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Scope of Study: Conservation is a way of life. It must be introduced to students at a young age if it is to be a part of our educational program. A study, therefore, was made of the existing guides from the various states. A new guide for Conservation Education was written for junior high schools to use in the modern core curriculum as one unit of study. There was a need for an integrated program that would show the relationships among Conservation, Science, Social Studies, English, and Mathematics. Since few teachers are familiar with Conservation Education, there was also a need for a detailed guide for faculty and administration.

Findings and Conclusions: A new guide was written for Conservation Education. A complete introduction and purpose was given in the study, along with a history of Conservation Education, to acquaint the faculty and administration to the subject. The guide contains suggested in-service training for personnel, educational objectives, and evaluation of objectives. The course work is broken down into weekly objectives and suggested activities for Mineral Resources, Land and Soil Resources, Water Resources, Plant and Forest Resources, Wildlife Resources, and Human Resources. For each week, suggestions for an integrated program for Science, Social Studies, English, and Mathematics are outlined. The objectives in each case was to show relationships with a transfer of learning, and to develop a more democratic and conservation-minded youth. The very existence of man as a species, or his ability to hold dominion over all the rest of the animal kingdom, may well depend upon how efficiently our youth is educated toward a conservation-directed culture.

ADVISER'S APPROVAL James H. Zant

A GUIDE FOR A CORE CURRICULUM IN CONSERVATION EDUCATION FOR JUNIOR HIGH SCHOOLS

By

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A GUIDE FOR A CORE CURRICULUM IN

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JUNIOR HIGH SCHOOLS

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PREFACE

Conservation is the planned management and wise use of nature's resources. It aims, in cooperation with science and nature, to increase their quality, quantity, and availability throughout the years. Conservation is not merely a subject for school curriculum or for attention of game wardens and departments of the government: it is a way of life for all people.

This Conservation Education Guide is intended to serve as a realistic and useful instrument for junior high schools and their faculties in developing core curriculum units by using conservation education as a core for one unit of study.

The author wishes to acknowledge the assistance given him by his advisor, Dr. Frederick M. Baumgartner, whose efforts made this guide possible. The author also wishes to acknowledge Dr. James H. Zant, Director of the National Science Foundation at Oklahoma State University, for his guidance in this work.

The author also wishes to express his appreciation to the U. S. Department of Agriculture, The U. S. Department of Health and Education, the U. S. Forest Service, the U. S. Soil Conservation Service, the U. S. National Park Service, the Colorado Fish and Game Commission, the Michigan Department of Conservation and Department of Public Instruction, the Nebraska Education Association, the National Science Teacher's Association, the Canadian

Conservation Association, and the many other conservation agencies, fish and game departments, and state educational departments who so whole heartedly offered their research and literature to this endeavor.

Finally, I give my gratitude to my wife, Betty, whose encouragement and typewriting brought this guide to print.

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CHAPTER I

INTRODUCTION

The time has come for a revision of our conception of the benefits and responsibilities of holding dominion over all other created things. A new script is abroad as scientists and laymen realize that man and the rest of nature are united and indivisible. Mankind is welcome to dominate the other forms of life, provided he can maintain order among the relentless energies whose balanced operation he has disturbed. Our past is full of somber warnings of what happens when we fail to meet this responsibility. The evidence lies in the remnants of great civilizations buried beneath mud and sand.[1]

Only when we recognize that the study of all living things is a profoundly necessary human thought, do we reach the moment of truth. Then, we realize that we are part of a complex that stretches back to the beginning of time and reaches out on every hand to the boundaries of the universe. Everyone of us is an actor in a great drama in which each plays his part as both to cause and effect.

The forces set in motion by every act of every animal and

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1. "Conquest of the Land Through 7,000 Years", U. S. Department of Agriculture, Soil Conservation Service, Bulletin No. 99, Washington D. C., 1953, pp. 2-20.

bacterium, by every inch added to the growth of plant or tree, affect the lives of other creatures. The principles which govern these interrelationships are called ecology. In other words, ecology is the study of how the household of nature is kept in order and balance.

There are three good purposes for developing a workable curriculum in science education. These are: (1) our advancing technology uses up resources in increasing quantity, (2) our increasing population puts each year a greater pressure upon our living space, (3) our continued existence depends upon our keeping our natural environment productive for the essentials of life.[2]

In an address to the Toronto Field Naturulists' Club, A. F. Coventry said, "For a long time we have been breaking the little laws, and the big laws are beginning to catch up with us".

The purpose of this study is to develop a curriculum designed to show how nature maintains its balance. If the number of any living species tends to increase out of proportion, some force will arise to control it. There is an equilibrium in undisturbed nature between food and feeder, hunter and prey, so that the resources of the earth are never idle. Some animals or plants may seem to dominate the rest, but they do so only so long as the general balance exists.

These laws cannot be disregarded without disaster. Nature, which is our word for the total of the conditions and principles which influence the existence of living things, will not accept

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2. Fred A. Seaton, Conservation of Our Natural Resources, U. S. Department of the Interior, Bulletin No. 39, 1957, pp. 1-4.

ignorance of her laws as an excuse for breaking them. Nature's law does not command us to do, or to refrain from doing anything. It merely states that if a living organism does so-and-so, then the result will be such-and-such. If we wish to avoid disability, pain, and dissolution, we must attend this warning. Nature, like a good government, carries its checks and balances, and supply and demand mean survival itself.[3]

An effective curriculum embracing conservation education must then teach not only parts and pieces, but rather one must show relationships and a transfer of learning to each and every student. There must be shown the interrelationship between soil and water, plants and trees, importance of environment, effects of human acts, and how our youth can continue to learn, educate, and reeducate itself if it is to survive in the future.

Looking at each of these in its own proper perspective, one must derive the purpose of each. Therefore, let one first work out the place of soil and water in nature's mosaic.

Good soil is a living thing, and its health is a matter of life and death to plants and animals. What folly it is to call silver, gold, and gems "precious" and dirt "base". If there were as great a scarcity of soil as there is of jewels and precious metals, we would gladly give a heap of diamonds to purchase only so much earth as would grow a tiny violet in a tiny pot.

Soil is a changing thing. In the soil we find the laws of life itself: birth, growth, death, decay, and rebirth. Nothing

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3. An Outline For Teaching Conservation in High School, U. S. Department of Agriculture Soil Conservation Service, PA-201, (August 1952), pp. 8-9.

is wasted in soil. Everything nourishes something else until the bacteria return it to the soil. The roots of man's physical and mental health spring from the good earth.

What then is soil and its purpose? First it is rock, then rock particles, then a mixture of organic matter from dead plants and animals, and finally a community of living plants and animal organisms. Rats, insects, worms, and bacteria build fertility into it, while small mammals plow it and aeriate it. The soil becomes packed with organic matter containing the packaged energy from the sun. Soil then is the storehouse of energy itself.[4]

Water is essential to soil development, as it is, indeed, to all living things.

Movement is the essence of water, and the most damaging impact of civilized man on his environment is the shattering of this cycle of movement. The break is caused by the destruction of plant cover, removing the sponge-like texture of the complex topsoil--topsoil which, it is estimated, took five hundred years per inch to build. Breaking the water cycle has wiped out civilizations in Mesopotamia, North Africa, and elsewhere, but because of soaring world populations we have reached a new crisis. Never has the hydrologic cycle been so badly dislocated in the presence of so many hundreds of millions of people. Waste of water, including unnecessary run-off, or excessive use from any one place for industrial and domestic purposes, or for irrigation, can lower the underground water table, sometimes far away, and deplete

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4. Teaching Soil and Water Conservation, U. S. Department of Agriculture Soil Conservation Service, PA-341, (December 1957), pp. 2-20.

or temporarily exhaust the supply.

The primary means of increasing and maintaining water reserves is to protect and improve the plant cover on our watersheds. From these areas of drainage, the water is fed by run-off and seepage to surface and underground streams. The watershed problem is one of the red-letter problems of the day. Almost everything that has to do with renewable natural resources, with forestry, farming, hunting, fishing, and the economics of production, is tied up with the watershed.[5]

Let one then examine the place and purpose of plants and trees.

It is quite correct to say that all flesh is grass. Animals lack the ability to subsist on the simple elements in air, water, sunshine, and soil. To perpetuate themselves, they must eat grass or one another. The plant alone can turn inorganic chemicals into living tissue.

No one can deny, then, the importance of plant life to the continuance of the human race. Without that silent, endless manufacturing process which goes on in the green leaf under the influence of chlorophyll, sunshine, air, and moisture--the world's primal industry--we should surely die.

Every spring, nature's factory starts again to produce food, harnessing the sun's energy, and combining it with elements from air, water, and rock, with living tissue. From the roots, through the fibers, the sap runs up carrying the water and nourishment to every part of the plant, and in the inside part of the bark, it

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5. George E. Rotter, Problems and Progress in Soil and Water Conservation, Division of Supervision, Lincoln, Nebraska, 1959, pp. 20-34.

flows down, bringing the foodstuffs which the leaves have manufactured.

Forests are living societies of trees, shrubs, and other forms of plant cover. Although more than forty percent of our earth's surface is covered by trees, our people are becoming conscious of the need to conserve and expand our forest resources.

Conservation education must envisage the fact that all industrial nations pass through three stages in forest history. The first is marked by energetic and often ruthless exploitation of virgin forests. This is generally followed by a period of increasing dependence on foreign supplies. Then the third long chapter begins with the effort to rehabilitate or partially restore the domestic forest resources. It is our part, knowing more of the interrelationships of all nature, to repair the damage where we can, and to make sure that such things do not occur again.[6]

Let one now try to decipher the intricasies and the purpose of environment. What is environment, in the sense of "natural environment?" It includes all factors, natural and artificial, that affects the development of all living things. Life is a correspondent with environment. Different creatures seek different environments, but everything exists at a specific place under specific circumstances. As human beings, our greatest psychological asset is a sense of confidence in our environment.

The carrying capacity, which is the measure of the amount of life any area of land or water will support under given circumstances, may be altered from time to time by changes in conditions

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6. Effie G. Bathurst and Wilhelimina Hill, Conservation Experiences for Children, Bulletin No. 16, 1957, pp. 60-61.

caused by nature or by man's use of the area. These changes often lead to a precarious existence.

The creatures in the area may seem to be leading a static life, but our environment is not a museum display case in which petrified groups are forever removed from contact with nature. Something is always happening, and just a little change, a little more severity, a little more depletion, may bring to an end the existance of groups of all the population.

No one knows how many species during the ages failed to meet the challence of their environment. Records show 21,000 species of extinct vertebrates and even a larger number of extinct higher plants have been described.[7]

Today it is necessary for mankind to adjust its usage and to manage the earth's remaining resources more creatively if it is to survive. We see the warnings in the life history of every forest. Trees such as oaks grow so big that their own seedlings cannot survive in their shade; so the oak forest perishes and is replaced by shade-tolerant trees. Then, as long as the climate continues, this will remain a climax forest because these trees and plants have the ability to reproduce under their own shade. So must man adjust to his environment if he is to reproduce his kind and endure.

This then brings one philosophically to the point of the purpose and effects of human acts.

It is a curious commentary on our sense of values that

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7. Concepts of Conservation, The Conservation Foundation, 1955, pp. 36-38.

though we think of mankind as being the highest form of life; the other forms of life almost invariably go into decline wherever we take possession of a piece of the earth.

Civilized man has been more ruthlessly wasteful in his attitude toward the natural world than has served his material interests. The practical utility of land, water, and forests has been diminished seriously by our determination to allow them to serve no purpose but our own. This exploitation has led philosophers to say, "Everything seems to foretell that man, the last comer to this earth, will be the first to leave it."

Through the use of his intellect, man has to some extent escaped from the controls of nature. He has meddled with small parts of a machine of whose total design and purpose he was ignorant. He now faces the hard task of encouraging natural forces to work in restoration of the damage he has done.

Because of the danger attending ignorance, we need much more information about nature than we have yet gathered. Even well-meant efforts may bring disaster, as witness the experience with deer at Kaibab Forest. In an effort to increase the deer population, the authorities killed off the predators. The deer population leaped from 4,000 to 100,000 in fourteen years and sixty percent died of starvation since the land did not have such a carrying capacity.[8]

Thus, it is difficult to foresee the end result from often well-meant acts of human beings. Any act or change, regardless

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8. Arthur H. Carhart, Trees and Game--Twin Crops, American Forests Products Industries Inc., 1958, pp. 6-9.

of how large or small, effects some plant or animal and in the end affects the human race.

We need to realize the affects of hunting and fishing either as industrial or recreational. We need to realize the reasons for game and fish laws and the restrictions on pollution of streams.

Even now we are worried about nuclear fallout and dumping of radiating materials. This is just another influence by man that can have a far reaching impact on all living organisms.

As a summary to these purposes then to the development of a workable curriculum, we must try to develop at least a partial answer to the questions that have been opened to the educator.

Biologists are aware of the need to preserve nature's balance, and of the techniques, but only public opinion nurtured amid such scenes can make the application of these procedures effective. There is no automatic force in nature which will carry human beings forward irrespective of their own efforts. We need a new creed--to be stubbornly faithful to the facts of life; and a new determination--to contribute our effort in doing the right things.[9]

Our hope is in education. The problem is not as simple as two plus two, quickly answered and as easily disposed. This is a problem for statesmanlike people who take a long view; who look not at the next vacation, balance sheet, or next election, but at the future of mankind.

Since the beginning, the world has presented challenges to living creatures: to crawl out of the sea to live on dry land, to

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9. Fred A. Seaton, The Conservation of Our National Resources, Conservation Bulletin No. 39, 1959, pp.15.

climb trees and mountains, to change in keeping with changing environment. Every creature is to itself the center of its own universe, but it must have contact with all surrounding creatures. The challenge to us is nothing less than preservation of our species by restoring and maintaining its essential environment.[10]

We are surrounded by, and we are part of the eternal flux of life in an environment of natural forces, and living things of all sorts are our kin in the wholeness of nature.

If we wish, then, to preserve our present way of life we must come to terms with what is left of natural forest, soil, water, and wildlife, and it will be terms laid down by nature, not imposed by us. Any wrong which nature may for centuries commit, she has centuries to repair, but we, whose days are short, must walk warily lest we become the victims of the wasteland we make.

These are the purposes of designing a program for our junior high school that can encompass each student and teacher to a complete reality of his or her debt to nature. Each must realize that only with knowledge, understanding, work, and cooperation can our civilization endure the ravages of time.

The purpose of this study, therefore, is to develop a guide for conservation education at the junior high school level. To be more exact, the purpose is to develop a core curriculum by using conservation education as the core for one unit of study.

Many junior high schools are moving in the direction of allotting blocks of study time and combining the time and efforts

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10. Harold C. Bryant and Wallace W. Atwood, Research And Education in the National Parks, United States Government Printing Office, Washington D. C., 1936, pp. 54-58.

of several teachers to one general topic of study. Science, English, and Social Studies are especially applicable to core curriculum areas of study. Therefore, the author feels that conservation education becomes a natural unit for the core type of curriculum.

To develop such a curriculum, the main objective must be to show the relationships between man and nature. Such a curriculum must reveal that to subdue nature and to bend its forces to our will has been the acknowledged purpose of mankind since human life began.

CHAPTER II

HISTORY OF CONSERVATION EDUCATION

A complete history of conservation education would indeed entail volumes. Therefore, only a quick general look at its rise can be brought up in this paper.

If one accepts conservation education as a set of attitudes toward nature, life, and society, it becomes clear that conservation education consists of more than merely imparting a select body of information or a certain set of specific skills. It must be regarded not only as a vocational education in the sense that it prepares the learner for a specific job, but as preparation for a conservation-oriented way of living, resulting in the development of habits and attitudes and a point of view toward nature, life, and society.

If one defines conservation education within this frame of reference, it dates back to antiquity. We can find many references to it in the Bible, and we know that the ancient philosophers of Greece tried to impress some of its principles upon their students. Therefore, any history of conservation deals with ancient, medevial, and modern history.

This paper will attempt to give only a brief history of conservation education in this country.

Our country was settled chiefly by working classes of Europe. Here they found a people, the American Indian, who was a natural conservationist who killed only for food and clothing, and realized that his livelihood depended upon not despoiling his environment. He was part of the wildlife of the forest and streams and took only what he needed to survive. The colonist, however, wished immediately to change the environment to suit his European ideals of tilling the soil for economic and personal consumption. It is readily apparent why two such completely different philosophies of life should come to open war fare. These colonists, not given to abundance, were overwhelmed with plenty, and became wasteful and destructive from the sheer joy of consuming without limit. They lived until they used up one area, then moved on west to a new one.

The United States was predominately agricultural until after the civil war, then the growth of cities got under way. As the farm population came to be more and more at a disadvantage in the face of growing industrialism and the declining fertility of the soil in older settled areas became more apparent, it seems reasonable that the farmers should have petitioned the government to provide some educational assistance for agriculture.

The result of this petition was the Morill act of 1862 which created the land grant colleges. Thus, conservation education in the United States had its beginnings toward the end of the last century. It arose as one phase of the growing conservation movement, particularly in the field of forest conservation and management. Because of the spectacular nature of forest destruction then going on, public interest tended to center upon that

problem and to support public effort to ameliorate the condition. It was natural that those colleges and universities that were somewhat more interested in the classical approach to education than in trying to deal with the practical problems of the day should participate in the training of the necessary personnel. It is significant that the leaders of the budding conservation movement--persons who were speaking, writing, and exerting organizational effort to promote conservation--were often the same persons who were giving lectures and conducting investigational work in the interests of conservation in the colleges and universities.

It is not clear just where or when the first educational work in conservation was offered at the college level. Whether or not the botanist and horticulturists were the first formally to offer such work, they apparently laid a good foundation for it in a number of institutions. Such outstanding educators as V. M. Spalding at the University of Michigan, W. J. Beal at Michigan State College, S. B. Green at the University of Minnesota, C. T. Bossy at the University of Nebraska, H. H. McAffee at Iowa State College, and A. N. Prentiss at Cornell University were known to have incorporated some forestry instruction in their botonical, horticultural, and agricultural courses.[1]

The first four year collegiate course for training foresters was established in 1898 at Cornell University. The school closed at the end of five years with only seventeen graduates. The

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1. Charles E. Lively, and Jack J. Preiss, Conservation Education in American Colleges, The Ronald Press Company, New York, 1957, pp. 29-54.

college of forestry was reopened in 1910 and continued through 1936. At that time, it was incorporated under the Department of Conservation.

Gillford Pinchot, a name well remembered in conservation circles, taught a two-year graduate course in forestry at Yale University in 1910. The Pinchot family endowed the course. In the meantime the University of Michigan had established an undergraduate department of forestry in 1902 which was headed by the pioneer of American forestry, Gilbert Roth.[2]

The rise of soil conservation and its establishment as an integral part of educational offerings of American colleges and universities followed a pattern similar in certain respects to that of forestry, though at a somewhat later date. Perhaps some of the factors that help to explain this later development are:

(1) The rapid destruction of the forest resources by man constituted an event that tended to stir the imagination of the people more than the less spectacular process of soil erosion and of fertility decline. Also, the notion of exhaustibility of the soil had as yet scarcely caught on with the farm population generally.

(2) Soil science was still in its elementary stages even in Europe, where forest management was well developed. The first experimental work in soil in American colleges appears to have been carried on by men chiefly trained in Botany, Zoology, and other allied specialties.

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2. Charles E. Lively and Jack J. Preiss, Conservation Education in American Colleges, pp. 29-54.

(3) Early farmer demands for assistance with agricultural problems appears not to have been oriented specifically to soils. Agricultural experiment stations were not created until 1887 as part of the land-grant college system.[3]

Cattle raising in Arizona, Nevada, and Washington brought about overgrazing and subsequent soil erosion until in 1903 President Roosevelt appointed a commission on public lands and in 1904 the National Livestock Association agreed to such controls.

Enthusiasm for soil conservation came slowly. Little literature on the subject was produced until as late as 1928. In 1933, the CCC camps were created, and with the formation of the Soil Conservation Service in 1935, work in soil conservation leaped to the fore. By 1938, literature on soil conservation was multitudinous and without end. Soil conservation was finally firmly entrenched with the public.[4]

As compared with forestry and soil conservation, the conservation of wildlife, with its curricula for the preparation of specialists in wildlife research and management, is a latecomer to the colleges and Universities. Early conservation thinking centered primarily upon land and forest resources. Wildlife was by most people regarded in the light of a "fringe" subject. Also, wildlife was viewed chiefly from the standpoint of the sportsman, and although its growing scarcity might be deplorable from a

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3. Charles E. Lively and Jack J. Preiss, Conservation Education in American Colleges, The Ronald Press Company, New York, 1957, pp. 36-38.
4. Ibid., P. 50.

recreational point of view, the subject was given scant consideration at such levels as college teaching and research. It was assumed that wildlife would eventually disappear as civilization advanced, and all that could be done was to restrict the annual kill and put off the day of final dissappearance. The notion that science might be used to perpetuate desirable species of animals had not yet appeared.

With the birth of the conservation movement during the administration of Theodore Roosevelt, the notion of renewable resources came into being. Wildlife came to be regarded as a renewable resource, and game perpetuation became a "cause" for which to fight. Gradually the feeling of public responsibility for these resources took hold, and eventually science came to be recognized as the proper means for attainment of the conservation goal.

The earliest protagonists of wildlife welfare came from trained foresters who saw the ecological value of the wildlife. The society of American Foresters, organized in 1908, has exerted a strong lobby in this direction.

The U. S. Department of Agriculture's Division of Economic Ornithology and Mammology was established in 1885 and began to make studies of animal life in relation to agriculture. Stomach analyses were made, and liabilities or assets to farmers were computed. Thus, ecology got its start.[5]

During the 30 years following the turn of the century, such happenings as the growing scarcity of game, the establishment of

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5. Charles E. Lively and Jack J. Preiss, Conservation Education in American Colleges, The Ronald Press Company, New York, 1957, pp. 29-30.

wildlife refuges, and the notable contrasts between the thriving wildlife populations in the national forests and other refuges as compared to the wildlife populations elsewhere, not only sharpened interest in the problems of wildlife management, but tended to stimulate research as well. Still, little research was carried on by any but government agencies until after 1930 when wildlife conservation began to flourish. The sudden development can almost be attributed directly to one man, Aldo Leopold, who published his classic book on game management in 1933 after an extensive game survey of the middle west in 1928.[6]

Since 1930, public opinion and demand has continually put a greater pressure upon the colleges. This same pressure is being felt now in our elementary, junior high, and high schools. This pressure must be met with an adequate curriculum. Although conservation education is new, and at this time experimental, it will probably continue to expand until it is as well entrenched in our public schools as are the present three "R's".

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6. Charles E. Lively and Jack J. Preiss, Conservation Education in American Colleges, The Ronald Press Company, New York, 1957, pp. 53-54.

CHAPTER III

OBJECTIVES OF CONSERVATION EDUCATION

Education is a process of changing the behavior patterns of people. This is using behavior in the broad sense to include thinking and feeling as well as overt action. When education is viewed in this way, it is clear that educational objectives, then, represent the kinds of changes in behavior that an educational institution seeks to bring about in its students. A study of the learners themselves would seek to identify needed changes in behavior patterns of students which the educational institution should seek to produce.

The most useful form for stating objectives is to express them in terms which identify both the kind of behavior to be developed in the student and the content or area of life in which this behavior is to operate. If one considers a number of statements of objectives that seem to be clear and to provide guidance in the development of instructional programs, one will note that each of these statements really includes both the behavior and the content aspects of the objective.[1]

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1. Ralph W. Tyler, Basic Principles of Curriculum and Instruction, The University of Chicago Press, Chicago, Illinois, 1959, pp. 1-30.

From this frame of reference, the author has endeavored to set down the objectives to a workable unit of Conservation Education by using conservation as the core for a core curriculum.

GENERAL OBJECTIVES TO BE ATTAINED

A. Recognize the significance of the local community.

   1. Survey and use effectively all available local resources for improving community living.

   2. Study the home, neighborhood, and community in relation to the basic needs of people.

B. Develop an understanding of democracy.

   1. Appreciate our heritage of freedom.

   2. Understand the cultural and resource contributions of all nations of the world.

   3. Learn how to use democratic procedures in all activities.

C. Recognize conservation as a way of life.

   1. Recognize that freedom involves the inter-relatedness of human natural resources.

   2. Understand that the great variation in world food supplies causes social, political, and economic unrest throughout the world.

   3. Understand that man should maintain indefinitely the productivity of the land.

   4. Acknowledge that world-wide shifts and increases in population and resultant problems are related to survival.

   5. Understand that people are only one species of living forms existing in complex relationship with myriad other forms of life.[2]

D. Clarification of the fundamental concepts of conservation.

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2. Gerald E. Eddy, and Lynn M. Bartlett, Leadership Guide in Conservation Education, Bulletin No. 421, Department of Public Instruction, Lansing, Michigan, 1959, pp. 7-8.

1. The learning of tangible concepts broad enough to be developed and concrete enough to be taught.

2. Learning the true definition of conservation: wise use, management, and sustained yield.

3. Acknowledge that conservation is a stabilizer.

4. Acknowledge that conservation deals with the present as well as the future.

5. Recognize the six major natural resources and that any natural resource may be listed under one of these.

   a. Demonstrate an understanding of soils.

   b. Demonstrate an understanding of water.

   c. Demonstrate an understanding of forests, grasses, and other vegetation.

   d. Demonstrate an understanding of wildlife, including bird and aquatic life.

   e. Demonstrate an understanding of minerals.

   f. Demonstrate an understanding of the nation's youth.

CHAPTER IV

CRITERIA FOR EVALUATION OF A GOOD CURRICULUM PROCESS

The ultimate objective of any good curriculum program must always be better learning. This breaks down into the improvement in the scope and variety of learning opportunities on the one hand and the improvement of the quality of instruction on the other. Evaluation, however, cannot always be carried on through direct measurement of the ultimate objective. Consequently, it is necessary to set up a number of pragmatic criteria with which to examine any curriculum development.

Some of the criteria being currently employed to judge curriculum programs are stated in terms of rather pragmatic questions like the following:[1]

1. Is the conservation curriculum comprehensive in that it deals with the entire program of the community school and at the same time "broken front" in that it isolates certain problems of a high priority and moves to the solution of those problems, such as those relating to conservation and resource-use?

2. Is the conservation curriculum realistic, i.e., does it stem from the real nature of society with its persistent life problems; from the real nature of the human organism and its ways of learning and growing?

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1. Gerald E. Eddy, and Lynn M. Bartlett, Leadership Guide in Conservation Education, Bulletin No. 421 Department of Public Instruction, Lansing, Michigan, 1959, pp. 11-12.

3. Does the conservation curriculum tend to implement generally the democracy principle, i.e., does it seek to democratize the social life of the school, the teaching processes of the school, and the administration of the school?

4. Does the conservation curriculum seek to implement the package of findings referred to as child development findings by setting up new instructional organization, i.e., continuing primary unit where the teacher stays with the children for three years; or the development of basic and continuing case studies of learners to be passed on and used from level to level; or the development of the self-contained classroom, e.g., a room where one teacher has the total responsibility of children with the help of such resources from a school system and community as may be available, or a concentrated effort by several qualified teachers in a core curriculum?

5. Is the conservation curriculum cooperative in nature, i.e., are the decisions as what to work on and how to work on it made by the cooperative machinery of the curriculum program or by some functionary?

6. Does the conservation curriculum seek to round out the scope of service of the community school, i.e., does it seek to extend the school program upward and downward to meet legitimate learning needs of children and citizens? Does it seek to broaden the offerings of the secondary program to increase the holding power of secondary education through the meeting of all the needs of all the children?

7. Does the conservation curriculum result in effective professional growth in teachers?

8. Does the conservation curriculum develop leadership in your system?

9. Does the conservation curriculum tend to clarify the real purposes of education?

10. Does the conservation curriculum bring about more realistic evaluation of teaching efforts and of curriculum?

11. Does the conservation curriculum result in new instructional policies, new resource units, and new cooperative teaching plans?

12. Does the conservation curriculum show evidences which indicate the effectiveness of specific conservation learnings including the following:

a. Understanding the basic resources--natural, social, and human?

b. Understanding the problems created by various uses of resources?

c. Understanding the techniques for successful management for resource improvements?

d. Understanding how decisions and policies relevant to resource-use are made and administered?

e. Realization of subsequent changes in improved behaviour patterns by individuals and groups?

CHAPTER V

PLANNING FOR IN-SERVICE CONSERVATION EDUCATION PROGRAMS

Since core curriculums are new in many junior high schools and too few teachers are qualified in conservation education, careful planning must be carried out for an effective conservation unit. It would seem wise, therefore, to implement an in-service conservation education program for the entire staff previous to the conservation unit.

Since education is in a continuous process of change, it is necessary that curriculum methods and materials be modified with every new advance made. This means that teachers need the opportunity to study current research and analyze and exchange workable ideas on the methods of teaching conservation.

Many school systems have utilized various methods of in-service education as an aid to improve their instructional program. Teachers should be encouraged to enroll in conservation classes when possible. Programs of curriculum revision should be planned by administrators which include units of conservation and ways in which it can be integrated with other subjects. Arrangements should be made to visit and observe other schools where conservation is being used as the core of the core curriculum. One or more pre-school conferences should be devoted

to the teaching of conservation. Other methods which have been successfully utilized as techniques for in-service training are workshops, camping experiences, and field trips. Pre-planning for the initiation of such a program should be done primarily by local people who know some of the problems and the particular areas which need to be studied. Resource people should be involved in the planning of the program to help the local community in clarifying their problems.[1]

A planning committee needs to be selected which will decide on the time, place, general theme, kinds of publicity, and a detailed program for the in-service session. This committee should be composed of a member of the school administration, a representative of the State Conservation Department, representatives from colleges and universities, a county conservation worker, representatives from interested local organizations, and principal and teachers. Teachers should be chosen from the core staff and various grade levels.

The ideal situation for this type of program is to release time for teachers to participate. Time prior to the opening of school, before or after school hours, or Saturdays may be used. Funds for the expenses involved should be budgeted in advance by the school systems.

The best setting for this type of meeting is one which promotes accessibility to the out-of-doors. This would probably necessitate using cars or busses for transportation to local or

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1. Gerald E. Eddy, and Lynn M. Bartlett, Leadership Guide in Conservation Education, Bulletin No. 421, Department of Public Instruction, Lansing, Michigan, 1959, pp. 13-14.

distant places. Sportsman's clubs or conservation clubs have excellent sites for this type of session. Some clubs are willing to loan their clubhouses, grounds, and services for in-service programs. Meetings held in such places permit greater concentration and opportunities for field work. They also provide stimulating group experiences.

A varied program should be chosen after a general theme has been chosen. This may include several things such as demonstration teaching, lectures, field trips, discussion periods for exchange of ideas and underlying philosophies, films, studying resource materials and teaching aids, and a period for summarizing and evaluating the program.

The final program should include short-range and long-term objectives that are established to meet community needs. Topics to be studied in successive years need to be outlined. These topics should be of a local nature and related and integrated to all areas of conservation. It is important that this program be planned so that it is applicable and practical for classroom use.

Some method for the purpose of evaluation should also be arranged. This could be an evaluation sheet which would be filled in by each participant in the program, or a discussion period, or committee member observations. Results from this evaluation should be used in planning the continuous in-service program.[2]

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2. Gerald E. Eddy, and Lynn M. Bartlett, Leadership Guide in Conservation Education, Bulletin No. 421, Department of Public Instruction, Lansing, Michigan, 1959, pp. 13-19.

CHAPTER VI

THE CORE PROGRAM IN THE SCHOOL

Some subjects are much easier to integrate into a core program than are others. It is generally felt by most educators, especially at the junior high level, that Science, Social Studies, and English lend themselves the most naturally to the core program. Mathematics usually does not integrate too well but may be dovetailed into the program by the alert and energetic mathematics teacher. Many problems of a practical nature may be developed in this manner and produce a transfer of learning for the student. This is especially of value since the drop-out from school is often the heaviest at the termination of the junior high level. Therefore, mathematics should also be integrated into the core program if possible.

Science lends itself easily to the program. Here the students have a chance to identify and work with the various forms of nature. This is the classroom where they can develop their projects and start their research programs. In other words, the Science class may be called the "core of the core."

Social Studies, consisting of History and Geography, easily work into the curriculum. In these classes, may be taught the true meaning of conservation, the relationships to home, community,

school, and nation. In these classes, the student can learn to appreciate how conservation effects individuals, cities, counties, states, and nations.

English also tends to enter the conservation mosaic in many fascinating patterns. The ingenious English teacher can employ many outside readings, reports, compositions, and spelling lessons that will contribute to the entire conservation program and produce an interest in the students that will tend to carry on the program in a chain reaction.

With these generalities in mind, let one now outline a sample core program in which each of these classes are integrated into a complete block of conservation education.

The unit on conservation should cover at least a six-weeks period. Most of our school systems are set up to be administered in these six-weeks periods, and the six distinctive areas of conservation fall well into this pattern. More time should be spent in this area, but from a practical standpoint, knowing that other units must be taught, it would be well to spend the first week on mineral resources, the second week on soil resources, the third week on water resources, the fourth week on plant resources, the fifth week on wildlife resources, and the sixth week on human resources and evaluation.

It is plain to see that such a quick journey over that many areas takes the coordination of all teachers involved, but the block system of time alloted by a core program can indeed balance the time needed for a similar program taught in a single class.

B. Suggested Activities.[2]

1. Collect sample pieces of metals such as iron, aluminum, zinc, lead, chromium plated material, nickel plated material, gold and silver jewelry, silverware, or coins.

2. Collect samples of rock such as sandstone, limestone, shale, quartzite, rock salt, slate, marble, granite, and basalt. Schools may purchase rock and mineral samples.

3. Collect coal, a bottle of some liquid fuel (kerosene, fuel oil, or other petroleum derivation). Natural gas may be available in class. If not available, distill some crushed coal in a test tube and ignite the gas which is given off.

4. Compare outward appearance of samples of metals, rocks, and ores.

5. Scratch each specimen with a thumb nail, penny, and a file.

6. Strike each specimen with a hammer or bend.

7. Expose specimens to a flame.

8. Feel their surfaces.

9. Which materials have a shiny luster?

10. Which ones lend themselves to shaping?

11. Which ones break up into granular or dust materials?

12. Look at various samples under a microscope and determine their crystalline structure.

13. Test limestone with hydrochloric acid.

14. Group the materials collected and tested in three major categories: metals, non-metals, and fuels.

15. What are some of the problems in classifying minerals? Where would you place water? brines? uranium? petroleum? mercury? peat? limestone?

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2. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 1-29.

16. Locate a disintegrating rock. Break it and freeze part of it. Place the frozen portion of the rock in a bowl of hot water and soak. Observe the break up of rock. How does this show one of the purposes of soil making? How does the process compare with the processes of weathering? Compare the rock fragments with the untreated sample of the same rock.

17. Place a rotten rock under a faucet of rapidly running water. Observe what takes place. What physical process of weathering does this activity illustrate?

18. Discuss how atomic energy is produced and how it is used. What by product isotopes are now being used in medical practice and in industry?

19. Has atomic energy increased the life span of people? How?

20. Has atomic energy contributed to the development of precision machinery?

21. Has the use of atomic energy increased our use of other natural resources? How? Why?

22. If possible, visit an industry or institution that makes use of radio isotopes. Hospitals often use them.

23. Visit an atomic reactor if possible.

24. Invite an expert to discuss atomic research.

25. Obtain movies on atomic energy or atomic reactors.

26. Make a bulletin board exhibit on atomic energy.

27. Discuss the question of the need for atomic energy to have international controls.

28. Visit a scrap dealer and list the metals he buys. Find out who buys from him and why.

29. Study the process for manufacturing steel and note use of scrap materials.

30. Make a list of all the metals that are reused.

31. Why are batteries collected at service stations rather than by junk dealers?

32. Are there nonmetallics that can be reused?

33. Why don't we save tin cans and tinfoil during peacetime?

34. Why are the minerals used in paints, sprays, gaoline, and drugs not reusable?

35. Why is it necessary to employ different processes for beneficiating low grade iron ores mined in the United States?

36. How is copper extracted from mine tailings?

37. Plastics and fiberglass are substitutes for metals. List products that were once manufactured from metal that are now being made of plastic.

38. Abundant metals are often used to replace scarce metals. List some of these instances. For example--aluminum for copper, rhodium for chromium plating. Why are substitutes often developed during wars?

39. Bring into the classroom an old kerosene lamp. Light the wick and show how it burns clean; then turn the wick up high until it smokes. Notice the deposit of soot or carbon on the chimney. This was considered a waste produce for many years. Now a use has been found for it. Today carbon black is basic to the production of rubber.

40. What is being done in some areas with the gas that was once burned as waste? (Pumped back into the oil producing formation to maintain the pressure in the oil reservoir). Why is this a good conservation practice?

41. The mineral germanium was discovered in fly ash? What is fly ash?

42. Germanium is worth $250-300 per pound. It is used in making transistors. What are other uses for germanium?

43. What rare, minor elements are stored in coal?

44. What are some of the examples of the utilization of waste products?

    a. Cinders used in blocks.

    b. Oil sludge on dusty roads.

    c. Salt brine on roads for dust control.

    d. Fly ash in making building blocks and concrete.

e. Have the class construct and add to this list.

45. What are the common ores used in the production of atomic energy and where are the most prominent reserves located?

46. How do isotopes used as tracers work in plant physiology, plant and animal diseases, plant breeding, metallurgy, cancer research?

47. Discuss the ultimate source of all energy on the earth.

48. What are sources of energy yet unused?

49. Assuming that technology could find a way to put these potential sources of energy into immediate common use what economic and social complications would result?

50. Visit a chemical company's waste treatment plant and find how harmful wastes are removed, compliance with laws, and how industry cooperates in waste control.

II. THE SECOND WEEK--SOIL RESOURCES.[3]

A. Characteristics, distribution, and status of land and soil resources.

1. Geologic erosion is a natural constructive force fundamental to the building of soil.

2. Soil is formed from rocks by physical, chemical and biological processes.

3. As most soils age and mature, the layers of topsoil and subsoil become more distinct from parent material.

4. Soils are a combination of minerals, living organisms, organic matter, water, and air.

5. Some soils are made almost entirely of decomposed plant msterials with varying amounts of soil particles.

6. Soils differ in color, depending on chemicals, mineral compounds, the amount of humus in the soil, and drainage conditions.

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3. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 3-4.

7. Differences in soil texture are dependent upon the size of soil particles.

8. Soils differ because of the parent materials from which they are derived,

9. The water-holding ability of soil is dependent upon the size of soil particles and the amount of humus in the soil.

10. There is a variation in the availability of water and nutrients for plant growth in different soils.

11. Soils vary in their ability to support different kinds of plants and animals.

12. Land may be classified according to its capability.

13. Glacial action is largely responsible for extremely varied soil conditions.

14. Soil materials usually are eroded by wind, water and gravity.

15. Soil erosion is influenced by the type of soil, the amount of wind, the degree of slope of the land, the kind of cover on the land, and the season.

B. Suggested Activities.[4]

1. Do the streams and other formations in your area give evidence of geologic erosion?

2. Show the film "Earth's Rocky Crust."

3. Have students rub two pieces of sandstone together to see that as rocks rub against each other small particles are worn off.

4. Place a few pieces of sandstone in a heavy glass screw-top jar. Fill the glass with water and shake until small particles of rock break off and can be seen in the bottom of the jar.

5. Look for lichens on rocks. The honeycomb effect on the rock portion that was covered by the lichens may be easily seen through a hand lens.

6. Why is carbonic acid so common in nature? What is its source?

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4. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 29-58.

7. Observe a soil profile on a road cut or ditch bank or by making a hole in the ground. A fresh cut will reveal the layers more distinctly. Note the number of layers, the thickness and the color of the layers. More mature soils usually have distinct or well-developed layers.

8. Observe soil profiles in more than one location. Compare profiles in well-drained areas with those of poorly drained areas. Are they different? Sample profiles can be made by filling similar sized boxes or bottles with soil from the different layers.

9. Bring into the classroom a large shovelful of top soil preferably from the woods. Spread the soil out on a sheet of white paper the size of an open newspaper. Carefully sort the soil watching closely for living things. Place the different kinds of animal life in a bottle. You may find worms, grubs, snails, insects, spiders. Separate the soil particles according to size: coarse sand, pieces of rock, fine soil, nondecayed vegetation, and plants. Place a sample in liquid and observe through a microscope. How would a lack of any one of these materials affect the use of soil? In which materials are the minerals found?

10. Partially fill a pyrex bottle with seemingly dry soil and put the lid on the bottle. Heat the soil and note the drops of water which form inside the bottle. How does this water affect our use of soil?

11. Half fill a quart glass jar or similar container with soil. Fill with water. Note the air bubbles as they rise to the surface and form on the sides of the glass.

12. Take samples of peat, muck, loam and sand, burn in a kiln, in direct coals or with a blow torch. Observe which type of soil burns most quickly and most completely. Why did some soils burn longer than others? Do the combustible materials in the soil have any relationship to man's use and management of the soil?

13. Sift the coarser materials from equal amounts of peat, muck, loam and sand. Place these sifted samples in glass containers of the same size and add equal amounts of water to each. Shake the covered container thoroughly. Observe that more soil particles "settle out" from sand and loam than from peat and muck. Why did some soils settle more slowly than others?

14. Collect and compare some soil samples where much organic material and little organic material or humus is present. Which is darker? Why?

15. Collect several types of soil samples. Crush, then feel for comparison. A sandy soil will feel coarse and gritty when dry and will not form into clods when wet. Dry silt and clay soils, when crushed, feel smooth like cornstarch or face powder, have very little grittiness, are slightly cloddy and will retain the feeling of smoothness when wet. Clay and silt soils form lumps when dry but are sticky and gumbo-like when wet with a tendency to "ribbon out" and shine. Silt feels mealy and will not "ribbon out" or shine. Loam is essentially a combination of equal parts of sand, silt, and clay and has a combination of their characteristics. How do the differences in soil texture indicate the different types of soil? How does the size of soil particles affect the ease of cultivation, and the retention, and percolation of water?

16. Fill three funnels lined with paper filters or towels with dry sand, clay, and loam. Place the funnels in glasses in order to catch the water which runs through. Run identical amounts of water through the three funnels. Measure, at different intervals during the day, the water which runs through in order to determine the amount of water held by each of the different-textured soils.

17. Fill two identical jars one-third full of soil, one with soil from a fence row, the other from an adjoining cultivated field that has been farmed many years. Be sure that the soil is as dry as possible. Settle well. Fill the jars with water, using the same amount in each jar. When the soil is saturated, pour off and measure the water left standing on the top of the jars to see which type has absorbed more water. This can also be determined by weighing each jar originally and reweighing when saturated to measure the water obtained.

18. To see the increased water-holding ability of soil such as much or peat, weigh a piece of dry peat moss and record its weight. Soak the peat moss in water for an hour or so, and weigh again. This should absorb seven times its original weight. What does the water-holding ability of soil mean in determining the value or use of soil?

19. Take four large flower pots or cans and fill each one with one of the four following types of soil: (1) sand, (2) clay, (3) loam, and (4) muck. Plant

the same kind of seed in each pot and care for the plants through maturity. Observe over a period of time and the rate of growth and sturdiness of the plants as they develop in each type of soil. There are many ways to keep records of this observation. This activity can be followed up by taking a field trip and observing the plants that grow in the different types of soil in nearby areas.

20. Take a field trip, perhaps with your county agent, to see evidence of all types of erosion in the area. Occasions such as hard rain, a spring thaw, or a flash flood would give an opportunity to see erosion in action, with gullies forming, banks giving way, and streams getting muddy.

21. Watch wind action on a sand dune or see pictures of a sand storm. This kind of erosion goes on constantly, changing land contours. Often just looking out at your playground on a windy day will show that a great deal of soil is blown away by the wind. This can be demonstrated in the classroom by using an electric fan and letting it blow from a distance across a pan of dry soil. Discuss the effects of this type of erosion on topsoil after a long period of time.

22. Make a model ridge of soil on a board. Pack firmly. Pour water on it from a sprinkling can with a long, slender spout, or from a can with a small hole punched in the bottom. Observe how the portion of the soil on which the water is poured is worn away. This is how water erosion forms valleys. This can often be seen on or near the school grounds. A less extensive amount of water erosion can be demonstrated by observing the residue of soil left by a puddle after it dries, or by the amount of raindrop splash.

23. Place dry loam, sand, and muck in separate boxes or pans. Use an electric fan to simulate wind erosion, and observe the difference in amount of soil blown away. Tip the boxes slightly and pour identical amounts of water over them to see differences in amount of water erosion.

24. Use the box or pan of muck on a slope and observe the difference in carry-off between a gentle stream and a full-force stream of water poured over it. Use pre-moistened muck.

25. Fill two boxes or pans with the same type of soil. Arrange them so that one has a greater degree of slope than the other. Pour the same amount of

water gently over both. Observe the variation in the amount of soil carried away.

27. Experiment by planting the same kind of seed in different types of soil with known variations of fertility and observing the rate of growth over a period of time. Set up the experiment in the following manner: Place soil low in fertility in pots of the same size; in one pot place sterile soil along; in another place sterile soil but add sludge (sterilized residue of the organic bulk of sewage often sold commercially); in a third pot place sterile soil but add some type of commercial fertilizer suitable for lawns; fill the remaining pot with ordinary garden soil. Plant the same number of seeds in each pot and water with the same amount of water each time. Care for the plants to maturity. Observe and chart the rate of growth and sturdiness of plants in each of the different pots. Compare these findings. How does this experiment show that nutrients, which in most instances came originally from the soil, must be returned to the soil in some form?

III. THE THIRD WEEK--WATER RESOURCES.

A. Characteristics, distribution and status of water resources.[5]

1. All fresh water resources originate as precipitation in a very pure condition.

2. Water is a self-replenishing and self-depleting resource; it is intermittently replenished by precipitation and is steadily depleted by evaporating into the air and by draining away to the ocean.

3. The force of gravity is always pulling water down toward lower levels; in response to this pull, water generally exerts force.

4. Water tends to cling to earth particles and to spread through the earth materials by capillary attraction.

5. Water is unevenly distributed geographically and the quantity of water in any locality varies from time to time.

6. Water is a very active and mobile resource; it is hard to capture and keep it where it is wanted, or to keep it out of places where it is not wanted.

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5. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 5-6.

7. Water readily dissolves and carries away a wide range of substances and it picks up and carries in "suspension" particles of solid material.

8. Many aspects of water conditions and behavior are not readily apparent.

9. All phases of the "hydrologic cycle" are closely and complexly interrelated.

B. Suggested Activities.[6]

1. Collect rain water in a clean container. Boil samples of the rain water, tap water, and pond water in separate containers; two table-spoonfuls of each sample should be sufficient. Which sample left the least residue? Why? How does the pure water from precipitation become impure?

2. Try testing equal amounts of the different waters for chlorides by adding a teaspoon of silver nitrate solution to each. Pure water will yield no precipitate, but a white curdy precipitate will form if a chloride is present. Why is it important to use measured quantities? How do these tests relate to the principle?

3. Make a leak-proof drain plot. In it place sand about one inch deep, then cover the sand with sod. Make a ditch about six inches long at the outlet end. Place a dam across the outlet of the drain plot. Simulate "rain" on the sod until it is saturated and water forms in the ditch. Remove the dam which may be compared to the outlet of a stream, and watch the water drain away into a pail. Repeat another "rain". Observe. Discuss how these phenomena occur in nature.

4. Make the water (lake) evaporate from the pail, with or without the aid of wind (electric fan) or sun (heat source). Discuss how these events occur in nature, such as when the streets and yards drain and dry following a rain, yet are replenished after another rain. Observe the water cycle in a terrarium with a cover. Explain.

5. Demonstrate the response of water to gravity by activities such as: (1) Watching water tricle down

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6. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 61-88.

a window. (2) Pouring water into a pan. (3) Displaying pictures of waterfalls, mountain streams, meandering streams, deltas or hydraulic mining. (4) Watching it rain. Discuss: What did water do in each of these activities? Compare the variation of force of gravity as demonstrated in deltas, meanders and waterfalls.

6. Discuss the force of water in the destruction of dams, bridges and dikes. Focus the force of water from a hose or faucet onto a piece of sod. Observe the results. How is this principle used in hydraulic mining?

7. View the film, THE RIVER, and discuss the understanding as it relates to the film.

8. Mark a line one inch from the bases of two identical tumblers. Fill them with water to the level of the marks. Then fill the tumblers, one with friable clay, and the other with loam. Have the students observe the moisture movement upward and through the earth particles by capillary attraction. Mark the limits of the soils moistened. Have the students compare the speed of water movement in the two soils. What other soils might be used? How does gravity help to store ground water for upward movement of moisture by capillary attraction? How can capillary attractions be delayed to slow the loss of ground moisture?

9. Weigh a small tin full of freshly dug loam. Heat the tin and contents in a hot oven for one-half hour. Weigh again. Discuss: (1) What was the cause of the weight loss? (2) How does this experiment show that water clings to earth particles? (3) How can the water in earth materials be conserved for plant use?

10. Demonstrate that water will move readily even on a level surface. Show that water poured on a table top will thin out. Show that it is almost impossible to pick it up or to recover it.

11. Let a tumbler of water stand a few days in a room, or heat some water in an open pan. What happens? Why? What is the counterpart in nature? How does this activity illustrate the understanding?

12. Build a small earthen dam in a pan. Slowly overfill the miniature impoundment and watch for the effect of the water as it cuts through. How does this show that water is hard to capture? Discuss the problems that are encountered in the construction of dams. Which kind of soils hold water best? Have a student

devise a demonstration to show this. Can the water which escapes by evaporation be recovered easily? Discuss the problems of keeping water from the basements of dwellings where it is not wanted.

13. Obtain a jar of muddy water. Let the jar stand for several days. Sand, silt, and clay tend to settle out in that order. Pieces of organic material may rise to the top. Clay in suspension may "cloud" the water. Discuss the observations. Have the class examine some samples of the water under a microscope or bioscope. Are there plants and animals present in the water? How do they depend upon the ability of water to dissolve substances?

14. Demonstrate chemical tests to show the presence in the water of different dissolved mineral compounds as follows: (1) For a chloride test, add silver nitrate solution to a sample of the water. If a curdy, white precipitate forms which darkens after exposure to light, the sample contains a chloride. (2) For sulfate, add barium chloride solution to a sample of the water. If a fine white precipitate forms that does not darken in the light, the sample contains a sulfate. (3) For nitrate test, add freshly prepared ferrous sulfate solution (use distilled water prepared) to a sample of the water in a test tube. Carefully allow a few drops of concentrated sulfuric acid to slide down the inside along one side of the test tube to settle on the bottom. If a brown ring forms between the heavy layer of acid and the mixture above it, the sample contains a nitrate. (4) Discuss the effects of the minerals tested in relation to water use.

15. Obtain water samples from various sources: tap, lake, stream, eaves-trough spout, and distilled water. Point out that they all look the same regardless of source. Conduct simple chemical tests such as litmus to determine acidity, silver nitrate for chlorides, and the soap test for hardness. Prepare agar-agar cultures of each for indication of bacterial content. Discuss the observations. Were any of these discoveries apparent before testing? Why?

16. Obtain a copy of a local water-drilling record. Discuss the information it contains. Point out that none of this information is apparent from the ground surface. Discuss the important aspects of the information.

17. Have the class observe a stream or a picture of one. Discuss: (1) Can we tell by looking at it how much

water is flowing in it? (2) How high may it rise during flood? (3) How low does it fall in drought? (4) How much rain would it take to produce a two-inch rise in it? (5) Would this amount of rain on a wet watershed produce an equal effect on the stream as the same amount of rain on a dry watershed? On a flat watershed as on a hilly one? On a clay watershed as on a sandy one? (6) Why can we not tell these many important aspects by just looking at the streams?

18. Stand a glass tube of such length in a tumbler that it extends above the tumbler several inches. Fill the glass with sand, then add water to the top of the sand. Siphon the water from the tube, observing the water level. Discuss: (1) What happens to the surface water level? In nature how is the surface water replenished? (2) Would the increase in surface storage of stream water tend to increase the natural underground source in adjacent lands? (3) Would heavy pumpings from an underground reservoir that contributes to stream flow reduce the stream flow?

19. Make a sketch of the "hydrologic cycle" to show that water vaporizes from the seas, moves by winds, to condense on lands or seas, and thus returns to the seas again.

20. Plant bean seeds in three separate containers of dry soil. Water two of the containers. Observe the plant growth. Discontinue watering one of the plants to see what happens to it. Dig up the soil in the container that had no water at all to observe the condition of the seeds. What has happened to them? Why?

21. Put two inches of soil into two pans. Plant grass seeds in the soil. Water both plots until the grass has grown to a height of about two inches. Continue watering one plot but let the other dry out. Does this demonstrate that plants need water to continue growth?

22. Select two potted plants of the same kind. Water only one. Observe what begins to happen to the unwatered plant. Then continue to water both plants but place one where the temperature is much lower for a week. Compare the evaporation rate from the two pots. Which one needed to be watered more often? Why?

23. Put earthworms into two containers of sod. Let the moisture completely evaporate from one of the containers. Continue to add moisture to the other.

What happens to the worms that have been denied water? Why?

24. Heat a pan of soil to remove all the moisture from the soil. Plant seeds in it and cover loosely with transparent covering to allow sunlight in but to minimize atmospheric moisture. Simulate all other conditions for natural growth. Wait a few weeks. Why did the seeds not germinate? Point out the presence of sunlight and soil, the absence of water. Supply the same seeded soil with moisture for the same length of time. Discuss all the results and causes. Why is water necessary along with soil and sunlight to supply man's food, clothing and shelter?

25. Visit the water department to learn how the community uses water, to learn if industry is encouraged by ample supply, to learn how and where the water is returned, and to learn of future planned uses.

26. Trace the use of water through the manufacuring and processing of one industry's product in the local area. Study what happens to the water after it is used.

27. Class committees may make a dual watershed as follows: (1) Make a box about 6' x 4' x ¼'. Use a divider to make two equal compartments. (2) In the two compartments press chicken wire so that the two parts have almost equal contours. Make a depression along the middle of each to simulate a river into which depressed "tributaries" drain. (3) Place strips of paper, dipped in paste, over the contours to dry until a base for waterproof paint is laid. Water-proof the base layers. (4) With other strips, locate them so that gullies are formed and poor practices are indicated on one part by use of suitable materials. (5) On the other half construct check dams, terracing, etc., with mache or suitable materials. (6) Finish both parts such that one shows how water can be made to work and serve over a long period and the other shows almost immediate runoff, flood, etc.. Sponge materials, sphagnum, sand, clay, mosses, etc., are useable.

28. Select two flower pots of identical size in which put the same quality and quantity of moist soil. Plant a geranium in one; leave the other plantless. Now record the weight of each pot. For five consecutive days compare the quantity of water required and the frequency of watering the two pots to maintain like soil moisture. To insure accuracy add only enough water each day to bring each pot up to its original weight.

Discuss: (1) Which soil required the more frequent watering? (2) What happens to the water? (3) Where does it go? (4) Can this same water be readily used over again? Why?

29. Discuss: (1) What restrictions are placed on lawn watering during a dry spell? (2) What conflicts arise between consumptive and industrial use? Between consumptive and recreational use? (3) How are the conflicts resolved?

IX. THE FOURTH WEEK--PLANT AND FOREST RESOURCES.

A. Characteristics, distribution, and status of forest resources.[7]

1. The forest is a community of plants and animals in which trees are the dominant members.

2. Trees have distinctive characteristics by which they can be identified.

3. Trees depend upon water, soil nutrients, sunlight and air for growth.

4. Climate, soil, and topography influence the natural range and distribution of the different types of forest communities.

5. Forest communities influence their climate and their soil.

6. Forest litter, humus and roots give forest soils an exceptional ability to absorb moisture and resist erosion.

7. In the forest, some organisms are adapted to living in the forest soil, some on the forest floor, some in the undergrowth, and some in the trees.

8. Forests are constantly undergoing change, and as they mature and are harvested or die, some species of plants and animals may be replaced by others.

9. The interrelationships between the plant and animal members of forest communities and their environments determine the characteristics of a particular forest.

a. Each of the plants and animals which make up

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7. Important Understandings for Conservation Education, Bulletin No. 434, The Department of Public Instruction and The Michigan Department of Conservation, 1959, p. 8.

a forest community have an influence on it.

b. Forest communities influence the plants and animals of which they are composed.

10. Fires, diseases, insects, man, and animals may be harmful or beneficial to the forest.

11. Some lands are better adapted for the growing of forests than for other uses.

12. Forests have certain characteristics which make them attractive for recreational activities.

13. An expanding population and new uses for forest products and services make necessary more intensive multiple purpose management of forest resources.

B. Suggested activities.[8]

1. Have the class prepare a room display or permanent collection of leaves, twigs, bark, fruits, seeds, and nuts from their local community. A piece of screen or chicken wire makes a good foundation to which specimens can be fastened. Select and label the parts that most readily characterize the tree. Older children can construct a simple key for tree identification. Observe trees in the school yard or the adjacent community for typical shapes, color and texture of bark. Colored slides or pictures may be made for a permanent collection. How are these characteristics used in classifying trees?

2. Study a copy of the United States Forest Service Chart, HOW A TREE GROWS. Locate a newly cut stump or log, or bring into the classroom a section of cut log. Foresters or saw mill operators will cooperate to furnish log sections. Count the annual rings to illustrate lateral growth. Discuss: (1) How old was the section when it was cut? (2) What causes the difference between the spring wood (light color) and the summer wood (dark color) in the annual rings?

3. Count the whirls of branches on coniferous trees around your school to determine their age and to illustrate vertical growth. How many inches did the conifers grow in any one year? In which years did the trees grow most rapidly? In which years did

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8. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 89-124.

they grow most slowly? Older students can check Weather Bureau records to discover if there is a relationship between the size of the annual rings or the length of the internodes and the amount of precipitation in any one year.

4. If possible, trees or log sections from different sites should be observed and comparisons made between rates of growth on soils of high and low fertility, in crowded and open conditions, in wet and dry situations.

5. On a field trip compare a wooded area to an open area with respect to temperature, humidity and wind velocity. Wet and dry bulb thermometers will give temperature and humidity data. An anemometer or Beaufort Scale may be used to determine wind velocities. Discuss the differences observed between wooded and open areas. Study the use of trees as a windbreak and the effects of windbreaks on the land.

6. Visit a forest or woodlot which has not been used for grazing and which does not show signs of other serious disturbances. A dense stand of mature hardwoods is best. Dig a small trench two feet deep. Keep a clean cut along one wall to show the soil profile. In cutting through the fragile top layer, disturb it as little as possible. Observe litter, stages of decomposition of organic material and gradation into mineral soil below. Notice the odor, density, texture and color of the different layers of soil as they are excavated. Dig a similar trench on a grazed hillside, or in a recently burned woods. Compare the odor, density, texture and color of soil layers in the two situations. Also compare the depth of root penetration and the numbers of small animals found in the soil. Discuss: (1) How do plants and animals help to form soil? (2) What causes deepening of the organic layer of soil? (3) What factors might determine the depth of penetration of tree roots? (4) How does the character of the vegetation influence the kind of soil? (5) How does the type of soil determine the kind of vegetation growing in it?

7. On a field trip to a forest community observe whether or not the proportion of kinds of tree seedlings present indicates any change in the species which will dominate the community. Study the changes in forest communities where aspen forests replaced the white and red pine forests following logging and burning. What are the natural factors which would bring about

changes in forest communities? How does the changing nature of forest communities affect the ways in which man can use them? Can man manipulate and control the natural factors affecting changing forest communities?

8. Discuss and prepare a list of the chief enemies of the forest. List the causes of fire.

9. Visit a burned over forest area. Study the extent of damage to trees, soil, and animal life. Is new forest growth starting? What species of plants are growing there? Is any salvage possible? Is reforestation needed? Are there evidences of soil erosion?

10. Have a state or local forester explain the rehabilitation of a burned over area. Debate whether or not a forest fire always does more harm than good.

11. Write the following headings across the top of the blackboard: (1) sawlogs, (2) stumps, (3) slabwood, (4) sawdust and chips, (5) pulpwood, (6) sap, (7) gums and resins, (8) bark, (9) fruits and nuts, (10) roots. Starting with the first item, have each pupil in the class list one product derived from sawlogs, and continue in rotation in case of all ten items until they have listed all the products they can think of.

12. Have the class collect and make a display of as many products as possible which are derived from trees. From what part of a tree are the most products derived? The fewest? What products are usually derived from the following kinds of trees: white pine, red pine, jack pine, oak, maple, hickory, ash, birch, black cherry, walnut, aspen, and spruce.

13. Invite a representative of one or more wood-using industries to visit the class and explain how the company depends upon research to find new uses for wood and wood products, how research leads to the development of new products or improved products, and how formerly or presently wasted by-products of the sawmill (sawdust, chips, etc.) are being utilized. If possible, supplement the speaker's presentation with a visit to the industry or factory which he represents.

14. Have the students do individual or group research projects on the methods used to control one of the various kinds of forest insects and diseases which are a problem in your area. Does one kind of insect or disease usually attack only one kind of tree? How does this influence the programs of control?

How are insect and disease outbreaks detected? What are the characteristics of the various kinds of damage? How do the life histories of insects and diseases determine the types of control measures which are effective? What factors affect insect build-up and decline? What is biological control?

15. To demonstrate the effects of thinning, visit tree plantations where thinned and unthinned stands may be observed. If possible, have a forester accompany the class. Using an increment borer, take cores from some of the trees in each stand. Compare the growth rates by observing the widths of the annual rings shown on the cores. The cores may be taken back to the classroom, protected in soda straws where the annual ring widths can be accurately measured and the growth rates computed mathematically and plotted on a graph. Why didn't the trees in the unthinned stand grow as rapidly as in the thinned stand? What effect does thinning have on the quality of trees remaining. Does thinning of a stand result in the production of more wood per tree by the trees remaining? How do you select trees to be thinned? How does thinning affect the length of rotation in cutting?

16. To show natural pruning and the necessity for proper techniques in artificial pruning using a board with knots as a demonstration, discuss the formation of branches and their effect on the quality of lumber. Observe trees on the school grounds and in the school neighborhood and notice the way in which trees heal wounds where branches have naturally dropped off. Look for examples of artificial pruning in which a branch was cut close to the trunk and also examples in which a stub of the branch was left. Will the wound where the stub was left heal faster or slower than where the branch was cut close to the trunk? What causes tight or loose knots? How effective is natural pruning in producing quick healing wounds? Why does artificial pruning result in greater economic returns when the mature trees are harvested?

17. Plan a tree planting activity for the purpose of beautifying the school grounds, creating wildlife habitats, and establishing an outdoor laboratory for observation and identification. Or the planting might be for the improvement of school forests or other lands in the vicinity. Contact a local forester for recommendations as to where trees might be obtained. Visit a tree nursery to select the trees to plant and learn how they have been grown. Discuss the "do's and don'ts" to be observed in

planting trees as well as the reasons behind them. The actual tree planting might be used as part of a special Arbor Day observance. Why is it necessary to reforest some areas artificially by planting trees? Discuss planting objectives and selection of species for various site conditions. What insect and disease problems must be considered? Local private nurseries may furnish information on special selection, planting techniques, and the care of planted trees.

18. Visit an aspen or pine forest having predominantly large trees. Have the class survey the ground cover to determine what kind, and how many per small unit of area, of tree seedlings are starting to grow in the shade of the mature trees. Is the aspen or pine forest reproducing itself? What kind of trees are reproducing in the shade of the aspen or pine? When the aspen or pine forest is cut or dies of old age, what kind of forest trees are evidently going to replace them? Your conclusion should be based on your investigation of the young trees growing in the shade of the aspen or pine. Discuss the problems of natural seeding such as seed source, suitable seed bed and growing conditions, and competition. How does this project illustrate one state in forest succession?

19. Invite a forester to visit the classroom to discuss how volume and growth rates are measured, and the importance of these measurements in forest management. Also have him demonstrate the function of the tools which are used to make these measurements: increment borer, diameter tape, calipers, Biltmore stick, and volume tables. Diameter tapes, calipers and Biltmore sticks can be made by students and used in a cruising exercise to measure the volume of timber in a nearby forested area.

V. THE FIFTH WEEK--WILDLIFE RESOURCES.[9]

A. Characteristics, distribution, and status of wildlife.

1. Wildlife includes all wild animals used by man for pleasure or profit.

2. Wildlife is a living, and thus a renewable, natural resource.

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9. Important Understandings for Conservation Education, Bulletin No. 434, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 10-11.

3. All wildlife species have individual, specific living requirements, yet are interdependent with their total environment.

4. The carrying capacity of the environment for a particular species of wildlife is limited.

5. All species of wildlife are directly or indirectly dependent upon water and plant life.

6. Some species of wildlife have a high breeding potential, while others have a low breeding potential.

7. Populations of some wildlife species are cyclic.

8. Animals occupy and defend land for the same reasons that people do.

9. All animals possess protective instincts and other protective physical characteristics.

10. Some wildlife species are migratory.

11. Some wildlife species can, within limits, adapt themselves to a changing environment, others cannot.

12. Certain wildlife species, exotic to this country, may or may not be beneficial.

13. Wildlife is suceptible to disease and parasites.

14. Certain species of wildlife may become extinct while others may become too abundant.

15. Wildlife is a factor in the distribution of many plant species.

B. Suggested Activities.[10]

1. Collect specimens or pictures of local natural resources. Group and label according to renewable, nonrenewable and inexhautible types. Why is wildlife termed renewable?

2. Have pupils list the birds that live in: (1) open fields, (2) thickets, hedges and borders of woods, (3) within the woods, (4) marshes and lakes or streams, (5) on the ground, (6) near the ground in shrubs and trees, (7) high up in trees, (8) in cavities (holes) in dead, decayed limbs or trunks of trees, (9) in man

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10. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and the Michigan Department of Conservation, 1959, pp. 125-160.

made structures (buildings, bird houses, etc.). Which birds in the foregoing lists are primarily seed and fruit eaters? Which are primarily insect eaters? Which of these birds are predators? Scavengers? Discuss and group the birds on the foregoing lists according to their ability to adapt themselves to changes in their habitats.

3. Study and list the habitat requirements of mammals: (1) cottontail rabbit, (2) fox squirrel, (3) meadow mouse, (4) red fox, (5) muskrat, (6) beaver, (7) white-tail deer. Point out what the habitat must provide for the year-around needs of wildlife with respect to both food and cover. List elements in the habitat of each animal in the foregoing list that meets its needs for a year-around food supply, protection from extremes of weather, protection from enemies, den sites, reproduction and care of young. What are the critical factors which determine each animal's ability to survive in its habitat, or make it necessary to seek a more favorable location?

4. For a fish such as a pike, bass, trout, or bluegill, construct a food chain. Which are predators and which are prey?

5. Discuss the physical and climatic forces in nature which create, or destroy, or modify wildlife habitats. Discuss the activities of man which tend to disturb or destroy wildlife habitats.

6. Discuss the life histories of the bluegill and the brook trout. Discuss the following factors which may limit fish populations: (1) basic fertility of the water, (2) land use in the watershed, (3) water temperature and light penetration, (4) presence or absence of impurities or silt in water, (5) oxygen content of water, (6) character of bottom of lake or stream with respect to food organisms, spawning sites, and shelter, (7) aquatic vegetation, (8) predatory species. How do farm management, grazing of livestock, forest management, domestic and industrial pollution affect the carrying capacity of lakes and streams? Compare the fish carrying capacity of a lake with that of a pasture for livestock. What part may predacious fishes play in maintaining good bluegill fishing? Under what circumstances is restocking with hatchery fish advisable? Not advisable?

7. Make charts or displays to illustrate: (1) Habitat required for survival at all seasons by each species selected for study. Consider requirements for homes

(dens, nests, etc.), for escape from enemies while feeding or loafing. (2) Types of food essential for survival of each species at all seasons of the year. (3) Where and how each species survives in winter. (4) Ways of escape from enemies. (5) Number of young produced per litter. (6) Number of litters produced per year. (7) Age of the animal when first young are produced. (8) Average length of life. (9) Whether species is classes as prey or predator. What relationship evidently exists between life span and number of young produced per litter and per year? Why do prey species produce more young per year than predatory species? Define the technical expression "breeding potential." What would happen to a given unit of habitat if most of the young produced by a species with a high breeding potential survived to breed in succeeding years? Do the same principles apply in case of birds and fishes which have a high breeding potential? Illustrate with examples such as English sparrow, and bluegill.

8. Make a list of the things any animal gets from land. What relation exists between an animal's size, his method of locomotion, and the area over which he operates in the process of fulfilling his daily and seasonal needs? What does thetype of food the animal eats have to do with the area he uses? How does a carnivore differ from a herbivore in this respect? Does a carnivore need more land than a herbivore? When animals die what happens to their home range?

9. Track animals after a light snow. One class member or a small group of students may participate in this activity. (1) Track a rabbit. How much area does he use? (2) Track a fox. How much land does he travel over? Try to identify the track by some peculiarity shown in the track. When a new snow falls, track the fox again. Did he use the same area? What is the home range of the fox? (3) Track a weasel. Learn all you can about its habits, range, etc.. (4) Band bird fledgings; trap them the following year. Does the same bird come back to the same place? (5) Study a rabbit's home range; lay it out on paper with land area and cover types shown. After establishing home range, take a large group of 30-40 students and line them up on one edge of the home range and try to drive the rabbitt off its home range. (Dens must be located and plugged to prevent escape.) What happens when the limit of the rabbit's home range is reached? The same drive technique can be used with a deer except that a larger area will be involved.

10. Using 20 small mammal live traps, place them equidistant apart (50-100 feet). Bait the traps with oatmeal and peanut butter. Catch animals and mark them with some identification. Keep record of each catch. How many of the traps caught the same mouse? Can you limit the mouse's home range by the frequency with which it is caught and the area over which it is trapped? A vacant lot may be used to do this if the lot is large enough.

11. Does a deer use the same home range in winter that it does in other seasons? In the winter, take the class to a deer yarding area. Invite game specialists to accompany the class. Attempt to learn why deer come to a yarding area. Take the temperature in an upland area and in a swamp. Which is colder? Often the swamp is colder? Why do the deer come to dense cover?

12. Have individuals or groups of students study and report upon the protective characteristics of the following species of animals: (1) deer, adults and fawns, (2) fox, (3) snowshoe hare, (4) skunk, (5) opossum, (6) woodcock, (7) ruffed grouse, (8) pied-billed grebe (hell-diver), (9) katydid, (10) preying mantis, (11) wooly-bear caterpillar, (12) tomato worm, (13) tree frog, (14) toad, (15) turtle, (16) fishes.

13. Collect and display specimens or pictures of wildlife, insects, amphibians, reptiles and fishes which feature protective coloration and other protective characteristics.

14. Make a chart for recording observations of migrations. Record time of arrival or departure, whether they travel singly, in pairs, in small groups or in flocks or schools (as for fish). Do males and females travel together? What maneuvering is observed in preparation for departure or after arrival? What are the weather conditions? Promising migratory species include waterfowl, salmon, walleye, smelt, antelope, elk, western deer, caribou. What are some of the theories regarding causes of migration? Distinguish among immigration, emigration and nomadism. From a reference (encyclopedia) determine what is thought to trigger migrations. What is a "physiological clock"? What gives direction to migration? How has the "sun-compass" figured in determining direction?

15. Make a display of the seeds which attach to animals fur (hitch-hiker seeds), and seeds which are carried and stored by birds and animals (acorns and nuts). Make a permanent display of leaves, identify and re-

late to acorns and other seeds dispersed by animals. Plant a bird nest in a flower pot. Identify what grows. Discuss the effectiveness of this method of seed distribution compared to other methods such as: wind, water, and expulsion. How do animals limit plant distribution? Recall the potentially destructive effect of beavers, and browsing effects by other animals. Can you name any animals that distribute seeds by means of their droppings? How valuable is wildlife in this activity?

16. Consider the following questions for an interview with a farmer to find out what wildlife species have become harmful. (1) Have you suffered any damage from wildlife recently? (2) What animals and what crops were involved? (3) Did you attempt to control the animals and if so, did the damage stop? (4) Were other species involved? (5) Under what conditions does a species become harmful? (6) Are these species game animals? (7) What circumstances prompted these species to be harmful? Discuss the usefulness of these species. Relate this to the balance of nature. Do fishes ever become harmful? How about the snapping turtle?

17. Visit a trout hatchery, if possible. Ask a fish specialist to explain the program of trout propagation and stocking. Why are trout streams of today not producing enough fish without stocking? What are the factors which determine the suitability of certain species of fish to a particular habitat? Discuss improved hatchery practices, more efficient planting procedures, disease control, more effective regulation, and the watershed in relation to lake and stream improvement.

18. Secure information regarding private shooting preserves. Discuss this means of providing increased hunting.

19. Obtain four large bottles (preferably of two gallon size). Place approximately two inches of sand in the bottom of each bottle. Plant the same number of water plants which may be obtained from any store which sells goldfish and aquarium supplies in each bottle, fill each bottle with water, place two fish in each bottle. Label the bottles one to four. In number one place a snail; in number two drop a half slice of bread; in number three place 2 c.c. of toxic chemical such as tannic acid; in number four place a half pound of colloidal clay. Seal each bottle with a cork and sealing wax. Leave in sunlight. Do not disturb any of the bottles but the one containing

colloidal clay. This bottle should be shaken slightly several times a day in order to keep the clay suspended. Observe the changes that take place in the color of the water in bottle number two. What caused the color to change? How were the fish affected? How does the control bottle number one differ from two, three, and four in the appearance of the plants and animals? Keep a record of what happens and the time of observation of the experiment. Analyze the relation of the living requirements of both plants and animals in respect to what happened in each of the four experiments.

20. Have children construct some type of winter bird feeding station. Instructions can be secured from the local Audubon Society. Suet, coconuts or peanut butter might also be hung outdoors, preferably near a classroon window. Identify and discuss types of birds that visit the station. How is one helping the birds? What would happen after the eating habit has been established if you discontinued feeding them? Have any other animals visited the station?

21. Invite a member of the Audubon Society to discuss song birds that are protected by law. Discuss reasons for complete protection. Discuss banding permits which are obtained from the government. If possible, find someone in your community who has such a permit.

VI. THE SIXTH WEEK--HUMAN RESOURCES.

A. Characteristics, distribution and status of human resources.[11]

1. The individual is a prime consideration in the field of human resources; development depends on many factors: (a) interaction with other individuals; (b) interaction with social institutions; (c) interaction with the physical forces and facts of his environment; (d) the condition of the personality at a given time with reference to such factors as security, inhibitions, attitude toward learning and freedom.

2. The life span of the individual has been lengthened by the application of scientific knowledge and his health and comfort have benefited.

3. The tremendous increase in population has created considerable concern about the availability of enough

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11. Important Understandings for Conservation Education, Bulletin No. 434, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 12-13.

resources to meet the expanding needs.

4. The goodness of a culture depends directly on the many contributions of the people in it.

5. An individual may need re-education or specialized help because of physical disability, social maladjustment or mental limitation.

6. The diverse needs of individuals demand a variety of recreational opportunities, some of which are non-material and non-economic.

7. Religion and evolution are compatible.

B. Suggested activities.[12]

1. Plan and carry out a common project, the nature and complexity of which is adapted to the grade level; such as beautification of the school grounds, setting up outdoor laboratory, making a nature trail, or city planning. Activities can include various projects. Should the class choose to construct a model city, then the members of the class should confer and plan with school authorities, health and sanitation officials, conservation officials, members of the city council, members of the City Planning Commission, police officers and members of other institutions and agencies. In carrying out plans, the class takes into consideration various physical factors, such as climatic conditions, drainage, land slope, soil conditions, land use, existing highways, business districts, shopping centers, parking lots, streams or rivers, industries, schools, etc., dependent upon local conditions.

2. Relate the health curriculum to factors that cause health, comfort and longevity. What are the factors that make for comfort, good health and longevity and will increase these? Note accounts of epidemics, plagues, infant mortality, and long, crippling illnesses that were universal before these scientific advances.

3. Discuss the financial loss, emotional strain, and discomfort to family and individuals due to distresses. Compare the modern, almost universal feeling of well-being as a result of a better standard of living,

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12. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 161-186.

better health, more comfort and the reduction of feelings of fear when epidemics, accidents or other distresses strike.

4. Show that life span has been lengthened. Compare census figures for homes for the aged, and life insurance statistics on the increase of life expectancy. How has the span of life been increased? Search for reasons. Collect data. Study the work of the Public Health Department of your community. Present findings to the group, using all mediums to make them interesting and graphic.

5. What are some of the factors that affect longevity, health, and comfort? Investigate pharmacology, the wonder drugs, vitamins, antibiotics, hormones, endocrines, etc.. Study nutrition and food habits, exercise and their effects on health. Study the effects of the use of alcohol, tobacco and narcotics.

6. The average post sixty-five life is essentially wasted. If this could be reversed to even a neutral factor, there would be a vast impact on society. Do you have any Golden Age clubs in your community? How do they operate?

7. Analyze a classroom situation arising from an incident such as a youngster who became emotionally upset and discouraged over not being able to excell in a situation. Discuss with the class: (1) Who in our group has good ideas for us to work out? (2) Who helps us work out these ideas? (3) Who helps us by making very good art for our projects? (4) Who helps us with the arithmetic in our activities? (5) To whom do we like to tell our troubles? (6) Who is good at helping out when needed at home? (7) Who can run fastest? (Try to involve everyone in these answers.) What can John do best to help us all? (8) Would it be a very happy place if everyone were all alike? Why? What conclusions must we draw? (9) Do you think this would be true no matter where we were or how we lived? Why? (10) Then what are some things we must never forget when we are working with people wherever we are? How can John talk to himself next time he feels discouraged over lack of an ability?

8. Using Detroit's industrial economy, and the agrarian economy of the rural south, and the Chicago area as examples, list the resources which are not fully utilized. What are the percentages of unemployment in these areas compared with the national norms?

9. Survey the employment opportunities for your senior class in your area. How many will have to leave the community to find employment elsewhere, or to find additional training?

CHAPTER VIII

SUGGESTIONS FOR THE SOCIAL SCIENCE PROGRAM

I. THE FIRST WEEK--MINERAL RESOURCES.

A. Understanding the uses of minerals and their importance to man.[1]

1. The economy of all industrialized countries is dependent upon the use of minerals.

2. No industrialized country is self-sufficient in its mineral resources.

3. Today, minerals are our chief source of energy.

4. World trade, foreign policy and international relations are greatly influenced by the availability of minerals.

5. Most industries are directly or indirectly dependent upon minerals for preparation and manufacture of their products.

6. The location of industries is influenced by mineral deposits.

7. Changes in cultural patterns of society affect the demand for minerals.

8. New mineral uses often bring about cultural changes.

B. Understanding problems and techniques of management.

1. Large capital investments are necessary for extraction and processing of minerals.

2. Processing minerals requires considerable use of water and often creates waste disposal problems.

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1. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp.1-3.

3. Some minerals can be used repeatedly.

4. New methods of extracting and processing are needed to develop new mineral resources and to extend the supply of known minerals.

5. Benefication and related technological developments make it commercially practicable to mine low grade ores.

6. Renewable resources sometimes may replace, or be substituted for, scarce or expensive minerals.

7. When value warrants, minerals are reclaimed from industrial wastes.

8. Minerals formerly thought of little value are in demand as sources of atomic energy.

9. Energy sources change with progress in research and technological development.

10. Atomic wastes are causing particular concern because of their radiation hazards.

11. The development of mineral resources is a highly competitive activity that must adjust to fluctuating markets.

C. Understanding policy and administration.

1. Continuous refinement of exploratory techniques is needed to satisfy our mineral demands.

2. Industrialists assist in determining oil and gas policies and practices in the United States.

3. Industries are required by state and federal laws to control pollution of water resources.

4. The federal government has relied on trade agreements with other nations to obtain certain strategic minerals.

5. Depletion allowances are incentives which encourage mineral exploration.

6. In the United States, mining of uranium ore has been rigidly regulated.

7. Strategic minerals are stockpiled.

D. Suggested Activities.[2]

1. Color an outline map of the world to show known mineral deposits. Make a color key to show where the commercial minerals are found. Use color keys and cross-hatching for location. Suggested minerals are: iron, copper, silver, lead, zinc, molybdenum, chromium, diamonds, gypsum, nitrogen, uranium. What are the uses of each mineral? Why are iron and copper not fabricated where they are mined? How and why does the industrial use of minerals bring about better living?

2. Obtain reference material on the extraction of aluminum and magnesium. What are the most common ores from which aluminum is extracted? How common are these ores? Why is it necessary that cheap sources of electricity be available in aluminum manufacturing? What is the source of magnesium today? How much magnesium is present in a ton of its source material? What method is used for the extraction of magnesium? What is the present source of metallic magnesium? What is the chief waste problem in producing magnesium?

3. List the following minerals on the board: aluminum, antimony, chromite, copper, iron, lead, manganese, mercury, nickel, tin, tungsten, asbestos, barite, china clay, coal, flurospar, graphite, gypsum, magnesite, mica, nitrates, petroleum, phosphates, potash, pyrites, sulfur, talc and soapstone. Make a pictograph of the minerals imported. Use bar graphs to show the percentages imported and exported by the U. S.. Which are abundant in this country? Which do we export?

4. List the countries to which we export minerals. Determine what manufactured products and minerals we get from them. List countries from which we import minerals. What manufactured products do we send them? How do tariffs affect trade in minerals. Chart trade routes. Where are key mineral areas? In what ways have mineral deposits affected international relations?

5. Obtain a large map which shows principal highways and cities or draw a map on the blackboard. Mark the places where our principal mineral industries are

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2. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 1-29.

located. Compare your mineral industry map with a geologic map and discuss relationships observed. Locate and discuss the industries that are near or on the mineral deposits. Locate industries that are dependent on distant sources of minerals and their strategic location.

6. Have the students interview their parents, grandparents, and elderly neighbors to obtain information about the changes that have taken place during the past fifty years in the kind and amount of equipment or appliances used in the home, for travel, for farming, for food packing and manufacturing. Compare farm equipment of fifty years ago and the present day. Illustrate with pictures from old and present day magazines.

7. Information from the World Almanac and encyclopedias can be graphed to show increased use per capita of minerals over the past fifty years in the United States. Draw a pictorial time line to emphasize the trend of mineral use.

8. Write the Atomic Energy Commission for information on methods of waste disposal. What are the hazards? Costs? What are some of the future complications? What are the problems resulting from fall-out of atomic explosions? Obtain data on amounts of fall-out in the past ten years from experimental explosions? Where does the concentration of the fall-out occur? How do wind currents figure into this problem? What would be the result of a wide-scale atomic war?

9. Discuss how the petroleum industry works with agencies such as the Conservation Department and the Interstate Oil Compact Commission to make the best of our oil and gas supplies. Diagram the typical strata in an oil producing area. How is the gas pressure affected by the number of wells? What other factors affect the flow of oil? Why are regulations needed? (Consider: location of wells, casing, plugging and abandoning, pollution and fires hazard, and transportation).

10. Locate the countries of the world that are major producers of iron, copper, chromium, manganese, nickel, tungsten, lead, zinc, platinum and rhodium. Find out how self-sufficient the United States is in each of these mineral resources. How does the United States make trade agreements with other nations to secure the minerals we need? What is the relationship between our tariff and our trade agreements? What implications for world peace are there in trade agreements? How does the level of living of various nations relate to trade agreements?

11. Obtain a copy of the United States Government Organization Manual from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.. Determine the functions and services of the United States Bureau of Mines and the United States Geological Survey. Discuss the following: (1) What is the nature of the federal research program? (2) Why is the research program concerned with long-range planning for future mineral needs? (3) Does the program have any concern with the problem of safety in the mineral industry? (4) How much money does the government allocate on mineral research and exploration? What is the source of this money? Compare the amount of money spent by the government with the amount private industry invests in research and exploration. Use figures from trade journals to illustrate in graphic form. List some tangible results from specific research projects.

II. THE SECOND WEEK--LAND AND SOIL RESOURCES.

A. Understanding the uses of land and soil and their importance to man.[3]

1. Soil is a basic resource, a fundamental heritage of man.

2. Soil supplies man's food, shelter, and clothing.

3. The welfare of people is affected by the way the land is used.

4. The erosion and misuse of productive topsoil has helped to cause the disappearance of some nations.

5. A change in the fertility of surface soil has caused a shift in population.

6. Fertile soil was partially responsible for the pattern of development and the speed of advancement of civilization.

7. Man brings previously uncultivated lands into agricultural production by irrigation, drainage or removal of forests.

8. Land may be used for various purposes, such as forests, agricultural crops, grazing, recreation and building sites.

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3. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 4-5.

B. Understanding problems and techniques of management.

1. Conservation practices begin with man and his use of soil.

2. Man may accelerate or retard erosion.

3. Man must build up soil and supplement the nutrient materials in the soil if production is to be maintained.

4. The characteristics of each acre of land may be different and should be studied to determine what use should be made of it.

5. Soil, water, wildlife, and vegation are interdependent.

6. Some good agricultural land is taken out of crop production for man's other needs.

7. Sound soil-management legislation is essential to the success of a soil conservation program.

C. Understanding policy and administration.

1. People are becoming increasingly concerned about proper land management.

2. A comprehensive program of administration of land and soil resources requires research and study.

3. Good citizenship obligates one to be informed about land management policies, and to act accordingly.

4. Wise use of land requires cooperative planning and administration.

5. Zoning and planning are methods man uses to define and adjust himself to proper and varied land use.

6. A high-level of soil productivity through economic application of effort and energy is necessary to provide food, clothing and shelter for the tremendous increase in population.

7. In certain instances, landowners may more effectively improve land use practices by working together.

8. Incentive payments, loans, income tax deduction, and technical assistance are used by government to encourage soil conservation.

9. The use of some land should be restricted to grazing, trees, wildlife, or recreation.

10. Administrative agencies have the responsibility to help determine which lands should be dedicated for public use.

11. Crop surpluses have caused the government to pay for temporarily taking land out of production.

12. Soil is a very complex physical, chemical, biological system, and much more money is needed for research.

D. Suggested activities.[4]

1. There are many evidences of glacial action in the United States such as moraines, drumlins, eskers and kames, composed of sand, silt, and gravel. See how many of these can be located in your county and locate on a map.

2. Obtain from the county soil conservation office a map of a farm that will show a variety of soils. Why is there less variety in types of soil in the southern states of the United States? What effect has glaciation had on soil production in various sections of the United States?

3. See the twelve minute film CHILDREN MUST LEARN. Discuss the ways that the land affected the welfare of the people in the film. Have students list the ways that they and members of their family use the land. This activity can be extended to the community. Possible uses include: home sites, gardens, farms, parks, factories, roads, abandoned farms, shopping centers, ghostowns, parking lots, woods, forests, cemeteries, resorts. How does the use of the land affect the class members and other people of the community? Could the land be used differently?

4. Read to find out about some of the ancient civilizations of the world such as China and the Indians of Central America. Read about the fertile soils and their distruction in relation to these civilizations. Help the students to explore the hypothesis that fertility often caused the people to be so content with what they had that they progressed only to a certain point and there they remained. In other sections of the world the lack of fertility in the soil helped to speed up man's advancement because he was seeking

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4. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 30-58.

better ways by which he could improve his soil and agricultural methods. From this data make a pictorial time line or frieze showing the sequence of development of agricultural tools and machinery. How did the invention of agricultural tools and machinery help in the advancement of civilization?

5. From your social study readers, map sets and films, learn about the early pioneers' use of the land and how they "cut down, wore out, moved on" to more fertile areas to repeat the same pattern. Make a territorial expansion map showing the migration westward to the rich Ohio Valley. A puppet play could demonstrate this. How did this pattern affect the development of our country?

6. Secure a map of your county. Using colored crayons, indicate various land used in your county. See if you can estimate the percentage of each use. How do uses such as building sites, highways, and airports, compare with agricultural and forestry uses? How much land is available for several uses such as forestry and recreation?

7. Observe that increased human activity and our increasing population are demanding more land for such things as highways, airports, seaports, bridges, urban settlements, school sites, cemeteries, factories, recreational areas, artillery and airforce ranges and reserved atomic use areas. Make a survey of use changes in a local area to determine how much crop land has been taken out of production for other needs.

8. Trace the history of the soil conservation movement in the United States with particular attention to men such as J. W. Powell, Theodore Roosevelt, Gifford Pinchot, James Garfield, Charles R. VanHise, Hugh Bernnett and Franklin D. Roosevelt. Note the length of time that passed between recognition of the problem and legislation passed to assist in solving the problems. Note too, the conflict of interests of the individual who tries to decide what is good for society. What factors are useful in deciding sound legislation? Discuss the relative significance of the cultural, economic, physical, sociological, and political factors affecting legislation? Are there other factors?

9. Prepare a list of colleges, governmental agencies, industrial organizations and others engaged in agricultural research as it applied to conservation of land and soil. Secure information concerning current problems of research, including the nature of the

research and the person or persons involved. Set up teams to present and discuss the findings to date. They may be able to prepare charts, graphs, pictures, etc..

10. Secure a farm conservation booklet from the local Agricultural Stabilization and Conservation office which is usually located in the county seat. This booklet will list and describe all incentive payment programs. Payments are on the following: Wildlife, pasture improvement, liming, fall cover crop, pond construction, and fertilizing hay. Find out which ones apply particularly to your area. Investigate how the Farm and Home Loan program operates in your county. Do payments serve as an incentive for soil conservation? How are loans secured?

11. Interview your county agricultural agent and local farm planner and find out the scope of their work and the assistance they give or can give to the local community. How can we and our community use to a better advantage the technical assistance available to us?

12. Secure a county map and block out all areas which have been set aside for public use. Group these in lists indicating their primary use. Have various individuals or committees investigate the history of different areas to see why they were dedicated to public use and how they were acquired. Do you feel these uses are currently justified? Secure a copy of a state highway map showing areas of public ownership. Make a similar study of some of these areas. Do you think the state has enough land dedicated use, or too much? How have land uses changed in the areas you studied? Were the areas ever used for crop production?

III. THE THIRD WEEK--WATER RESOURCES.

A. Understanding the uses of water and its importance to man.[5]

1. Water is indispensible for plant and animal life, and varies with climatic conditions.

2. Water takes its place along with soil and sunlight in making the earth yield to the needs of man.

3. Water has various recreational values.

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5. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 6-7.

4. Water acts as a powerful natural force with potential good or harm to man.

5. Demands for water are increasing at a greater rate than the population growth.

6. The supply and availability of water at any given locality is variable and does not always equal the demand.

7. Water gives varied and repeated services.

8. In any location, the ease of water's availability tends to influence the use that is made of it.

9. The wisdom and foresight with which a water resource is used may importantly influence the extent to which it can be used.

10. The usefulness of water at any location may depend importantly on how adjoining and upstream lands are used.

11. Consumptive use of water is increasing and creating shortages for other purposes.

B. Understanding problems and techniques of management.

1. Control of pollution is an essential aspect of water management.

2. Certain land management practices help to reduce the flood waters and silt that small streams empty into rivers and lakes.

3. Transporting and storing water to meet increasing needs require expensive management techniques.

4. The increasing demands for water and the conflicting uses of water require cooperation and coordination among water uses.

5. Stabilization of flow of streams and the levels of lakes enhance their usefulness.

6. Flood control involves many different types of management techniques.

7. Complete management of water is seldom feasible except on a very small area. To a large degree we must adapt our water uses to natural conditions of water.

8. Safety problems increase as more people use water for recreation.

C. Understanding policy and administrative techniques.

1. Water resources are so important and the problems are so complex that much study and research are necessary.

2. Because water resources recognize no state, county, township or municipal boundaries in their occurrence and travels, it is important that all units of government be given maximum opportunity for cooperating to solve mutual water management problems.

3. When state water rights legislation is agreed to be necessary, the basic common law principles that now govern must be considered.

4. In planning expanded water use, it is important for all groups that may be affected by that expansion to participate and cooperate in the planning.

5. Good public understanding of water resource problems, possible solutions, and management are extremely important.

D. Suggested Activities.[6]

1. Develop these ideas: (1) That the amount of water on the earth's surface varies as to the location and time. (2) That some areas have a plentiful supply of water. (3) That some areas, such as bogs and swamps, have much water. (4) That other areas, such as deserts, have little water. Have the students color the seas, oceans, or inland waters on maps. Locally, a county map might be obtained from the county highway department to accent local water distribution.

2. Take a trip to observe evidences of water having been at a higher level in lakes, ponds or streams. Discuss: (1) Why is it important to know that the water is not distributed equally over the earth's surface? (2) Why does the quantity of water vary from time to time at any one locality? (3) What problems might develop from unequal distribution of water? How can they be solved? (4) What benefits might be derived from unequal distribution of water?

3. Survey the water recreation possibilities of the

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6. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 59-88.

local area. Pin point this information, numbered with a key, on a large map. Provide materials for the class to study and discuss: (1) Why is it important for this community to be aware of the value of its water resource? (2) Does this community make good recreational use of this resource? In what ways? (3) Is a community near a lake or river more attractive to tourists than one not so located? Why? (4) Are there areas that plan their economy around water recreation attractions? If so, in what ways are the plans effective? (5) In what ways do you use water for recreation and enjoyment?

4. Make a bulletin board display to show water as a friend or foe of man. Include illustrations of the following: (1) Friend: develops electric power, moves logs, moves pulpwood, washes leaves, moves wastes. (2) Foe: erodes river banks and beaches, cuts gullies, rain-packs or washes away topsoil, destroys bridges, dams and sea walls.

5. Secure a map (county or state). Back it with firm material, then cover it with clear plastic (storm window plastic) on which a cellophane pencil will mark. Have the students locate and mark with red the cities and villages in a selected area. Use a blue cellophane pencil to connect each city site with its water supply source. Study and discuss: (1) The proximity of water supply to the community. (2) The density of the communities in relation to the water source. (3) Present water supply in relation to projected future needs. (4) Quality factors such as hardness, mineral content, bacteriological content, as related to use. (5) The comparative size of two communities as related to the availability of water. (6) The comparative use of water of those two communities as related to growth. (7) The use of water in the early years of those communities; reason for site development. (8) The availability for recreational uses.

6. Divide the class into groups to study the effect of water use upon man's advancement: (1) In social development take a field trip in various sections of the area to compare the relation between apparent water use and homesite development, beauty of surroundings, health aspects, location and use of recreational centers, for example. What planning appears to have been done (or not done) to maintain or improve water uses to effect good social development? (2) In economic development study the economic growth of an urban center for a ten year period. Compare the figures for the water used in these years with figures for economic growth so far as the water resource is concerned. Compare with the T.V.A. growth. How does

foresight influence future use of water? Have the groups present the information in panel discussion for total participation.

7. Obtain a county map from the county highway department. Trace the waterways and shade the places where community growth and agricultural development are geared to the dependable water supply at the usual levels of water. Discuss: (1) What problems might rise if the water levels were quite variable? (2) Are there low flows for dependable fish habitat in recreational uses of the water? (3) Can the low flows handle the waste that must be treated? (4) The process used by county supervisors for establishing stabilized lake levels. How are the costs of stabilizing apportioned?

8. Have the class discuss why it is important that there be available the best possible information on the following topics: (1) Methods of treating industrial water and municipal water most inexpensively and most effectively. (2) Data on the amount of water flowing in the various streams at various times. (3) The size, shape, character and water-yielding capacity of underground reservoirs. (4) The chemical and bacteriological quality of water in streams, lakes and underground reservoirs, and how that quality changes. (5) Methods of controlling evaporation losses from open water surfaces. (6) Methods for increasing the proportion of rainfall that enters the soil and underground reservoir. (7) Methods for replacing salt water with fresh water in certain underground sandstones and other aquifers. (8) Natural variations in the amount and intensity of rainfall and runoff. (9) Water requirements of various crops and development of new strains with lesser requirements. (10) Methods of conversion of salt water to fresh water.

9. Obtain or make a large map of the watershed in which the local community is located. List for discussion, the civil jurisdiction areas wholly or partially within the watershed: counties, townships, cities, villages and drainage districts. Discuss what authority each governmental unit has over the water resource. With reference to the map. (1) Point out how downstream users are subject to upstream influences, good or bad, such as land use practices that increase or decrease runoff and silt load, waste disposal from upstream cities and industries, and operation of power dams and lake-level control dams. (2) Point out that suitable reservoir sites for water supply or drought flow improvement or for flood control are situated

without reference to civil jurisdiction. (3) Point out that upstream water users are morally and legally responsible to downstream interests for injuries resulting from increased runoff (damage, dam failure, arbitrary operation of dams), and from quality impairment (waste disposal, silt-producing land use).

10. Discuss the possible disputes which might be settled more effectively by an agency with watershed-wide authority than by a group of autonomous governmental units. (Note: local representation in planning watershed control is provided for in laws which govern watershed districts.)

11. List the types of uses that are made of water resources (quantity, dependability, elevation, etc.) each type of use requires. Discuss the effect upon each use that increasingly restrictive legislation could have in the following example:

    The common law permits a land owner (or occupant) to pump water from the ground for beneficial purposes on his premises. (1) Suppose the law requires that all wells must be drilled by professional drillers. What does this do to the cost of developing remote areas for private cottages, for providing emergency supply for pasturing cattle, etc.? (2) Suppose the law requires professional drillers and a state permit for the well. What does the permit imply with regard to land usefulness for various purposes in view of possible arbitrary conditions imposed by the permit-granting agency? (3) Suppose that the permits are revocable at the discretion of the state agency. What does this imply with regard to the development potential and value of lands for various purposes? (4) Suppose the law limits the proximity of wells to each other and also the amount of daily production from each well. What does such restriction imply with regard to land value and potential use?

12. Have the class make a file of publication clipping which deal with disputes on water problems such as highway improvement, lake level maintenance, flood control, lawn sprinkling, city water supply, farm drainage, etc.. Have committees study the disputes related to water problems and investigate possible solutions. Form a panel to present the problems, available facts, and possible solutions at an assembly program. Have newspaper reporters attend, make interviews, and submit articles to the paper. Evaluate the activities and discuss: (1) How can the public be informed? (2) What might happen if there

were no information or mis-information? (3) How can improvements be effectuated? (4) Why is it important that a public be kept informed?

13. Find out if the school enrollment has increased. How many new school buildings have been built? Does this indicate a significant trend in population growth? What effect will this have upon the future demands for water resources? What may be the future demands for water? What problems in demands for water may emerge along with technological advances?

IV. THE FOURTH WEEK--FOREST RESOURCES.

A. Understanding the uses of forest resources and their importance to man.[7]

1. The original forests were primary sources of building material and influenced the development of the United States.

2. Forests yield many essential products for man's use.

3. Many communities are highly dependent upon local forests, forest industries, and forest recreation for economic stability.

4. New uses for the products of the forest are being discovered through research and development.

5. Forests provide a wide variety of recreational opportunities.

6. Forests are important in helping to protect watersheds from floods and droughts.

7. Wilderness areas in which consumptive uses of the forest are not carried on have value to society.

B. Understanding problems and techniques of management.

1. Forests can be managed to produce a continuous supply of wood and wood products, wildlife, water, and recreational opportunity.

2. Foresters use various practices in managing forest resources:

a. Insect and disease control.

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7. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 8-10.

b. Fire control.

c. Harvesting practices.

d. Thinning and pruning operations.

e. Reforestation.

3. Volume and growth data are essential in determing management practices necessary to produce the optimum amount of forest products.

4. Research is essential for the development of new and improved forest management practices and the more efficient utilization of forest products and services.

C. Understanding policy and administration.

1. Public use of forest land carries an obligation for good citizenship.

2. Small woodland owners control a major portion of commercial forest lands which are a potential source of larger quantities of forest products and services.

3. The woodland owner can obtain technical advice and assistance in forest management from many public and private organizations, and agencies.

4. Current state and federal programs provide financial assistance as incentives for better management of forest resources.

5. Many progressive public and private owners of forest lands are managing forests for multiple uses rather than solely for timber production.

6. Forest owners have responsibilities as well as rights in the management and use of forests under democratic living.

7. Cooperation between public agencies, private owners, and the general public is necessary in protecting forests against fires, diseases, insects, and excessive animal populations.

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8. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 89-123.

8. Policy decisions must be made to settle differences of opinion which arise from competing uses of the forests.

D. Suggested Activities.[8]

1. The location of forest types corresponds to the distribution of certain types of climate, soil, and topography. Have the class construct a paper mache relief map of the United States to show the effect of prevailing winds, land masses, and elevations on forest growth. Include latitude lines and label temperature zones. Paint and indicate by a color key the general soil areas. Use arrows to indicate the prevailing winds. Outline the major forest regions of the country. Label the major tree species grown in each area. Determine from a United States Weather Bureau map the average area precipitation. Place colored applicator sticks, cut to scale, in the appropriate area. Discuss: (1) What percentage of the total continental area of the United States is covered by forests? (2) What percentage of this area lies east of the Great Plains? (3) How will the addition of Alaska and Hawaii change the percentage?

2. What is required for a forest to become established and grow? Discuss the importance of suitable soil, moisture, temperature, air, sunlight, and seed source. To what extent do temperature and type of soil determine the species of trees that will grow in an area? Why are forests missing in desert regions? Prairie regions? Tundra regions? Why are different forest types found at different altitudes and latitudes? What is the "timberline" and why does it exist?

3. Obtain a contour map and a soils map of your township or county. You may find it expedient to combine the two maps into one by coloring in the soil types on the contour map. Locate on the map the areas of farm abondonment. Were the abandoned lands originally in forest? Are the abandoned lands located in areas having uneven topography, steep slopes and poor soils? Did these lands become abandoned because the land was not capable of producing profitable agricultural crops? Are these abandoned lands best used for forestry?

4. Conduct a survey of the forested areas in your township, county or school district. Determine how much forest land has been used in the last five or ten years for highways, airports, resorts, recreational use, cropland, and living space for an expanding population. Also determine how much forest land has increased through tree planting and natural seeding.

Is the forest acreage increasing or decreasing in your area? How much are the forests in your area producing in the way of forest products and services? How could they be managed to make a greater contribution? What incentive does the forest land owner in your community have to improve his woodland property? Is federal aid available to forest owners who wish to improve his woodland property?

5. Conduct a community survey by interviews with old settlers, local historians, businessmen, farmers, and others to determine the extent of past logging operations and forest industries. Supplement the interviews by using local library facilities to find accounts of lumbering operations contained in old newspaper files, county histories, etc.. Compile as much data as possible about the following: (1) The extent of the virgin pine and hardwood forests which supplied local industries with logs. (2) The kind and volume of lumber produced in your county and state. (3) The amount of lumber shipped out of the community and state. (4) The means by which the lumber was transported. (5) The location of the principal markets for the lumber. Determine the number of people locally employed in the lumbering industry, and why the industry moved or disappeared, if it did so. If possible supplement the community survey with a field trip to the site of a ghost town, an abandoned logging camp, or the former site of a sawmill. Discuss ghost towns in your county or region of the state. Why did some towns disappear and others survive?

6. Visit a local lumber yard, sawmill, paper mill, or other wood-using industry to obtain information on the value of timber at different stages of harvesting and processing from living trees to finished products.

7. Have a committee from the class interview the secretary of the local chamber of commerce, or local resort owners and local businessmen to obtain data on the proportion of income derived from tourist trade. In this survey try to find out how much is spent locally by tourists for gas, oil, sporting goods, food and lodging. Contact the township supervisor by personal visit or letter to get data on the value of resort property in the township; or for a county-wide survey, contact the county treasurer. What proportion of the property tax revenue is derived from resort property? What part of the school tax revenue

is derived from this source? If neither public nor private land was available to the public for recreational uses, what would happen to the tourist and resort industry in the forest areas? How extensive are the private hunting club lands? Are they becoming more extensive? How do they affect public recreational opportunity?

8. Locate on a map of the United States the areas that have been reserved as wilderness on federal land. Locate on a map the state wilderness areas. Why were these wilderness areas reserved? Discuss the value of wilderness areas with respect to the following: (1) Wildlife reservations--Certain wilderness animals, including some species which are approaching extinction, require large tracts of forest land to meet their life requirements. (2) Watershed protection--The undisturbed vegetation of a forested wilderness area contributes fully to water storage and water supply. (3) Recreation--Visitors to wilderness areas can relax in a natural situation which has not been changed by man. (4) Research--Wilderness areas provide a control laboratory where the principles of forest ecology can be observed without the disruptive effects of man.

9. Discuss how forest fires are detected and fought. Make a map or a model that illustrates the location of lookouts, tool caches, water ponds, fire breaks, manpower and motorized equipment. What is the role of the smokejumper in forest fire fighting? How are fire protection associations organized? How are planes being used in locating and fighting fires? What does the law require of citizens in reporting and fighting fire? Are brush and grass burning permits mandatory? How can they be obtained?

10. Make a survey of some of the forest owners in your county or area to learn how many types of uses each owner is making of his forest. Group the owners under such headings as timber-production, hunting, fishing, trapping, camping, hiking, watershed protection, skiing, nature study, and research. How many owners manage for all uses? Why do many owners limit certain uses?

11. Organize a role-playing situation in which to discuss the rights and responsibilities of forest owners. Some suggested roles are: (1) Forest owner who wants to do as he pleases with his land. (2) Sportsman who is interested in having places to camp, hunt, and fish. (3) City businessman who is interested in preventing

floods and in maintaining the water supply for the city. (4) Operator of a forest industry who needs a substained supply of wood over a long period of time. (5) Lawyer who is interested in the legal aspects of the rights which the other parties claim. (6) District forester who has responsibility for publicly-owned land. Topics which would be useful for discussion in role playing are: (1) Should public forest lands be sold for private uses? (2) Should private lands be kept open for public uses? (3) Are forest owners obligated to cooperate with other interests in managing lands for watershed protection?

V. THE FIFTH WEEK--WILDLIFE RESOURCES.

A. Understanding the uses of wildlife and their importance to man.[9]

1. Wildlife is valuable. It contributes to recreation and has economic importance.

2. Some natural checks on wildlife overpopulation have been disturbed by man.

3. Some species of wildlife may become harmful under certain circumstances.

B. Understanding problems and techniques of management.

1. One phase of wildlife management is the proper control and manipulation of the habitat by means of: (a) Fire, cutting and spraying; (b) Flooding; (c) Food and cover planting; (d) Lake and stream improvement; (e) Soil conservation practices.

2. Wildlife habitat is sometimes changed by man and also by natural forces.

3. Maintenance of a harvestable surplus of certain kinds of wildlife may be helped by artificial propagation and stocking.

4. A knowledge of wildlife populations and their distribution is necessary for proper management and can be determined by such things as: (a) census checks; (b) tagging and banding; (c) age and sex determination; (d) harvest checks.

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9. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 11-12.

5. Harvesting the annual surplus wildlife can be an important part of management.

6. Water pollution affects and limits growth of aquatic forms.

7. Artificial feeding benefits the individual animal but may be poor resource management.

8. Illegal taking of game may interfere with proper game management.

9. State, federal, and private wildlife refuges, and other reserves have been established to protect wildlife populations.

10. The understanding of food chains is basic to management of wildlife.

11. Wildlife populations are decreased by many natural and man-made factors including: (a) seasonal environmental changes; (b) predation; (c) disease; (d) autos and farm machinery; (e) food and cover deficiencies; (f) chemicals used for plant and animal control.

12. The patterns of land use determine the type and quantity of wildlife.

C. Understanding policy and administrative techniques.

1. Wildlife in this country is public property, but public ownership does not confer the right to hunt or fish on private land.

2. Federal funds, derived from excise taxes, are being used along with state funds for game and fish research and management practices.

3. Game and fish laws and their enforcement are essential to ensure equal opportunity for everyone in harvesting fish and game and in preventing overharvesting of some species and underharvesting of others.

4. Interstate and international cooperation is essential for sound wildlife management.

5. Wildlife regulations should be flexible enough to keep pace with changing times.

6. Some wildlife species are under complete protection by law.

7. Under certain conditions, permits may be obtained to breed, raise, and harvest some wildlife species.

8. Conflicts between groups sometimes arise concerning the use of land and water for wildlife purposes as opposed to other uses.

D. Suggested Activities.[10]

1. Make a chart showing the parasites and diseases affecting pheasants, rabbits, and game fishes. Show their effect on the host; their effect on man. Discuss the methods which may be employed to control parasites and diseases. What is the relationship between the incidence of diseases and overpopulation of a game species? What are some of the obvious parasites encountered by sportsmen? Which of the diseases and parasites are those to which domestic animals and man are also susceptible?

2. Read of the wildlife which have become extinct. List all the fish and game animals that are in danger of extinction or overabundance. Why did some animals vanish? Why are others nearly gone? Is man the only factor involved in causing animals to become extinct? What fish and wildlife have been reintroduced after an absence in this state? How does some wildlife become too abundant? How can man control this problem?

3. Have students prepare a questionnaire to determine the recreational use of wildlife made by people in the community. The results might enumerate: the number of bird watchers, hunters, fishermen, operators of feeding stations, photographers of wildlife, bird banders, and guides. After the survey of the community is complete, compile and summarize the data. What value do you attach to the uses shown in the survey?

4. To gain a perspective on wildlife values, try the following: (1) A fifteen months old steer weighs 500 pounds. How much would it be worth at current livestock prices? (2) If your father were to sell a woodcock, a grouse, or a deer, what would he spend? Consider cost of equipment, ammunition, clothing, transportation, food and lodging.

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10. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 127-159.

5. Study the game and fish law digests. Discuss why the hunter, fishermen or trapper harvests game illegally. Discuss the proposition that the hunter and fishermen should observe bag and creel limits and open and closed seasons. Discuss: (1) How research may be incorrect if true number of kills is not known. (2) How research has changed the understanding of the best methods to manage wildlife. (3) That regulations in hunting and fishing are designed to promote the perpetuation and the equitable distribution of game harvest. (4) That it is not wise to equally harvest all kinds of wildlife.

6. Read articles on how man has changed the wildlife pattern by effecting changes in environment. Discuss such aspects as: rurbanization, diminishing wetlands, decreased or increased forest lands, changes in agricultural and forest practices, and the recreational use of wildlands. How has the changing land use pattern affected the various species of wildlife?

7. Estimate the amount of land in your area which is posted with "No Trespassing" signs. Discuss whether the game and fish within these lands belong to the land owner. Can the public be prohibited from taking public fish and game on private land?

8. Discuss the following reasons for research: (1) A knowledge of life history of wild animals. (2) An understanding of feeding and breeding habits of wildlife. (3) An understanding of cover and water requirements of game and fish. (4) Study of predator, disease, and disaster relationships. (5) Study of wildlife populations and their fluctuations. (6) Study of long-range effects of laws and regulations covering various species.

9. Study the game and fish law digests with regard to taking males only or both sexes, bag and creel limits, and season limits. Notice the difference in license fees for resident and non-resident sportsmen. Discuss why regulations are more liberal on some species than others. Why do non-residents pay more for hunting and fishing privileges than others? Would you support a single fee for all hunters? Discuss how changing regulations keep pace with changing deer populations. What regulations are suggested for handling the increase in deer populations? Do all citizens have an equal right to harvest the fish and game? How will regulations change with the increase in hunting pressure? What are some species which require an additional license or stamp? Why are they so regulated?

10. Make a continuing scrapbook during the year containing clippings from newspaper and other publications regarding the controversial issues of land-use involving wildlife versus other interests. Discuss and debate each issue as it becomes apparent and review the progress and problems of the controversy from time to time. Discuss or debate how industry, highways, agriculture and airports could cause conflicts with wildlife use.

VI. THE SIXTH WEEK--HUMAN RESOURCES.

A. Understanding the importance of human resources.[11]

1. The attainment of cultural goals is dependent upon the fullest development of human resources.

2. The American democratic ideology is particularly dependent upon equality of educational opportunity and a high level of education.

3. The success of a democratic society depends on the extent to which it is able to create an atmosphere and condition in which all human resources are fully utilized.

4. Man can foresee the consequences of his management of his environment. The resources within himself which make this possible are of prime concern in the field of conservation.

5. Man creates institutions to cooperatively develop, manage, and use other resources.

B. Understanding the problems, development and management of human resources.

1. Education is democracy's process for establishment and realization of goals for conserving and utilizing natural resources.

2. Management of natural resources is dependent upon personnel adequately trained in the natural and social sciences.

3. The full development of the individual depends upon the effectiveness of the home, supplemented when necessary by the school and other community agencies.

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11. Important Understandings for Conservation Education, Bulletin No. 424, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 13-14.

4. Lack of understanding often results in discrimination which limits opportunities for personal development.

5. The proportion of citizens over 65 years of age has increased rapidly in recent years causing a dislocation of existing economic and social patterns.

6. The increase in the proportion of non-working hours requires the development of new community programs and the adjustment of established programs.

7. As a society becomes more cooperative in nature, communication must be correspondingly increased and improved.

8. The rapid development of the world community, due largely to scientific change, requires a new emphasis on citizenship education.

C. Understanding policy and administrative techniques.

1. The use of the resources by a society brings a responsibility to maximize over the long period the benefits to all.

2. Effective communication is necessary to bring about the cooperation of all social agencies and institutions.

3. Social agencies and institutions should recognize the distinctive role of the family and where the family has a peculiar responsibility they should build their programs on a supplementary basis.

4. Increase in invention and natural resource-use are interrelated; continued scientific experimentation and research study of these phenomena are necessary in order that social policy and administration may be wisely adjusted.

5. Community programs should be so arranged as to help and encourage citizens to become more aware of their rights and responsibilities and to participate more effectively in policy development and decision-making.

6. Community programs should be designed to bring about a condition in which discrimination does not determine or result from living conditions, employment and recreation.

7. Society should provide broad opportunities and support for individual or group activities of a creative nature.

D. Suggested Activities.[12]

1. How can individuals who are now making little or no contribution to society be brought into useful citizenship? Investigate the ways that your area is utilizing social organizations, such as the educational and correctional program in prisons, orientation classes for parolees, limited-security cottage prisons, conservation work camps for prisoners to assist children and adults. What is the federal and state program in physical and vocational rehabilitation?

2. Have small groups plan an outdoor vacation for the family. Consider various seasons and kinds of recreation, such as camping and fishing, winter sports, hunting, water sports, gardening, hiking and nature study. Try to arrive at decisions which will satisfy each member of the group. Discuss: (1) How many types of recreation have you considered? (2) Does our immediate area provide for these? (3) If not, can they be found in easily accessible areas? (4) Is there enough variety of recreational activities in a particular area to provide for the needs of both the children and the adults? (5) Did anyone want a kind of recreational opportunity which could not be satisfied? (6) What are the effects of increased leisure time, expendable income, and mobility on recreation activities? (7) Are there enough public recreation sites? (8) How are the public and private agencies expanding their programs to meet the public need? (9) What special problems in parks, forests, aquatic areas are being created by increasing uses? (10) Do we have enough fishing sites, camping facilities, hunting areas? (11) What values do a family derive from the recreational activities enjoyed on a trip? (12) Can all the values derived from a vacation be measured economically?

3. Children learn the elements of democracy through life experiences which give opportunity for the development of democratic behavior. Prepare an exhibit showing the effects of the removal of forest cover.

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12. Guide to Teaching Conservation and Resource-Use in Michigan, Bulletin No. 425, The Department of Public Instruction and The Michigan Department of Conservation, 1959, pp. 161-186.

The democratic planning and preparation of the exhibit will give the children opportunities to (1) develop attitudes of respect and tolerance for the ideas of others; (2) assume temporary positions of leadership; (3) share in cooperative tasks; (4) exercise choice in helping with the various jobs to be done; (5) assume responsibility either individually or as a member of a committee for the carrying out of various committments; (6) develop a feeling of worth because of the contributions they have been able to make; and (7) participate in non-authoritative solutions to conflicts which arise when people work together.

4. Have the students read historical accounts of early attempts for social reform. How successful were first attempts of each? Was difference notable between "reforms" initiated by society and those being "sold" by leaders to the public? Keeping in mind the examples discussed, relate this understanding to a specific current, local problem. Diagnose possible reasons for failures and successes of the proposed programs. Explore and organize available data and prepare a bulletin board display, school newspaper release, or youth forum type of presentation which will help to develop public awareness. Discuss: (1) Is education of this sort employed only by the schools? (2) What are other ways by which the public becomes "educated?" (3) What can we learn from popular advertising techniques concerning influence upon public opinion? (4) How can mass media be used for adult education purposes?

5. Collect news items, make comparison charts, and investigate the range of problems pertaining to older people. The area needs thorough investigation with the view to solving these problems:

   (1) Youth needs to be made aware of the problems of citizens over 65 years of age. (2) About 70,000 new jobs need to be created each year to employ the youth who become of age for the labor market. To prevent societal ills, youth must find his place. (3) The over 65 group has greatly increased. The ratio is about 3-1. This group competes with the youth group. Older people often retain considerable productivity. Capacities of the older citizens vary in type as well as extent. (4) The older citizen needs guidance so that he can have the satisfaction of making his contribution to society, and so that he may become self-supporting, but not competing. Our culture is set up to enforce senility too early, causing people to diminish in social competency prematurely and unnecessarily.

6. Using a simulated United Nations situation, allow students to assume the roles of representatives of other countries. Discuss a problem which has universal significance and implications. Possible topics: distribution of the world's food supply, distribution of industrial products, regulation of destructive forces, development of "dependent" countries, and use of costal waters. For whose benefit it is natural for most of us to try to direct decisions?

7. Collect items from current newspapers and magazines which illustrate both the brotherhood-of-man approach, and the everybody-for-himself approach to international problems. Try to project into the future and anticipate results. Why may we find it necessary in some instances to set aside selfish interests when making decisions? How has the cooperation of nations in the United Nations specialized agencies (UNICEF, FAO, WHO) projects benefited the world community? How can we, as individuals, help to determine standards of living in the world community? Why might this problem be considered more urgent now than ever before?

8. Collect news clippings on community problems for discussion. Fringe areas usually have severe problems such as water supply, sewage disposal, transportation, fire protection, overcrowded classrooms, poorly equiped schools. Pupils and parents sometimes have a difficult time viewing their own school and community objectively. Pupils will develop preferences as to specific problems they wish to study. Gather information by collecting pictures, taking trips, interviewing individuals, and inviting qualified people as consultants. Think of approaches to solve these problems. What methods might be used to acquaint the public with these problems? How can both students and public be involved so they will assist in working out solutions that are satisfactory? Prepare a visual presentation of your findings.

9. Inventory the class to determine the kinds of volunteer activities and the number of volunteer hours that parents contributed to community projects. Make a list of the special responsibilities that the home, school, church, and other community agencies generally assume. Where do families seek help when certain responsibilities cannot be assumed? Make a study of the work of any coordinating agencies that exist in your community such as ministerial associations, etc.. Ascertain how they help members of families and representatives of agencies plan together.

10. Survey the community by phone, interview, or letter or locate those groups working for improved human relations. The class should set up a short questionnaire to find out such things as: how many people are involved in the improvement of human relations, what their programs are, what their biggest problems are, and how much has been accomplished. The class working in teams collects the information and makes reports to the class. The class secretary makes a list of all these groups and presents it to the librarian for other groups to utilize. The second phase may be concerned with further investigation of activities of the groups which are of interest to the class. Members of the class may send invitations to several of these organizations to send a member to help them discuss specific areas of the problem such as, living conditions, employment and recreation.

11. Study the increase in the research activities in federal, state and local agencies, business organizations. By visits to local businesses and industries, investigate how current research is being applied. How many new jobs have been created locally because of automation and how are these related to research? How much unemployment exists locally, and how much of this was due to automation and competition?

12. Study the existing fiscal tax and tariff policies that affect the expansion of production. Relate your findings of the policies of labor unions, management organizations, political parties, employment and foreign trade. In your local stores investigate costs of foreign products and compare these with costs of American-made products. What are the implications for domestic employment and the expansion of foreign trade?

CHAPTER IX

SUGGESTIONS FOR THE ENGLISH PROGRAM

I. OBJECTIVES FOR THE SIX WEEK UNIT OF CONSERVATION.

A. Transferring the use of effective grammar and literature to the world around us.

1. Understanding cooperative readings as a class project.

2. Developing skills in letter writing:

a. Letters to parents asking them to visit exhibits.

b. Letters to seed companies and ordering of seeds.

c. Letters asking for conservation materials.

d. Letters to resource people asking them to speak to the class.

3. Development of ability to write up written reports of things observed on field trips.

4. Develop speaking ability as to what has been observed on field trips and work on projects.

5. Develop the ability to write life histories of plants, animals, and people.

6. Understanding the effects of nature on the humanities.

7. Understanding basic dramatic concepts.

8. Developing better and faster reading habits.

9. Develop the ability to write and edit articles for the school paper.

10. Development of spelling and vocabulary.

11. Understanding the library and the use of its materials.

II. THE FIRST WEEK--MINERAL RESOURCES.

A. Make a library survey for the following books and pamphlets:

1. Rocks and Minerals of Michigan, Pub. 42, Geological Survey Division, Michigan Department of Conservation.
2. Geology, Merit Badge Book, Boy Scouts of America.
3. Rocks and Minerals, Zem and Shaffer, Simon and Schuster, Inc., Golden Nature Series.
4. "The World We Live In", Life Magazine.
5. All About Rocks, Zim and Shaffer, Simon and Schuster, Inc., Golden Nature Series.
6. How to Know the Minerals and Rocks, Richard M. Pearl, A Signet Key Book.
7. Mineral Facts and Problems, Superintendent of Documents, Government Printing Office, Washington, D. C.

B. Assign written and oral reports from materials found in libraries.

C. Write letters to mining companies asking for samples and free materials.

D. Look up the meanings and learn to spell the following vocabulary:

conservation	brines	thorium
minerals	strata	bismuth
metals	stabilization	antimony
nonmetals	conveyors	beryllium
fuels	fluorspar	cadmium
resources	diamond	titanium
Geology	topography	zirconium
uranium	hydrochloric acid	nitrogen
petroleum	aquatic	asbestos
mercury	vegetation	barite
peat	compounds	rhodium
marl	aluminum	graphite
volcanic	magnesium	nitrates
metamorphic	chromium	nitrites
sedimentary	manganese	phosphates
limestone	tungsten	potash
shale	cobalt	pyrites
granite	molybdenum	sulfur
sandstone	vanadium	talc
lava	platinum	soapstone
gypsum	radium	bituminous

anthracite	kerosene	stockpiles
strategic	germanium	industrialist
plastics	elements	pollution
fiberglass	isotopes	compliance
substitutes	metallurgy	depletion
abundant	radiation	

III. THE SECOND WEEK--LAND AND SOIL RESOURCES.

A. Write letters to a member of the local Soil Conservation Service and ask him to speak to the class.

B. Write an essay on what was observed on a field trip.

C. Make a survey and report on soil conservation resources found in the school and public libraries.

D. Write an essay on "How Soil Conservation Effects Me."

E. Define and learn to spell the following words:

erosion	weighing	establish
physical	absorb	localities
mature	laboratory	publications
combination	nutrients	assistance
organisms	sturdiness	predictable
organic matter	moraines	recommendations
decomposition	drumlins	surpluses
chemicals	eskers	meandering
humus	kames	possibilities
drainage	climatic	siphon
variation	hydrologic cycle	apparent
capability	bacterial	distribution
glacier	capillary	residue
gravity	granule	puddle
biological	glaciation	pamphlet
processes	gullies	population
lichens	misuse	agriculture
lens	cultivate	investigate
carbonic acid	condition	beautiful
source	forestry	contour
profile	retard	furrow
decayed	model	fertilizer
pyrex	commercial	controlled
muck	sterilize	classification
loam	sewage	research
kiln	measure	summary
silt	existance	interdependence
clay	environment	relationship
feldspar	sequential	legislation
influence	democratic	survey
funnel	annual	communication
texture	ordinances	hypothetical
identical	technique	planning

production	civilization	survey
commissioner	fertility	significance
administrator	irrigation	transportation
marginal	percentage	recreation
evaluation	accelerate	preparation
simulate	windbreak	zoning
hydraulic	litter	individuals
technological	sludge	decision
indispensible	vicinity	attention
actual	urban	policies
evidences	wildlife	committee
necessities	Ecology	replenished
basic	communities	moistened

IV. THE THIRD WEEK--WATER RESOURCES.

A. Debate: Divide class into two parts and debate "Water as Friend or Foe."

B. Write short articles for the class paper on the following subjects:

1. The feasibility of construction of by-pass channels around high value areas.

2. The costs of various flood control projects (local projects if possible).

3. The location of control structures such as reservoirs, levees, run-off controls, and channel deepening and widening.

4. The topographical data which indicates the need of each control structure or technique.

5. An estimate of a comparison of costs for urban flood protection with that of farm land protection.

6. What present and past knowledge of flood occurance is necessary to avoid flood danger areas?

C. Flash articles on screen with opaque projector and have the class grade each paper for grammer, punctuation, and spelling.

V. THE FOURTH WEEK--FOREST RESOURCES.

A. Have students survey library for forest conservation resources.

B. Write letters to local forest service personnel asking one to speak to the class and for field resource materials.

C. Have students write an essay on the "History of Forestry" or the "History of Forest Conservation."

D. Have each student write a "life history" on some plant.

E. Have each student write a paragraph on the diseases of plants.

F. Define and learn to spell the following words:

transition zone	circumference	overpopulation
demarcation	conifer	incentive
precipitation	relief map	commerce
temperature	prevailing	reduction
acidity	elevations	canoe
microorganisms	continental	condensation
dynamic	timberline	selectively
species	humidity	smokejumper
tolerant	velocity	cores
consequently	penetration	economic
supplant	effectiveness	investigation
catastrophe	seedling	calipers
botanist	interaction	prevention
succession	competition	immediate
dominant	ecological	detrimental
watershed	salvage	abandonment
wilderness	expanding	management
consumptive	resins	pulpwood
pruning	extensive	tourist
reforestation	mammals	miniature
optimum	evaporation	attractors
potential	continuous	overgrazing
progressive	detection	harvested
multiple	thinning	mandatory
responsibilities	knots	artificial
texture	observance	nursery
characteristics	diameter tape	increment borer
classifying	litterbug	volume
collection	provisions	available
benefit	aerial	involving
lateral	rehabilitation	permit

VI. THE FIFTH WEEK--WILDLIFE RESOURCES.

A. Have students write an essay on "How Animals Depend Upon Plants."

B. Have students write an essay on "How Man Depends Upon Plants and Animals."

C. Have students write a short essay on the life history of some bird, fish, or mammal.

D. Have students write a short essay on "Animals as a Renewable Resource."

E. Have each student write a short essay on "Bird Migration", and trace some bird's migration from wintering ground to breeding ground.

F. Have students write an essay on "My Favorite Animal."

G. Have students write an outline on the development of fish and game laws.

H. Define and learn to spell the following words:

renewable	invertebrate	bulletin
specimen	immigration	aquatic
inexhaustible	lamprey	requirement
thickets	parasite	refuge
hedges	extinct	prospered
cavities	questionnaire	additional
primarily	symposium	passenger
predator	representative	phenomena
scavenger	census	plagues
adapt	analyze	locomotion
habital	creel	fulfilling
requirement	inevitable	seasonal
reproduction	regulation	oviparous
critical	flexible	amphibian
diorama	raccoon	ventral
capacity	opossum	exoskeleton
comparison	shrew	caribou
browse	rodent	nomadism
legalized	cyclic	legacy
fawn	herbivore	tularemia
fauna	coloration	enumerate
impurities	aquarium	status
spawn	vertebrate	maintenance
restocking	migratory	propagation
litter	emigration	colloidal
prey	exotus	experiment
carnivore	susceptible	mortality
viviparous	disperse	federal
camouflage	depict	license
dorsal	manipulation	pigeon

VII. THE SIXTH WEEK--HUMAN RESOURCES.

A. Have students write essays as to the relationship of human resources to: (1) education; (2) medical services; (3) government and public services; (4) religion; (5) home and the family unit.

B. Have students write essays on the relationship of human resources as to transportation including the following:

(1) land, air and water; (2) development of transportation; (3) locations of principal railroads, highways, waterways, and air routes; (4) growing importance of air transportation; (5) comparison of transportation with other industries; (6) changes in ways of living and distribution of population.

C. Have students write essays on the relationship of human resources to communication, power, recreation, and government.

D. Have students write to the Department of Public Information on how various United Nations Organizations help Eastern Hemisphere countries develop conservation practices.

E. Write a long detailed essay covering the conservation unit on "What Conservation Now Means to Me."

F. Learn the following vocabulary as to spelling and meaning:

survival	attitudes	incapacitated
value judgements	productivity	paradoxical
ideology	inadvertently	opportunities
existance	maximigation	creative
potentialities	re-utilization	consideration
accommodation	allocation	personality
fabricated	preservation	curriculum
longevity	mortality	epidemics
pharmacology	antibiotics	hormones
endocrines	alcohol	tobacco
narcotics	municipal	consumption
culture	unique	contribution
rehabilitation	facilities	recognition
perpetuate	generation	achieving
behavior	universal	atmosphere
emotionally	agrarian	institution
advertising	opinion	media
categories	guidance	diminish
prematurely	expendable	format
consultant	counselor	ministerial

CHAPTER X

SUGGESTIONS FOR THE MATHEMATIC'S PROGRAM

Arithmetic is not too well adapted to integration into a core curriculum. Still, the energetic and versatile mathematics teacher can help bolster the conservation unit by preparing problems that will not only produce problem solving skills but will also add to the total conservation effort. Since it is impossible to foresee at what level of advancement the students will have attained at the point of the core unit on conservation, the author can only hope to provide a few type problems to help guide the arithmetic teacher. The author hopes that these will bring forth many more fruitful ideas for problems in this area.

I. OBJECTIVES FOR THE SIX WEEK UNIT ON CONSERVATION.

A. To create an interest in conservation by showing some of the results of exploitation and conservation.

B. To teach some facts about resources and their conservation through their presentation in arithmetic exercises.

C. Suggested types of problems.[1]

1. In 1947 the tussock moth threatened to destroy 413,469 acres of Douglas-fir forests in Idaho, Washington, and

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1. Ranger Arithmetic, U. S. Department of Agriculture, Forest Service, Washington, D. C., U. S. Government Printing Office, 1956, pp. 1-7.

Oregon. However, prompt airplane spraying with DDT saved those forests and probably the jobs of thousands of people at a cost of $1.57 per acre. How much was the total cost?

2. In planting forest trees, about 1,000 trees are usually planted on each acre. The white pine, a tree common to the Northeast, averages about 27,000 seeds per pound. If 1 pound of seed is planted in a forest tree nursery and 64 percent of the seeds grow, how many acres of forest land can be planted with these white pine trees when they are taken from the nursery?

3. A farmer owns six tourist cabins built of logs from the surrounding national forest. Tourists who come to the national forest for vacation and rest may rent these cabins for $1.65 per night per person. If two people stay in each of the six cabins for a period of 1 week, how much money does the farmer get from his cabins for that week?

4. Range studies show that in some parts of the Southwest as much as 432 cubic feet of soil per acre is being eroded away each year because of overgrazing and range decline. How many cubic yards of soil would be lost to erosion each year on 2,000 acres of such land?

5. Between 1934 and 1942 the United States Forest Service cooperated with farmers in the Great Plains to plant thousands of miles of trees in strips. These strips are called "shelterbelts" because they protect farm soil and crops from strong winds. After 7 years the trees in North Dakota averaged 16 feet in height, those in Nebraska 20 feet, and in Texas the trees were 24 feet high. What is the average annual growth in height (ignoring height when planted) for shelterbelt trees in North Dakota? Nebraska? Texas?

6. There are 4,200,000 small forest ownerships in the United States and 97 percent of them are east of the Great Plains. How many are east and how many are west of the Great Plains?

7. In one year, 3,321,993 sheep and 1,153,246 cattle grazed on the national forests. The livestock owners paid Uncle Sam 11 cents per month for each sheep and 49 cents per month for each head of cattle. If each animal grazed for 3 months, how much did the stockmen pay for using the national forests for grazing that year?

8. Forest litter is made up of leaves and branches that drop to the ground from trees and other plants. This litter protects the soil and helps keep it porous so it can absorb a lot of water. The porous soil on 1 acre of a well-protected forest absorbed 226½ tons of water. How many tons of water would 1 square mile of this same forest land absorb?

9. During one recent year there were about 200,000 forest fires in the United States. Ninety percent of them were caused by smokers alone. If everyone had been careful, how many forest fires would there have been that year?

10. The American Red Cross reports that between June 1920 and June 1940 there were 392 flood disasters in the United States in which the Red Cross carried on relief operations. What was the average number of flood disasters per year in the United States during that period?

11. Clyde is making a book rack in his industrial arts class. He has a board 4 7/8 inches wide which he wants to cut the long way so that both pieces are of exactly the same width. If he cuts it on a power bench saw which cuts 1/8 of an inch in sawdust, how wide will each piece be?

12. Jimmy learned that there are about 7,375,000 deer and 132,000 black bear in the United States. He asked a forest ranger how many deer live on the national forests. The range told him 29 percent. When he figured it out, how many deer did Jimmy find live on the national forests?

13. Wilderness areas, wild areas and roadless areas within the national forests are set aside to preserve primitive conditions of wild land. Roads, resorts, camps, summer homes and commercial logging are not allowed. There are 77 such areas totaling about 14,014,000 acres of national forest land. What is the average number of acres in each area?

14. 345,000,000 acres of our commercial forest land is privately owned. About 40 percent of it is owned by farmers; 35 percent by other small owners; and 25 percent by large owners. How many acres are in each kind of ownership?

15. A Girl Scout troop has a triangular piece of forest land for its camp. If the land has a base of 540 feet

and an altitude of 300 feet, how many square feet does it contain?

16. Each year more and more people are using the national forest for recreation, both summer and winter. A ski tow on a national forest in the White Mountains of New Hampshire is three-eights of a mile long. How many feet long is the tow? Rods?

17. Mr. Davis bought 26,496 board feet of lumber and 2,000 red bricks for the new house he will build. (Lumber is measured in board feet and 1 board foot is a piece of wood 1 foot square x 1 inch thick.) If lumber costs $69 per thousand board feet, how much is the total bill for lumber?

18. There are 461,000,000 acres of commercial forest land in the United States. Of this amount, 345,000,000 acres are owned by private individuals. What percent of our forest land is privately owned?

19. Each of the 152 national forests is divided into districts. In charge of each district is a forest ranger. There are about 800 district rangers. Approximately 24,000,000 people visit the national forests each year. If these visitors were equally divided among the ranger districts, how many forest guests would each ranger have on his district in a year?

20. One New Year's Day a heavy rain fell on a steep western mountain which had been heavily burned by a forest fire. There was little plant cover to help hold back the water and keep it from flooding the town below. Damage by the flood which followed the rain amounted to $5,000,000. If 4,000 people lived in the town, how much would this damage be per person?

21. Two men built a camp fire in the forest and failed to put it out--Dead Out--before they went to their homes 7 miles away. Their carelessness caused a forest fire which burned 212 acres of timber. If the timber was worth $126.35 per acre, what was the total loss?

D. More advanced problems.[2]

1. One rain washed 4 tons of soil per acre off a 20-

2. An Outline for Teaching Conservation in High Schools, U.S. Department of Agriculture Soil Conservation Service, PA-201, U.S. Government Printing Office, 1959, pp. 19-20.

acre cornfield planted in straight rows uphill and downhill. On a nearby 20-acre field where corn was planted in level rows around the hill, only one-half ton of soil per acre was lost. How much more soil was lost from the straight-row field?

2. Farmer Brown raised 82 bushels of corn an acre in a 30 acre field planted on the contour. His neighbor Jones, who planted his corn the old way (uphill and downhill), had 35 acres of corn which produced only 70 bushels an acre. Which one had more corn? How much more?

3. A farmer cut 30 boards 1 inch thick from one white oak tree; 12 of them were 1 foot wide and 10 feet long, and the other 18 were 8 inches wide and 6 feet long. How many board feet of lumber did the tree produce? (One board foot is 1 foot square and 1 inch thick.)

4. Three fields on one farm needed limestone, according to soil tests. The 20-acre field needed 3 tons per acre, the 15 acre field 2 tons per acre, and the 10-acre field 4 tons per acre. How much limestone was needed for all three fields?

5. Soil is being washed into a lake at an average rate of 40 acre-feet a year. The lake averages 20 feet deep over 50 acres. How soon will the lake be filled with soil?

6. Assuming that the soil washed into the lake, in problem 5, was removed by sheet erosion at a uniform rate from 3,000 acres of farm land in the watershed of the lake; how long will it be before this land will lose 6 inches of topsoil?

7. An inch of topsoil weighs 140 tons per acre. How many tons are in a 40-acre field where the topsoil is 10 inches deep?

8. A soldier eats 4 pounds of meat each week. If one farm produces 10 tons of meat in a year, how many soldiers will it feed for 1 week?

9. When the Mississippi River is at flood stage, it carries enough soil past Vicksburg, Miss., every minute to cover 40 acres 7 inches deep. How many acres would it cover at the same depth with soil that flows by in 1 day?

10. If the average weight of the dry topsoil on a 40-acre field is 87 pounds per cubic foot and the

average depth of the topsoil on the field is 7 inches, how many tons of dry topsoil are on the field? (An acre covers an area of 43,560 square feet.)

11. If 6 percent of the average dry topsoil in problem 10 consists of organic matter and 5 percent of the organic matter consists of nitrogen, how many pounds of nitrogen are in the organic matter of the topsoil of the 40-acre field? How much would this nitrogen cost if purchased in commercial fertilizer at a price of 27 cents per pound?

12. If 20 acres of the field in problems 10 and 11 are farmed with rows running up and down the hill and lose an average of 20 tons of soil per acre each year, and if the other 20 acres are terraced and farmed with rows running on the contour and lose only one-half ton of soil per acre each year, what will be the difference in the commercial value of the nitrogen lost in the organic matter from the two 20-acre fields in five years?

13. If the fine sandy loam topsoil on a 30-acre field weighs 90 pounds per cubic foot, and 550 tons of topsoil are washed off the field each year by sheet erosion, how long will it take for the top 3 inches of the soil to be removed?

14. When the Mississippi River is at flood state it carried 40,000 tons of soil past Vicksburg, Miss., every minute. Assuming that 75 percent of this soil is topsoil washed from upland farms and that the average dry weight of the soil is 85 pounds per cubic foot, how many acres of upland will be washed off to furnish the soil carried by Vicksburg in 24 hours if each acre lost 1 inch of topsoil?

15. A 30-acre field of very fine sandy loam loses through sheet erosion an average of 18 tons of topsoil per acre per year for 5 years. The topsoil is 6.5 percent humus, and 5.2 percent of the humus is nitrogen. How many pounds of nitrogen are lost in the organic matter of the topsoil during the 5 years?

16. The farmer attempted to replace the nitrogen by spreading barnyard manure on the field in problem 15. He hauled 1½ tons of manure per load that contained 0.7 percent nitrogen; how many loads did he have to haul to replace the nitrogen lost through erosion in 5 years?

17. Farmer Brown planted 40 acres of corn and 40 acres of oats in square fields with rows running uphill and downhill. He made 50 bushels of corn and 40 bushels of oats per acre. His neighbor planted 25 acres of corn, 25 acres of oats, and 30 acres of red clover in contour strips on a terraced field and made 65 bushels of corn, 50 bushels of oats, and 2½ tons of clover hay per acre. Assuming prices for the crops were 90 cents per bushel for corn, 65 cents per bushel for oats, and $15 per ton for clover hay, which farmer received the most for his crops? How much?

18. Field A, with rows up and down the hill, loses 25 times as much topsoil per acre per year by sheet erosion as does field B with contour strip crops. But if field B lost 33 tons per acre per year more than it now loses, it would lose 3 times as much as A. How much topsoil is washed from each field per acre each year?

19. The topsoil on field A is 2 times as deep as on field B, but field A is farmed with straight rows up and down the hill whereas field B is terraced and farmed on the contour. Field A losts 1/20 of its topsoil each year from sheet erosion, which is 11 times as much as field B loses. Field B loses 1/110 of its topsoil each year. How deep is the topsoil on each field and how many years will it be before the amount of topsoil remaining on the fields will be the same?

20. Before the conservation farming practices were started on a farm, it produced an income of $10 per acre from the cropland and $5 per acre from the pasture land, and the total income was $1,025. After soil and water conservation practices had been established, the cropland produced an income of $15 per acre and the pasture land produced $10 per acre, the total income being $1,625 per year. What was the total average in crops and pasture?

21. A hawk ate 32 mice and 4 rabbits for every chicken he ate. Each chicken weighed 16 times as much as each mouse and one-half as much as each rabbit. The total weight of the rabbits and mice he ate was 10 times as much as the weight of the chickens. How many pounds of chickens did he eat?

22. Soil from an overgrazed grassland watershed washes into lake A at 12 times the rate that soil washes into lake B which has a well-managed range on its watershed. Lake A will fill up with silt in 20 years at the present rate. Lake B now holds three-fourths as much water as lake A. How long will it be before both lakes hold the same quantity of water? How long before lake B will be completely filled with silt?

CHAPTER XI

SUMMARY

The author has developed a guide for Conservation Education for a core curriculum at the junior high level of education. The background and history for a staff to develop an understanding and depth of such a problem has been provided. It is hoped that this effort will not be taken lightly, but that the staff may understand the responsibility of such an adventure. Man's survival as an enduring species upon this earth may well depend upon conservation education.

An inservice training guide for the staff preceding the school term or directly preceding the conservation unit has been provided. It is hoped that this guide may produce a well integrated unit from which the staff may produce a lively, interesting, learning situation.

An endeavor has been made to set up objectives of a far reaching nature that are both plausible and practical to the basic needs of the nation, states, communities, and students, and to describe them in behavior patterns of social relationships. This has been accomplished by developing an integrated pattern of weekly concepts. This endeavor covers the fields of Science, Social Science,

English, and Mathematics in a detailed outline of relationships.

The final evaluation of the students' comprehension and relationships is left to the discretion of the individual staff members. A general evaluation of the unit as a whole should cover only general concepts and relationships gained by the student.

An excellent standardized testing program over conservation education has been prepared in cooperation with the Educational Testing Service, Princeton, New Jersey, and the Conservation Foundation of New York. These Tests of Reasoning in Conservation, forms A, B, and C, give an excellent coverage of the various conservation concepts.

The final evaluation of this guide will be in a more educated and informed youth, dedicated to a conservation-directed way of life.

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