bound fractions arise primarily from organically bound tritium in food. Biological half-lives of tissue-bound fractions are longer than the half-life of the body-water component and may be as long as one-third of the organism's life-span. Tritium in all compartments in a chronically contaminated ecosystem would be expected to be uniformly labeled with H3, with the tritium ratio being dependent on release levels. (Auth)

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<568>
Hett, J.M. 1971, December. Land-Use Changes in East Tennessee and a Simulation Model which Describes these Changes for Three Counties. ORNL-IBP-71-8; 56 p. (ESD #414)

The rates of change and amounts of nine land-use categories were determined for five counties in East Tennessee (Rhea, Meigs, Roane, Loudon and Knox). Data were collected from a 1939 TVA field map and aerial photographs from 1953 and mid-1960. Within each square kilometer cell, the fraction of land occupied by each land-use was determined. These land-use types include: open (primarily agriculture), old field (non-forest including power line cuts), pine forests or plantations, cedar-hardwood, mixed and hardwood forests, water, urban and special (a "catch-all" including steam plants, quarries, etc). All five counties are shifting from open land to forest, water, urban and special land uses with an average yearly decrease in non-forested land of 5.28 km2/year, of which 2.39 km2/year represents an increase in forested land and 2.85 km2/year is irreversibly lost to water, urban and special uses. Approximately 160 km2 of land was lost to water in Meigs, Rhea and Roane counties--the largest change in any land-use category other than open land. Using the data averaged for Meigs, Rhea and Roane counties, a simulation model was developed to investigate both land-use changes and how man influences rates of change. The 1939 data were used as initial conditions for the constant coefficient model which predicted the amount of land in each usage for the next two time periods. Time varying coefficients were used to account for effects of dams on the Tennessee River and influence of Bowaters pine pulp and paper mill on the rate of establishment of pine plantations. The simulation indicates that man's influence on the landscape necessitates a more complex model; for example, pine and water were not even closely approximated in 1964 if time varying coefficients were not included. (Auth)

<569>
O'Neill, R.V., and O.W. Burke 1971, November. A Simple Systems Model for DDT and DDE Movement in the Human Food Chain. ORNL-IBP-71-9; 18 p. (ESD #415)

This report documents a model of DDT and DDE movement in human food chains. The model constructed was relatively simple. The food supply was divided into a portion receiving pesticide by direct application and a portion receiving contamination from an environmental pool, particularly recycling from the soil. The model does not explicitly consider the environment as a variable because revelant data were missing. Six simulations were performed to calculate concentrations in humans based on various assumptions about DDT application. The model forecasts a slow reduction in man over a considerable period of time if DDT application continues to decline. If usage is permitted to increase, concentrations in man would continue for a considerable period of time and would be significantly above present levels in the next century. Limitations of the model were noted. (BBM)

<570>
Cooley, J.L., and F.L. Miller, Jr. 1971. Effects of Chronic Irradiation on Laboratory Populations of the Aquatic Snail PHYSA HETEROSTROPHA. Radiation Research, 47(3), 716-724 (ESD #416)

Effects of chronic gamma (cobalt 60) irradiation on population dynamics of snails (PHYSA HETEROSTROPHA) were studied in the laboratory. Groups of snails of known age were exposed throughout their life span to dose rates of approximately 25, 10, and 1 rad per hour. Growth of snails was significantly increased by 10 and 25 rads per hour. A dose rate of 25 rads per hour eliminated reproduction and led to extinction of the population within one generation. Fecundity was reduced significantly by 10 rads per hour and probably would lead to extinction of the population in two generations. The dose rate of 1 rad per hour gave indications of reducing fecundity, but the effect was not definitive. The two higher dose rates significantly reduced egg hatchability and adult survival. (Auth)

<571>
Goldstein, R.A., and D.F. Grigal 1972. Computer Programs for the Ordination and Classification of Ecosystems. ORNL-IBP-71-10; 125 p. (ESD #417)

Six computer programs for use in ordination and classification studies are listed and explained. The computer outputs resulting from application of each program to the same sample data are included and illustrated. (Auth)

<572>
Booth, R.S., and S.V. Kaye 1971. A Preliminary Systems Analysis Model of Radioactivity Transfer to Man from Deposition in a Terrestrial Environment. ORNL-TM-3135; 21 p. (ESD #418)

A mathematical model was constructed simulating selected terrestrial pathways by which fallout radioactivity can be transferred ultimately to man. This model is intended for preliminary predictions of radionuclide intakes by man through consumption of milk, beef, and plant parts contaminated directly by fallout as well as by uptake from the soil. The intake rates and total intakes of 25 radionuclides were predicted for a "standard" man based on a hypothetical fallout of 1 uCi/m2 of each radionuclide. In the first few days after deposition, milk and directly contaminated plant parts provided the greatest intake of radioactivity from this mixture of radionuclides. After approximately 30 days, the intake rate via beef was 2.5 times more important than that from directly contaminated plant parts. Finally by 500 days, the intake rate from plant parts contaminated by uptake from the soil was the most important source of radioactivity to man in the contaminated area. This generalized dynamic model is sufficiently versatile that it can be applied to many terrestrial environments and to all radionuclides. This first version of the model is expected to undergo future refinements. (Auth)

<573>
Auerbach, S.I., S.V. Kaye, D.J. Nelson, D.E. Reichle, P.B. Dunaway, and R.S. Booth 1971. Understanding the Dynamic Behavior of Radionuclides Released to the Environment and Implications. A/CONF-49/P-085; Part of Proceedings of the Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy held in Geneva, Switzerland, September 6-16, 1971, (p. 3.3-1 - 3.3-18) (ESD #419)

The results are reviewed of environmental research at ORNL which has emphasized the behavior and effects of radionuclides released to aquatic and terrestrial ecosystems. The review is carried out in the context of its pertinence to nuclear power safety problems and its use as the basis for a system of rate process models which, in turn, can be used in estimating population exposure levels. A description of environmental systems analysis is included because this methodology appears promising as a means for meeting future health and safety needs in a nuclear power economy. (KM)

<574>
Grigal, D.F., and R.A. Goldstein 1971. An Integrated Ordination-Classification Analysis of an Intensively Sampled Oak-Hickory Forest. Journal of Ecology, 59, 481-492 (ESD #420)

A Combination of ordination and classification techniques was used to investigate the structure of a continuously varying oak-hickory forest. A 97.5 hectare watershed was sampled by 290, 0.08 hectare plots. Densities of the twelve most important species, as measured by basal area, were used as the variates in the analyses. Four numerical classifications, based on mutual information, within-group dispersion using standard distance, and the weighted pair-group method using both standard distance and the correlation coefficient were made; all recognized the same four major groups of vegetation. Canonical analysis of the results of each of the classifications showed that the groups were distinct. Although the composition of each group varied somewhat with the classification, 131 core stands belonged to the same groups throughout all the classifications. The four groups, as identified by the core stands, were pine (predominantly PINUS ECHINATA), yellow poplar (LIRIODENDRON TULIPIFERA), oak-hickory (QUERCUS spp; CARYA spp.), and chestnut oak (QUERCUS PRINUS) in composition. Although canonical analysis showed that these core groups were clearly different, principal component analysis of all the stands on the watershed showed no distinct groups, and even plotting only the 131 core stands in principal component space did not show separation by group. (Auth)

<575>
Hett, J.M., and O.L. Loucks 1971. Sugar Maple (ACER SACCHARUM Marsh) Seedling Mortality. Journal of Ecology, 59, 507-520 (ESD #421)

The several views on variability in seedling establishment of sugar maple and on its mortality rates over the first decade are reviewed and compared with the negative exponential and power function models for describing the age distribution of seedlings. The age distribution for sugar maple seedlings was obtained for three different locations in Wisconsin, one northern, one southern, and one central. Analysis shows that the power function adequately describes the seedling depletion and that the effects of drought, warm spring temperatures and other environmental influences are not detectable in the surviving numbers of seedlings. The organization of the forest canopy above the seeding layer, particularly in relation to the presence of multiple strata in old growth forests, appears to have some influence on seedling survival. (Auth)

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Van Hook, R.I., Jr. 1971. Energy and Nutrient Dynamics of Spider and Orthopteran Populations in a Grassland Ecosystem. Ecological Monographs, 41, 1-26 (ESD #422)

Population dynamics, energy budgets, and nutrient concentrations were used to develop a compartment model for evaluating energy flow and nutrient fluxes in the spider and orthopteran components of an eastern Tennessee grassland ecosystem. Weekly estimates of arthropod density and biomass and monthly estimates of vegetation biomass were made during the 1968-69 growing season. Supporting studies included: (1) determination of caloric equivalents; (2) measurements of arthropod metabolism; (3) determination of whole-body concentrations of sodium, calcium, and potassium; (4) estimation of biological turnover rates of these nutrients with radioactive analogues; and (5) field studies of arthropod feeding habits and food consumption. Total net primary production of the grassland ecosystem was 1,274 kcal/m2; 89% of this total was by grass species and 11% by green forbs. Herbivores and omnivores consumed 9.6% (122.9 kcal/m2) of net primary production. Annual net secondary production by the insect community was 32.05 kcal/m2. Total net tertiary production by spiders was 2.26 kcal/m2. Total annual energy flow (equals total assimilation) through the community was 75.6 kcal/m2. Herbivores accounted for 79.8% of this total, omnivores 12.2%, and predators 8.1%. Whole-body concentrations of sodium increased with higher trophic position in the food chain. Calcium concentrations decreased from vegetation (5.82 milligrams per gram ash-free dry weight (AFDW)) to prey (0.85 milligrams per gram AFDW) and remained constant to predators (0.88 milligrams per gram AFDW). Potassium concentrations were much higher in vegetation (14.28 milligrams per gram AFDW) than in either the prey (1.87 milligrams per gram AFDW) or predators (1.96 milligrams per gram AFDW), which were essentially the same. Sodium and potassium behaved similarly in their movement through arthropod food chains. The low concentrations of calcium in arthropod trophic levels and the rapid elimination of this element from each trophic level suggest that calcium is not as limiting as are sodium and potassium in this arthropod community. Herbivores, the dominant members of the arthropod fauna, attained a maximum standing crop of 917 mg/m2. This trophic level was responsible for 85% of the sodium turnover, 76% of the calcium turnover, and 78% of the potassium turnover by the arthropod component of the ecosystem. The omnivore PTERONEMOBIUS fed equally well on fresh vegetation and on litter. It reached a maximum biomass of 194 mg/m2 and utilized 10% of the sodium, 22% of the calcium, and 20% of the potassium which passed through the arthropod community. The predator (LYCOSA spp.) biomass reached a maximum of 146 mg/m2 in late fall and was responsible for 5% of the sodium, 2% of the calcium, and 2% of the potassium utilized by the arthropod component of the ecosystem. Wolf spiders consumed 21% of total net secondary production. Absence of other predator species in collections from the arthropod community suggests that LYCOSA was the dominant invertebrate predator in this grassland ecosystem. (Auth)

<577>
Styron, C.E. 1971, October. Effects of Beta and Gamma Radiation on a Population of Springtails, SINELLA CURVISETA (Collembola). Radiation Research, 48(1), 53-62 (ESD #423)

Population dynamics of adults, juveniles, and eggs of the springtail, SINELLA CURVISETA, were studied following acute doses of strontium 90-ytterium 90 beta radiation or cobalt 60 gamma radiation (1885 to 29,700 rads). Fecundity rates (eggs per adult per day) of adults were increased 48% by the lowest dose (1885 rads) of beta radiation, but fertility rates were reduced by radiation at all other doses. Survival values for adults suggest an apparent relative biological effectiveness (gamma/beta) of 0.497 for externally delivered beta radiation; for juveniles, 0.568; and for eggs, 0.931 as dose was measured by our methods. Gamma radiation was also more effective than beta in reducing fertility rates. Juveniles were more sensitive than adults to both types of radiation, and day-old eggs were the most sensitive stage studied. (Auth)

<578>
Dean, F.C. 1972, March. POPSID, a Fortran IV Program for Deterministic Population Studies. ORNL-IBP-71-11; 42 p. (ESD #424)

POPSID (Population Simulation-Deterministic) is designed to permit deterministic study of the behavior of population parameters in response to varying conditions of reproduction and mortality, all modifiable on an age-sex selective basis. The program calculates and presents results on a number-of-animals and age-sex specific basis for each year or reproductive cycle that is followed. Information is provided on input instructions, program sequence, interpretation of output and test data sets. A sample simulation is described. (KM)

<579>
Witherspoon, J.P., and F.G. Taylor, Jr. 1971. Retention of 1-44 Micron Simulated Fallout Particles by Soybean and Sorghum Plants. Health Physics, 21, 673-677 (ESD #425)

Six-week-old soybean and sorghum plants were contaminated in the field with a siliceous fallout simulant containing cesium 134. Initial fallout interception and retention of particles by whole plants and plant parts were determined for a 5 week period. Initial interception of particles was similar with values of 39.5 and 38.2% of the deposition quantity retained by soybeans, and sorghum, respectively. Sites of initial interception, however, differed greatly between species. Weathering half-lives for particles were determined for different plant parts and for two time components (0-7 and 7-34 days following deposition). Half-life values were similar for the 0-7 day component, but differences between species and plant parts were found for the 7-34 day component. (Auth)

<580>
Goldstein, R.A., and J.W. Elwood 1971. A Two-Compartment, Three-Parameter Model for the Absorption and Retention of Ingested Elements by Animals. Ecology, 52(5), 935-939 (ESD #426)

In many experiments on the absorption and retention of ingested elements, the measured retention curve is fitted to the sum of two exponential functions. The model used most often to interpret results assumes that the instantaneous rate of absorption of an element is proportional to its instantaneous rate of ingestion. The authors propose instead a model that assumes the instantaneous rate of absorption is proportional to the amount of unabsorbed element in the gut. The models lead to different interpretations of the parameters of the retention curve and to different functional descriptions of the accumulation of absorbed element in the body. Data are presented to support the authors' proposed model over the commonly used model. Since both models are of equal mathematical complexity, there is no justification for favoring the commonly used model. Suggestions are made about how modeling should be incorporated into ecological studies. Models based on meaningful and testable hypotheses should be formulated prior to data collection. (Auth)

<581>
Van Hook, R.I., Jr., and E.T. Herbert 1971. Effects of Gamma Radiation and Temperature on the Biological Assimilation and Retention of Cesium 137 by ACHETA DOMESTICUS (L.). Health Physics, 21, 845-850 (ESD #427)

Cesium 137 retention was determined for brown crickets, ACHETA DOMESTICUS, which had been irradiated with 0, 1000, 2500 and 5000 rad gamma radiation and maintained at 20, 25 and 30 degrees centigrade. Parameters examined for temperature and dose effects were (1) per cesium 137 assimilated into body tissues (p sub 2), (2) rate of isotope passage through the gut (k sub 1) and (3) rate of elimination of assimilated cesium 137 (k sub 2). Increases in temperature and gamma dose resulted in a general decrease in %cent cesium 137 assimilated per day (p sub 2). The first-component elimination coefficient (k sub 1) was not significantly affected (P less than or equal to 0.05) by either temperature or dose changes. Biological elimination coefficients for assimilated cesium 137 (k sub 2) increased with increasing temperature between doses of 0 and 2500 rad. Above 2500 rads however, increases in temperature had no noticeable effects on the rate of assimilated cesium 137 excretion. At higher dose levels, radiation was the dominant factor influencing the parameter k sub 2. (Auth)

<582>
Witkamp, M. 1971. Soils as Components of Ecosystems. Annual Review of Ecology and Systematics, 2, 85-110 (ESD #428)

Mineral flow through soils is examined with emphasis on forest ecosystems. Attention is focused on nutrient supply because productivity is more often checked by mineral availability than by lack of energy input. Specific parts of the mineral cycle in soil are discussed from the input of minerals mainly from plants, to their leaching in water; their exposure to leaching; microbial decomposition as a result of litter comminution by the fauna; subsequent immobilization-remineralization cycles by the flora; and then reabsorption into plants. (KM)

<583>
Coutant, C.C. 1971. Effects on Organisms of Entrainment in Cooling Water: Steps Toward Predictability. Nuclear Safety, 12(6), 600-607 (ESD #429)

Models are being developed at Oak Ridge National Laboratory and elsewhere for predicting ecological effects of thermal shocks received by organisms passing through thermal-power-plant cooling systems. The models were developed initially for studying lethal effects directly but they are applicable to such sublethal effects as equilibrium loss and increased susceptibility to predation. These predictive models and the basic biological data required for their use provide for selection of limits of temperature elevation and durations of exposure to warmed water at power plants, which will prevent detrimental effects. (Auth)

<584>
Henderson, G.S., R.M. Anderson, L. Boring, J.W. Elwood, T. Grizzard, W.F. Harris, A. Hunley, W. McMasters, W.J. Selvidge, J.L. Thompson, and D.E. Todd 1972, March 1. Walker Branch Watershed: A Study of Terrestrial and Aquatic System Interaction. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 30-48), 188 p. (ESD #430)

The Walker Branch Watershed was characterized by a geological survey and a reconstruction of the past history including land management practices on the watershed prior to acquisition by the AEC. Remeasurement of the 298 permanent growth plots on the watershed revealed that of the four forest types basal areas increases were greatest for chestnut oak stands, followed by those of oak-hickory and mesophytic hardwoods, while pine stands decreased in basal area. Preliminary summaries for biomass production and mortality are also presented. Seasonal patterns of nitrogen, phosphorus, potassium, and calcium concentrations in foliage of ten tree species are shown together with quantities of these nutrients returned to the forest floor in litterfall. Preliminary estimates of litter biomass are presented for the O1 and O2 soil horizons. A brief description of a soil moisture and evapotranspiration simulation model is introduced in this report. (Auth) (HP)

<585>

<585>
Oen, C., B.N. Collier, and G.U. Ulrikson 1972, March 1. Ecological Sciences Information Center. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 127), 188 p. (ESD #430, Section)

The mission of ESIC is to collect, analyze, and store in machine readable form ecological bibliographic references and make these files of information available to the Environmental Sciences Division, the AEC and other interested groups. (HP)

<586>
Dahlman, R.C., T. Cox, S.L. Deal, B.E. Dinger, G.J. Dodson, P.B. Dunaway, C.W. Francis, H.L. Frank, R.F. Gaskins, W.F. Harris, G.S. Henderson, M. Hoglund, L.K. Mann, J.B. Mathies, J.F. McBrayer, J.S. Olson, R.V. O'Neill, M.G. Nielsen, L.N. Peters, D.E. Reichle, M.H. Shanks, P. Sollins, J.D. Story, F.G. Taylor, R.I. Van Hook, J.P. Witherspoon, and M. Witkamp 1972, March 1. Radionuclide Cycling in Terrestrial Environments. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 1-29), 188 p. (ESD #430, Section)

Research results on retention and weathering of fallout-simulant particles by grass indicated an initial rapid loss rate (T sub 1/2 equal 4 to 5 days). Redistributed particles eventually became trapped in the litter mat of the turf grass vegetation, and over half the particles remained in contact with biotic components for 50 days. A simulation based on data from several experiments on grass contamination with a fallout simulant illustrated that the radiocesium content of living foliage diminished rapidly, dead vegetation remained contaminated for the longest time interval, plant uptake from soil was several orders of magnitude greater than direct foliar contamination, and soil served as a sink for radiocesium. Other studies of radionuclide cycling include direct plant-to-plant transfer of radiocesium, where results on rainout transfer of radiocesium from tree to ground cover indicated that foliar absorption can be a major pathway for movement of some radionuclides between the canopy and understory vegetation. Chemical exchanges, leaching, and mixing by soil animals were the processes responsible for redistribution. Research on food-chain transport of radionuclides by arthropods has revealed that many transfers result in discrimination rather than concentration of radioactivity. While concentration of radionuclides may be negligible in arthropod food chains, high feeding, elimination, and population turnover rates can significantly enhance the cycling of radioactivity in terrestrial environments. (Auth) (HP)

<587>
Reichle, D.E., R.M. Anderson, B.S. Ausmus, E.E.C. Clebsch, T.L. Cox, B.E. Dinger, G.J. Dodson, R. Gaskins, R.A. Goldstein, N.T. Edwards, C.W. Francis, W.F. Harris, G.S. Henderson, J.M. Hett, B.A. Hutchison, CR. Maline, J.F. McBrayer, M.G. Nielsen, C.J. Richardson, M.H. Shanks, S.Y. Shieh, M.H. Shugart, P. Sollins, P. Sommers, L.A. Stephens, F.G. Taylor, D.F. Todd, and R.I. Van Hook 1972, March 1. International Biological Program: Oak Ridge Research Site. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 49-96), 188 p. (ESD #430, Section)

The Oak Ridge Site of the U.S. IBP Eastern Deciduous Forest Biome proposes as its unique contribution the analysis of landscape interactions based on research and modeling implemented by hierarchal levels of resolution. Simultaneous development of the level of processes and components of specific ecosystems permits evaluation of the significances of these processes and consequences of their modification and alteration to total system behavior. Information on the basic production processes which regulate forest ecosystems is being obtained to provide comparative data on the efficiences of alternative choices of land use in terms of solar energy conversion, biomass production, and mineral utilization. Rates of transfer of energy and materials among the components of these ecosystems are being identified and quantified. Emphasis is being placed on the concomitant development of (1) mechanistic process models, (2) the coupling of process models leading to construction of dynamic stand models; and (3) the integration of stand models; for the development of predictive models of watersheds. (HP)

<588>
Adamus, P., S.H. Bowen, D.S. Carroll, C.C. Coutant, M.A. Eischen, J.W. Gooch, C.P. Goodyear, H. Guderley, P.D. Neuman, J.M. Rochelle, W.G. Stockdale, and G.U. Ulrikson 1972, March 1. Thermal Effects Studies. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 126), 188 p. (ESD #430, Section)

Thermal effects studies are briefly described Subjects included: 1) temperature tolerance of the Asiatic clam, 2) the evaluation of effects of thermal stress on fish by means of electrophoretic separations of blood serum proteins, 3) temperature selection in the field by largemouth bass tagged with an ultrasonic temperature-sensing fish tag, 4) responses of Clinch River fish to shutdown and startup of the Bull Run Steam Plant, 5 annual review of thermal effects literature and survey of current thermal effects research, 6) temperature effects of feeding competition between bluegill and rainbow trout, 7) temperature effects on relative susceptibility of juvenile largemouth bass and juvenile goldfish to predation, 8) zooplankton studies at Bull Run Steam Plant, (9) experimental marking of nonsalmonids with liquid nitrogen cold brand, and 10) temperature effects on growth of bluegill.

<589>
Auerbach, S.I., R.L. Burgess, R.E. Funderlic, R.A. Goldstein, M.T. Heath, K.R. Knoerr, J.B. Mankin, E.E. Miller, C. Mills, C.E. Murphy, C.W. Nestor, J.S. Olson, R.V. O'Neill, M. Reeves, H.H. Shugart, and T.C. Tucker 1972, March 1. Eastern Deciduous Forest Biome, U.S. International Biological Program. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 97-108), 188 p. (ESD #430, Section)

The region of temperature deciduous forest in the eastern United States is a complex of aquatic and terrestrial ecosystems that collectively covers about 1/3 of the country, but presently supports 2/3 of the people. In the common, yet unique situation where land and water systems interface, research is aimed at determining the uptake, transfer, discharge rates, and pathways of critical mineral elements, potential pollutants and biological materials so that the functioning of the total system, both land and water phases may be described mathematically in a systems model. The value of such an approach is rapidly coming to be recognized as essential to sound planning and wise resource utilization. To assist in the management of the total program, a graphic technique has been developed to illustrate the time phasing of individual projects, and synthesis of individual process models into total ecosystem models. Formulation of a mechanistic model of energy dynamics in a terrestrial ecosystem has begun. Watershed modeling and infiltration of water into soils are discussed. (HP)

<590>
Booth, R.S., O.W. Burke, R.E. Funderlic, R.A. Goldstein, M.T. Heath, S.V. Kaye, J.B. Mankin, E.E. Miller, C.E. Murphy, C.W. Nestor, R.V. O'Neill, J.S. Olson, M. Reeves, P.S. Rohwer, H.H. Shugart, P. Sollins, and T.C. Tucker 1972, March 1. Systems Ecology and Environmental Systems Analysis. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 109-118), 188 p. (ESD #430, Section)

Contributions which represent specific advances and applications in the field of environmental systems analysis were collected in this section. Attention has been focused on modeling the important environmental pathways leading to intake of radioactivity via ingestion of food or drink. A systems analysis model was developed to predict transfer of radioactive iodine, cesium and strontium from air above a pasture into milk and meat produced by cattle. A 2 compartment, 3 parameter model for the absorption and retention of ingested elements by animals is proposed. As part of its long-range planning, the Environmental Science Division is assessing priorities of its environmental research that also bear on broad AEC mission responsibilities. (HP)

<591>
Crouse, L., D. DiGregorio, P.B. Dunaway, J.T. Kitchings, J.D. Story, L.E. Tucker, R.I. Van Hook, and J.P. Witherspoon 1972, March 1. Radiation Effects in Terrestrial Ecosystems. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 119-123), 188 p. (ESD #430, Section)

Average seed production of Ky-31 tall fescue was reduced 50% by chronic, low-level, beta-gamma in situ radiation of 9 to 17 rads/day. When the dose rate was diminished by 40%, seed production was 20% less than that of the controls. Results indicate that seed production is affected by dose rate rather than total long-term exposure to a chronic in situ radiation source. In sunflowers receiving adequate moisture and those under moisture stress, the foliage saturation deficits are doubled following the 200-rad treatment and are more than doubled following the 400-rad treatment. No normal foliage developed following either treatment. The effects of radiation on animal populations are described. (HP)

<592>
O'Neill, R.V., O.W. Burke, D. Chapman, R.E. Funderlic, M.T. Heath, J.M. Hett, J.B. Mankin, and M. Reeves 1972, March 1. Other Programs. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 128-144), 188 p. (ESD #430, Section)

Some divisional activities that involve the application of modeling to the solution of environmental problems are discussed in the following. They are: the attempt to integrate ecology and resource economics; systems analysis of the Aleut ecosystem; and a simple model for DDT NAND DDE movement in human food chains. A modeling study on the ecological effects of power plant siting has been conducted. Results indicated that most effects were highly localized but damage to sensitive plants might extend for distances of perhaps 10 miles downwind. Research on 1) cycling of heavy metals, 2) behavior of methylmercury stream ecosystems, 3) toxicity of organic and inorganic arsenicals, 4) powerline revegetation, 5) ecological assessment related to the federal repository, and 6) cadmium studies in bluegill were discussed briefly. (HP)

<593>
Carter, M., E.B. Douple, J.W. Elwood, M. Frank, N.A. Griffith, H. Hackett, D.J. Nelson, and G.U. Ulrikson 1972, March 1. Radionuclide Cycling in Aquatic Systems. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 125), 188 p. (ESD #430, Section)

Research on radionuclide cycling in aquatic systems is briefly described. Research subjects include: 1) biological half-life of cesium 137 and cobalt 60 in turtles from White Oak Lake; 2) analysis of interacting effects of temperature, feeding rate, growth rates and the turnover of cesium-137 by bluegills; 3) the uptake and turnover of tritium in White Oak Lake bluegills; and 4) distribution of radionuclides in White Oak Lake in various components of the food chain. (HP)

<594>
Allen, C.P., B.G. Blaylock, G.F. Cosgrove, M. Frank, and N.A. Griffith 1972, March 1. Effects of Radiation on Aquatic Systems. ORNL-4759; Part of Ecological Sciences Division Annual Progress Report for Period Ending September 30, 1971, (p. 124), 188 p. (ESD #430, Section)

Research on effects of radiation on aquatic systems are briefly described. Included were: 1) population and cytogenetic studies, 2) chromosome aberrations produced by tritiated water, 3) hatchability of carp eggs in different concentrations of tritiated water, 4) synergestic effects of pesticides and radiation, 5) effects of acute ionizing radiation on carp embryos, and 6) effects of temperature and radiation on GAMBUSIA. (HP)

<595>
Coutant, C.C. 1972, January. Index for Annual Reviews 1967-1970. Thermal Pollution-Biological Effects. ORNL-EIS-71-25; 120 p. (ESD #431)

The index is designed to facilitate the use of the Thermal Pollution-Biological Effects sections of the Water Pollof the Journal of the Water Pollution Control Federation (JWPCF) annual literature reviews on wastewater and water pollution control. Inclusion of a thermal effects section in JWPCF began with the 1967 review and the large volume of the annual literature review precludes simultaneous publication of indexes. An alphabetical index is provided for authors. The title index is an alphabetical key-word-in-context (KWIC) index of all significant words appearing in the titles. A bibliography of the references in included. The code number used by the Journal of the Water Pollution Control Federation is included. (BBM)

<596>
Reed, J.R. 1971, December. Uptake and Excretion of Cobalt 60 by Black Bullheads ICTALURUS MELAS (Rafinesque). Health Physics, 21, 835-844 (ESD #432)

Black bullheads were able to accumulate cobalt 60 from water. During uptake the gills contained from 19% to 30% of the whole body cobalt 60 activity. After 3 days of cobalt 60 uptake the muscles accounted for 16% of the total activity. Fish that were dosed in a single feeding lost 95.5% of the initial activity in one day of excretion whereas fish that were exposed in cobalt 60 dosed water lost 28% of the initial activity during the first day of excretion. Elimination of cobalt 60 after intake from water or from food occurred in three components. The initial rapid loss of activity after uptake from food had a biological half-life of 1.5 days, compared to 3.4 days for the initial component after uptake via water. The intermediate components had biological half-lives of 35 and 40.5 days, respectively, after water uptake and after food uptake. The third components in both cases had long, undetermined biological half-lives. Radiocobalt and stable cobalt analyses showed that the blood and blood-rich organs, particularly the kidney, were principal sites of cobalt concentration. (Auth)

<597>
Bowen, U.T., J.S. Olson, C.L. Osterberg, and J. Ravera 1971. Ecological Interactions of Marine Activity. Part of Radioactivity in the Marine Environment, Chapter 8, (p. 200-222) (ESD #433)

Arguments are presented to encourage research on ecosystems rather than on specific organisms within marine systems. Lower trophic levels of the seas are likely to have greater concentrations of radioactivity than higher trophic levels. If the population explosion forces man to use these lower trophic levels as food sources, then the capacity of the seas to safely accept waste radioactivity will decrease. If, as suggested, marine species are more closely linked than those of other ecosystems, and if unique, or very limited, species interdependences are more common here, then the radiation resistance of marine ecosystems will often be strongly limited by that of the least resistant species. No marine radioactivity levels have yet approached possible danger points, but this is argued as one of several aspects of the oceans needing fuller consideration in these contexts. In order to assess properly the consequences to man of radioactivity in the marine environment, continued research is needed into the physics, chemistry, and biology of the oceans and into the interdisciplinary "hyphenated" offspring of these basic sciences. Of particular importance is increased research into the radiosensitivity of marine ecosystems. It is hoped that with the aid of modern high-speed digital computers we will attain new and more profound understandings of how the oceans will respond to the presence of this new contaminant - man-made radioactivity. (Auth)

<598>
McBrayer, J.F., and D.E. Reichle 1971. Trophic Structure and Feeding Rates of Forest Soil Invertebrate Populations. Oikos, 22(3), 381-388 (ESD #434)

Trophic level relationships of a soil invertebrate community were determined using the transient behavior of cesium 137 in experimental soil microcosms. Feeding rates were estimated from radionuclide mass balance equations using radiocesium uptake coefficients, equilibrium concentrations of cesium 137 in consumers, and cesium 137 composition of food bases. The fungivore trophic level included Scatopsidae larve (diptera), Enchytraeidae (annelida), Entomobryidae and Onychiuridae (collembola), Rhodacaridae (mesotigmata), and Oribatulidae, Camasiidae, Carabodidae, and Cymbaeremaeidae (oribatei). Approximately 60 per cent of the total faunal biomass occurred in the fungivore trophic level. Fungivores averaged 7.0 plus or minus 2.4 percent dry body weight ingested per day. Cecidomyiidae larvae (diptera), Diplopoda, Isotomidae (collembola), Uropodina, and Phthiracaridae (oribatei) were determined to be surface-feeding saprophages. Subsurface-feeding saprophages included Symphyla, Cillibidae (uropodina), and Palaeacaridae and Epilohmanidae (oribatei). Surface-feeding saprophages averaged 1.0 plus or minus 0.4 per cent dry body weight ingested per day. Feeding rates were not calculated for saprophages feeding within the mineral soil horizon. Predators included Dolichopodidae larvae (diptera), gamasine mites, and the Scutacaridae and other prostigmatid mites. Predators averaged 2.5 plus or minus 1.0 percent dry body weight ingested per day. (Auth)

<599>
DiGregorio, D., P.B. Dunaway, J.D. Story, and J.T. Kitchings 1972. Cesium 137 Accumulation, Dosimetry, and Radiation Effects in Cotton Rats. CONF-700909; Part of AEC Symposium Series #24; Part of Proceedings of a Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War held in Upton, Long Island, New York, September 15-18, 1970, (p. 535-547), 745 p. (ESD #435)

Cesium 137 accumulation, dosimetry, and radiation effects were determined in cotton rats living in their natural environment, which was contaminated with cesium 137-labeled sand. Cesium 137 levels were relatively high 6 months after application of the fallout simulant but decreased as the simulant descended from the vegetation toward the ground. Radioactivity levels in organs and tissues, in general, paralleled those of the whole body. Dose rate to cotton rats paralleled radioactivity levels in the whole body. No effects on peripheral blood or body weight due to irradiation were observed in this study. (Auth)

<600>
Van Hook, R.I., Jr. 1972. Survival of Crickets, ACHETA DOMESTICUS (L.), as Affected by Variations in Gamma Dose Rate. CONF-700909; AEC Symposium Series #24; Part of Proceedings of a Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War held in Upton, Long Island, New York, Setpember 15-18, 1970, (p. 521-526), 745 p. (ESD #436)

Effects of 5000 rads of gamma radiation delivered at five different dose rates on the survival of young adult crickets, ACHETA DOMESTICUS (L.), were determined. Significant (P less than 0.05) differential mortality occurred as a function of dose rate. Lower dose rates resulted in reduced mortality. Mortality increased with increasing dose rate up to 200 rads/hr, above which further increases in irradiation intensity produced very similar mortality rates. (Auth)

<601>
Styron, C.E., and G.J. Dodson 1972. Responses of Some Grassland Arthropods to Ionizing Radiation. CONF-700909; AEC Symposium Series #24; Part of Proceedings of a Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War held in Upton, Long Island, New York, September 15-18, 1970, (p. 509-520), 745 p. (ESD #437)

Response of arthropod communities to ionizing radiation and the interactions of radiation with other environmental parameters are being investigated in (1) studies of biological and physical dosimetry of beta and gamma radiation from simulated fallout in a grassland area, (2) long-term field observations on interactions of the fallout radiation with seasonal changes in composition and structure of the arthropod community, and (3) short-term laboratory studies on interactions of fallout radiation with population dynamics of selected insect species. Beta- and gamma-radiation levels in the simulated fallout area were determined by thermoluminescent dosimetry. Lithium fluoride microdosimeters attached to grasshoppers and crickets in the fallout field indicated that these closely related organisms received significantly different radiation doses owing to differences in habitat. Numbers of soil-, litter-, and grass-inhabiting arthropods collected in the simulated-radioactive-fallout field varied significantly among months and taxa. There was no significant difference in variation between arthropod communities of field enclosures before application of the simulant. The only significant differences among numbers of individuals in taxa comprising the arthropod communities of control and contaminated areas occurred 4 months after contamination. No significant increase in species composition dissimilarity between the contaminated and control areas appeared during the second year following application of the fallout. Consequently the threshold for effects of fallout radiation on species composition of the arthropod community must be above the approximate 13 rads/day delivered over this time. Data on exposure of laboratory populations of FOLSOMIA (COLLEMBOLA) to beta radiation from strontium 90-yttrium 90 fallout indicate that population dynamics were affected primarily by sensitivity of fertility rates rather than by sensitivity of adults. Dose rates estimated to give an LD 50/30 or LD 50/60 for adults were more than twice as high as dose rates required to reduce fertility rates to zero. (Auth)

<602>
Reichle, D.E., J.P. Witherspoon, M.J. Mitchell, and C.E. Styron 1972. Effects of Beta-Gamma Radiation of Earthworms Under Simulated Fallout Conditions. CONF-700909; AEC Symposium Series #24; Part of Proceedings of a Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War held in Upton, Long Island, New York, September 15-18, 1970, (p. 527-534), 745 p. (ESD #438)

Experiments on cobalt 60 gamma and strontium 90-yttrium 90 beta radiosensitivity of LUMBRICUS TERRESTRIS and dosimetry models of soil systems were designed to study the effects of fallout radiation on natural earthworm populations. Epithelial tissues (skin and/or intestinal) were the primary sites for radiation damage. The LD 50/30 days for gamma was 67.8 krads; no significant increase in mortality occurred for beta irradiations up to 102.4 krads. In situ dosimetry models with cesium 137 show that beta radiation is important only for direct contact (because of soil shielding) and that gamma radiation typically would contribute from 68 to 100% of the external body dose of natural populations. Habitat shielding, high radioresistance of earthworms, and radioactive decay preceding particle incorporation into soil suggest minimal population mortality due to radiation from anticipated weapon yields. (Auth)

<603>
Hett, J.M. 1971. A Dynamic Analysis of Age in Sugar Maple Seedlings. Ecology, 52(6), 1071-1074 (ESD #439)

Age data from populations of sugar maple (ACER SACCHARUM Marsh.) seedlings in southern Wisconsin were used to investigate two plant-population models: a negative exponential model and a power function model. A weighted death probability was calculated and compared to densities of potential germinants, and the influence of seed-crop numbers on stem density was analyzed. The power function model, implying a decreasing mortality rate as the seedling ages, is a good model for describing population dynamics of sugar maple seedlings. Seed crops and potentially viable seeds appear to have no effect on the numbers of stems remaining in the population after several years. However, the density of the initial input into the population system does affect the probability of a seedling surviving during its germination year. (Auth)

<604>
Burgess, R.L., (Reviewer) 1971. Commentary - An Ethic for Natural Beauty. Ecology, 52(6), 957-958 (ESD #440)

A review is presented for the book, "The Unforeseen Wilderness", an essay on Kentucky's Red River Gorge, by Wendell Berry. ThereBerry, University Press of Kentucky, Lexington. There exists a credibility gap of major proportions between professional ecologists concerned with conserving some semblance of ecosystem stability and politicians bent for "environmental control." The book should be required reading for all legislators. (BBM)

<605>
Oen, C. (Coordinator) 1972, January. A Bibliography on Radioecology. ORNL-EIS-71-10; 223 p. (ESD #441)

Because of growing interest in radioecology from government, research, and private sectors, a bibliography was compiled of current literature in the field. The 524 references in this bibliography are those designated as primarily of ecological interest by the Life Sciences section of Nuclear Science Abstracts. Each entry provides two types of indexing. The first consists of alphabetically arranged subject headings, together with the free-text modifying phrases that describe the relation of the document to the heading. The second type of indexing is a list of keywords. Indexes are provided for corporate author, author, report number and subject. (BBM)

<606>
Peters, L.N., and J.P. Witherspoon 1972. Retention of 44-88 Micron Simulated Fallout Particles by Grasses. Health Physics, 22, 261-266 (ESD #442)

A quartz fallout simulant containing cesium 134 was deposited (1.85 g particles/ft2) on 4 common species of grasses used for pasture on turf purposes (Zoysia, Bluegrass, Fescue and Bermuda). Initial interception of the fallout simulant varied between species from 68 to 82%. Weathering half-lives of particles on foliage averages 3.5 plus or minus 0.6 S.E., 36.7 plus or minus 8.6 S.E. and 80.5 plus or minus 39.5 days, respectively, for time periods of 0-2.5, 2.5-35 and 35-48 days following deposition. Particles lost from foliage were mostly trapped by dense mats of stem and dead foliage, and transfer of particles to the soil surface amounted only to 31% of the original deposition at 48 days. Thus fallout contaminated grasses might be expected to receive greater radiation doses and retain more radioactivity for food chain transfers than other agricultural plants with less effective structures for particle retention. (Auth)

<607>
Dahlman, R.C. 1972. Prediction of Radionuclide Contamination of Grass from Fallout-Particle Retention and Behavior. CONF-700909; AEC Symposium Series #24; Part of Proceedings of a Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War held in Upton, Long Island, New York, September 15-18, 1970, (p. 492-508), 745 p. (ESD #443)

Retention of large (44 to 188 microns) fallout-simulant particles by dense fescue grass approached 50% initially, but, from 1 hr to 1 day later, weathering processes decreased retention to 10%. A modified negative-expoential function characterized particle weathering over a 2- to 3-week period. Half-time for early weathering loss was 3 to 4 days, but retention approached an asymptotic level after 2 to 3 weeks, at which time 2% of the ground-surface deposit remained on vegetation. Particle deposits on leaf blades were readily removed by slight wind (less than 1 mph) and phytotaxic movements of the foliage. Axillary deposits, however, were not readily removed by wind and rain. Using Miller's contamination factor convention (a sub L=C sub p/m) and nuclide leachability, we predicted the cesium 137 contamination of fescue foliage (F sub L) from fallout simulant independently according to the expression F sub L=a sub L x W sub L. (Auth>

<608>
Booth, R.S., O.W. Burke, and S.V. Kaye 1971. Dynamics of the Forage-Cow-Milk Pathway for Transfer of Radioactive Iodine, Strontium, and Cesium to Man. Part of Proceedings of American Nuclear Society Topical Meeting on Nuclear Methods in Environmental Research, August 23-24, 1971, (p. 127-143) (ESD #444)

A systems analysis model was developed to predict the time-dependent concentration of radiostrontium, radiocesium, and radioiodine in the milk, meat, and soft tissue of cows that forage a pasture contaminated by fallout. The variables in this model are adjustable to a wide variation in weather conditions, ecological conditions, and countermeasures. Simulated concentrations were based on reasonable, conservative parameters derived completely from published measurements. There was continued contamination of the milk and meat several weeks after a short-term deposition on the grass (radioactive cloud above the pasture for 1 hr). However, the concentration in milk was in transient equilibrium with the grass (a 14-day environmental half-time for loss of radioactivity from the grass was specified) within a week after the deposition, and the majority of man's uptake of radioactivity from consumption of milk and meat was accomplished within the first few weeks after deposition. The transfer of radioactivity to man was almost exclusively via the direct grass to cow gut to cow blood (body fluid) to meat and to milk pathway. The predicted equilibrium concentrations indicate the potential uptake by man from a continuous source of radioactivity above the pasture. The influence of environmental conditions and countermeasures was studied. If, for example, the cows were moved from the contaminated pasture 1 day after an impulse source to the grass, the cumulative meat and milk concentration would be only 5% of that obtained when no countermeasures are applied. (Auth)

<609>
Goldstein, R.A., and R.I. Van Hook, Jr. 1972, April. Dynamic Model of Insect Grazing in a Forest Canopy. EDFB-IBP-72-5; 43 p. (ESD #445)

A descriptive model has been developed for estimating the consumption of canopy vegetation by insects and the model has been applied to a LIRIODENDRON TULIPIFERA research site. The model divides canopy leaves into generations, according to time of leaf emergence. Periodic measurements were made of distributions of gross leaf area and "hole" area for each generation. Gross area distributions were used to determine empirical growth functions for the canopy vegetation. The rate of change in hole area is a function of insect consumption and subsequent hole expansion due to leaf growth. The hole expansion rate was determined empirically by punching holes of known area in growing leaves and correlating hole expansion to leaf growth. From the above relations, a linear differential equation was derived to describe dynamics of insect grazing in the canopy. This model is being used to interpret the effect of insect herbivory on the energy and nutrient cycles in a LIRIODENDRON forest (Oak Ridge Reservation). (Auth)

<610>
Reichle, D.E. 1971. Energy and Nutrient Metabolism of Soil and Litter Invertebrates. Part of Proceedings of the Brussels Symposium on Productivity of Forest Ecosystems held in Brussels, Belgium, 1969, Unesco, Paris, France, (p. 465-477) (ESD #446)

The ecological consequences of the activities of decomposer invertebrates on the over-all ecosystem is the ultimate question, and one which has yet to be resolved. Solution to this question may be accomplished in several ways. One approach involves the experimental manipulation of natural populations in situ to judge the effects of the presence or absence of various species combinations on ecosystem components and processes. A complementary approach is the development of "systems" models to permit testing of hypotheses through mathematical manipulations. A pattern is beginning to unfold from energy balance models, and resonably consistent relationships can be constructed to describe input and output parameters for populations. Virtually no data are available for the ecological efficiency and the trophic level assimilation efficiency. This void reflects on two problems: (a) the physical limitations on procuring environmental data for entire trophic levels, and (b) the computational problems encountered in attempts to process these large quantities of data. (KM)

<611>

<611>
Auerbach, S.I. 1971. The Deciduous Forest Biome Program in the United States of America. Part of Duvigneaud, P. (Ed.), Proceedings of the Brussels Symposium on Productivity of Forest Ecosystems, held in Brussels, Belgium, 1969. Paris, France, (p. 677-684) (ESD #447)

The long-term goal of the deciduous forest biome program is to evaluate the impact of man's activities on regional complexes of ecosystems so that a scientific basis of resource management and long-term utilization of land and water can be derived in order to maintain or improve environmental quality. The objectives of the program include: elucidation of the productivity, nutrient cycling, energy flow, and other ecosystem parameters; determination of of rates of change, transfer pathways, and food chain kinetics in major ecosystem types in eastern United States; determination of the functional role of animals and microorganisms; determination of the rates and efficiencies of ecosystems for nutrient and mineral cycling; understanding the influence of terrestrial ecosystems on the quality of water and the biological production of aquatic ecosystems, analysis of production of important managed and unmanaged landscapes; and the evaluation of the actual and potential efficiency of natural versus managed ecosystems for utilization and conversion of solar energy. During the initial phase of this program, much of the research will be oriented toward processes. Emphasis will be placed on the basic major processes that govern exosystem function and structure. Teams with modellers will work on problems of local process and on regional or biome scale models. The research program is planned as the initial start up of a minimum five-year program. The five sites for early work are: Oak Ridge reservation and Melton Hill Lake basin; Lake Wingra, Madison, Wisconsin; Lake George, New York; Coweeta Hydrologic Laboratory, Franklin, North Carolina; and Duke Forest and Triangle Universities, Durgam, North Carolina. (KM)

<612>
Reichle, D.E., and R.I. Van Hook, Jr. 1970. Radionuclide Dynamics in Insect Food Chains. Part of Proceedings of a Symposium on Ionizing Radiation in Entomology held at Winnepeg, Manitoba, Canada, August 24-26, 1970. Published in The Manitoba Entomologist, 4, 23-32 (ESD #448)

Knowledge of food chain dynamics is a prerequisite to understanding the fate of chemical compounds in ecosystems, since food chains are the primary biological mechanisms for the dispersal and concentration of radionuclide contaminants in the environment. The dynamics of material transport along insect food chains has received considerable attention in recent years, and mathematical models have been developed describing the variables affecting the behavior of radionuclides in food chains. Knowledge of uptake, assimilation and metabolic turnover of radionuclides have led to predictable models of transient behavior of materials along food chains, resultant trophic level concentrations and efficiencies of trophic level exchange. (Auth)

<613>
Witherspoon, J.P. 1972. Field Studies of Fallout Retention by Plants. CONF-700909; AEC Symposium Series #24; Part of Proceedings of a Symposium on Survival of Food Crops and Livestock in the Event of Nuclear War held in Upton, Long Island, New York, September 15-18, 1970, (p. 396-404), 745 p. (ESD #449)

Several field studies on the retention by plants of local fallout particles (particles exceeding 44 microns in diameter) are summarized. Although initial fractions of fallout intercepted varied as a function of plant-foliage characteristics and particle size, average initial retention values are similar for studies done with a wide variety of plants in different geographical regions. Rapid losses of particles from foliage and other plant parts due to weathering occurred generally during the first week following initial particle deposition. Losses from tree species during this period were several times greater than losses from crop plants. In a period of 1 to 2 weeks following deposition all plants lost 90% or more of the fallout particles initially intercepted. After about 3 weeks the loss of particles was relatively constant and proceeded at a slow rate (average weathering half-life of 21.3 plus or minus 3.9 days) regardless of subsequent rain and wind conditions. (Auth)

<614>
Witherspoon, J.P. 1970. Interception and Retention of Radioactive Aerosols by Vegetation. Atmospheric Environment, 4, 591 (ESD #450)

The results of field studies on retention of aerosols by plants are not directly applicable to retention of particulate fallout in cases where particle diameters may exceed several microns. The larger experimental values of field loss of strontium 85 during summer vs. winter periods, and the suggested role of increased shedding of leaf cuticle during active growth, may represent phenomena that should be considered in studies on mineral cycling and food chain analyses. The use of normalized specific activity computations for "chronic" contamination events represents a useful method for comparing fallout studies. (KM)

<615>
Huckabee, J.W., F.O. Cartan, and G.S. Kennington 1972, June. Environmental Influence on Trace Elements in Hair of 15 Species of Mammals. ORNL-TM-3747; 38 p. (ESD #451)

Many trace element nutrients and toxicants present in the blood are deposited in mammalian hair. Thus, hair may provide a monitor of the trace elements in the mammal's diet. The usefulness of hair as such a monitor was studied by collecting hair samples (from ungulate herds in Idaho and Wyoming, from a population of coyotes in Wyoming, and from populations of small mammals in Idaho and Wyoming) and analyzing them to determine their trace element content. No species-specific patterns of hair trace-element content were found. The trace-element content of hair does appear to be related to environmental distribution of trace elements. Variations in the trace-element content of hair may be due, in part, to food preferences, phenology of food organisms, microhabitat selection, physiological differences among species, and trophic level. (Auth)

<616>
Jacobs, D.G., E.G. Struxness, M.J. Kelly, and C.R. Bowman 1972. Consideration of the Radiological Impact From the Hypothetical Use of Contaminated Natural Gas from Nuclearly Stimulated Reservoirs. Health Physics, 22, 429-440 (ESD #452)

Commercial utilization of nuclear engineering in undergound applications, such as stimulation of a gas reservoir, may result in detectable quantities of residual radionuclides becoming a part of the distributed product. The concentration of radionuclides is small, but their existence implies that sizable population groups could be exposed. It is prudent to consider the radiation exposures before they occur and, unless they are clearly insignificant, balance them against the benefit the population would derive from this application of Plowshare technology. The concentrations of tritium and krypton 85 at the beginning of production testing were about 700 and 110 pCi/cm3, respectively, and the concentration has decreased exponentially with the quantity of gas removed from the well. Traces of argon 37 and argon 39, fission product rare gases, and low concentrations of carbon 14 (5700 yr half-life) were the only other radionuclides reported to be present in the gas. None of the gas removed from the well has actually entered the production system, but an assessment has been made of the radiation doses to consumers and workers by considering the hypothetical introduction of Gasbuggy gas into the actual gas collection and processing system during production testing. Workers at the Blanco gas processing plant could potentially receive a dose-equivalent to the gonads of 0.3 mrem during the processing of Gasbuggy Gas and could receive as much as 1.3 mrems if gas processed through the plant were used for home heating with non-vented heaters. Both estimates are for dose received during the lifetime of the well although most of this dose would be received during the first year of gas production. The potential contribution of tritium and krypton 85 to the general (atmospheric) background has also been considered in areas consuming large quantities of gas, but this is small relative to the potential dose to the individual occupying a space heated home where the combustion products are not vented properly (Auth)

<617>
Goff, F.G., and P.H. Zedler 1972, April. Derivation of Species Succession Vectors. The American Midland Naturalist, 87(2), 397-412 (ESD #453)

By placing size classes of individual species in sequence within a reference ordination model, a series of succession vectors is produced. These vectors show how the pattern of association of a given species changes in relation to growth. Analysis of data from 879 forest plots in northeastern Wisconsin shows some tree species entering into successional sequences in accordance with existing theory. Other species, particularly those of the xeric sand plains and poorly drained sites, are apparently as self-perpetuating as the traditional "climax" species of mesic sites. (Auth)

<618>
Moore, R.E., and C.J. Barton 1972, June. Progress Report on Radiological Safety of Peaceful Uses of Nuclear Explosives. Preliminary Equations and Computer Techniques for Estimating and Controlling Tritium Doses from Nuclearly Stimulated Natural Gas. ORNL-TM-3755; 72 p. (ESD #454)

An equation is derived to express the tritium concentration in dry natural gas flowing from a nuclearly stimulated well as a function of the volume of gas removed from the well, the initial number of Curies of tritium in the hydrocarbons and hydrogen in the chimney, and a factor equal to 1 - (volume of gas flowed into the chimney from the rock formation divided by the volume of gas removed). Computer programs based on this equation are described which calculate the tritium concentration in gas flowing from multiple-well fields. They are designed to aid in scheduling the opening of wells in these fields so as to control the tritium concentration and the tritium doses received by persons exposed to gas combustion products. The procedure used in calculating tritium doses received by persons exposed to stack emissions from a power plant burning the gas is outlined. A computer program is described that will compute the annual tritium dose received by any person living in the vicinity of such a power plant. A related program is also described that will compute the maximum tritium concentration, averaged over a one-year period, which would be permitted in gas burned in a power plant so that no person would receive more than a predetermined annual tritium dose. Details and examples of the use of the computer programs are presented, including all the information needed to use the four programs. (Auth)

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<619>
Kelly, M.J., C.J. Barton, A.S. Meyer, E.W. Chew, and C.R. Bowman 1972, July. Theoretical Evaluation of Consumer Products From Project Gasbuggy. Final Report. Tritium Behavior in a Natural Gas Processing Plant. ORNL-4775; 41 p. (ESD #455)

An experiment was performed in a small natural gas processing plant near Big Lake, Texas, to study the behavior of tritium during the processing of natural gas containing tritiated hydrocarbons. Approximately 40,000 ft3 of natural gas drawn from the Project Gasbuggy well, created by the detonation of a 29-kiloton nuclear explosion near Farmington, New Mexico, on December 10, 1967, was transported to the plant in two tank trucks. This gas, containing 12.5 mCi of tritium, was diluted with 1,800,000 ft3 of field gas during a 12-hr period. The tritium activity in the diluted gas entering the plant and in the output gas was measured continuously during the experiment with on-line monitors. Samples of gas and liquid plant products were taken periodically and transported to Oak Ridge National Laboratory or to a commercial laboratory for analysis. Additional tritium (about 70 mCi) in the form of HT was added to the fuel gas being burned in plant boilers or compressors during the test to raise the tritium level in the plant atmosphere to detectable levels. Analysis of 30 samples of atmospheric moisture collected during the test showed a maximum concentration of tritium in air of 131 pCi/m3, which would give a calculated whole-body dose of 0.06 millirem for continuous exposure during a normal working year (2000 hr). Analysis of urine samples from people present in the plant during the test showed a maximum individual dose commitment of 0.65 millirem, which may have resulted from a small escape during transfer of the tritium used to spike the fuel gas. Plant operators received small or undetectable tritium dose commitments during the experiment. The observed tritium distribution among plant products followed the pattern predicted by pre-test calculations. There was no evidence of isotopic exchange that would cause a buildup of tritium in the plant processing oil. The test results suggest that plant processing of gas from nuclearly stimulated wells will result in doses less than 1% of natural background to plant operating personnel and no other operating problems. (Auth)

<620>
Stephenson, R.L. 1972, July. CATCH: Computer Assisted Topography, Cartography, and Hypsography. Part II. ORGRAT: A General Subroutine for Drawing Graticules. EDFB-IBP-72-7; 18 p. (ESD #456)

A subroutine has been written for drawing graticules (networks of latitude and longitude lines) using a 29.5-inch Calcomp plotter. This program makes use of subroutines which accept latitude and longitude and return distance north and east in meters. Potentially the program can draw a graticule in any projection for which such subroutines are available. (Auth)

<621>
Nelson, D.J., S.V. Kaye, and R.S. Booth 1972. Radionuclides in River Systems. Part of River Ecology and Man. Academic Press, Incorporated, New York, New York, 1972, (p. 367-387) (ESD #457)

A discussion is presented on sources of radionuclides released to rivers, fate and transport of the released radioactivity, and potential radiation doses to man utilizing the Clinch River, Tennessee, for drinking water, fisheries, and recreation. Radionuclide releases to the environment originate from one of the following potential sources: (a) nuclear power stations; (2) fuel reprocessing plants; (3) AEC-sponsored production and research laboratories; (4) nuclear weapons testing; and (5) other potential sources including medical institutions, university and industrial research laboratories and reactors, and peaceful nuclear explosives. The transport of radioactivity by streams is primarily by hydrodynamic processes which include disperion by turbulent diffusion and gradient diffusion, convective flow of dissolved radionuclides, transport of suspended loads, and movement of bed sediments. However, movement is also dependent upon physical and chemical characteristics of the radionuclide and of the stream system. Organisms accumulate some radionuclides such as Sr 90, Ba 140, Na 24, and Ca 45 directly from the water. Others such as Cs 137, P 32, Cr 51, Cu 64, As 76, and the rare earths are primarily accumulated by ingestion of contaminated food. Initial entry into the food chain with the latter group of radionuclides occurs largely by adsorption on algae or other particulate matter. Subsequent movement through the food chain occurs through assimilation. In aquatic systems the relative level of radionuclides in organisms can be related to the concentration of radioactivity in water through the use of concentration factors. The unique experience on the Clinch and Tennessee rivers for a period of almost 20 years shows that nuclear facilities can utilize rivers for the disposal of small quantities of radioactive waste effluents without excessive exposure to downstream populations. (KM)

<622>
Coutant, C.C. 1972, July. Successful Cold Branding of Nonsalmonids. Progressive Fish-Culturist, 34(3), 131-132 (ESD #458)

Cold branding with liquid nitrogen coolant seems to be an acceptable technique for rapid, short-term marking of bluegills and probably other large-scaled fishes. Development of a legible mark is dependent, however, on the duration of contact between the tool and the fish. A minimum contact period of 4 seconds was established by experimental branding as effective in producing marks lasting 1 month. Longer periods of contact or similar contact periods used on smaller fish may yield marks with longer-lasting effects. This technique has advantages over other marking techniques (e.g. fin clipping and inserted tags) since the body surface is not broken (no chance for infection) and no body parts are removed (physical performance is not affected). (Auth)

<623>
Barton, C.J., H.M. Butler, R.B. Cummings, and P.S. Rohwer 1972, May - June. The 1971 Tritium Symposium at Las Vegas. Nuclear Safety, 13(3), 225-235 (ESD #459)

A tritium symposium sponsored by the Western Environmental Research Laboratory of the Environmental Protection Agency and the University of Nevada at Las Vegas was held in Las Vegas Aug. 30 to Sept. 2, 1971. Approximately 100 papers were presented covering a broad range of topics, including tritium production, its movement in the environment, environmental release and monitoring, detection and measurement, biological effects, biokinetics, applications in biology and medicine, and health physics. Some speakers reviewed published information, but many new data were discussed by others. The symposium served a useful purpose in gathering together scientists concerned with diverse aspects of this important hydrogen isotope. Most of the papers from the symposium, along with some that were not presented, will be published in the proceedings during the summer of 1972. This article touches on all aspects of the meeting, but papers of particular interest in the field of nuclear safety are emphasized. (Auth)

<624>
Olson, J.S. 1971. Primary Productivity: Temperate Forests, Especially American Deciduous Types. Part of Proceedings of the Brussels Symposium on Productivity of Forest Ecosystems, 1969, Paris, France (ESD #460)

A review of the studies of two leading ecological analysts of woodland productivity along with other new summaries and previous publications indicates the degree of resolution in primary productivity studies which seems rather appropriate and feasible for a fairly detailed stand study, or a sampling of stand conditions, which differ regarding vegetation structure or position in a climatic-topographic gradient. There seems to be a huge gap between the summaries of world or regional economic or biogeochemical carbon fixation, and studies of small ecosystem components and processes which must become integrated for understanding why porductivity attains a certain level, and how this level can be changed. (KM)

<625>
Witkamp, M. 1972. Transfer of Cesium 137 From Detritus to Primary Producers. Part of Proceedings of a Symposium on Isotopes and Radiation in Soil-Plant Relationships Including Forestry held in Vienna, Austria, 1972, (p. 341-348) (ESD #461)

A combination of radiotracer, microcosm and systems analysis techniques was used in evaluating recycling minerals from detritus back to the vegetation. A greenhouse experiment with microcosms of increasing complexity showed the effect of millipedes and snails on cesium 137 movement from leaf litter to tree seedlings. Millipedes increased the organic matter content of the soil and the concentration and availability of cesium 137. The increase in growth and mineral uptake by plants suggests that millipedes affect both nutrient and cesium 137 kinetics in similar ways. With snails there were smaller increases in cesium 137 turnover in soil and less tree growth than with millipedes. Snails also reduced plant growth by consuming part of the foliage. Gross transfer coefficients for movement of cesium 137 from detritus to plants were determined through analysis of cesium 137 turnover using a simulation model. (Auth)

<626>
Reichle, D.E., and S.I. Auerbach 1972, July. Analysis of Ecosystems. EDFB-IBP-72-44; 31 p. (ESD #462)

The potential of the systems approach for the analysis of ecosystems is illustrated by means of examples. The goal of ecosystem analysis is to develop a quantitative ecosystem science which may provide new theoretical insights into the organization and function of natural systems at their most complex level. One of the basic hypotheses being tested is whether the landscape is organized in logical patterns of self-sustaining, dynamic, and internally regulated components. In ecosystems analysis the challenges lie in interfacing processes to consturct total systems. The world-wide recognition that environmental problems transcend not only political but also intellectual boundaries is resulting in emergence of the environmental sciences as a broad, interdisciplinary field of endeavor. Within this context, ecosystem analysis may provide both a conceptual and an operational framework for linking the research of various environmental disciplines. (KM)

<627>
Monheimer, R.H. 1972, April. Heterotrophy by Plankton in Three Lakes of Different Productivity. Nature, 236(5348), 463-464 (ESD #463)

Evidence is presented which does not support the hypothesis that the only significant uptake of naturally occurring dissolved organic compounds by plankton is carried out by heterotrophic bacteria and that competition by phytoplankton for these compounds is insignificant. The importance of heterotrophy in relation to the total metabolism of plankton communities in freshwater ecosystems is shown. (KM)

<628>
Witkamp, M. 1971. Forest Soil Microflora and Mineral Cycling. Part of Duvigneaud, P. (Ed.), Proceedings of the Brussels Symposium on Productivity of Forest Ecosystems held in Brussels, Belgium, 1969. Unesco, Paris, France, (p. 413-424) (ESD #464)

The process of microbial remineralization, the physical as well as chemical unlocking of unavailable mineral elements, is the major effect of the microflora on forest production. This paper reconciles the recommended minimum microbial requirements with the information needed to optimize sustained forest productivity. The relative estimates of viable propagules representing certain groups of microbes that are provided by serial dilution colony counts and the also relative estimates of live microbial standing crop can be used as indices of microbial activity measured as rates of substrate decay or evolution of CO_2. Loss of weight and respiration in turn reflect rates of mineral turnover. Radioactive tracer techniques and environmental manipulation of microcosms with increasing complexisty provide a basis for simulation of gross mineral flux in predictive models of mineral transfer and the effect of mineral flux on forest productivity. (KM)

<629>
Brooks, A.A., and R.L. Sayrs 1972, October. Documentation and Submission of Data Sets. EDFB-IBP-72-6; 33 p. (ESD #465)

Adequate documentation, as defined in this report, is the most important prerequisite to storing data sets generated by the investigators of the Eastern Deciduous Forest Biome in the Information Center. Definitions and descriptions of the various fields on the data set documentation form are presented in alphabetical order. Examples are given with each description and two completed forms are included. (Auth)

<630>
Coutant, C.C., and C.P. Goodyear 1972, June. Thermal Effects. Journal Water Pollution Control Federation, 44(6), 1250-1294 (ESD #466)

A review is presented of literature published during 1971 concerning thermal effects. Topical categories included reviews, site studies, producers, consumers, decomposers, disease, and beneficial uses. Tables give comparative results for reproduction, embryonic development, larval development, and moropological abberations caused by temperature of embryonic or larval development, distribution, thermal tolerance, and interactions of temperature and other stresses. The bibliography contains 394 references. (BBM)

<631>
Taylor, F.G., Jr.. Phenodynamics of Production in a Mesic Deciduous Forest. EDFB-EBP-72-8; Part of Lieth, H. and Stearns, F. (Eds.), Proceedings of a Symposium on Phenology and Seasonal Modeling held at the University of Minnesota, August 28-29, 1972, (44 p.) (ESD #467)

The International Biological Program has provided recent impetus to incorporate phenological consideration into analysis of ecosystems. While the sequence of phenological events is determined by the genetics of a species, the onset of a phase is often controlled by one or more environmental factors such as meteorological factors interacting with growth processes. Many phenological events are correlated with changes in functional processes within the ecosystem, e.g., photosynthesis and respiration. Associated with phenological development of species or communities are changes in biomass and rates of productivity. Phenological considerations in productivity studies are valuable adjuncts to process madels of the functional aspects within the system, thus providing some measure of the impact of man or man-related activities on natural ecosystems. Phenological observations are reported from the Oak Ridge site and species are noted in the appendix. (BBM)

<632>
Not given 1972, August. Progress Report 1970-1971. Eastern Deciduous Forest Biome, US-IBP. EDFB-IBP 72-9; 290 p. (ESD #468)

The progress report for the Eastern Deciduous Forest Biome for 1970-1971 details its first full year of research. Included are reports on site research performed at the site stations and process research involving terrestrial and aquatic production and decomposition and aquatic mineral cycling. Progress in modeling and systems analysis and Biome-wide studies of vegetation ordination, forest succession and biomass production are detailed. The appendices include EDF Biome Annual Reports and Interim Progress Reports. (BBM)

<633>
Dunaway, P.B., J.D. Story, J.T. Kitchings, and J.A. Payne 1972, September. Seasonal Alterations in Rodent Blood. ORNL-TM-3898; 89 p. (ESD #469)

Seasonal hematological changes during one year were measured for eight species of rodents in free-ranging populations on the Oak Ridge AEC Reservation in East Tennessee. Erythrocyte count was greater in the smaller species than in the larger species. Average RBC counts for mice were highest during winter and spring, highest during winter in the woodchuck, and highest during autumn and winter in the cotton rat and muskrat. Hemoglobin concentrations paralleled RBC count in seven species, but hemoglobin concentrations in the woodchuck were highest in summer and decreased fairly regularly to spring. Hematocrit percentages were lowest in two of the largest species, cotton rats and woodchucks, but hematorrit values for muskrats were within levels for the mice. Mean corpuscular volumes (MCV) were less in smaller species than in larger species Total leukocyte (WBC) counts were highest in the two largest species, were lowest in the smallest species, and were intermediate in the other species. Mature neutrophil and small-lymphocyte counts ranged from 18-46% and 48-78%, respectively, in the six smallest species. Number of lymphocytes in these six species correlated well with total WBC. Differential counts for the muskrat differed from those for the other species in that immature neutrophils were numerous (51%). Albumin-globulin ratio (A/G) was low (0.43) in the woodchuck, and the next lowest A/G (0.86) was found in the next largest species, the muskrat. Albumin-globulin values for other species ranged from 0.96 to 1.44. (Auth)

<634>
Coutant, C.C., E.E. Huber, and H.A. Pfuderer 1972, September. Thermal Effects on Aquatic Organisms, Annotated Bibliography of 1971 Literature. ORNL-EIS-72-28; 155 p. (ESD #470)

Indexed bibliographic information from the 1971 literature on thermal effects on aquatic organisms is presented. The Environmental Information Systems standard format was used for entering data into a computerized file. I Each entry contains the following bibliographic data: author, title, publication description, corporate author, publication date, subject category, keywords, date of data, geographic location of date (when given), abstract, and taxon. Indexes are provided for author, keywords, taxon, and title. Four hundred and four references are included. (BBM)

<635>
Reichle, D.E. 1971. Systems Analysis as Applied to Ecological Processes: A Mechanism for Synthesis, Integration, and Interpretation for IBP Woodlands Ecosystem Research. Bulletins from the Ecological Research Committee, No. 14; Part of IBP Workshop on Systems Analysis in Northern Coniferous Forests held in Kratte Masugn, Sweden, June 14-18, 1971, (p. 12-28) (ESD #471)

The evolving IBP Woodlands/Forests models will serve to synthesize and integrate data collected at research sites as well as between them. Ecosystems analysis must be emphasized at the level of research sites where analysts and investigators can function in close communication. Progress in integrated ecosystems synthesis will call for an effort by the (Production, Terrestrial) section and its biome coordinating committees along with continuing program of international meetings and workshops. (BBM)

<636>
Reichle, D.E., P. Duvigneaud, and J.S. Olson 1971. International Woodland Synthesis Symposium. A Proposal. Bulletins from the Ecological Research Committee, No. 14; Part of IBP Workshop on Systems Analysis in Northern Coniferous Forests held in Kratte Masugn, Sweden, June 14-18, 1971, (p. 179-192) (ESD #472)

An illustration is given for how an international synthesis of IBP ecosystems research can be accomplished. Recommendation is made for an immediate action program for a Woodland/Forests Symposium at the fifth IBM General Assembly in Seattle, Washington August 30-September 7, 1972. It was urged that symposium papers should emphasize total ecosystems results and should have structured discussion groups chaired by members of the Woodlands committees. A proposed format is given for ecosystems data documentation. (BBM)

<637>
Malone, C.R. 1972. Effects of a Non-Selective Arsenical Herbicide on Plant Biomass and Community Structure in a Fescue Meadow. Ecology, 53(3), 507-512 (ESD #473)

Community structure and standing crop biomass of vegetation were affected similarly in a fescue meadow by single applications of sodium cacodylate and by severe heat stress. Recovery of species diversity and percentage similarity toward control levels was rapid although not complete in one growing season. Repeated applications of the herbicide were necessary to suppress fescue growth, and this treatment regime caused sustained simplification of community structure and reductions in biomass throughout the growing season. Litter accumulated on heat-stressed areas, but its rapid decomposition on sprayed areas diminished an important nutrient sink and exposed the ecosystem to possible leaks in nutrient pools. (Auth)

<638>
Harris, W.F. 1972. Morphological Responses of LIRIODENDRON TULIPIFERA L. Seedlings to Acute Fast Neutron Radiation and Reduced Light. Radiation Botany, 12, 205-219 (ESD #474)

Dormant seedlings of yellow poplar (LIRIODENDRON TULIPIFERA L.) were irradiated acutely with fast neutron radiation from an unshielded fast reactor and grown postirradiation in light environments of 100, 50 and 25 per cent sunlight. Several morphological responses were monitored for a period of up to two growing seasons with the objectives of determining the separate and interacting effects of ionizing radiation and reduced light. Morphological responses measured were: diameter increment, terminal and lateral growth and bud formation. Terminal and lateral bud mortality, and complete stem kill were independent of reduced light treatments. Other parameters examined were found to interact variously with responses to reduced light. Terminal growth of the seedlings was independent of reduced light at a dose higher than 300 rad. Below 300 rad, terminal growth was stimulated. Growth of lateral shoots was increased following irradiation and shading, but the same treatments decreased the number of lateral buds developing per seedling--differences in total lateral growth among radiation doses were undetectable because of the interacting responses. (Auth)

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Kolehmainen, S.E. 1972, September. The Balances of Cesium 137, Stable Cesium, and Potassium of Bluegill (LEPOMIS MACROCHIRUS Raf.) and Other Fish in White Oak Lake. Health Physics, 23, 301-315 (ESD #475)

Concentrations of cesium 137, stable cesium and potassium, and the intake and elimination rates of these nuclides were determined in bluegill and 6 other species of fish inhabiting a small radioactively contaminated lake in Oak Ridge, Tennessee during the period from June 1967 to January 1969. Cesium 137 concentrations increased by a factor of 4 in bluegills (LEPOMIS MACROCHIRUS Raf.) from 1 to 7 g, but the concentration of stable cesium decreased slightly with increasing fish size. In all species the concentrations of cesium 137 cycled seasonally with a minimum in summer and a maximum in winter. Radiocesium concentration was highest in species feeding on food from which a high percentage of cesium 137 was absorbed. The concentration of stable cesium cycled similar to that of cesium 137. Concentrations of potassium decreased somewhat with increasing fish size, but did not fluctuate seasonally. There were only small differences in the concentration of potassium in different species. The specific activities of cesium 137 in fish were in the same ranges as the specific activity of cesium 137 in water. In bluegill the absorbed cesium 137 was eliminated by a two-component exponential process. At 15 degrees centigrade, the rates were 0.0912/day (fast component) and 0.00370/day (slow component) in bluegill above 70 g. The proportion of the body burden eliminated by the fast component was 37% after a single feeding of food contaminated with cesium 137; in the equilibrium state, the proportion of the body burden eliminated by the fast component was only 2.3%. Rates of cesium elimination decreased with the increasing weight of bluegill. There was no significant difference in rates of the slow component between fish in equilibrium with cesium 137 intake and in fish that had received a single feeding of cesium 137. Potassium was eliminated at a single exponential rate, 0.019/day at 15 degrees centigrade in bluegill. The absorption of potassium was almost complete for all types of food. Intake rates of cesium 137, stable cesium, and potassium in bluegill were calculated on the basis of seasonal changes in body burden and elimination rates of these nuclides. (Auth)

<640>
Goldstein, R.A., (Reviewer) 1972. Mathematical Properties of Several Population Dynamics Models. Ecology, 53(4), 762-763 (ESD #476)

A critical review is written on the monograph, "On the Volterra and Other Models of Interacting Populations", by N.S. Goel, C.S. Maitra, and E.W. Montroll, published by Academic Press, New York. The book is based on a paper originally published in Reviews of Modern Physics (April 1971), and the paper could satisfy many readers. Warning is given that in modeling ecological systems, one must be wary of becoming so involved with mathematics that one loses sight of ecological principals. The book is difficult to read and consists of almost continuous strings of mathematical derivations and manipulations. The book is recommended only to researcheronly to the researcher whose major interest is specifically the application of Volterra's model or modifications of it to the study of interacting populations. (BBM)

<641>
Burgess, R.L., (Reviewer) 1972. Environmental Quality. Ecology, 53(4), 765-766 (ESD #477)

A critical review is given for the first issue of the Journal of Environmental Quality, another in a series of publications produced by the consortium of the American Society of Agronomy, Crop Science Society of America, and the Soil Science Society of America. The first issue contained papers presented at a symposium on Agriculture and the Quality of the Environment in the Seventies. (BBM)

<642>
Coutant, C.C. 1972. Biological Aspects of Thermal Pollution. II. Scientific Basis for Water Temperature Standards at Power Plants. CRC Critical Reviews in Environmental Control, 3(1), 1-24 (ESD #478)

The second report in the review series on the biological aspects of thermal pollution deals with thermal standards for water bodies affected by power stations. The review presents an overall evaluation of aquatic thermal effects. There appears to be scientifically justifiable bases for water temperature standards available for use in this country at the present time. In order to protect organisms, the temperature criteria for a body of water should be based on temperature requirements of the important species found in it. These requirements can be defined by several biological limitations characteristic of the particular aquatic species. At any one time of the year, the most sensitive species or life stage can be indentified from among the important species. Those species judged important should include organisms of direct and indirect importance to man through food chains or other interactions. Distint criteria are needed for short-and long-term exposures to elevated temperatures. Each is applicable under a particular set of circumstances that may occur naturally or be induced by man. More general criteria must be retained for intelligent, site-specific environmental analysis using species-specific thermal requirements for migration, spawning, and other functions and community measures of species diversity or nuisance growths. One hundred and four references are given. (Auth) (BBM)

<643>
Huckabee, J.W. 1972. Mercury Concentrations in Fish of the Great Smoky Mountains National Park. ORNL-TM-3908; 17 p. (ESD #479)

In order to obtain data on mercury concentrations in fish at or near natural background levels, 121 fish of three species were collected from high altitude streams 15-20 mi from the nearest fly ash or other pollution source. Mercury analysis was by flameless atomic absorption spectrophotometry. There was no significant difference in mercury concentrations among fish analyzed whole, with gastrointestinal tract removed, or a strip of axial musculature. There was no significant difference in mercury concentrations in all samples of one species and each separate sampling of one species. There was no systematic change in mercury concentration in the fish along an elevational gradient. The mercury concentration (mean values in ppm) were: rainbow trout (SALMO GAIRDNERI), 0.036; brook trout (SALVELINUS FONTINALIS), 0.018; stoneroller (CAMPOSTOMA ANOMALUM), 0.039. There was no evidence of trophic level concentration of mercury, since the primary consumer stonerollers had a higher mean mercury concentration than the secondary consumer rainbow trout collected at the same sampling station. These results indicate that all fish acquire about the same tissue concentrations of mercury at chronic exposure to very low levels. (Auth)

<644>
Witherspoon, J.P. 1973, February. Education. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 88-89), 127 p. (ESD #480, Section)

The education program is designed to disseminate the use of advanced methods and techniques available at Oak Ridge National Laboratory for studying and consulting problems associated with energy, radioactivity and other forms of environmental pollutants and chemical cycles. Training activities are planned for participation ranging from outstanding college undergraduates to senior postdoctoral-level personnel. A listing of institutional and university collaboration in research during the year is included. (PHH)

<645>
Bradburn, D.M., and E.H. Rosenbalm 1973, February. Forest Management. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 90), 127 p. (ESD #480, Section)

The forest is managed on a multi-use, sustained-yield basis with two primary objectives--an ecological park for research studies and high-quality timber products. A renewed regeneration program was begun to regenerate areas that are understocked or nonproductive for timber products. Machine planting was done using either loblolly pine (PINUS TAEDA) or yellow poplar (LITRIODENDRON TULIPIFERA). Timber stand improvement included basal injection with 2,4-D and 2,4,5-T into unwanted hardwood species in pine stands. Timber product removals provided much revenue with the timber being harvested by Longleaf Industries and pulpwood being sold to Anderson County pulpwood. Southern pine beetle activity was limited to small scattered spots of less than one acre. One area was cut for pulpwood due to moderate infestation of both the Southern pine beetle (DENDROCTONUS FRONTALIS) and the black turpentine beetle, (DENDROCTONUS TENEBRANS). (PHH)

<646>
Kaye, S.V., C.J. Barton, R.S. Booth, M.J. Kelly, G.G. Killough, R.E. Moore, J.W. Poston, P.S. Rohwer, E.G. Struxness, and A.S. Meyer 1973, February. Environmental Hazards Evaluation. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 59-70), 127 p. (ESD #480, Section)

The research is organized under two projects. One project involves development of guides and methods to assess releases of radioactivity to the environment, while the other project deals with evaluation of radiological exposure to population from Plowshare applications. The topics covered in separate sections are: development of radiation safety guides for environmental releases of radioactivity, radiological support activities for environmental impact statement preparation, characterization of the radioactivity in liquid effluents from light-water power reactors, development of computer capabilities for estimating radiation dose, radiation doses from hypothetical exposure to Rulison gas, Ecofit-a hybrid computer program for iterative fitting of analog computer models to digital data and performing error propagation analysis, dose estimations for the hypothetical use of nuclearly stimulated natural gas in the Cherokee electric generating plant, computer techniques for estimating and controlling tritium doses from nuclearly stimulated natural gas, estimation of the contribution of radon in natural gas to natural radiation doses in homes, the relative risks from radionuclides found in nuclearly stimulated natural gas, development of sampling and analytical techniques to measure air circulation and residence times in homes and tritium behavior in a natural gas processing plant. (PHH)

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Reichle, D.E., R.M. Anderson, B. Ausmus, J.J. Beauchamp, M. Breed, T. Cox, E.E.C. Clebsch, B.E. Dinger, G.J. Dodson, W.T. Edwards, R.A. Goldstein, C. Gard, W.F. Harris, G.S. Henderson, B.A. Hutchison, J.B. Mankin, D.R. Matt, J.F. McBrayer, M.C. McBride, R.K. McConathy, R.V. O'Neill, C.J. Payne, K.L. Reed, M.H. Shanks, S.Y. Shieh, P. Sollins, H.H. Shugart, J.L. Thompson, and D.E. Todd 1973, February. International Biological Program: Oak Ridge Site. ORNL-4848; Part of Environmental Sciences Division Annual Progres Report for Period Ending September 30, 1972, (p. 20-33), 127 p. (ESD #480, Section)

The Oak Ridge site of the Eastern IBP Eastern Deciduous Forest Biome is concerned with the analysis of forest ecosystems, including both the functional characteristics and relations which govern the dynamics of these systems. Emphasis is placed on the concomitant development of mechanistic models of ecosystem processes, the coupling of process models leading to construction of dynamic ecosystem models of C, water and nutrient elements, and the integration of terrestrial and aquatic ecosystem models at the spatial scale of watersheds. Mathematical models are being developed to aid in the design and coordination of research projects, as an analytical tool to study behavior of intact systems and to permit predictions of sytem response to perturbation. Research is concentrating of physiological processes such as photosynthesis, transpiration, decomposition and animal grazing. At the ecosystem level, flows and cycles of C, H2O, N, P, K and Ca are being considered. Models will include data on the effects of solar radiation, temperature, precipitation and mineral inputs as drawing variables on system processes. At the watershed level, chages in water and mineral output from Walker Branch Watershed will be simulated based on seasonal variation in meteorological and ecological variables. (FMM)

<648>
Oen, C.J., B.W. Collier, H.A. Pfuderer, P.J. Gillespie, C.T. Sanders, B.B. McMullin, and F.A. Martin 1973, February. Ecological Sciences Information Center. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 86-87), 127 p. (ESD #480, Section)

The program of the Ecological Science Information Center is directed toward developing a comprehensive base of information to include 65th literature references and numerical data relevant to the movement, cycling, and concentration of elements isotopes, natural mateirals and environmental pollutants in different ecosystems. The effects of radiation on species and populations the cycling of radionuclides and the effects of thermal enrichment are of particular interest. A computerized system of information storage and retrieval is used to cover the vast, diffuse literature. Subprojects within the Center are the Thermal Effects project, the Environmental Plutonium Data Base Group project and the Ecosystem Analysis project. (FMM)

<649>
Burgess, R.L., R.S. Booth, T.R. Crow, D. DeAngelis, N. Ferguson, F.G. Goff, R.A. Goldstein, J.M. Hett, W.C. Johnson, J. Kercher, J.B. Mankin, Jr., R.V. O'Neill, D.M. Sharpe, and H.H. Shugart, Jr. 1973, February. Eastern Deciduous Forest Biome, U.S. International Biological Program. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 39-44), 127 p. (ESD #480, Section)

The Biome is involved in research into primary and secondary biotic production, decomposition, mineral cycling and abiotic environmental parameters. A large mathematical modeling component, a Biome Information Center, and a Biome and Regional Analysis Program, focusing on entire landscapes where the spatial mix of ecosystem types and the transformation of an area, through time, from one type to another, are important program elements. (FMM)

<650>
Tamura, T., E.R. Eastwood, and O.M. Sealand 1973, February. Applied Soils and Waste Management Studies. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 49-51), 127 p. (ESD #480, Section)

Progress is reported on the characterization of Pu-contaminated soil from Nevada Test Site and in the development of plugs to be used as sealants in the Salt Mine Repository. In the Pu study the results of extraction from four surface soil samples are presented. (FMM)

<651>
Blaylock, B.G., C.P. Allen, G.E. Cosgrove, J.W. Elwood, L.D. Eyman, M. Frank, N.A. Griffith, R.L. Jolley, D.J. Nelson, W.W. Pitt, C.D. Scott, J.R. Trabalka, G.U. Ulrikson, and H.H. Shugart 1973, February. Applied Aquatic Studies. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 79-85), 127 p. (ESD #480, Section)

A study was made to provide an updated assessment of the concentrations of radionuclides in teh bottom sediments of White Oak Lake and White Oak Creek for estimating the radiation dose received by organisms living in the bottom sediments. Tritium behavior in fish from chronically contaminated White Oak Lake was studied under field and laboratory conditions to determine distribution and biological turnover. The investigations reported include long-term cytogenetic studies on CHRONOMUS TENTANS, effects of radiation and temprature on the channel catfish, ICTALURUS PUNCTATUS, radiation effects on aquatic communities, the niche-variation hypothesis, an experimental study with DROSOPHILA populations and chlorination effects on sewage effluents and natural waters. (FMM)

<652>
Dahlman, R.C., A.J. Adepetu, S.H. Anderson, B. Ausmus, E.A. Bondietti, F.S. Brinkley, T. Cox, G.J. Dodson, D.T. Farrar, A. Fetcher, C.W. Francis, M. Hoglund, J. Jamison, G. Kennington, M. Levitt, R. Levy, L.K. Mann, J.F. McBrayer, D.E. Reichle, S. Rush, M.H. Shanks, D. Shimishi, C. Stein, J.D. Story, R.I. Van Hook, M. Witkamp, and A.J. Yates 1973, February. Radionuclide Cycling in Terrestrial Environments. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 1-8), 127 p. (ESD #480, Section)

Reciprocol transfers of environmetnal radioactivity are investigated for three major components - soil, plant, and animal - of forested and grassland ecosystems. Dynamic characteristics first are determined with manipulated microcosm, and the results are validate in large-scale field-plot and ecosystems experiments. Investigation of radionuclide behavior at the atmosphere - plant and soil - plant interfaces illustrates how lazaidons materials initially enter biological circulation. Separate sections cover soil chemistry, root-soil relations, radionuclide cycling in the deptus-soil-root pathway, scientific application of new techniques and concepts including Pu analysis in environmental samples and estimating microbiol parameters that influence nuclide transfer. (PMM)

<653>
Coutant, C.C., D.S. Carroll, D.K. Cox, H.M. Ducharme, J.W. Elwood, M.L. Frank, C.W. Gehrs, R.A. Goldstein, J.W. Gooch, C.P. Goodyear, E.E. Huber, J.S. Mattice, M.A. Pfuderer, J.M. Rochelle, L.M. Stubbs, W. Van Winkle, and C.A. Young 1973, February. Thermal Effects. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 71-78), 127 p. (ESD #480, Section)

The objective of the Thermal Effects program is to develop information that has predictive utility for assessing impacts of thermal discharges on aquatic life. Information sought ranges from the level of physiological effects on single organisms to the level of dynamic aquatic communities that may itneract with cooling waters of power plants. Research projects reviewed were: 1) the annual review of thermal effects literature; 2) effect of cold shock on susceptibility of juvenile fish to predation; 3) effects of temperature and other environmental factors on the growth and development of Eurasian water milfoil; 4) temperature and fiou growth; 5) effects of acute thermal shock on carp eggs; 6) acoustic temperature telemetry from free-swimming fish 7) effect of temperature on rate of food consumption and phosphorus turnover in a benthic invertebrate; and 8) population dynamics of striped bass. (HP)

<654>
Dahlman, R.C., B.E. Dinger, C.W. Francis, W.F. Harris, R.V. O'Neill, J.S. Olson, D.E. Reichle, F.G. Taylor, and F.W. Woods 1973, February. Program Applications. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 34-38), 127 p. (ESD #480, Section)

The Ecosystem Analysis Program is aimed at encouraging application of basic research to solution of applied problems. Much effort has been directed toward environmental impact assessment related to nuclear and nonnuclear technologies. Studies include biological denitrification, terrestrial disposal of industrial effluents, survey of ozone production association with energy production facilities, and environmental effects of cooling tower drift. An International Biological Program workshop was conducted and among its accomplishments was the filing of 30 documented data sets on ecosystem production, mineral cycling, and hydrologic cycles representing 18 different woodland research sites in 14 countries. (PMM)

<655>
Van Hook, R.I., C.P. Allen, C.F. Baes, B.G. Blaylock, E.A. Bondietti, F.S. Brinkley, G.J. Dodson, E.R. Eastwood, C.W. Francis, W.A. Griffith, G.S. Henderson, J.W. Huckabee, R. Levy, R.G. Olmstead, R.M. Perhac, D.E. Reichle, S. Rush, M.H. Shanks, R.A. Stella, S.J. Steubs, F.H. Sweeton, T. Tamura, and J.P. Witherspoon 1973, February. Toxic Materials in the Environment. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 52-58), 127 p. (ESD #480, Section)

Emphasis is placed on biological forms, distribution and availability of heavy metals in water, soils and sediments, soil-water-plants, and food chains. Among the topics discussed are biogeochemical survey of trace elements in ecosystems, trace contaminants measurements at and around the Allen Steam Plant Facility, zonal centrifugation, anaton separations, toxic metals in lake and stream sediments including cadmium and zinc in the Holston River and Joe Mill Creek and the ecology of toxic metals including cadmium in aquatic ecosystems, mercury transfer in an aquatic food chain and a fly ash microcosm study using Hg 203 as a tracer. (PMM)

<656>
Bogle, M.A., R.C. Dahlman, G.J. Dodson, P.B. Dunaway, W.F. Harris, R.S. Kamm, J.T. Kitchings, L.K. Mann, J.D. Story, C.E. Styron, F.G. Taylor, L.E. Tucker, R.I. Van Hook, and J.P. Witherspoon 1973, February. Radiation Effects in Terrestrial Ecosystems. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 45-48), 127 p. (ESD #480, Section)

The effects of chronic low-level radiation on various components of terrestrial ecosystems were studied. Among the problems investigated were the effects of simulated fallout radiation deposits on pollen viability, radial growth of PINUS ECHINATA around an shielded reactor, radiation effects and radionuclide (Co 60 and Mn 54) excretion in a natural population of pine voles and responses of arthropods to ionizing radiation. (PMM)

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Henderson, G.S., R.M. Anderson, S.H. Anderson, C. Barr, C. Comiskey, R.M. Cushman, R. Dueser, J.W. Elwood, T. Grizzard, W.P. Harris, A.E. Hunley, M. Kangas, M.J. Kelly, O.C. Phillips, J.C. Randolph, W.J. Selvidge, J.D. Sheppard, H.H. Shugart, J.L. Thompson, D.E. Todd, and R.I. Van Hook 1973, February. Walker Branch Watershed: A Study of Terrestrial and Aquatic System Interaction. ORNL-4848; Part of Environmental Sciences Division Annual Progress Report for Period Ending September 30, 1972, (p. 9-19), 127 p. (ESD #480, Section)

The project aims at quantification of biogeochemical cycles in a forested landscape. Both terrestrial and aquatic ecosystems of the watershed are studied to establish quantitative relationships between the hydrologic and mineral cycles, to relate water quality and aquatic productivity to characteristics of the adjacent terrestrial system, to compare the system with ones modified by cultural treatments and to evaluate the impact of man's activities on the total ecosystem. The focus of the project is on the nutrient elements, N, P, K, Ca and Mg. Studies have been done on bird, insect and small animal populations as regulating factors of system processes. The terrestrial studies include analysis of aboveground biomass accumulation, estimation of root biomass, influence of forest type on litter fall, N and P fertilization effects on decomposition of White Oak leaves, N, P and K pools and fluxes in Oak-Hickory stands, habitat utilization and functional role of avifauna and density and biomass of canopy arthropods. The aquatic studies have emphasized the determination of the sources and utilization of carbon by benthic macroinvertebrates in Walker Branch. In the hydrologic studies the flow characteristics of the East and West Forks were investigated. (FMM)

<658>
Mathies, J.B., P.B. Dunaway, G. Schneider, and S.I. Auerbach 1972, December. Annual Consumption of Cesium 137 and Cobalt 60Labeled Pine Seeds by Small Mammals in an Oak-Hickory Forest. ORNL-TM-3912; Ph.D. Thesis, Michigan State University, 216 p. (ESD #481)

Annual and seasonal consumption of eastern white pine seeds was determined radioisotopically in both laboratory and free-ranging populations of small forest mammals within a 2-ha, oak-hickory forest in eastern Tennessee. From radioecological and health physics aspects, the results from chronic feeding of radioisotopes in a food base indicated that cesium 137 was excreted at a faster rate after injection or single-feeding studies than after chronic feeding. Excretion of cesium 137 after chronic feeding could not be used to predict chronic uptake adequately in the same animal. Radiation-dose estimates would be higher if body burdens after chronic feeding were used rather than body burdens after injection. Application of this equilibrium technique would be of value in energy-flow studies to characterize the total importance of a consumer within an ecosystem. (Auth)

<659>
Goldstein, R.A., and J.B. Mankin 1972, December. Space-Time Considerations in Modeling the Development of Vegetation. EDFB-IBP-72-11; Part of Murphy, C.E., Jr., Heskett, J.D. and Strain, B.R. (Eds.), Proceedings of the Workshop on Tree Growth Dynamics and Modeling held at Duke University, October 11-12, 1971, (p. 87-97), 199 p. (ESD #482)

Three models of different temporal and spatial resolutions are being developed. One is a steady state photosynthesis model of an idealized photosynthetic surface. One is a dynamic simulation model of an idealized closed canopy forest consisting of an overstory, a woody understory, and herbs. The model simulates the system on a day to day basis. The structure and environment of the forest is assumed to be homogeneous in all directions but the vertical. The last is a watershed development model of an actual watershed. The objective of the first two models is to study relative effects on plant development resulting from perturbation of the environment. The objective of the third model is to make absolute estimates of the effects of changes in the environment and plant characteristics on forest growth, productivity, and development and is strongly species-site dependent. (Auth) (BBM)

<660>
1972, February. Eastern Deciduous Forest Biome Directory. EDFB-IBP-72-1; 42 p. (ESD #483)

The directory for the Eastern Deciduous Forest Biome is presented for 1972. Research sites and participants, organizational charts, and an alphabetical directory of all personnel are included. (BBM)

<661>
Taylor, F.G., and J.P. Witherspoon 1972, December. Retention of Simulated Fallout Particles by Lichens and Mosses. Health Physics, 23, 867-869 (ESD #484)

Lichen (CLADONIA SUBTENUIS (abb.) Evans) and moss (DICRANUM SCOPARIUM Hedw.) tussocks or mats of uniform size were placed in a field contaminated with a fallout simulant (88-175 u in diameter) containing cesium 134. The study was designed to complement previous retention studies on other plants exhibiting different growth habits. The fraction of the initial deposition intercepted by lichens is similar (71%) to that reported for grass species (68-79%). Mosses, however, intercepted a much greater fraction. The contamination factor was 2-3 times greater for mosses than lichens. After the first day, mosses retained an average of 83.1 plus or minus 8.4% of the simulant compared to 64.8 plus or minus 8.4% of the simulant compared to 64.8 plus or minus 13.6% for lichens. Values for weathering half-life obtained for lower plants are within a factor of those reported for higher plants. (BBM)

<662>
Coutant, C.C., and J.S. Mattice 1972. AIF Topical Conference on Water Quality Problems. Nuclear News, 15(11), 123-125 (ESD #485)

A report was filed on the topical conference on Water Quality Considerations in Siting and Operating of Nuclear Power Plants held October 1-4, 1972 in Washington, D.C. The conference was sponsored by the Committee on Environment of the Atomic Industrial Forum. Authors of the report felt that papers presented at the conference were of two types, reviews of little help to those who keep current with the literature, and papers ordering social priorities, defining water quality and previewing new developments. Papers on rediological impact were lacking in the conference. Although the meeting offered no clear solutions to current problems, the meeting was worthwhile, especially if it had any impact on decision makers in the utility industry and governmental agencies. (BBM)

<663>
Goldstein, R.A., and D.F. Grigal 1972, July. Definition of Vegetation Structure by Canonical Analysis. Journal of Ecology 60, 277-284 (ESD #486)

The overstory vegetation on a 97.5-ha oak-hickory watershed was analysed with a combination of classification methods and the ordination method of canonical analysis. Canonical analysis was used not only to order groups of stands but also to compare different classifications. Four distinct types of vegetation were defined. Three of these types represent extrema in the canonical distribution of vegetation. They also represent extrema in ecological conditions found on the watershed. Although the fourth group does not represent an extremum, it is still unique from the viewpoint of species composition. The analysis provides a framework by which any portion of the watershed may be related to the entire watershed. It is reasonable to assume that similar oak-hickory watersheds may be related to each other using this framework. (Auth)

<664>
Macklin, C.E., and M. Witkamp 1973, January. Decomposition of Leaf Litter from Tulip Popular (LIRIODENDRON TULIPIFERA L.) Trees Defoliated with Cacodylic Acid. ORNL-TM-3507; 35 p. (ESD #487)

Applications of one-third, one, and three times the normal crown-kill dose rate of arsenical cacodylic acid were used to study the effects of the defoliant herbicide on the decomposition of leaf litter from stem-injected tulip poplar (LIRIODENDRON TULIPIFERA L.) trees. Data were collected weekly on carbon dioxide evolution, on litter breakdown, and on densities of fungal mycelia and invertebrate taxa associated with both treated and control litter. At the triple dose rate (2.157 g cacodylic acid per 2 in. DBH), the herbicide significantly decreased weekly measurements of carbon dioxide evolution from the forest floor. At both the normal dose (0.719 g per 2 in. Diameter Breast Height) and the triple dose, densities of entomobryid Collembola increased significantly, but there was a significant decrease in fungal mycelium densities. There was a pattern of instability in the densities of all faunal groups examined. Persistent trends were found for increasing effects with increasing dose rates of herbicide. Treatment with the herbicide had no observable effect on weight loss of the leaf litter, on fractional rates of weight loss (litter breakdown rates), or on overall rates of decrease in carbon dioxide evolution from late summer to midautumn. (Auth)

<665>
Witnerspoon, J.P., Jr. 1973. Radioecology. Part of Dalrymple, G.V., Gaulden, M.E., Kollmorgen, G.M., and Vogel, H.H. (Eds.), Medical Radiation Biology, W.B. Saunders Company, Philadelphia, Pennsylvania, 1973, (p. 250-257), 339 p. (ESD #488)

Radioecology is a disicipline which is concerned with the distribution and consequences of radiation and radioactive substances released to the environment. Sources of such releases may be natural (background), peaceful or military uses of nuclear explosives, and industrial or technological uses of radioactive substances. The consequences of releasing radioactivity into the environment depend on how ecologic systems (forests, lakes, fields, oceans, etc.) regulate the biologic distribution of radioactivity. Major study areas are (1) dynamics of radionuclides in food chains, (2) identification of pathways by which radionuclides may expose individuals or populations (including man) to ionizing radiation, and (3) determination of the radiosensitivities of living components of ecologic systems. In addition to considering radionuclides as pollutants, the radioecologist uses them as tools to determine structure and function of ecologic systems. This basic information is necessary for assessing the impact of nonnuclear technologies on the environment. (Auth)

<666>
Blaylock, B.G., and H.H. Shugart, Jr. 1972, November. The Effects of Radiation-Induced Mutations on the Fitness of DROSOPHILA Populations. Genetics, 72, 469-474 (ESD #489)

The change in frequencies of D. MELANOGASTER and D. SIMULANS in competition experiments was used to measure the effect of radiation on the fitness of a population. A dose of 250 or 500 rads given to the males of highly inbred lines of D. SIMULANS at the beginning of competition and every three weeks thereafter increased the relative frequency of the irradiated population. If the dose was increased to 1000 rads, the deleterious effects of radiation became too great a burden on the population, and the frequency of the irradiated population decreased. From these results it was concluded that below certain doses the introduction of radiation-induced mutations into a highly homozygous population would increase the fitness of the population. (Auth)

<667>

<667>
Hoffman, G.R. 1972, June. The Accumulation of Cesium 137 by Cryptogams in a LIRIODENDRON TULIPIFERA Forest. Botanical Gazette, 133(2), 107-119 (ESD #490)

The accumulation of cesium 137 in cryptogamic components of a tagged LIRIODENDRON TULIPIFERA L. forest at Oak Ridge, Tennessee, was determined in 1968. Within a 500 m2 study plot, tagged in 1962 with 467 mCi Cs 137, terrestrial bryophytes had accumulated 1.16 mCi, tree-base mosses 0.39 mCi, epiphytic lichens on main stems 2.52 mCi, and canopy lichens 0.16 mCi. The total, 4.23 mCi, is less than 1% of the total cesium 137 introduced in 1962, but the cesium 137 content of certain of the cryptogams was greater, on a unit dry weight basis, than tree foliage which represents the source of the radionuclide to the cryptogams. Terrestrial bryophytes receive all, or most, of their cesium 137 directly from raindrip from the overhead tree canopies, and epiphytes receive their cesium 137 from stemflow. Experimentally determined uptake efficiencies of cesium 137 were 92% for the terrestrial bryophyte mat (living plus dead), and 67% for the vertically oriented epiphytic lichens, most of which were foliose. Tree-base mosses plus their absorbent bark substrate absorbed 90% of the cesium 137 supply. Loss rates of cesium 137 by cryptogams were also determined experimentally. The interpretation of "uptake" (or "input") influences the calculation of loss rates. If uptake is considered to be the total supply of cesium 137 which reaches the cryptogams, loss rates will necessarily be higher than if uptake is that ammount of cesium 137 which reaches the cryptogams multiplied by an uptake fraction; the uptake fraction is determined experimentally. Elimination half-times are discussed in light of loss rate calculations. A computer simultion of cesium 137 accumulation by cryptogams from 1962 to 1969 was done to provide form to the process of accumulation by the cryptogamic components of the LIRIODENDRON forest. (Auth)

<668>
Burgess, P.L., (Ed.) 1973, February. Eastern Deciduous Forest Biome Directory. EDFB-IBP-73-3; 43 p. (ESD #491)

The directory for the Eastern Deciduous Forest Biome is presented for 1973. Research sites and participants, organizational charts, and an alphabetical directory of all personnel are included. (BBM)

<669>
Blaylock, B.G., and H.H. Shugart, Jr. 1972, November. The Effect of Radiation-Induced Mutations on the Fitness of DROSOPHILA Populations. Genetics, 72, 469-474 (ESD #492)

The change in frequencies of D. MELANOGASTER and D SIMULANS in competition experiments was used to measure the effect of radiation on the fitness of a population. A dose of 250 or 500 rads given to the males of highly inbred lines of D. SIMULANS at the beginning of competition and every three weeks thereafter increased the relative frequency of the irradiated population. If the dose was increased to 1000 rads, the deleterious effects of radiation became too great a burden on the population, and the frequency of the irradiated population decreased. From these results it was concluded that below certain doses the introduction of radiation-induced mutations into a highly homozygous population would increase the fitness of the population. (Auth)

<670>
Moulder, B.C., and D.E. Reichle 1972, Fall. Significance of Spider Predation in the Energy Dynamics of Forest-Floor Arthropod Communities. Ecological Monographs, 42, 473-498 (ESD #493)

Spiders were the most important entomophagous predators of a Cs 137 tagged LIRIODENDRON TULIPIFERA decomposer community. Radioisotope techniques were used to quantify the bioenergetic impact of spider predation on the forest-floor detritus food web. Temperature-dependent Cs 137 elimination by spiders and Cs 137 concentrations in field animals were used in intake-loss equations to estimate ingestion by the spider population. Radiocesium body burdens fluctuated seasonally in response to litterfall and seasonal differences in temperature and precipitation. Ingestion rates, assimilation efficiencies, and respiratory energy losses were used to estimate gross and net production of the forest spider population. Annual mean population density of spiders was 126 individuals/m2. Population-density peaks occurred in fall, early winter, and summer. Mean biomass for the year was 43 mg dry wt/m2; maxima occurred in early winter and spring. Spiders 1-10 mg in size accounted for 59% of total biomass; Spiders <1 mg n is greater than 10 mg comprised the remaining 24% and 17% of the population, respectively. Predicted values for ingestion, assimilation, and respiration indicate that forest-floor spiders were active throughout a temperature range of 5 to 20 degrees centigrade, with 13.3 the optimum for net production by spiders of all size classes. Spiders killed an equivalent of 2.08 kcal prey tissue/m2 per year. Trophic level efficiencies calculated from seasonal energy-budget data were: (1) intake efficiency (prey killed/ingestion), 73 to 86% (2) assimilation efficiency (assimilation/ingestion), 90 to 99%; (3) respiration efficiency (respiration/ingestion), 58 to 96%; (4) respiration/assimilation, 63-106%; (5) ecological growth efficiency (net production/ingestion), -5-34%; and (6) tissue-growth efficiency (net production/assimilation), -4-37%. (Auth)

<671>
Francis, C.W. 1973. Adsorption of Polyvinylpyrrolidone on Reference Clay Minerals. Soil Science, 115(1), 40-54 (ESD #494)

A set of experiments was carried out to elucidate the quantity and method of adsorption of polyvinylpyrrolidone (PVP) to reference clay minerals under various conditions. Of particular interest was the subsequent effect of PVP adsorption in the identification of specific clay minerals. Adsorption of PVP occurs in the interlayer regions of montmorillonitic clays but not vermiculitic clays. Monolayer adsorption occurs in the interlamellar region of cesium and alkaline-earth montmorillonites and probably double layer adsorption in the case of sodium and potassium montmorillonites. The isosteric heat of adsorption was calculated from adsorption data at different temperatures and concentrations. Infrared data were difficult to interpret and were inconclusive in determining if any specific chemical reaction was responsible for adsorption. In general, adsorption of nonionic polymers to surfaces is attributed to van der Waal's forces. (BBM)

<672>
Reichle, D.E., (Reviewer) 1972, June. Human Ecology. BioScience, 22(12), 385 (ESD #495)

A book review is presented for the book, Man and the Environment: An Introduction to Human Ecology and Evolution, by Arthur S. Boughey and published by the MacMillan Company, New York, 1971. The book conveys in very readable text fundamental ecological and evolutionary principles of human biology. The author coalesces a seemingly disordered array of concepts into logical patterns which leave the reader with new perspectives. The book is recommended for an appreciation of man's past and an insight into his future. (BBM)

<673>
Goldstein, R.A., and J.B. Mankin 1972. PROSPER: A Model of Atmosphere-Soil-Plant Water Flow. Part of Proceedings of the Summer Computer Simulation Conference held in San Diego, California, June 14-16, 1972, (p. 1176-1181) (ESD #496)

A phenomenological model was developed that simulates atmosphere-plant-soil moisture relations on a day-to-day basis. Evapotranspiration is conceptualized as occurring from a single surface of complex geometry which includes both ground and canopy surfaces. The soil is divided into several layers having different physical properties and containing different quantities of roots. The behavior of the model is illustrated by a simulation of moisture conditions on a 97.5-ha oak-hickory watershed for the year 1969. (Auth)

<674>
Johnson, W.C., and D. West 1973, April. Death is a Part of Life in a Memorial Forest. American Forests, 79(4), 8, 57-58 (ESD #497)

The Joyce Kilmer Memorial Forest located in western North Carolina is a virgin forest where cutting is prohibited by the U.S. Forest Service. In the December 1972 edition of American Forests, H. A. Miller expressed disapproval of the cutting moratorium. The authors of the article respond to Mr. Miller's remarks. They feel the real issue is that unmanaged wilderness including decaying logs and broken trees is desirable to a large segment of the population. Wood products can be obtained from managed forests. Both managed and unmanaged forests are desirable and necessary to serve the total needs of the population. (BBM)

<675>
Dunigan, E.P., and C.W. Francis 1972. Adsorption and Deadsorption of Cobalt 60, Strontium 85, and Cesium 137 on Soil Humic Acid. Soil Science, 114(6), 494-496 (ESD #498)

Adsorption, desorption, and retention of strontium 85, cesium 137, and cobalt 60 on a soil humic acid are described. A strontium-humic acid equilibrium is established quite slowly. It appears that adsorption is controlled by the rate at which other cations can be displaced from the acids. The effect of pH on radionuclide adsorption was investigated using solutions containing Sr 85, Co 60, and Cs 137. Although humic acid exhibited some buffering, the addition of increasing amounts of base resulted in an increase in the amount of adsorbed strontium. The opposite effect was noted with cobalt and cesium. Experiments were conducted to determine the ease with which adsorbed Co 60, Sr 85, and Cs 137 could be desorbed from the humic acid complexes by several 1N salt solutions. Results showed that more than 98% of Sr 85 was removed by each salt solution. Addsorbed Co 60 appeared to be bound more tenaciously than Sr 85, but the percentages of removal ranged from 91 to 99 percent. Varied results were obtained with the desorption of Cs 137. (BBM)

<676>

<676>
Bonner, W.P., T. Tamura, C.W. Francis, and J.W. Amburgey, Jr. 1970. Zonal Centrifugation - A Tool for Environmental Studies. Environmental Science and Technology, 4, 821-825 (ESD #499)

Although most separation techniques either destroy a component of interest or chemically alter the system, recent developments in zonal-centrifugation techniques, especially for biological systems, suggest several ways of separating environmental samples into their various components. The major problem is separating samples containing clay-size inorganic minerals by Z-C is flocculation, preventing individual component banding and other components from reaching their isodensity or isopycnic point. When the Z-C techniques is applied to a calcareous pond sediment, five distinct density fractions or bands are obtained. The technique also offers the possibility of concentrating and identifying minor components such as anatase and dolomite. This paper reports the results of laboratory tests and describes a satisfactory method for suspending and banding environmental samples containing clay minerals, with suggestions of possible applications of the described technique. (Auth)

<677>
Francis, C.W., G. Chesters, and L.A. Haskin 1970, July. Determination of Lead 210 Mean Residence Time in the Atmosphere. Environmental Science and Technology, 4, 586-589 (ESD #500)

Rainwater was filtered through a 0.22-u Millipore filter before radioassay of the resulting dust and filtrate fractions for Po 210. Lead 210 contents of the fractions were obtained by following the growth of Po 210 activity in stored samples as a function of time. At the time of rainfall, the Po 210 contents of the dust and filtrate fractions were approximately equal, but the dust fractions contained less than 3 percent of the total Pb 210. Polonium 210 and Pb 210 in the dust fractions were already in radioactive equilibrium at the time of the rainfall, suggesting that their presence in the dust was not a result of recent scavenging of Pb 210 from the troposphere. Ratios of Pb 210 to Po 210 used for calculations of mean atmospheric residence time for Pb 210 should, therefore, be those of the filtrate. From those ratios, a mean atmospheric residence time for Pb 210 of 9.6 days, plus or minus 20 percent, is obtained. (Auth)

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