DOCUMENT RESUME

ED 096 138 SE 018 040

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TITLE Man and His Environment (Environmental Workshop).
INSTITUTION Delaware State Dept. of Public Instruction, Dover.; Del Mod System, Dover, Del.
SPONS AGENCY National Science Foundation, Washington, D.C.
REPORT NO NSF-GW-6703
PUB DATE 30 Jun 73
NOTE 17p.

EDRS PRICE MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS *Curriculum Guides; *Ecology; Environmental Education; Instruction; *Instructional Materials; Science Education; Secondary School Science; Teacher Developed Materials; Units of Study (Subject Fields)
IDENTIFIERS *Del Mod System

ABSTRACT

This monograph presents what was originally designed as a nine-week course in population ecology. The course guide is intended to provide the teacher and student with a basic framework for an environmental workshop. Learning objectives are not listed, based on the intent that they be developed as teachers and students interact during the workshop. The curriculum guide does include: (1) a philosophy, (2) goals, (3) educational and instructional objectives, (4) instructional activities, (5) learning resources, (6) reading lists, (7) guide for field studies, and (8) a course evaluation form. Emphasis is directed toward population ecology, organization and dynamics of communities, energy flow and pollution problems. (EB)

MAN AND HIS ENVIRONMENT

(ENVIRONMENTAL WORKSHOP)

By

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June 30, 1973

Printed and disseminated through the office of the Del Mod Component Coordinator for the State Department of Public Instruction, John G. Townsend Building, Dover, Delaware 19901

Preparation of this monograph was supported by the National Science Foundation Grant No. G.W. 6703 to the Del Mod System, P. O. Box 192, Dover, Delaware 19901

NEWARK SCHOOL DISTRICT
OFFICE OF INSTRUCTIONAL SUPERVISORS
NEWARK, DELAWARE

MAN AND ENVIRONMENT*

Paula Henderson and Harry Dillner

I. Orientation (one day)

II. Population Ecology (11 days, total)

A. Definition and Measurement of Populations

1. A-T - Measuring Populations (one day)

2. Class activity (one day)

a. calculation of number of beans on classroom floor

b. discussion of examples of measuring populations (i.e. - Gallup poll)

3. Field Work (one day) Measurement of Dandelion population of school lawn

B. Growth Rates and Growth Curves

1. A-T (one day)
Measurement of per-cent growth rate

2. A-T (one day)
Biotic Potential and Growth Curves

C. Factors Influencing Population Size

1. Slide Inquiry (one day)
Predation - moose and wolves

2. A-T (one day)
Selective hunting - Kaebab plateau and deer population

3. Class discussion (one day)
"Scientific American" article on rats
American Chestnut
Walking Catfish

*This was designed originally as a nine week course for Christiana High School. Through the use of field trips and branching activities it can be adapted to fit the summer school pattern.

D. Human Population Growth

1. A-T (one day)

Interpretation of world and U.S. population growth

2. Class discussion (one day)

Family size; alternatives to population growth, problems associated with population growth

E. Review and Evaluation (one day)

III. Organization and Dynamics of Communities (13-14 days, total)

A. Major Terrestrial Ecosystems

1. A-T (one day)
Tundra and coniferous forest

2. A-T (one day)
Desert and grassland

3. A-T (one day)
Deciduous forest

4. Field Trip (one day)
Desert environment

5. Discussion Inquiry (one day)
Zonation on a jetty

6. Class Discussion (one day)
Film loops

a. Mountain trees
b. Grasslands and deciduous forest

B. Community Organization and Interaction

1. Two A-T's (two days)

a. Succession
b. Niche
c. Species diversity
d. Climax

2. Field Trip (one day)
Woods and field - Christiana High School

3. A-T (one day)
Use of compound microscope

4. Lab (one day)
   Termite Symbiosis

5. Class Discussion (one day)
   Commensalism, parasitism, symbiosis
   Film loops and slides

C. Review and Evaluation (one day)

IV. Energy Flow (five days, total)

A. Energy Patterns

1. A-T (one day)
   Energy Relationships

2. Worksheet (one day)
   Food web

3. Class Discussion (one day)
   Pyramid of Numbers
   Film loop

4. Class Discussion (one day)
   Marine Food Chain
   Slides and transparencies

B. Review and Evaluation (one day)

V. Pollution Problems (seventeen days)

A. Water Pollution

1. Class Discussion (one day)
   White Clay Creek slides

2. Lab (two days)
   Identification of organisms in pond and creek water using identification chart.

3. Lab (one day)
   Use of milipore apparatus to prepare coliform bacteria cultures

4. A-T (one day)
   Acid-Base Relationships
   ph of different water samples

5. A-T (one day)
   Test for phosphates
   Lab results of coliform test

6. A-T and Eq Index (one day)
   Water Pollution

7. Class Discussions (two days)
   Filmstrips "Causes of Pollution"
   "Results of Pollution"

8. Review and Evaluation (one day)

B. Air Pollution
   A-T and Eq Index (one day)

C. Solid Waste Disposal

   1. Class Discussion (one day)
      Filmstrips "Our Mountains of Trash"

   2. A-T and Eq Index (one day)
      Trash

D. Natural Resource Depletion

   A-T and Eq Index (one day)

E. Destruction of Wildlife

   1. Inquiry (one day)
      DDT Concentrations in Fallons

   2. A-T and Eq Index (one day)
      Disappearing Wildlife

F. Review and Evaluation (one day)

ENVIRONMENTAL WORKSHOP

Course Guide

Prepared by: Paula Henderson
Harry Dillner

A. PREFACE

This course guide is intended to provide the teacher and student with a basic framework for the Environmental Workshop. Day-to-day learning objectives are not included. It is intended that they be developed as teacher and students interact during the workshop. The following are included in the curriculum guide:

1. Philosophy
2. Goals
3. Educational Objectives
4. Instructional Objectives
5. Instructional Activities
6. Learning Resources
7. Reading List
8. Guide for Field Studies
9. Course Evaluation Form

B. PHILOSOPHY

The Environmental Workshop course is designed to assist students in understanding ecology by getting them out of the classroom into the natural environment of Delaware. Students can expect to get wet feet, dirty hands, aching muscles, and mosquito bites. Field trips will be taken to places such as White Clay Creek, Lums Pond, Cape Henlopen, and the C & D Canal. Specimens and data collected on these field trips will be taken back to the laboratory for identification, analysis, and interpretation. These field studies are designed to provide a basis for understanding ecological principles involving population dynamics, food chains, nutrient cycles, succession, and the structure of ecological communities. Man's impact on the natural system will be stressed. Films, individualized learning activities, and group discussion will augment the field studies.

The curriculum for this course is designed with enough flexibility to accommodate students with varying degrees of academic ability in grades 9 through 12. Students are expected to be able to work independently, have a desire to learn, accept responsibility, and behave with appropriate maturity and self-discipline during field trips and laboratory activities. All students are not expected to complete the entire list of instructional objectives. Some objectives are intended to be pursued by individuals working on independent research projects. Students are expected to keep a notebook in which they will record information about their research projects. The "Guide for Field Studies" will serve as a format for the notebook.

In this activity oriented course there will be no examinations or formal lectures. Attendance is required. Evaluation of student performance will be based on the successful completion of field studies and individualized learning activities. Students will evaluate the course using a course evaluation form. The evaluation will serve as a basis for course revision.

C. CURRICULUM GUIDE

GOAL NO. 1 To develop in students an understanding of ecological concepts and field studies

EDUCATIONAL OBJECTIVE NO. 1

To understand the structure and dynamics of fresh-water ecosystems.

	Instructional Activities	Resources
a. To describe the watershed concept.	Discuss and analyze a watershed map of the White Clay Creek area.	Watershed map of the White Clay Creek
b. To list and describe types of data which can provide meaningful information about a stream.	Class discussion.	Examples are given in Fresh-water Ecology by W. A. Andrews, Copyright, 1972, Prentice-Hall.
c. To conduct map and aerial photograph reconnaissance of a watershed to gain information about factors which affect water quality	Using topographic maps and aerial photographs of the White Clay watershed, trace the flow of the stream, describe the landscape, and identify human activities	U.S. Geological Survey Maps: Newark East Newark West West Grove Kennett Square Wilmington South Aerial photographs available from New Castle Co. Planning Office.

d. To conduct biological, geological, and chemical studies of streams.	Analyze water using chemical testing kits for such data as DO, BOD, temperature, phosphates, etc. (Field Trip).	Hach Engineer's Water Analysis Kit Water Analysis Handbook Copyright, 1973, Hach Co.
	Analyze water for bacterial content. (Field Trip).	Millipore Environmental Biology Kit. "Testing Water for Bacterial Pollution" by H. Dillner. (Unpublished).
	Collect and identify aquatic plants and animals (Field Trip)	The Life of Rivers and Streams by R.L.Usinger, Copyright,1967,McGraw-Hill. A Guide to the Study of Freshwater Ecology by Needham & Needham,Copyright 1962,Holden-Day.
	Measure stream velocity, volume of flow, sedimentation, and turbidity. (Field Trip).	Freshwater Ecology by Andrews Copyright, 1972, Prentice-Hall.
e. To identify and analyze land usage practices along the course of a stream.	Identify land usage practices in the White Clay watershed. Relate land usage to water quality.Determine projected land usage practices. (Field Trip).	Topographic maps, aerial photos. Visit to New Castle Co. Planning Office. Maps-"Greater Newark District of 1968" "New Castle Co. General Land Uses 1964" "Proposed Greater Newark Planning Dist. Plan 1985"

		"Trees, Woods, Urbanization, and You" by Catts, Jones, Longcore, Univ. of Del. Agriculture Experiment Station, Circular 3, Dec., 1966. "White Clay Dam-A rundown" Evening Journal, Aug. 12, 1971 "Dam Priority Defused by Stir" Evening Journal, Aug. 13, 1971
f. To analyze a variety of stream data to gain a comprehensive view of the watershed as an ecosystem.	Class discussion of acceptable pollutant levels, characteristics of healthy and polluted streams. Relate biological, geological and chemical data to land usage practice. Draw conclusions.	
g. To describe chemical and physical properties of water which affect pond and lake ecosystems.	Discuss, with the aid of diagrams, density properties of water, stratification, wind, currents, dissolved oxygen vs. temperature, etc.	Concepts of Ecology, by Kormondy, Copyright 1969 Prentice-Hall. Film - Nature's Way, The Inland Pond.
h. To measure various physical, chemical, and biological properties of a pond ecosystem,	On a field trip to a pond, repeat many of the tests which were used during the stream study.	Film - The Pond-Parts 1, 2, and 3. Delaware State Film Library.
i. To describe the water cycle.	Class discussion using diagrams.	
j. To describe causes, effects, and remedies for water pollution.	Case studies will be made on topics such as: eutrophication, thermal pollution, sewage disposal, industrial waste disposal, etc.	"The Aging Great Lakes" by Powers and Robertson Scientific American, Nov. 1966 Pollution in the Great Lakes Time-Life Filmstrip Series.

"Thermal Pollution" unpublished paper by H. Dillner.

Many references listed on the "General Reading List"

Film - The River Must Live

EDUCATIONAL OBJECTIVE NO. 2

To understand the structure and dynamics of marine ecosystems.

a. To describe the effects of chemical and physical factors on marine ecosystems.	Discuss using charts, maps, diagrams,etc. Salinity, temperature, waves, tides, currents, pH, oxygen concentration, etc.in Delaware Bay and adjacent areas.	The Life of the Seashore by W.H.Amos,Copyright,1966. McGraw-Hill. Marine Ecology by H.Moore, Copyrightm 1958,Wiley. Films-Beach,The-A River of Sand; World in a Marsh; Beach and Sea Animals; Marshland is Not Wasteland Living Tide;pts. 1,2,3
b. To trace the flow of energy through marine ecosystems.	Discuss food chains,food webs, the inverse relationship, and harvesting food from the sea.	Energy Transfer in Ecological Systems by R.G. Wiegert,Copyright 1970, Rand McNally.
c. To conduct chemical and biological tests on the marine ecosystem associated with the high-salinity, sandy-beach environment.	On a field trip to the Lewis-Cape Henlopen Area, test water samples for temperature, salinity, pH, etc. Also collect and identify marine organisms.	Hoch Engineer's Water Analysis Kit Hudrometer - Seine Collecting bottles Thermometer

d. To conduct chemical and biological tests on the marine ecosystem associated with the high-salinity rocky coast environment.	Conduct field studies at Indian River Inlet.	**Ecology of Intertidal Zones** by G.K.Reed,Copyright,1967, Rand McNally. "Zonation"-unpublished research by H. Dillner includes slides and transparencies.
e. To conduct chemical and biological tests on the marine ecosystem associated with the marsh environment.	Conduct field studies at the Canary Creek - Roosevelt Inlet Area near Lewes.	
f. To assess the importance of marine ecosystems to man.	Discuss such topics as recreation, food, transportation, and mineral resources.	Films - **Crisis in the Estuary** and **Endangered Shores**
g. To assess the impact of man on marine ecosystems	Discuss such topics as land development,ocean dumping, oil transfer, and dredging.	**Energy, Oil, and the State of Delaware** (Gaither Report) 1973 by Delaware Bay Oil Transport Committee "Showdown on Delaware Bay", Saturday Review, March 18, 1972.

GUIDE FOR FIELD STUDIES

I. Title of Research Project -

II. Description of Project - (Be specific - what is your goal? What data do you intend to collect? How will you analyze your data? What equipment and technique will you employ?)

III. Relationship to Class Project - (Explain how your project relates to the comprehensive project of the entire class.)

IV. Background Readings - (Summarize information from books, magazines, etc.,that pertains to your research. List titles, authors, dates, and publishers.)

V. Data Collected - (Record actual data and observations from field and laboratory studies.)

VI. Analysis of Data and Conclusions - (Explain any conclusions that can be reached based on your data.)

VII. Suggestions for Further Research -

EDUCATIONAL OBJECTIVES NO. 3

To understand the structure and dynamics of land ecosystems.	Class discussion with slides and movies.	**Ecology and Field Biology:** by Robert L. Smith, 1966 Harper & Row. **High Artic Bione** **The Grasslands** **The Desert** Delaware State Film Library.
a. To state characteristics of the following ecosystems:deciduous forest, coniferous forest,desert, grassland, rain forest and Savanna.		
b. To list environmental factors affecting ecosystems.	Discuss and analyze Ecosystems listed above emphasizing such factors as rainfall,climate,temperature, soil, light, and humidity.	
c. To conduct physical and Biological studies of the deciduous forest ecosystem.	Analyze evidence of Animal life (Field trip) Analyze Plant life Present (field trip)	**The Temperate Deciduous Forest**: Delaware State Film Library. **Concepts of Ecology**: by Edward J. Kormandy 1969, Prentice Hall Inc.
d. To describe the process of succession stating the order of stages and relative length of each stage.	Discuss examples through reading, film and group discussion.	**The Study of Plant Communities**: by Henry J. Doshing, 1956; W. H. Freeman and Co.
e. To describe factors influencing the succession process.	Analyze data collected at C&D Canal regarding soil, rainfall, temperature, climate, wind, and humidity (field trip)	**Succession-From Sand Dune to Forest**: Delaware State Film Library. Topographic maps and aerial photos.

		List plant life found at various locations at C&D Canal showing different stages in succession (field trip) List animal life present at C&D Canal (Field trip)	**Peterson's Field Guide to Wildflowers**
f.	To escribe dominance changes in the succession process	To conduct a population study of plants present at the C&D Canal comparing results to a past study and predicting future conditions.	

ATIONAL OBJECTIVES NO. 4		
To extend and expand study of interrelationships between man and environment.		**The Prospects of a Stationary World Population. Scientific American; March 1973**
a. to describe population growth and factors influencing it.	Analyze laboratory data of yeast and graphs presented in class.	**The Limits to Growth : Meadows et al: 1972 Universe Books; The Crisis for Survival; Morris H. Rubin, ed. 1970 The Progressive Inc.**
b. to assess the relationship between population growth and food production	Analysis through lab work reading material, films, and field trips to U of D experimental station	**Report of the President's Commission on Population Growth and the American Future.**
c. to assess the relationship between population growth and natural resource depletion	Analysis through reading material. Include discussion of the energy crisis.	**"Future Prospects for Energy-Sources and Uses" James Wei; 1971, U of Del.**
d. to assess the relationship between population growth and environmental destruction.	Analysis through reading material and discussion of such factors as air pollution, trash recycling and disposal, disappearing wildlife, climatic changes, etc.	**"The Closing Circle" by Barry Commoner and Paul Erlich; Environment, April, 1972 Air is for Breathing - A Shell Oil Film.**
e. to describe possible life style alternatives necessary to achieve a balance between man and environment	Discuss present research being done (trip to U of D experimental stations)	**"Mr. Forrester's Terrible Computer" by David C.Anderson; Wall Street Journal,Sept.,1970 Vital Views of the Environment by M.E.Hawkins, Ed. 1970 NSEA**
f. to describe the effects of population growth upon man as an animal.	Discussion and reading assignment.	**"Man into Superman": Time, April 19, 1971**