CURRICULUM CONTENT IN

CONSERVATION

FOR ELEMENTARY SCHOOLS

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by

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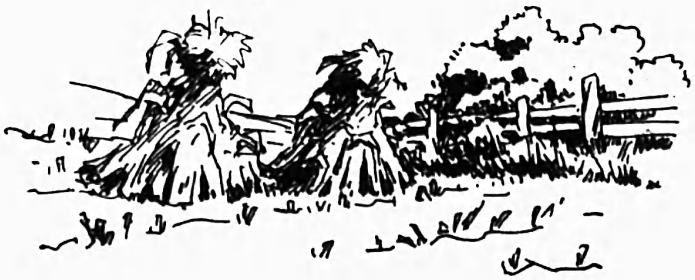

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FOREWORD

IN VIEW of increasing concern about the Nation's serious waste of natural resources and the growing interest in a permanent program of conservation education, it is fitting and desirable that schools should be able to secure help from the U. S. Office of Education in introducing the subject into the regular school curriculum. Courses of study and textbooks have long been planned for the teaching of nature study, general science, and current social problems. As a result, children have developed concepts about natural resources. However, while such instruction is valuable as far as it goes and necessary as a background, it is not sufficient to help pupils develop understanding and attitudes which lead to intelligent participation in conservation activities and, when they become adults, to prudent civic action.

The purpose of this bulletin is to suggest educative values of conservation in their relation to curriculum content in such a way that the teacher can quickly consider them in her plans for teaching and better help her pupils to participate in conservation enterprises of worth to the community. The bulletin is one of several publications by the U. S. Office of Education in the field of curriculum materials for the teaching of conservation.

The U. S. Office of Education is indebted to many Federal Government agencies for their helpful cooperation in supplying information and material of value in the development of this bulletin. Among these agencies are the Bureau of Mines, the Geological Survey, the Division of Civilian Conservation Corps Education, the National Resources Committee, the Agricultural Education Service, the Reclamation Service, the National Park Service, the General Land Office, the Soil Conservation Service, the Bureau of Biological Survey, the Agricultural Adjustment Administration, the Forest Service, and the Bureau of Fisheries. We express appreciation to them for their assistance. We appreciate the help of Irving Brant and Carl Dion of the National Park Service in checking the pictorial accuracy of the bulletin. We also appreciate the use of illustrations supplied for the most part by the Bureau of Biological Survey, the Forest Service, the Farm Security Administration, the Soil Conservation Service, and by divisions of the United States Department of the Interior.

BESS GOODYKOONTZ,
Assistant U. S. Commissioner of Education.

Young mallards.

CURRICULUM CONTENT IN CONSERVATION FOR ELEMENTARY SCHOOLS

CONSERVATION PROBLEMS IN THE SCHOOL PROGRAM

THE UNITED STATES is confronted with the need for an extensive program in the conservation of natural resources. Such a program involves fundamental changes in social attitudes and points of view which can most successfully be achieved through education, and consequently questions of curriculum modification have arisen. Shall problems of conservation receive greater consideration by the school than they have yet received? If so, how? These are among the challenging questions of curricular extension and revision the school has yet faced. An overview of the conservation situation will help in answering them.

CONSERVATION AS A SOCIAL AND EDUCATIONAL PROBLEM

The need for conservation of natural resources was brought to the forefront with unprecedented urgency by the simultaneous occurrence of major social emergencies. Economic depression, which wrought turmoil in the lives of most, bore down with unusual severity on farmers in marginal and submarginal lands. Even in good times these farmers were financially unable to maintain American standards of health and happiness. Great floods, welling into thriving river valleys, brought sorrow and poverty to thousands of other American citizens, not only in the Lower Mississippi, but higher in the valley and in other valleys. In 1936, eight rivers were flooded beyond control. Thousands of homes and lives and millions of dollars' worth of property were lost. Representatives from the sufferers came to the National Capital to consult with the Government's experts. "Control of floods is a national rather than a local problem," was the conclusion reached after many discussions. "It requires the services of the country's best forestry and agricultural engineers and experts. A program of reforestation, restoration of grasslands, and control of waters near the sources of smaller streams in States above the flooded areas is essential. Dams, dikes, levees, and

This beautiful lake was once a source of pleasure and profit for the community.

reservoirs should be built for protection from waters that rise higher than normal. Financial assistance must be provided for people who have lost their savings and their businesses."

While help was being extended to the sufferers from the floods, and before the lawmakers were aware of a queer haze in the air surrounding the dome of the Nation's Capitol and hovering over the city's skyline, in homes and offices in the National Capital an ominous yellowish dust seeped through closed windows and settled on shining desks and chairs and on white linens. In the papers the next day the whole Nation read that the yellow dust came from fields 1,800 miles or more away—from Nebraska, South Dakota, and other Great Plains States. There rolling and level plains once covered by unbroken sod had now become huge farms plowed and harrowed and ready for crops. Winds had seized the loosened soil and whirled it into a dark blizzard. So strong were the winds and so fine and soft the soil that tons of it were carried and dropped all over the country. Where the winds were fiercest, the choking soil filled nostrils and lungs of man and beast. Unprotected, no life could survive. Sometimes the houses of the people where the storm began were nearly buried in the heavy dust. In some instances, young and old had to abandon their homes or perish in them.

Aroused by the unproductive fields, the floods, and the dust storms, to an awareness of the threatening new calamity to the

land, the people of the Nation became keenly conscious also of the waste of other natural resources, such as water, wildlife, forests, and minerals. The situation is bewildering in its seriousness.

The story told by history.—Exploitation of nature's gifts was begun by the early colonists. The first settlers found America a land of almost boundless natural resources. There were plenty of forests for houses, furniture, and implements of different kinds. In fact, trees grew so abundantly that they were looked upon by the sturdy settlers as nuisances, just as today weeds are regarded as nuisances by those who would use the land to fill their bins with wheat and corn. Consequently, the colonists cut the trees and cleared the land for planting grain. Willingly the obedient soil gave of its substance, and for a number of years ample crops were harvested. Not only was the newly discovered country rich in forests and in farming land, but it had water in abundance and falls for power. The rivers and coastal waters yielded fish sufficient to supply the present population had they been preserved; deer, bear, elk roamed the forests. Birds of many species made field and woodland joyful. The forest soil of the eastern hills, however, had only a limited surplus of plant food. It could not continue to produce so generously after its surplus was used. The fact that the farms soon ceased to respond readily to the lash

The same lake, 10 years later. Silt, slowly washed down from the upper parts of the valley, which had been cleared of timber and vegetation, left only a swamp and small dry run.

of the agriculturist did not trouble the early settlers of the coast. They simply moved away a few miles, cut down more trees, and plowed a new tract of soil.[1]

When the soil of the East was at last impoverished and the farm lands crowded, farmers went "West" and there took up life on a more fertile soil than they left. Here pioneers continued the ruthless practices which had ruined the soil of the East. The black grass-root soil was not soon despoiled. For many years on the prairies and plains, undisturbed, the farmers wrested from their lands bountiful crops. The Middle West became the "bread basket" not only of the East but of much of Europe. It seemed to the Nation that this land could not be depleted as the eastern farms had been. New land near Bismarck, N. Dak., produced such luxurious crops that the farmers considered the soil *too* rich. Barnyard manure was burned because they thought that the additional richness would be unwholesome if the manure were scattered on a soil so fertile.[2] "The soil is cream to the bottom, and there is no bottom." they said. But they were wrong, and surely, insidiously on the prairies as on the eastern hills, blighting waste destroyed not only the fruitful soil, but grasslands, woods, and wildlife as well.

The World War increased the work of destruction. "There must be food for the soldiers." Each farmer must "do his bit to win the war for the Allies." Fence corners, railroad land, and roadsides did not escape the plow. In this spoliation of the most fertile soil of the world's richest continent, even the Government was a party, and by encouragement and war inspiration, urged on the despoilers.

People of the present day have carried the tragic waste to greater extremes. Destruction of other natural resources relatively is as great as that of soil. Many species of birds have disappeared. A number of species of wild animals are reported extinct. Fish have been destroyed through river pollution by factory and mill wastes, floods, silt. Rich supplies of oil, gas, and minerals have been exhausted. Not in deed alone have the people sinned; but in spirit as well. "My farm is my own. No one is going to come here and tell me how to run it! Not if I can help it," said a farmer to a county agent who had been

[1] Parkins, Almon E., and Whitaker, J. R. Our natural resources and their conservation. New York, John Wiley and Sons, Inc., 1936. p. 19.

[2] The book of rural life, knowledge, and inspiration. Chicago, The Bellows-Durham Co. Ten volumes. Vol. III, p. 1279.

trying to influence the community to cooperate in a governmental plan for conservation of the soil. Hundreds of American citizens are like that farmer. They fail to recognize natural resources as the property and heritage of the Nation, not of individuals, nor of groups within the Nation.

A way of escape from possible disaster.—Wanton destruction must be halted before it is too late. It is imperative that nature's balance of soil, forests, and grasslands be restored. Birds, wild animals, and plants should be conserved. The forests must be protected and replaced; the soil renewed. Plans should be made for retaining rainfall and thereby raising the level of the table of underground water. Waste in mining and in use of fuels, which has accompanied the destructiveness in other activities, should cease. With respect to all of nature's resources there should be a plan for optimum use, which means the greatest progress possible for the present and for future generations. A Nation-wide program of sensible scientific conservation is the way of escape from the tragic decline that has met every nation which failed to use its natural resources wisely.

Successful conservation of the country's resources requires more than the development of a social and governmental program for conserving the Nation's soil and mines and for scientific forestry and the preservation of wildlife. The Nation cannot recuperate from its heavy loss of natural resources until all the individual citizens receive and practice restoration, protection, natural balance, and prudent use. Then conservation will have become, for all, a way of living.

RESPONSIBILITY AND FACILITIES OF THE SCHOOL IN A NATION-WIDE PROGRAM OF CONSERVATION

From the point of view just expressed, one returns to the questions with which the discussion began: Shall problems of conservation and of the restoration of nature's balance receive in educational programs the additional consideration they demand, and, if so, how? It is evident that, for the present, the school must consider these problems, because children as well as adults are so significantly affected by the waste of natural resources. Not only should the curriculum include a study of that waste, but it should provide for the children's participation in such conservation activities and enterprises as are best suited to their interests, needs, and abilities at different stages of their growth. Inexorable nature has brought the problems of conservation before us, and, as a

society of youths and adults, we must solve them, or suffer. In order to understand better how to introduce these factors into the curriculum and develop them, it is helpful for one to survey the facilities of the school as sketched in the following discussion

Teachers as leaders.—Many teachers are cognizant of the Nation's need. In some communities the teacher's education has given her a way of life that is broader than the struggle for existence, whereas the parents of the children may be engrossed, overwhelmed at times, in securing food and clothing for their families and themselves. To them the earth's resources mean existence only. In these communities, such teachers have had a break in the struggle for existence—a pause of 1 to 4 years in college. There some find joy in recreation that exists in wood and field. Many who learn to love the beauty of nature and wish to save it, grasp a vision of conservation as a means to higher standards of living and less struggle for existence. Other teachers have not been aroused to the Nation's need for conservation, nor to the possibilities of wood and field as means of recreation. Teachers of the first group are a source of direct leadership in the teaching of conservation and some of them have introduced the subject into school curricula. Those of the second group are potential leaders who must be educated for the work before results can be expected. It is important that any teacher who desires to begin the teaching of conservation should take appropriate steps to convince her community of the educational worth of the subject. If she can do this, her pupils will receive at home the sympathy, encouragement, and cooperation which add to the educative value of any school activity.

Children's ability to participate in activities of conservation.—Children can understand and engage in studies and activities along many lines of conservation. Even 5-year-olds learn to find greater pleasure in a flower on a vine than in the hand. Children in the upper elementary grades enter into a project to landscape their school ground or to assist in a forest enterprise with the eager earnestness which is characteristic of adolescents.

Although to many schools conservation is a new problem, there are others in which it has been taught successfully. Some schools have long taught aspects of the problem in connection with nature study,[3] science, and health. Others have given it a place

[3] Dunn, Fannie W. *and* Everett, Marcia. Four years in a country school. New York, Bureau of Publications, Teachers College, Columbia University, 1926. p. 164–66.

in social-studies instruction. School children are building nature trails, maintaining school forests, and planting wild flowers on school ground and highway. In one course of study [4] the suggestion is made that materials of instruction be organized around "protection and conservation of life, property, and natural resources" as one of the so-called major functions of social life. In a program [5] of curriculum revision, conservation is included tentatively as one of seven important social problems. Other courses suggest units on the subject or otherwise give it consideration. Several elementary textbooks treat the subject with emphasis. Units of experience have been developed on trees, forests, building materials, wild flowers, birds, minerals, fuel, soil, and other conservation topics. Arbor Day and Bird Day are observed. Special programs are planned for Conservation Week. A bulletin from the Office of Education points out other representative practices in conservation education.[6] Such examples of successful present practices are indications that children can participate with profit in activities of conservation.

LACK OF READINESS AND SUGGESTIONS FOR MEETING NEEDS

Although a beginning has been made in the teaching of conservation, in general, teachers have not had opportunity to prepare for it. The field of conservation education has not been defined, and desirable goals are not incorporated in the school program. Few publications on the subject contain organized teaching suggestions. Courses of study in general do not include conservation. Many teachers do not understand its significance as a current national problem. They are not cognizant of aspects of the subject which may become integrated with children's ways of living. Many have not the techniques for helping children combine learning with normal living which are especially required for incorporating conservation activities in the regular curriculum. Most of them lack pre-service and in-service training for the work.[7]

[4] Tentative course of study for Virginia elementary schools. Richmond, Va., State Board of Education, 1934. p. 16.

[5] Experimental scope and sequence of major learnings for the Santa Barbara city schools. Santa Barbara, Calif., 1937. (Folder.)

[6] Bristow, William H., *and* Cook, Katherine M. Conservation in the education program. Washington, U. S. Government printing office, 1937, p. 10–36. (U. S. Department of the Interior, Office of Education, Bulletin 1937, No. 4.)

[7] Ibid.

Educational efforts of nonschool organizations are not always well integrated with the school program and sometimes not fully utilized. As a result, there is danger of duplication of activities, with overstimulation of some pupils and inadequate participation on the part of others. Systematic coordination of the children's school and community activities in conservation should be achieved in such a way that desirable educational services provided by nonschool organizations can be properly utilized under guidance of school authorities responsible for organizing the public educational program.

There are too few books containing information about conservation based on children's interests, needs, and experiences, and prepared by authors who know how to write for children. Textbooks in geography and science, readers now and then, encyclopedias for children and young people, and a few supplementary books have information which can be used as a background for studies of conservation of wild animals, forest restoration and preservation, reclamation projects, national parks, soil erosion, and the like. With few exceptions, however, books bury this helpful material in a mass of general information, and teacher and children either cannot find it or do not recognize it as being essential to the understanding of conservation problems which they meet day by day. Furthermore, the material published at present, generally speaking, is appropriate for older rather than for younger pupils. To help pupils, especially those below the sixth grade, to become conservation conscious, more books should be prepared by talented children's authors; or the present geographies, readers, and books on science should be revised to include conservation facts in such a way that children will be able to use them in normal activities.

In a report of a survey of conservation education, the following statement is made:

> . . . Superintendents and teachers are making progress in the collecting of material on conservation and in its preparation for school use. So far, progress in this direction has been confined largely to local needs and problems, an excellent point of departure, as well as to favored localities. The work needs to be greatly expanded, vitalized, and integrated to the end that pupils in the schools have a clearer realization of their responsibilities and opportunities in conserving wildlife, forests, land and soil, oil and minerals, as well as to the place of conservation in the important fields of human health and human life.[7]

[7] Ibid, p. 5.

In general it would appear that the most urgent needs in an extended Nation-wide program of education for conservation are for (1) curriculum aids for teachers; (2) better preparation of teachers [8] in teacher-education institutions, including preservice and in-service courses in both subject matter and methods; (3) preparation of readable factual information for teachers; (4) more instructional helps [9] prepared by qualified writers; (5) the publication of more informational material directly bearing on the subject of conservation prepared especially for younger pupils; (6) compilation of bibliographies annotated from the standpoint of helpfulness for different age groups and for children's varying interests; and (7) systematic coordination of desirable services of nonschool organizations with the school program under guidance of the proper school authorities. In the following chapters of this bulletin, suggestions are given to meet these needs.

For example, the subject of conservation is defined from the point of view of its national significance as well as with respect to its importance in individual communities. Attention is called to types of conservation that specialists consider essential for the different natural resources. Issues are mentioned that should be considered in national and local planning for conservation. The nature of such conservation activities as have educative value is described and the scope of these activities is indicated. Desirable results are indicated with respect to such content areas as wildlife, minerals, water, forests, and soil, as examples of the type of curriculum content which teachers and pupils can develop with respect to all of the natural resources.

This bulletin is to be used in any way which the teacher considers practical. Examples are given of subject matter and activities that can be utilized in elementary schools, together with desirable results in the way of understanding, attitudes, and continuing interests that children can be expected to develop. These desirable results, or objectives, as they are frequently called, instead of being expressed in lists, are presented in learning situations in which children can be expected to achieve them at different levels of ability. Some teachers will find them helpful in the planning and teaching of lesson units on conservation. Others will use them in connection with different subjects,

[8] The need of a Nation-wide program of conservation in education. The elementary school journal, 37: 644–49, May 1937.

[9] Ibid.

topics, or activities in which conservation emphasis is desired. Many of the suggestions are related to children's experiences. In this respect, it has been possible to develop suggestions for instruction in certain natural resources in greater detail than others because children normally have more experiences with them. The suggestions are intended to be illustrative, not exhaustive. As teachers read and study the subject they will think of other activities and subject matter appropriate for their pupils.

No attempt has been made to suggest grade placement of subject matter. It is intended that children engage in activities according to their individual needs and abilities. Any school will find it necessary to plan some arrangement of topics and activities in order to prevent duplication of instruction as children progress from grade to grade. An illustration of such a plan is given in another bulletin.[10] Bibliographies for teacher and children will be found in the following publications: Conservation in the Education Program; Teaching Conservation in Elementary Schools; Good References for Conservation Education in Secondary Schools; Good References for Conservation Education in Elementary Schools; Good References on the Conservation of Birds, Animals and Flowers, for use in elementary schools; Good References on Conservation of Trees and Forests, for use in elementary schools.[10 11]

[10] Teaching conservation in elementary schools. Washington, U. S. Government printing office, 1939. (Federal Security Agency, U. S. Office of Education, Bulletin, 1938, No. 14.)

[11] Bristow, William H. *and* Cook, Katherine M. Op. cit.

U. S. Department of the Interior, Office of Education. Good references for conservation education in elementary schools. Washington, U. S. Government printing office, 1938. (Bibliography No. 70.)

——— ——— Good references for conservation education in secondary schools. Washington, U. S. Government printing office, 1937. (Bibliography No. 55.)

——— ——— Good references on conservation of birds, animals, flowers, for use in elementary schools. Washington, U. S. Government printing office, 1937. (Bibliography No. 72.)

——— ——— Good references on conservation of trees and forests. Washington, U. S. Government printing office, 1937. (Bibliography No. 71.)

SIGNIFICANT ASPECTS OF CONSERVATION

Conservation has been defined as elimination of waste; wise use.[1] That means an optimum, but not necessarily a maximum, use of natural resources. Gradually the term has acquired a broad meaning. For example, in the source just quoted, one reads:

> As our ideas of conservation have developed we have seen them expand to include not only the care of the forests and wonderlands, but also the preservation of certain recreational and historic sites, the maintenance of the fertility of soils, the prevention of soil erosion, the careful mining of metals and of fuels, the protection of wildlife, including the fish of the fresh waters and of the salt waters near the continent, the preservation of primitive beauty in the landscape, and finally, the conservation of the human life and culture of the Nation. Public opinion has become so favorable to the ideas of conservation that many projects are represented by their promoters to be in the field of conservation in order to secure popular support for those projects.

Another definition[2] has been worded thus: "Conservation means the greatest good to the greatest number—and that for the longest time." The ultimate aim of the conservation of the earth's resources is the conservation of human life,[3] which means reducing the intensity of the struggle for existence, subordinating mere subsistence, and giving opportunity for the development of a higher intellectual and spiritual way of living.

Many conservationists today regard the natural resources of the country as a national heritage. They admit the farmer's right to use his land as he pleases provided he does not exploit it or do harm to others. They believe that the forests justly belong to individuals or companies on condition that they hold the woods in trust and carry on scientific programs of cutting and of replacement of the trees they cut. Similar rules can be applied to the use of minerals, and of oil and gas. Nor can a selfish

[1] Parkins, Almon E., *and* Whitaker, J. R. Our natural resources and their conservation. New York, John Wiley and Sons, Inc., 1936. p. 19.

[2] Van Hise, C. R., Havemeyer, Loomis, *and others*. Conservation of our natural resources. Rev. ed., edited by Loomis Havemeyer and others, based on Van Hise's Conservation of natural resources in the United States. New York, Macmillan Co., 1937. p. 527.

[3] Ibid.

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A Government biologist bands a mallard, a method used for studying the bird's migratory habits, distribution, and abundance.

policy any longer be followed with respect to use of water, or of wildlife.

GUIDING PRINCIPLES

In a thorough study of conservation, the pupils will arrive at several simple conclusions regarding the facts. Among them are the following:

1. The United States is a land of abundant natural resources.
2. The present supply of all natural resources is much smaller than that the first settlers found. Many of the resources have been used unwisely and wasted.
3. Waste and misuse of the natural resources, however, is not confined to the past. It goes on every day.
4. Unmolested, nature maintains a balance among her resources which eventually insures a maximum vitality of all life and reduces barren areas to a minimum.
5. This natural balance is disturbed through greed, ignorance, and a lack of cooperation among citizens.
6. In order to restore the wasted resources and pass them undiminished to future generations, the Nation will have to reestablish and maintain the balance which has been upset. This should be the first objective in a program of conservation.
7. A successful program of conservation depends on the individual and cooperative action of informed and earnest citizens and communities and on the application of scientific principles of use and maintenance to each of the natural resources.

Technically applied, these facts and principles result in certain types of conservation:[3]

(a) Coal is limited in amount and irreplaceable. Therefore, conservation of coal consists in reducing the waste in mining and in use, thereby saving as much as possible for future generations.

(b) Although the supply of oil appears to be abundant, it, nevertheless, is limited in amount and irreplaceable. Therefore, conservation of oil consists in using substitutes wherever possible and in saving oil for those higher uses for which there are at present no adequate substitutes. Eliminating waste is important.

(c) Natural gas is definitely limited in quantity. It is abundant but has been recklessly wasted, and uneconomically used. The method of conserving it is to reduce the waste.

(d) Like coal, oil, and gas, metals are absolutely limited in amount. Unlike the fuels, however, when the metallic ores are extracted from the earth and reduced to the form of metals, they may be used again and again.

[3] Ibid.

Therefore, conservation of metals consists in:

(1) Reducing to a minimum the waste in mining and extracting.

(2) Refraining from using them for such purposes as destroy them by a single service.

(3) Refraining from using them in any way which makes them deteriorate rapidly, as iron does when it is exposed to the weather without a coat of paint or other protective covering.

(e) Water is never destroyed because through certain changes it is taken up by the air, condensed, and released as rain. It is unevenly distributed, however, and many regions have too little water to maintain life. The problem of conserving water is to use it completely—for domestic purposes, for water power, for navigation, and for irrigation—and to substitute water for irreplaceable resources whenever possible. Water, rather than steam, sometimes can be used for power. Thus coal or other fuel is saved.

(f) Forests may be renewed, but slowly. The principles of conservation applied to forests means that forests may be used but not more freely than they can be renewed.

(g) Wildlife can be scientifically restored, but slowly. Once a given species passes a certain low in respect to numbers, it will certainly be exterminated. To various groups of people, wildlife has a different appeal. Farmers object to some animals and birds that eat their crops although there usually are offsetting advantages. Nature lovers wish all wildlife preserved. Certain hunters desire unlimited freedom to kill. The problem is to bring these conflicting interests together by cooperation and yet meanwhile to continue measures necessary to the preservation of threatened species.

(h) Soil is renewed by the process of nature, but very slowly, probably at a rate not to exceed one foot in from 4,000 to 6,000 years. The problem of conservation with respect to soils is, first, not to allow erosion to occur more rapidly than the soil is being manufactured; and, secondly, not to deplete the soil of those essential elements limited in amount which are necessary for plant food, such as nitrogen, potassium, phosphorus.

(i) The conservation of human life involves the lengthening of life and increasing its healthfulness and happiness.

ISSUES IN CONSERVATION

Is too much emphasis being placed on conservation? Three issues have been mentioned:[4]

1. Why bother with soils . . . when Dr. W. O. Willcox announces that we could raise our present tonnage of crops on one-fifth the present acreage by intensive use of the principles of agrobiology?
2. Why worry about oil when motor engines can run on alcohol?
3. Why bother about the forest when houses can be built of steel, aluminum, and glass?

These questions suggest such considerations as the following:[5]

In the first place, even though it be granted that one-fifth of the present farm land could feed the people, how could this land be tilled and planted? Long-time planning for forest restoration, reliable sources of water, and erosion control would be necessary. Can the Nation foresee its future needs with sufficient accuracy to engage in such a program of planning? Secondly, suppose alcohol were substituted for oil. Alcohol is at present made from grain and other plants. Soil and water are required for these. If alcohol were substituted for oil, it would be necessary to add to the acreage of cropland. How much and how long can the Nation plan with sufficient accuracy not to disturb further the balance established by nature? Thirdly, suppose people cease building houses of wood. Suppose all the people desire and plan to live in glass houses or aluminum houses, or in houses of steel (steel is more limited than the potential production of wood). Though the country might not need the forests for wood, they would still be needed for paper. They would be needed also to protect the soil, to aid in the prevention of floods, to help control the water which is used for power and irrigation. "If the soil goes, life goes. It is not a mere matter of food . . . Erosion corrupts the whole continental balance."[5]

[4] Chase, Stuart. When the croplands go. Scholastic, 29:12-13, September 26, 1936.

[5] Ibid.

NATURE AND SCOPE OF ACTIVITIES

As an example of a study of conservation, assume that in a certain community, the Government is conducting a project with cooperating farmers to check the onslaught of erosion. This is a new idea and adults in the community discuss its pros and cons with intensity. The children also become curious about the project. They ask questions about contour plowing, strip farming, filling of gullies, grassed waterways, and other experiments in the conservation of the soil. One child wants to know why some farmers plant their land with strips of different kinds of crops. Another asks if farmers are compelled to try the new ways of farming. Is there any advantage in filling gullies if they are washed out in floods? Does conservation pay? Has the Government a right to compel farmers to protect their soils? What is the Government? With questions like these a study of conservation is initiated.

The teacher guides the pupils into a search for facts to help them answer their questions and to engage in desirable activities. They read. They interview people who have charge of the project. They take trips to observe the work as it is carried on. With the teacher's help they formulate answers to their questions,

A 4–H club member places sod bags at the head of an active gulley as a means of conserving the soil.

draw conclusions, make generalizations. If the children live on farms, they help their parents with such work as filling gullies and setting out trees. If they live in a town or city and have no opportunity to participate in the work of conservation, they can be led to approach their study with the purpose of learning what farmers are doing and why the work is a matter of concern for the whole community, city as well as country. In town or country, nearly all children can have gardens of their own and learn how to maintain the fertility of the soil in them.

An analysis of the illustrative enterprise just indicated and analysis of similar conservation studies[1] reveal qualities frequently considered desirable in children's activities—variety, freshness, possibilities for giving satisfaction, social significance, potentialities for community participation, practical relation to future living. Some explanation of these is in order.

VARIETY[2]

The activities required for studies in the field of conservation are varied with respect to the nature of the resources studied and the inclinations, needs, and desires of the pupils; their range is broad. Consequently they provide for many lines of child growth. Although the illustrative enterprise just described deals with the saving of soil, there are many resources besides soil which should be considered—birds, mammals, flowers, water, parks, forests, human life, and health. In connection with each of these there are many things children can do. Of the children who are interested in birds, for example, some may read and study about

[1] Raymond, Anne. Soil conservation in the Arizona schools. Arizona teacher, 24: 39-46, October 1936.

Bristow, William H., *and* Cook, Katherine M. Conservation in the conservation program. Washington, U. S. Government printing office, 1937. p. 30–36. (U. S. Department of the Interior, Office of Education, Bulletin 1937, No. 4.)

Follett, Minnie. Conservation. *In* Organization of curriculum for one-teacher schools. Bulletin of the Department of rural education. Washington, D. C., National education association, February 1933, p. 16.

[2] Barnes, Emily A., *and* Young, Bess M. Children and architecture. New York, Bureau of Publications, Teachers College, Columbia University, 1932. p. 19–22.

The staff of the elementary division of the Lincoln School of Teachers College. Curriculum making in an elementary school. New York, Ginn and Company, 1927. p. 29–41.

Stratemeyer, Florence B. The effective use of curriculum materials. Bureau of Publications, Teachers College, Columbia University, New York, 1931. p. 119. (Contributions to education, No. 460.)

birds. Others who are more interested in doing things with their hands than in reading or studying may build bird baths, plant shrubs to protect birds, establish feeding stations for birds in winter, build bird houses. In a study of birds there are opportunities for excursions. Children will wish to report the information they find to their classmates. In the autumn they make collections of birds' nests and learn to identify them. As in studies of birds, so in studies of water, forests, minerals, soil, and wild flowers there is a variety of things to do and learn. At any time a child who has studied one phase of the subject or carried on a certain type of activity need not repeat it because in the subject of conservation he can always find something different to do.

Conservation enterprises are also varied with respect to opportunities for both group and individual activities of different kinds. Children who desire to follow individual hobbies can specialize on some particular phase of the subject; engage in creative activity in music, painting, or writing; undertake experiments or engage in field activities. Children who like to work with others can find many things to do or to study with other children who have similar interests. They can organize clubs or work together informally.

FRESHNESS [3]

The quality of freshness is important. From the fact that it has only recently been introduced into the school curriculum, conservation is a fresh subject. It has not been spoiled for teacher and pupils by poor teaching or warped by overdirection. It has

[3] Follett, Minnie. Op. cit., p. 31.
Barnes, Emily A., *and* Young, Bess M. Op. cit., p. 23–27.

The nest and eggs of the mallard are well hidden from predatory animals.

not been taught and retaught till its activities have become so much a matter of form that children look forward to them from year to year—with pleasure or with dread according to the vividness, interest, and success with which the preceding class developed them. No "pattern" of questions, topics, organization, is likely to occur to the children for a conservation study, obstructing originality of thought as it does for some of the familiar lesson units, such as a study of Holland. In the latter the children sometimes without original thinking suggest topics which they have used in learning about other countries, such as industries, homes, and ways of travel. For studies in conservation few "patterns" have thus far been made. Accordingly, the children are free to plan creatively. Furthermore, the activities and experiences that children pursue in a study of conservation can be made new and fresh each year. The nature trail, for example, becomes a new trail every spring. If it has the same plants, these plants will have different leaves, new flowers, new roots. The saplings that members of one class plant become young trees for another class to protect.

POSSIBILITIES FOR GIVING SATISFACTION [4]

Study of conservation is satisfying to children because it is in line with some of their preceding experiences, with many of their interests, and with their individual capacities for growth. This quality has been pointed out as desirable in school activities. A class will work persistently, for example, to discover why the leaves of the familiar hard maple in the school yard turn orange, red, and yellow every autumn; why leaves fall; of what use are the leaves after they fall. The study is satisfying because the pupils desire the information, and it is in line with their ability. A group of children will study with interest the habits of the plants in a school garden, the kind of soil they need, and the ways it can be replenished. There is something for every child to do according to his capacities for growth; something which he finds interesting to study. Accordingly his activities result in success and satisfaction for him. As it is with a school garden, so it usually is with any other conservation activity.

[4] Barnes, Emily A., *and* Young, Bess M. Op. cit., p. 19–22.
The staff of the elementary division of the Lincoln School of Teachers College, Columbia University. Op cit., p. 31–32.
Dunn, Fannie W. Tentative criteria for curriculum selection. Progressive education, 11: 373, October 1934.

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SOCIAL SIGNIFICANCE [5]

Conservation studies are socially significant. They contribute to the children's participation in major social problems of the race and to some understanding of them—such problems, for example, as those of economic security, health, satisfying use of leisure time. Conservation of soil and forests is the basis of economic security. Conservation of forests, of wild flowers, of birds, makes possible a happy employment of leisure for many people, young and old. In fact, conservation of all natural resources is the very foundation of human life and health and the chief means of preserving human life at its highest possible development. Not only have conservation activities social significance, but children can feel this significance and respond to it

COMMUNITY PARTICIPATION [6]

A study of conservation often gives children opportunity to participate in community enterprises. It has aspects in which both children and adults can do their part. In the State of Washington, for example, at least two schools [7] have initiated forest projects of interest to the entire community. Each year children in high-school classes take charge of the projects, survey the work which was done by the class of the preceding year, set out new trees and plants, and make fresh plans for carrying the work a step further. The children have planted 10,000 trees in 5 years and "most of them are growing gloriously." In a certain city school in another State, the children and community cooperated in a project to improve a neighborhood of ugly and dilapidated houses in the vicinity of the school. In another school the children developed a plant exchange. Those who had young plants to spare brought them to the exchange and received in return plants to set out at home.

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[5] Teachers' guide to child development. Manual for kindergarten and primary teachers. Washington, U. S. Government printing office, 1930, p. 8, 12–13. (U. S. Department of the Interior, Office of Education, Bulletin 1930, No. 4.)

The staff of the elementary division of the Lincoln School of Teachers College. Op. cit., p. 38–39.

Dunn, Fannie W. Op. cit.

Hanna, Paul R., *and* research staff. New York, D. Appleton-Century Co. 1936. p. 35–40.

[6] Hanna, Paul R. Op. cit., p. 38.

[7] Clark, Frank J. High schools conduct reforestation. Washington education journal, 16: 137, March 1937.

Moose are still found in our National forests.

In a town or city that has community forests, children can well be invited to participate in setting out new trees and plants, in planning nature trails, building bird baths, and erecting supports to protect trees and shrubs. Work of this kind is profitably done with the close supervision and cooperation of park, city, or town commissioners, nurserymen, county agent, or others who are able to give expert advice and assistance.

Care should be taken that children participating in community enterprises are not asked to perform services which do not add to desirable child growth. The school's responsibility in children's services for the community is primarily the welfare of the child, and only secondarily the improvement of the community. Society gains nothing if it saves its material resources at the expense of the improvement of the human race, which is the ultimate goal of organized education.

RELATION TO FUTURE LIVING

Conservation activities are closely related to the children's immediate future.[8] For example, children who become interested in birds in school are apt to maintain and to expand this interest through life. Children's interests in a nature trail, a community forest, the damming of a gully, or any other conservation activity need not cease with completion of eighth grade or high school, any more than their responsibility as citizens ceases with graduation from school. Recreational interests in wildlife—valuable assets to people throughout their lives—receive impetus from conservation studies in school.

[8] Organization of curriculum for one-teacher schools. Op. cit., p. 31.
Dunn, Fannie W. Op. cit., p. 378.
Stratemeyer, Florence B. Op. cit., p. 118.

AREAS OF CURRICULUM CONTENT

Just as the subject of conservation has its body of knowledge as a whole, so in connection with each natural resource there is a body of facts and information which can be used to answer questions and to enrich activities. For convenience in the discussion in this bulletin, these bodies of facts and information are regarded as Areas of Curriculum Content. On the pages which follow, five of them are developed illustratively in the following order: Wildlife, minerals, water, forests, and soil. The order in which these resources are presented for study depends on the children's interests and the appropriateness of each in the development of the curriculum. Because of limitations as to space, not all kinds of wildlife or of minerals are discussed. Conservation of human life is not discussed because many courses of study provide for instruction in safety and for the development of mental and physical health; and because it is desired to concentrate the material of this bulletin on the conservation of natural resources as prerequisite to the conservation of human life.

Since the needs for conservation of natural resources are continuous, it is well for any class to have an appropriate organization of content whereby children will meet with new experiences of a type to challenge their growing ability as they move from grade to grade or from one type of work to another. Systematic instruction can be achieved by placing emphasis on different phases of the subject or on different activities at definite places in the curriculum. For example, according to one curricular plan, birds can be the center of activity one year, flowers another year, soil another and so on. Such a plan does not mean that, during the year in which the subject of birds is a center for the main study or activity, some other subject such as soil would receive no study, or that reading and study would be the pupils' only activities. It merely denotes the topic which receives major emphasis. Other studies and activities are carried on whenever needs for them arise and to the extent that satisfies children's immediate interests or urgent desires. Another plan does not designate points of emphasis. Instead, it considers the general problem of conservation as one major social enterprise in phases of which the children participate from year to year, as needs arise—in the care of a wild-flower garden, for example, establishing a community forest, serving hot lunch, or decorating the

classroom or rooms at home. In this case, the year's work is planned annually in advance to harmonize with the specific problems in which the school or community is engaged or is apt to undertake.

Still another plan,[1] not greatly different from the foregoing, treats conservation as a function of social life and through it aims to help pupils develop certain controls necessary for effective living. Centers of interest and problems are suggested for each grade level designed to meet the needs of children at different ages. For example, the first-grade pupils study the maintenance of life and health in home and school, with home and school life as the center of interest. The seventh-grade pupils learn how social and governmental agencies protect and conserve life, property, and natural resources, and have social divisions for cooperative living as a center of interest. Likewise, for other grades of the school, specific problems are suggested dealing with conservation in its relation to large centers of interest. In this plan no single social function is considered apart from the nine other social functions pointed out by the course.[2]

Some classes in conservation have developed their study around each of the country's natural resources—wildlife, minerals, water, forests, soil, human life—or some aspect of one of these. That fact does not mean, however, that every teacher should follow such organization. Her organization will be influenced by the interests and needs of her class.[3] Young children, whose

[1] Tentative course of study for Virginia elementary schools, grades I–VII. Richmond, Va., State Board of Education, 1934. Quoted *in* Bristow, William H., *and* Cook, Katherine M. Conservation in the education program. Washington, U. S. Government printing office, 1937. (U. S. Department of the Interior, Office of Education, Bulletin, 1937, No. 4.) 78 p.

[2] Suggestions for planning and organizing conservation activities are given in *Teaching conservation in elementary schools*. Washington, U. S. Government printing office, 1939. Federal Security Agency, U. S. Office of Education, Bulletin, 1938, No. 14.)

[3] Organization of curriculum for one-teacher schools. Bulletin of the Department of rural education, Washington, D. C., National Education Association, February 1933. p. 34.

The staff of the elementary division of the Lincoln School of Teachers College. Curriculum-making in an elementary school. New York, Ginn and Company, 1937.

Stratemeyer, Florence B. The effective use of curriculum materials. Bureau of Publications, Teachers College, Columbia University, New York, 1931. pp. 91–94.

understanding is mainly limited to concrete facts and simple concepts, are interested in a single item or topic, such as trees or birds, or in a manual activity. Children of the junior high school can sometimes study the subject of conservation as a whole. Pupils at this age have had enough experience and have read widely enough to enable them to use ideas abstractly. However, junior high-school pupils, like younger pupils, often become interested first in things to do about conserving trees, plants, or health. With the concrete simple concepts which they build thus, they can later formulate generalizations or conclusions and establish principles.

Material in each area of curriculum content is presented, not as information which the class should "learn" in the sense of "memorize," but rather as an aid in helping children develop desirable understandings, attitudes, and interests, and to suggest conservation activities in simple situations which pupils normally will encounter. Naturally the information contained herein is not sufficient for complete realization of the objectives indicated. More details and greater concreteness are necessary. Young pupils will learn through many observations and first-hand experience. Older pupils should be helped to plan studies and activities guided by books such as those suggested in the bibliography, and by such collections of bulletins and other materials as they are able to gather. For information not easily available, teacher and children should write or interview their county superintendent, county agent, State department of education, State department of conservation, and private organizations interested in conservation.

With a few exceptions which are mentioned, no effort has been made to differentiate among results to be achieved by primary pupils and by those more advanced, nor to analyze the understandings, attitudes, and interests which are pointed out. In complete learning situations the objectives mentioned will be developed in different ways by different pupils, depending upon their interest and their previous knowledge and experience rather than upon grade level. In the treatment of each division of content a similar organization is followed. Appropriate suggestions are included under each of the following heads: (1) Understandings to be developed; (2) participation in conservation activities; and (3) attitudes and continuing interests.

WILDLIFE

Birds.[4]—The situation with respect to bird life is deplorable. The annual widespread burning of forest margins, dry swamps, and fields has decreased the numbers of wild birds. The misused gun, the speeding automobile, careless insect poisoning and pollution of streams have taken their toll of bird life much to the delight of an increasing list of insect pests. Bird lovers are saddened at the loss of the cheery creatures of which they have become so fond. Furthermore, for practical reasons, everyone, whether or not he knows the birds as friends, should be alarmed at the rapid decrease in bird life. The birds are man's best protectors. Though most of them are small and timid and apparently of very little use, it has been said that humanity might soon disappear if the birds should vanish; that great armies of insects would destroy the beautiful flowers, eat the food, chew up the wood in forests, and even devour the people themselves. Nothing would be left on the surface of the earth but rocks, gray dust, and sharp yellow sand. In many places the birds are becoming more and more scarce. Unless man succeeds in adjusting and restoring the natural balance which he destroys,

[4] The books listed in the bibliography on pages 76–77 were consulted for information contained in the following discussion.

Our friend, the robin, builds his nest in the forks of a tree.

or in making it possible for nature to do so, he will suffer. Even the following more conservative view is startling:

> It may even be that if all birds were destroyed, other enemies of insects would be able to take care of the situation before desolation would become complete, but that no one can know. We do very definitely know that birds destroy a vast number of injurious insects, rodents, and weed seeds every year, and are to be considered one of the most important factors in checking the increase of such pests, which, if unchecked by any means, would quickly prove very disastrous to the human race because of their wholesale and widespread destruction of vegetation. It is quite definitely known that ruthless slaughter of insectivorous birds has been followed locally by immediate increase in the number of insects, to the great injury of forest and agricultural crops; that wholesale destruction of birds of prey has been followed by "plagues" of mice and other mammal pests.[5]

Can anything be done to save the birds that are left? This is a problem not alone for the conservationist but for society. One factor in its solution is education. If a boy in school learns the truth about the birds and understands humanity's dependence upon them, he will do what he can to protect them. There are things a boy can do to save the birds while he is a boy. There are more things he can do when he becomes a man.

(1) *Understandings to be developed.*—Children love birds. It requires no stage setting to initiate profitable activities for conserving bird life. Systematic study of birds will be helpful in understanding their practical and æsthetic value, the best ways of conserving them, and the conflicting interests in their conservation. Pupils should be helped to plan their own observations. A helpful step in any study of birds is identification of common varieties through observation of color and markings of male and female, general shape in flight and in repose, song, and habits of flight. Another consideration is usefulness. Topics to be studied are the food of different birds and where they seek it; the materials of their nests and the location, whether high or low in trees, whether in shrubs or grass, and the like; the time and manner of their migration; time of nesting; the way they care for their young.[6]

Are birds really useful? For general information about birds,

[5] Henderson, Junius. The practical value of birds. New York, The Macmillan Company, 1934. p. 9.

[6] Harris, Garrard. Elements of conservation. Richmond, Va., Johnson Publishing Company, 1925. p. 128–29.

children can write to agricultural experiment stations for bulletins of information. They can scan these bulletins to learn what the birds eat, and compute the losses that different ones save the farmer. If they have always considered the birds chiefly as devourers of the farm crops and fruits, they will be surprised to learn that without the birds we would raise fewer crops and fruits.

Children who have worked in discouragement to pick the bugs off potato vines will learn with gratitude that quail are very fond of potato bugs, along with other delicacies, such as worms, cutworms, chinch bugs, and bean leaf beetles, all of which are enemies to human beings. Some children may wish to make a list of the insects which are harmful to crops in the community. There are many other destructive ones, such as the May beetle, armyworm, corn-root worm, flea beetle, and the like. With such a list, they should then try to learn by reading which of the birds are particular enemies of the different pests. *Most birds are useful because of the insects they destroy.*

Children who are familiar with cotton growing may be interested in searching for facts to show which of the birds help save cotton.[7] More than 50 varieties of birds destroy the cotton boll weevil alone. Children will enjoy learning the names of some of these and making a list of them.[8] Other insect enemies of the cotton crop are destroyed by birds. The cottonworm, for example, is "bread and butter" for the yellow-billed cuckoo, or "rain crow," as the children may call him. *Many different kinds of birds destroy the various enemies of cotton.*

Some children will be interested in making a list of the birds which the farmer accuses of doing harm, and then in reading to find out the truth about these birds.[9] For example, pheasants are sometimes accused of pulling up young corn; hawks and owls of killing chickens; and the king bird or bee bird, as he is sometimes called, is believed to eat bees. In general, these *accusations against the birds are not true.*

The children may have noticed that the bee bird likes to perch on a tree near a beehive and dart out now and then to catch a passing insect. Older pupils can read for themselves the reports

[7] Beal, F. E., McAtee, W. L., *and* Kalmbach, E. R. Common birds of Southeastern United States in relation to agriculture. (U. S. Department of Agriculture, Farmers' Bulletin No. 755.) 44 p., illus.

[8] Harris, Garrard. Op. cit., p. 133.

[9] Harris, Garrard. Op. cit., ch. XVI.

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Great horned owls.

of the Biological Survey [10] and farmers' bulletins. They will learn that examinations of the crops and stomachs of bee birds revealed, not masses of fat brown bees, as might have been expected, but grasshoppers, cankerworms, boll weevils, and robber flies! *The robber fly, one of the worst enemies of the honey bee, is food for the bee bird.*

The Pennsylvania Game Commission made a scientific study of the food of birds killed in farmer's fields, giving special attention to the farmers' complaints that pheasants were pulling up their young corn. Pheasants were found pulling the corn, it is true. What they wanted, however, was insects—insects which had already injured the corn. The corn the birds pulled up would have died, anyhow. The study revealed corn in the stomachs of only two of dozens of pheasants killed.[11]

Searching for facts about birds in reliable sources will lead children to the conclusion of the scientists that *with the possible exception of a few varieties, insect-eating birds help protect the human race from a very probable early extinction by insects.*

[10] Henderson, Junius. The practical value of birds. New York, The Macmillan Company, 1931. p. 221–22.

[11] Arbor Day, Bird Day. Commonwealth of Pennsylvania. Harrisburg, Department of Public Instruction, 1934. p. 17.

Hawks, which are often thought harmful, are among the best friends the farmer has. The hawk is a very interesting bird for children to study. The following definition suggests valuable concepts for the student to form through his study:

> To the average uninformed farmer, a hawk is a robber of poultry yards; to the gunner, sportsman, and game breeder, "vermin" to be ruthlessly destroyed; to the ammunition manufacturer and sporting goods dealer, an unprotected bird and therefore another "target"; to the biologist, a wonderful example of adaptation for life in a certain definite niche, a check upon harmful rodents, a control against the overproduction of normally useful creatures, and an invaluable instrument in preserving what is known as the "balance of nature"; to the vast and rapidly increasing army of nature lovers and amateur bird students, one of the finest and most interesting forms of bird life, worthy of protection at all times.[12]

Some hawks take a chicken now and then, it is true, and the children should keep a record of the chickens taken by them. Usually such a record will establish greater innocence than the children are ready to believe offhand. Hawks also fight an enemy which digs out freshly planted corn to the value of hundreds of dollars, and which is very difficult indeed for the farmer to keep in check. This is the field mouse. *Hawks eat field mice, but very few chickens. Many other birds are thus unjustly accused of doing harm.*

(2) *Participation in conservation activities.*—A few suggestions will aid classes in beginning the conservation of bird life in their communities. After a beginning is made, the children and the teacher will continue to find new challenges and needs and to think of activities to extend their program of conservation. Of course children who have been killing birds should cease the deplorable practice. Then they might report to proper authorities any killing which they have witnessed of birds protected by law. In most States all birds are protected except a few game birds in certain seasons, and crows, sparrows, large owls, and certain large hawks. Children can also influence farm owners to put up "No trespass" signs to keep bird killers off their property. A class or school can make such signs for the farmers of their community. *Children can accomplish much in preventing people from killing useful birds.*

Can pupils influence other children and adults to protect the birds? One boy cooperated with an adult club to secure subcrib-

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[12] May, John B. The hawks of North America. New York, The National Association of Audubon Societies, 1935. p. xvii.

ers to a petition for a law to protect certain birds in the State. He began by asking adults of his acquaintance to sign the petition. Other children in the school became interested and induced acquaintances of theirs to sign the boy's petition. *Children sometimes can influence lawmakers.*

Pupils in upper elementary schools often can write articles for the local daily or weekly paper giving information about birds which will be of interest to many readers. Keeping a calendar of the birds seen each day may interest readers in observing birds. People are interested in the kinds of food the birds eat, and in the songs they sing. "Human interest" incidents about birds are appealing if well written. Many people are interested in knowing ways to identify birds, interesting methods of studying them first-hand, and ways of attracting them to the house. Children's experiences will be read. *If people become interested in birds and informed about them, half the battle of conservation with respect to them has been won.*

How can pupils have more birds about their homes? In the summer, birds are attracted to a home or farm which has desirable protected places in which to build nests. In certain fence corners it is well for the farmer to leave shrubs and weeds for protection. Food also attracts birds. Children may discover that some birds are attracted to sumac in fence corners, both for food and for protection. Other pupils may have seen birds eat mulberries. Many birds like wild grapes. Elderberries attract most birds. Conclusions the pupils draw from observation can be verified by reading. When they learn that birds of their community are fond of certain plants, more of those varieties can be set out.

Children can do many things to attract birds to a farm or suburban home.—Many children like to build bird houses. To do this they must read and observe habits of different birds to learn the kinds of houses in which they will nest. The pupils may find out by experience that just any house will not attract the particular bird they wish to protect. Some birds prefer houses placed high; others nest low. Size of hole for the bird to enter is a consideration. *Ventilation is important. Information on building bird houses will be found in Federal and State Government bulletins.* Farmer's Bulletin No. 1456, United States Department of Agriculture, *Homes for birds*, is an example.

In winter children attract birds by establishing feeding stations for them on the ground of school or home. A shelf built against

Sesban plants stabilize the banks of the pond and provide food for wild geese.

a tree or schoolhouse window provides a protected place to scatter grain or to tie suet. Branches tied above, or a shelter of boards will keep off the cold winds. Certain birds will be immediately attracted to such protection. Others prefer a shelter on the ground.

Children who live in the country have the best opportunity to learn about birds and to participate in their conservation. Pupils in cities may observe English sparrows, pigeons, robins, certain varieties of blackbirds, starlings, and the like in parks or landscaped corners. There is probably something that they can do to attract them, such as building shelters in parks, putting out food, and the like. Some can observe exhibits of birds in museums.

(3) *Attitudes and continuing interests.*—Knowledge of facts should lead definitely to the development of emotional responses. Children should develop appreciation of the beauty of birds, a tendency to protect them, and a feeling of revulsion at their destruction. Thoughtful and protective consideration of birds should make it impossible for a normal boy to hurl a stone "for fun" or destroy a nest in spring.

As they walk through meadows, children should take care not to tread on nests. They should refrain from rushing here and there in woods or meadow where they cause disturbance. Birds that nest near houses should not be too closely watched. Eggs and young should never be touched. In addition to the scien-

tific reasons for protecting birds, others such as love of their songs and their beauty are worthy of consideration. Such love, however, comes from many experiences with birds, not from exhortations. Ultimately through their experiences pupils should *feel hurt at the destruction of a nest or at anything which frightens a bird.*

Keeping a record of the names and description of birds observed will help the children value them for their beauty. Studying beautiful pictures is helpful, and also a visit to a museum or zoo to look at birds from other sections of the country. Discussing the things they enjoy about birds, observing the way different birds fly, the way they build their nests, their response to human kindness, also leads children to appreciate them more. "*The birds are very beautiful to see and enjoyable to have about,*" should be the child's response to birds in his environment.

Delicateness of color, grace of line and flight, melody of song are not the only points of beauty to be appreciated in birds. In large birds such as the hawks, owls, and eagles, their is another kind of beauty—the beauty of strength. It lies in the sweep of powerful wings, the majestic soaring, the distance of keen vision, and of life loyalty to one's mate portrayed by the eagle. In this connection it is worth while to read *Three Seasons at Hawk Mountain Sanctuary*, Publication No. 61, Emergency Conservation Committee. *No one should miss experiencing the thrill which such beauty gives.*[13] Because of its beauty and sterling qualities of character the eagle was chosen as the national emblem. Appreciation of this fact should lead children to remonstrate against the paying of bounties on eagles.

Children should learn to know bird calls and songs for the pleasure of listening to them. They will find it fun to try to put a bird's song to words. Some people think, for example, that the Phoebe calls her own name, and, when one listens, one easily can imagine that this is true. The saucy chickadee has been named from his own call, "Chick-a-dee-dee-dee." Every child knows the "Peter, Peter, Pumpkin Eater" of the meadow lark. *The purest pleasure, however, in bird songs is realized through their music, rather than through imaginative interpretation of it.*

Children might observe different birds and report to the class reasons for admiring them. A bird's song gladdens the hearts of poets and musicians. His assiduous labor to build and maintain his home and protect his family is a glorious example for human-

[13] Ibid., ch. XXII.

Heavy leaves and vegetation hide the woodcock's nest.

ity. The eagle's loyalty to a single mate is an example. Though shy and timid in many respects, most birds are creatures of great courage when the situation demands. Let a pair of birds, after they have built a nest, learn that a cat lives in the vicinity, and they will endure to the end to protect that nest and rear their young. *A bird's life can make man's life richer and better.*

It is practically impossible for children to engage in activities to attract and protect the birds and to learn more about them without forming many persistent interests in them. However, the persistence of any interest may be increased by continuous encouragement, and this is particularly true of an interest in birds because their activities are always changing. One of the very first things a child can begin and continue is the identification of birds. It is satisfying to identify birds in one's community, to know their habits, to recognize their songs. *It is stimulating to seek for information about a newcomer and finally add him to one's list of known birds,* especially if one knows his teacher and classmates will also be interested.

Children can follow other interest in birds. They may wish to make collections of poems or songs, or prose about them, or become expert in making drawings or paintings of birds, or in writing poetry about them. *One of the most fascinating interests for a child in the country to follow is to study the ways in which different birds nest, and then provide materials for them to use.* An interest of this kind

contributes both directly and indirectly to saving birds—direct because birds like to nest where they can find material, and indirectly because any activity to protect birds usually leads to still more study.

Wild flowers.[14]—Walking along an unwooded Iowa roadside 30 years ago a nature lover would have seen thrifty prairie flowers from May until October. In June the roadsides were pink and white with wild phlox, "wild orange blossoms", daisies, and wild roses. The lowlands added blue to the color scheme—violets, spider wort, blue flag, vetch. In August nature had a different color—lavender, yellow and orange, purple of varying shades. Milkweeds, asters, thistles, Joe-Pye-weed, were scattered in the rusty green grass. Here and there as though for accents were black-eyed Susans, goldenrod, and "gum weed." In other Middle Western States the Iowa roadside was duplicated again and again, the variety of flowers depending somewhat on the nature of the soil and the general climate. Today most of those prairie flowers are gone. The roadsides have been graded. In some of the States, laws require landowners to keep their roadsides mowed. While the good roads were being made no one thought of saving the wild flowers. The scattered plots of prairie and the fence corners that protected flowers for awhile after the first sod was broken have been plowed and cleared.

In wooded sections of the country, flowers have suffered still more. Dogwood, azalea, shadbush, mountain laurel, rhododendron are becoming rare. In some States roads have been landscaped for the purpose of preserving native beauty; in others, laws have been passed to protect the native plants. Such precautions have not saved the plants because many people disregard them.

It is important that Americans cease plundering wild flowers. Of many adult citizens there is little that can be expected in the way of regeneration. But schools can and should teach children to enjoy the beauty of wild flowers on tree, shrub, and vine. When people love wild flowers, they have no desire to break a branch that some one might enjoy if it were left growing. There are many experiences through which children develop love of wild flowers.

[14] Books consulted for the following discussion are listed in the bibliography on page 77.

(1) *Understandings to be developed.*[15]—Have varieties of wild flowers disappeared? Children will find facts in bulletins and magazines to help them decide. It is not necessary, however, for them to depend entirely on what they read. They should verify reading by experience. They can ask their parents to tell them about wild flowers they knew as children. Perhaps many of these the pupils will not be able to find anywhere in wood or field. *Certain varieties of wild flowers have disappeared in the last generation.*

Before children become interested in the conservation of wild flowers, they must know the flowers, especially the varieties which are common to their community. Very little children can learn to identify a few common flowers by size, color, shape, and fragrance at first and later more accurately by other characteristics. Pupils who live in the city can study certain wild flowers at first hand by observing them in a natural park. In their study they can visit a greenhouse and compare the cultivated plants with the wild ones observed in the park. In the country a few wild flowers are still available for study along the roadside, in fence corners, and in field and wood. *Flowers can be identified by the color and shape of their blossoms; by the shape, size, and other features of their leaves; by their fragrance; and by their behavior.*

Compiling lists of flowers used for food or medicine, or writing pamphlets about them is interesting, especially if based on the children's experiences. Some pupils are interested in learning that certain wild flowers can be used for food. Many have eaten lamb's quarter, mustard, and dandelions as greens. Common table mustard is made of pulverized seeds of the mustard plant. Some of the children like the flavor of pennyroyal or other mint. Others have eaten water cress. Many know various wild fruits and berries. Noticing bees on clover, some pupils have had the experience of pulling the blossoms apart and sucking the sweetness which the bees seek. *Although some flowers are useful for food, the greater number are usually of more value for their beauty.*

Pupils can engage in studies to learn what kind of flowers should be protected in their community. Sumac, wild cherry, and wild

[15] Clements, Frederic E. *and* Clements, Edith G. Flower families and ancestors. New York, H. W. Wilson company, 1928. 156 p., illus.

Duncan, Carl D. Wild flower roads to learning. Science guide for elementary schools. Vol. II, March 1936. Sacramento, California State department of education.

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crab are examples of bushes which are beautiful for their flowers and well worth saving. Of the smaller flowering plants, wild phlox, steeple bush, Joe-Pye-weed, cone-flowers, and daisies are examples of flowers which should be protected wherever found. In some communities, of course, plants like the thistle, "wild carrot," and dandelion cannot be preserved because of the harm they do to crops and pastures, and to other flowers. In rural communities, children can consult the county agent to learn what flowering plants are "noxious" weeds in their community. In many instances objectionable plants are those imported from other continents. In their new home, their natural checks and balances do not exist, and consequently they overrun the native flora.

A useful activity is the compilation of lists of flowers which are considered harmful in the community and of those which are poisonous. Pupils can learn what flowers are protected by law in their State. If none are protected, they should study the State's rare flowers and decide what ones ought to be protected and for what reasons. *In every community are wild flowers which must be protected if they are to be saved.*

Preserving flowers by planting seed leads children to study seeds of different plants, their ways of travel, and methods of pollination. It is interesting to note how some seeds like the dandelion seed are carried by the wind; how others, "stick-tights" and burs of different kinds, cling to clothing or the fur of animals and are carried thus from one place to another. Some are thrown by the bursting of the pod which holds them. *Plants can reproduce themselves under most adverse circumstances except those which man creates as he completely disturbs nature's balance.*

Children can make a study of correct ways of plucking wild flowers. The general rule is to pluck the blossom in such a way that the plant will not be destroyed: The violet, for example, just above the root; the anemone, just above the leaves; the wild phlox should be cut, not pulled, above the roots. This is an opportunity to teach children correct uses of the pocket knife, a tool which virtually every boy manages to possess before he leaves the grades. Never should all the flowers in a spot be taken. Enough should be left for seed. A wild-flower garden on the school ground provides an opportunity for the pupils to learn just how to pluck the wild flowers as well as not to pluck so many that there is no chance for them to seed themselves. When children have learned how to pluck flowers correctly they should observe

Forest life: Columbine growing among the pines at timberline in Colorado.

the practices of others. They should be convinced by study and observation that *many people destroy wild flowers by careless plucking*.

Are flowers destroyed in other ways? Pupils can learn the facts from bulletins. It is well for them to find out first-hand, however, that the facts are true. If near the school some farmer has burned wild grass, and another farmer across the fence has left the same grass standing, the children may compare the number and health of the plants that appear on the burned and unburned plots. *Fires in the field and in the forest destroy not only the plants but also the cover of roots and leaves that absorb the moisture, protect the plant roots from the cold of winter, and store valuable plant food.*

It is interesting to study the habits of flowers. Children who live in mountainous regions will be interested to observe the courage of flowers which push through snow to bloom, and compare them with the garden crocus which sometimes does the same thing. As children study the habits of flowers they will learn also some of the ways in which they can be protected. Flowers that grow along the edge of fields can be allowed to remain in fence rows and gardens instead of being destroyed. Stone walls separating fields are excellent protectors of wild flowers. (See illustration.) In limestone country "sinks"

may turn the plow and provide a flower sanctuary. The ungrazed farm woodlot is protection for certain flowers. In a well-managed woodlot, cattle do not destroy all flowers. A group of pupils in the country can perhaps secure permission to fence a plot in a farmer's woodlot to transplant, preserve, and to study wild flowers there. In an undertaking of this kind, certain pupils should observe and report whether or not rare and beautiful flowers are being destroyed. Others can make a study of ways of increasing the plant life in the lot. They might try to learn, for example, what flowers are adapted to the conditions of the lot, where these can be secured, how they can be taken up without spoiling the place from which they are dug, or how they can successfully be raised from seed. After studying the flowers in their local community, children can study the flowers of their State. They will be interested in learning what is their "State flower" and in finding out what is being done to protect it. *Any group of country pupils can discover different ways of protecting and preserving the wild flowers of their community.*

(2) *Participation in activities of conservation.*—To avoid the destruction of flowers is the first step toward their conservation. Participation in conservation should follow. A number of activities in protection of wild flowers may be carried on in connection with their study. For example, school pupils definitely can plan to influence others regarding the protection of flowers. Those who live in the country can initiate a campaign to have certain wild flowers and shrubs allowed to grow in fence corners. They can prepare posters for store windows of nearby towns or cities urging people not to pluck wild flowers when they are riding. Those who live in cities can plan similar campaigns for influencing playmates, parents, brothers, and sisters to spare wild flowers when driving, hiking, or picnicking. Children can circulate petitions for laws to protect wild flowers which especially need protection and perhaps plan other ways to influence lawmakers on behalf of wild flowers. Local newspapers frequently will publish articles which the pupils write about their activities. These are helpful to adults as well as to children. *A child who influences another to conserve makes a double contribution.*

Changes in wild-flower life can be recorded by pupils and kept in the school or community library for public reference. Parents usually are ready, when asked, to tell what they can recall about the changes which have taken place within their memory. They can point out places where wild flowers once grew most profusely.

They can give the names of those now extinct and perhaps tell the causes of their destruction. They can tell what garden flowers have become wild, such as, in some communities, black-eyed Susan, bouncing Bet, and "bread and butter." *Many people in the community will be interested in a history of the flowers.*

Pupils can help in the conservation of species. One way is to set out and preserve a wild-flower garden on the school ground. Some flowers may be transplanted. The seeds of others should be planted. Such a garden is helpful both for children and for adults who are interested in the study of flowers. Children who enjoy hiking and find wild flowers a source of pleasure can secure permission to establish beauty spots along the highway. They can also plant wild flowers by the side of a brook. *Conserving the species of wild flowers in a community is a means of education both for children and for adults.*

On a road that is used for hiking, children can secure permission from highway commissions to establish beauty spots. By the side of a brook, wild flowers can be planted and preserved each year. *Conservation of this kind carried on by children is only a beginning of the kind of work that is needed, but is valuable because it often leads to the development of desirable attitudes and to further activity.*

At flower shows in small cities and at country fairs, children can be invited to display bouquets and exhibits. They can make these instructive to adults and to other children by labeling them with information which leads to their conservation. Rare varieties can be pointed out. Charts showing correct ways of plucking are helpful. Information about seeding and resetting will interest people in preserving wild flowers. A poster is helpful with a list of wild flowers which are considered weeds in the community because they are hard to eradicate and cut down the yield of grain in the farmers' fields. *Children will think of original ways to make a display of wild flowers at a country fair. They might also have wild-flower shows in the schoolhouse, town hall, or an empty store.*

(3) *Attitudes and continuing interests.*—Reading about flowers, learning to identify them, and many similar activities are basic to proper attitudes concerning them. For example, choosing flowers for bouquets and arranging them to advantage leads to appreciation of their beauty. Care should be taken that pupils in their enthusiasm about bouquets do not pluck rare flowers and that they do not pluck too many in one patch. Beauty in flowers does not lie in color alone, but also in shape, size, delicacy, and fragrance of the blossom; in the grace, symmetry, and variety of

leaves; and in shape, color, and properties of seeds. Reading poems and looking at pictures in which particular elements of beauty have been emphasized also lead to appreciation. A garden of wild flowers on the school ground may increase the children's regard for them. *Appreciating the beauty of flowers adds to one's enjoyment of life.*

Children can develop concern for flowers and their preservation. This concern is strengthened by learning more about flowers and their habits, by having pleasurable experiences with them, and by observing the destruction caused by ruthless plucking. Very young children can be taught to have regard for the future. If they destroy all the flowers in a patch today, they have no pleasure in them tomorrow. If they kill them by ruthless plucking, there will be none to enjoy next year. Other people have a right to enjoy the flowers, and if one child destroys them, many people are deprived of the pleasure that belongs to them. Gradually children develop the feeling that *it is selfish to destroy in a moment of individual pleasure the flowers that belong to all.*

Many of the activities in which pupils engage as they study about wild flowers continue to be of interest long after the immediate purpose is achieved. Wild-flower landscaping for the home, school ground, or highway, are examples of continuing interests which children can build. Other examples are the painting of flowers; the use of flowers in designs for bookmarkers, portfolios, curtains; collecting books about the wild flowers of a given section; collecting pictures and so arranging them that other children can use them as a key to identification; and the like. Pupils who like poetry can make collections of beautiful poems about flowers. Poems about flowers can be printed on posters and decorated, or "illuminated" with sketches or paintings of appropriate flowers. *Such continuing interests on the part of children will develop citizens who desire to protect the flowers.*

The identification of new flowers continues to be interesting to pupils long after they have learned to identify the few common varieties with which they have most experience. They learn that the same flowers have different names in different localities. This is a lead to a study of scientific names and the use of a flower key [16] for identification. Children in the fifth or sixth grades and above can use a key if they are sufficiently interested in flowers.

[16] Pickwell, Gayle B., Hazelton, Karl S., *and* Smith, Emily. Spring wild flowers of the open field. San Jose, Calif., San Jose State college, 1933. 156 p. (Western nature study series.)

To use a botanical key, they must have learned something about flower parts.[17] Simpler keys may be made, however, by the children and the teacher, and these will help the children until their interest has led them to master a botanical key.[18] Such an interest is a useful one because *the child or adult who moves from one locality to another finds a fresh recreation in studying the new flowers which come to his attention.*

MINERAL RESOURCES

Minerals as a whole are our most abundant group of natural resources. Particular minerals, however, may be relatively scarce, and it is to these that attention must be given. A mineral is a substance occurring naturally in the earth with fairly definite characteristics. It is usually composed of two or more elements. For instance, hematite, the most common iron mineral, is composed of iron and oxygen. This is broken apart or reduced in the blazing blast furnace to give us iron. A mineral mixed with other minerals is called ore. It is the ore that is mined. Oftentimes this must be purified or separated so that the mineral can be easily worked.

Minerals are the oldest natural resource. They were created before present soil, plants, forests, and animals. Minerals were formed by changes in the earth which required millions of years. Present deposits will not be increased appreciably within the present era.

Of all the natural resources, the minerals especially should be considered the heritage, not of individuals, but of all mankind because they are so slowly collected by nature. In this respect they differ from the soil, which by intelligent use can be maintained at least to the extent that it is used; from forests, which can be restored if wisely used; from water, which can be retained for use by proper care of forests and grassland; and from plants and animals, which if taken in time can be replaced to the extent that they are used.

Mineral resources have been classified in three groups: Organic, metallic, and nonmetallic, according to their composition. The organic minerals consist of petroleum, natural gas, and coal; and of these petroleum presents the most important problems. The metal minerals are those of iron, copper, lead, zinc, gold, and silver, and a number of minor metals, including aluminum,

[17] Kenly, Julie C. Green magic. New York, D. Appleton-Century company, 1930. 194 p.

[18] Duncan, Carl D. Op. cit., p. 40–41.

chromium, magnesium, tungsten, and others. Petroleum and natural gas, coal, and iron are treated here as examples of the type of study which can be made of other minerals. Foreign supplies of minerals and metals are not considered in this bulletin because of its limited scope. Tin and nickel are almost wholly supplied by imports. Oil and even some iron ore is also imported.

The problems of conservation with respect to practically all of the minerals are concerned with the lessening of waste in mining, separation, and reduction; and more prudent and thrifty use of the products. Once used as fuel the organic minerals cannot be recovered. The metals, however, can be recovered after use, especially if they have been given some care. Legislation is one means to mineral conservation; another is education.

Instruction of younger pupils in the conservation of minerals is somewhat limited because of children's lack of first-hand experience with minerals. However, collections of attractive pebbles, greenstones, garnets, quartz, jasper, and agate, found along streams and lake margins can be made and used as stepping stones toward interest in the more important minerals.

(1) *Understandings to be developed.*—Through study of the formation of petroleum and other minerals children will be able to build simple concepts to help them conclude that minerals, once mined, cannot be restored. Understanding of this fact causes them to be more alert in seeing opportunities of saving and taking care of the minerals or mineral products which they use. Children living in mining communities can observe conservation methods at the mine. It is important that pupils in these communities be taught the importance of personal caution and safety in order to insure that future mine workers will reduce the number and seriousness of mining accidents.

(a) *Petroleum and natural gas.*—If children have become interested in the conservation of any of the minerals, they will probably think of the need for conserving lubricating oil and gasoline, which are petroleum products. They will ask how these can be conserved or how they are likely to be wasted.

Petroleum products are used in many ways. Gasoline is used for automobiles, for small power plants, and for gasoline lamps. Lubricating oils and greases are necessary to provide a cushion which will resist wear on the moving parts of all machinery. Diesel oils and heavier oils are used to drive steamships, streamlined trains, and city power plants. Many farmers have tractors

which use gasoline. Each household uses some petroleum product such as vaseline, candles and wax, furniture polish, or insecticide. Children might be asked to list the petroleum products which they know and tell how they are used.

Although new oil fields have been found every year, each new field found leaves less to be discovered. Annual oil production of the United States for the past 5 years averaged 1,099 million barrels and production in 1937 was the highest on record. On January 1, 1939, it was estimated that the Nation's proved oil resources amounted to 17,500 million barrels, or a 13-year known supply at recent production rates. Some States have reserves for only about 6 years, while in others the supply probably will last 20 years.[19] The known oil reserves of the United States are less than those of the rest of the world, although more oil is used in this country than in all of the foreign countries combined. In addition to the reserves of liquid oil, substitutes for oil can be distilled from coal and oil shale. However, this will cost more than well drilling and will sharply increase the price of oil products.

Petroleum is a liquid mineral nature has stored underground in the pore spaces of certain rocks which form a natural reservoir. Oil geologists search for these reservoirs, or oil fields or pools, and petroleum engineers drill wells through which the oil flows or is pumped to the surface. Because the oil of a given field may underlie many farms or ranches, and will flow toward a well, if one person reaches oil, then all must drill for oil. Otherwise, one person can drain the supply of others. When oil is withdrawn too rapidly, and proper care is not taken, more oil will be left underground than is brought to the surface.

As stored underground by nature, petroleum generally contains natural gas in solution with the oil, and natural gas often occurs also in the form of a "gas-cap" above oil-saturated sands. They are stored under high pressures and are held in place by an impervious rock layer. When this is pierced by a drill the gas and oil try to escape in a mad rush. Sometimes when the pressure is high the entire drilling apparatus is blown into the air. A spark may ignite the gas and the result is a blazing spire of gushing gas and oil. In most wells the waste is not as spectacular, but the gas is permitted to escape wastefully instead of being piped to gas mains. The natural gas helps the oil to flow through the pore

[19] Weiss, H. C. Current problems in oil conservation. Mining and Metallurgy Journal, 20: 145–53, March 1939.

spaces of the rock and in expanding it provides energy to move the oil. When such pressure declines to the extent that most of the natural gas has escaped from the oil, the remaining oil is more difficult to move and may be left underground. The pressure of water along the edges and at the bottom of the oil sands provides another source of energy and the movement of such water should be controlled to prevent its too rapid or irregular encroachment.

Laws have been passed in the past decade or so to prevent or lessen the waste of oil and gas. In many instances, however, State and Federal regulations could be improved. Children should read about well drilling and form opinions on this subject. *The purpose of State and Federal regulations is to prevent wasting the Nation's oil.*

In use, oil products can be conserved in many ways. When the exhaust pipe of an automobile or tractor "smokes," this indicates a waste of gasoline. Boys can remind their fathers to adjust the carburetor. Oil fires have been a prolific source of waste—of human life as well as of petroleum. Children should be cautioned in safe uses of gasoline; lower-grade children should not handle it at all. *The study of the conservation of liquid petroleum will reveal that it will be the first mineral to be exhausted and, therefore, its conservation is highly important.*

(b) *Coal.*—Another of the minerals which result from great collections of organic material is coal. Perhaps in curriculum units on modern life pupils learn how our civilization depends on coal. Children who have studied the lives of primitive people also will be impressed by the dependence of early peoples on fuel. Consequently, the class may arrive at the conclusion that *coal is and has been a large factor in our progress toward civilization.*

Through study to answer questions that arise, children will learn that the supply of coal is not inexhaustible, although it is much greater than that of petroleum. In 1938, the United States used 380,000,000 net tons of coal or enough to fill 76,000 freight trains of 100 cars each.[20] The supply of coal, taking into consideration an increase in consumption, may not last more than 2 or 3 centuries.[21] *More important even than the consumption or exhaustion of the general supply of coal is the exhaustion of the best coal.*

To determine whether or not coal can be saved at the mine, children will have to search for facts about the way coal is mined.

[20] National Bituminous Coal Commission. Weekly report No. 1121. Washington, D. C. January 7, 1939.

[21] Van Hise, Op. cit., p. 28.

Those who have not studied about the mining of coal may need to make a detailed study before they are ready to form conclusions. In many mines pillars of coal are left remaining to support the mine roof. It is necessary that some such support be left, but often in the past larger pillars have been used than were necessary. Frequently when two beds of coal lie near one another the higher-grade coal has been mined at the expense of the lower grade. Another mine waste of coal is failure to utilize low-grade coal for which there is no present market. *Wastes in mining are gradually being eliminated, but more progress can be made in this direction.*

Although it is not wise to save where saving means a sacrifice of standards of living, coal can be saved in many ways which cause no harm. Homes can be better built and more thoroughtly insulated. Coal fires should be given attention, and ashes in some cases should be screened to recover material otherwise lost. Keeping pipes and flues of heating systems clean is a real saving. Some waste in use or mining cannot be avoided. *Waste through carelessness and indifference is inexcusable.*

(c) *Iron.*—The most common and indispensable of our metals is iron, and a study of its conservation can begin with a discussion of some of its many uses. Perhaps the pupils have a problem in finding a substitute for iron for some activity. Suppose they are making a toy wagon and have no iron for axles; or perhaps they need a chain and must find something else that will serve their purpose as well. Such experiences are interesting and lead into a study of the uses and conservation of iron.

Playground apparatus, laboratory equipment, desks, and toys are common articles made partly of iron. If the study is widened, children will observe that household utensils, automobiles, railroad cars, machinery, buildings, and bridges consume great quantities of iron.

The chief iron mineral, hematite, is found mainly in commercial deposits in the region about Lake Superior. It occurs near the surface and is mined by the open-pit method. Huge electric shovels will fill a railroad car with three scoops of the bucket. Tremendous quantities of high-grade ore have been removed and the remaining supply may not last long. However, the low-grade ore is receiving more attention and as processing methods are improved, centuries of supply, at high production levels, will be assured. At the present time some mines are reclaiming great piles of low-grade ore that was previously removed as being worthless. *Improvement in ways of mining, using low-grade ore, and*

recovery of scrap iron will extend the life of our supply of iron resources.

Children will observe that in use, iron and steel can be protected in many ways. All moving parts of gasoline engines and other machinery should be well lubricated to prevent wear. Iron exposed to the elements should be painted or galvanized. Certain kinds of spoons and other household utensils do not rust because they are made of stainless steel. In the case of enamelware, the steel is plated with a protecting substance. Farmers sometimes protect their plow blades, garden tools, and other implements when not in use by covering them with grease or heavy oil drained from an engine crankcase. *Protection from corrosion and wear will extend the life of steel products. Old iron which has not rusted badly can be used again.*

Whenever possible, more common materials should be substituted for iron. Stone and concrete, for example, should replace iron in the construction of bridges and buildings. While wood should not be used as a substitute at the present time, in a few generations the wood supply may be so greatly increased that wood will be a reasonable substitute for iron. *A survey made by the class will convince them that concrete and stone should often be substituted for steel.*

Nonmetallic minerals in general are present in inexhaustible quantities. Stone, cement, sand, and gravel will never become scarce. Precious stones are a special problem and will not be considered here. Minerals used for fertilizers, such as the phosphates and nitrates, are worth conservation notice. The giant Muscle Shoals Dam on the Tennessee River was built to provide power for manufacture of nitrate fertilizer. The children should be led into further study of several of these minerals.

(2) *Participation in activities of conservation.*—There are ways in which children can help in the conservation of minerals. The most important is in influencing their parents and grown-up friends in saving resources. This can be done by collecting information from conservation books and State and Federal bulletins on the subject. Through a short study of the material, posters can be made and brief articles written for the school or community newspaper.

In conservation of oil and gasoline children can tell their parents about wind-driven generators used on many farms. The boy, especially, can remind his father to save gasoline and oil in auto or tractor use; that drainings from an engine crankcase can be used for cleaning or protecting tools and machinery

from rust; that gas or electricity can be substituted for cooking or heating. He can also help his father service machinery. An interesting project for the conservation class is to arrange an exhibit of petroleum products in sealed glass jars. These can be obtained from various oil companies.

With respect to coal, pupils who live in the country or city and perhaps help in filling stoves for home or school can learn the exact amount that is needed to maintain regular and healthful room temperature and in this way can practice saving coal. They can also screen coal ashes and remind their parents of the need for periodical cleaning of flues or pipes of heating systems.

As a rule children have interesting experiences with iron. Those living on farms can help put summer machinery under shelter for the winter. Children at home can have a part in cleaning and caring for household equipment such as cooking utensils, tools, and the like. In school they can care for dishes and playground equipment which are usually made partly of iron. Pupils can be encouraged to think of ways the articles of iron they use can be protected from rust.

In some communities old iron is not collected frequently, and children can gather and sell it to local junk dealers. Collecting iron and other metals is sometimes a way for a class to earn money. An activity of this kind impresses them with the fact that iron is usuable again and again and therefore should be saved. Tremendous waste would occur if all people threw away old iron.

(3) *Attitudes and continuing interests.*—Children will develop attitudes of appreciation of minerals by observing their importance in everyday life. No machinery could move for more than a few minutes without oil to cushion the bearing surfaces between moving parts. Oil and grease is needed at dozens of points in an automobile. Electric motors need oil. Almost every home has an oilcan on the shelf for servicing carpet sweeper or vacuum cleaner, sewing machine, washer, or other electric appliance.

Without gasoline the present automobile would be useless; and if Diesel oils were exhausted, the motors of railroad trains, ships, and power plants would be stilled. *Studying to discover the many uses of petroleum and its supply will cause children to appreciate its value and the pressing need for conserving it.*

Children can also appreciate the importance of coal in daily living. People depend on it for heat, light, and power. The power that moves the great machines of factories is usually produced by coal. The electricity that lights homes and produces

power for washing machines, pumps, and the like is often created through the use of coal. Children may deplore the nuisance of having to walk around a truck which is unloading its coal in a basement, but it is pleasant to reflect that the coal produces the heat and warms their homes. Coal is also useful in making dyes, drugs, engine oil, pitch that is spread on roads, and many other products. *It would be impossible to maintain the present standards of living without coal.*

Our modern civilization could not exist without iron. In the children's homes, cooking utensils, tableware, stoves, plumbing systems, and electric appliances are iron products. Skyscrapers, ships, bridges, and railroads could not be if there were no iron to make them from. Transportation is so largely dependent on iron that, were iron to disappear, people would have to do without many necessities of life. If there were no iron for farm machinery, the farmers could not raise enough wheat for bread to feed all the people of the Nation. *When children understand the dependence of modern ways of living on iron, they value it more highly.*

A study of the conservation of minerals will be more apt to develop permanent interest among older than among younger pupils. They may be encouraged to continue reading current magazine articles about the mining industries, or about inventions or discoveries leading to a better use of our mineral resources. Many pupils will wish to collect specimens of different minerals and to continue study of them even after regular work on any particular curriculum unit has ceased. *A class which has a collection of bulletins and other inexpensive literature about the conservation of minerals will probably desire to add to this whenever they find material.*

WATER

All life is dependent on water. In desert regions water is more truly appreciated than in humid regions. Underground water is the greatest source of supply for everyday needs. It has been estimated that half of the people get from underground the water they drink and with which they cook and wash.[22] The wells that furnish water for horses and cattle are fed by underground water. From great reservoirs underground is secured much of the drinking water on farms, in towns, and in cities. Many plants are often kept alive and growing by underground water. Part of the water which falls as rain is used by plants or collects in lakes and streams, where it is employed by man to run his factories, move his boats,

[22] Van Hise. Op. cit., p. 121.

water his crops, and, when purified, even used to drink. The remainder finds its way to the underground stores.

The supply of water is usually renewed by nature. The amount is permanent, but unevenly distributed. Some regions have a large amount of rainfall, others have little. Furthermore, although the total supply of water cannot be exhausted, the quantity may be reduced or increased in any particular community. This is evidenced in most of the States by the fact that the supply of underground water has been lowered. Floods near the mouths of rivers whose watersheds have been deforested are examples of undue temporary increase of the supply and maldistribution.

(1) *Understandings to be developed.*—Children are familiar with water that falls as rain and remains on the surface in ponds and streams. They are not so familiar with underground water. Younger pupils can learn many simple things about water, its use, its origin. They will want to learn where the water goes, or how it gets into the sky. The teacher's task with these pupils is to help them answer their questions for themselves. They observe that clouds gather before a rain falls. They gather water in a basin. They observe that rain falls only when there are clouds and conclude that it comes from clouds. They try to think of or to observe many different uses of water. Plants, for example, must have it in order to live. Animals of all kinds—birds, pet dogs and cats, horses—must have it to drink. They would die without it. People also must have it to drink. As an experiment the children can try to get along without water for half a day or so. Further observation in the school and in the home helps children to realize that water is very useful for washing face and hands, for washing clothing, for cleaning streets. In rural schools where children help prepare noon lunches, their experiences with cooking will help them understand that water is necessary in preparing most of our food. *Water keeps plants and animals alive.*

Older pupils are interested in learning "how" and "why" rain falls, and what becomes of it after it falls. The teacher should direct their reading in an encyclopedia, a geography, or a book on science. They ask how clouds are formed, and learn by reading that they are formed partly by evaporation from large bodies of water such as oceans, lakes, and rivers. Water in the clouds, cooled, condenses as rain. They can carry on a number of experiments with water. For example, holding a chilled

dipper over the spout of a boiling tea kettle brings condensation of water. An excursion after a rain enables children to follow the rills that run into a creek or brook nearby. Later observations can be discussed and discussion followed by reading and map study. Eventually children may decide that *much of the water that falls as rain runs off the surface and into the ocean.*

Children can perform experiments to help them understand evaporation. For example, after washing their hands they allow them to dry without using the towel and note that water has evaporated. They can plan diagrams to show that water moves in a cycle through evaporation into the air from bodies of water, and through transpiration from plants; that water in the air condenses and falls as rain; that some rainfall is used by plants and animals and that the rest runs off into the ocean, to begin the cycle again. In dry seasons children can be led to observe that grassland and woodland floors remain moist longest. In them the water sinks down slowly, and the pores of the soil are not clogged with mud. One way of conserving underground water is to keep as much rainfall as possible from running off into the ocean. By study and observation the children learn that *planting forests and restoring grasslands help to prevent water from running off rapidly to the ocean.*

Is there less water underground than in earlier days? Children who wish to prove this can be directed to Government bulletins and other informational material on conservation. They learn what comprises the underground water table. They learn that this has been lowered all over our country in the past 100 years. In eastern parts of the United States the level of underground water has been lowered from 10 to 40 feet.[23] "What about the underground water in our community?" some child asks. By making inquiries at home and counting the number of shallow wells and the number of wells which have failed in the community, the children will probably decide that *the underground water in their own community is lower than it was in earlier days.*

Questions arise as to what people have done to lower the level of underground water. Perhaps children will learn that swamps have been drained in the community, trees cut down, and grasslands plowed. With none of these things to hold it, the surface water has rushed off to the ocean instead of sinking down to increase the underground supply. The quantity of under-

[23] Van Hise. Op. cit., p. 122.

ground water in one community is often lowered by undue drainage or run-off in another community. *Each community is responsible for the welfare of other regions with respect to its use of water.*

Floods in the community lead children to seek to learn why rivers overflow and to take cognizance of the great loss of life and property which result from floods. They find that some authorities believe that in the Nation as a whole flood waters are increased by deforestation of the upper parts of valleys. They learn that during times of low water people shortened the spans of bridges to save cost in building and that the consequent narrowing of the channel caused water in wet years to overflow the banks of rivers above the bridges. Frequent drainage of sloughs and marshes has increased the volume of rivers and so added to the amount of the overflow. By further study the children find that the *Government is trying to combat floods by reforestation, engineering, and correction of undesirable drainage.*

If there is in the neighborhood a mill which is run by water power, children will be interested in it. What work does it do? How much does it cost? They try to find out how more water power may be used in the community. They estimate the amount of money that may be saved by using water instead of fuel for power. By observation as well as by study, children learn *what sites in local streams could be used for water power.*

Children can be interested in finding ways in which river water is polluted. Those living near rivers can secure information by inquiry and by reading, and can distribute their knowledge in the community. Into some rivers dust is thrown from sawmills; into others, dye from textile factories, and offal from packing plants. Children who are interested in wildlife report that pollution of river water kills the fish and destroys the homes of water birds. In some towns and cities sewage is turned into rivers before it has been purified by chemicals, thus endangering human life. Such unsocial acts are committed because many individuals, groups, or communities have too little regard for the rights of others, and are unwilling to meet the cost of purifying the water they have used. Water used for commercial purposes and later to be used by others *should be left as fresh and clean as in its original state.*

Children who live in an irrigation district observe that the unwise or careless use of water on one ranch is detrimental to another. They discuss ways by which both can use water most effectively and economically. They learn how water is appor-

tioned and gain increased understanding of *conservation as the greatest good to the most people for the longest time.*

Perhaps at the home of a child who lives in the country there is a spring high above the house. The children of the school can visit this and try to make a plan for running water into the house. In this way they realize the advantage of having running water and the simplicity of securing it when there is a local supply. They will need to write to the United States Department of Agriculture and State agricultural experiment stations for bulletins to help them plan. Through the activity they learn that both *State and National Governments publish material to help the people have more comfortable homes.*

By much reading about the distribution of water and by discussing questions in which they are interested the children will reach the conclusion that *water is not evenly distributed throughout the world.* In some communities there is so much water that children scoff when saving water is mentioned. In others, there is so little that pupils in school have to clean their hands with wet cloths rather than to wash them with soap and water. *The problems of conserving water are different in different communities and in different countries.*

(2) *Participation in activities of conservation.*—So closely should children's study of conservation of water be related to their everyday use of it that they will become thoughtful about ways of conserving it. Farm children who have studied how steps can be saved by running water in the house, will be more likely to desire the installation of running water in homes of their own. Older pupils who have studied ways in which springs may be used can contrive simple apparatus for the flow of water to cattle or hogs. If they have gardens they can plan how to use the springs to irrigate them. Study of the source of school drinking water may enable children and teacher to make recommendations to the Board of Education, and *the interest the children develop causes them to be thoughtful about the purity of drinking water.*

Sometimes community enterprises are undertaken for improved water use—a community power plant perhaps; a community project to prevent erosion; a better source of drinking water, such as a new town well or city reservoir. Often such plans are discussed by different community organizations and public opinion aroused. Perhaps the people are asked to vote on the question. In situations of this kind, *children in school can well study the matter with their elders, decide the stand they wish to take, and*

A natural spring on a Resettlement Project is cleared and purified for use.

then do their share in influencing public opinion. This may take the form of entering into home discussions, making posters, planning class or group statements for a school or community newspaper.

If children in school are interested in recreation, the teacher should encourage them to explore the possibilities of water as a means of enjoyment. Where winters are cold, the pupils can induce the school board to help them make a skating rink on the school grounds. In some schools or communities children can work to have a community swimming pool. In towns and rural communities, children can clear up a small stream for a nature retreat. Refuse can be cleaned away, trees and plants set out, and fish placed in the stream. Birds will congregate, flowers will bloom, and soon there will appear a beautiful nature plot which children and adults can continue to enjoy as it changes and develops with the seasons.

(3) *Attitudes and continuing interests.*—In studying about water, there is opportunity for children to develop an appreciation of the beauty of water in different forms. Pictures and books, for example, about Yosemite Falls may call attention to the tumbling torrent, white spray, green woods and shrubbery, blue skies and water. Beautiful word descriptions in the reading matter add to the appreciation developed by the picture. *In natural waterfalls there is great beauty.*

The study of conservation also has many opportunities for developing an attitude of consideration for the other person's rights. For example, pupils who discuss the possibilities of a power plant on the United States' side of Niagara Falls should imagine themselves in the place of the Canadians who have to look across at the plant and machinery instead of the beautiful trees and water. Although the plant means low-cost electricity for us, it means loss of beauty to hundreds of thousands of Canadians. No matter how the children decide the problem, *they will have exercised some consideration for others in their conclusions.*

Sometimes electric power plants prevent fish from migrating and so deprive people of food. If the pupils read such statements they will wish to learn about the habits of fish and find why the statement is true. They should be directed to information about "fish ladders" which enable fish to swim around a dam. Their interest will be apt to lead into a study of conservation of fish and game. At any rate, the situation is one in which the children will extend their appreciation of the fact that the *rights and needs of different groups of people must be adjusted.*

Children who are studying about the importance of flood control probably will extend their appreciation of flood problems through the use of pictures and stories. In this way they gain appreciation of human problems and tragedies, connecting these with their experiences. By taking part in control of the little streams in their own community, they appreciate more and more how *conservation in one community may be the means of protecting people and saving life in other communities.*

Many children find it interesting to make continuous studies of conservation outside of regular school work. For example, city children can study the need for controlling run-off by observing erosion in parks and ways of controlling it, and record the changes produced. They can also follow up any study of stream pollution which has interested them. Children who live on farms will find a number of continuing interests. They can chart the tributaries of streams that run through their farms, and note changes in these. A small stream that carries silt to its entrance into a larger stream is a good subject for such study. Any child may follow a stream to its source, which may be a gully, and make a record of recent erosion or deposits of silt along the branches. It will require time and study to locate the cause of the gully or other evidences of erosion. Poor methods of plowing, failure to rotate crops, plowing up grasslands, and the like, will require their

share of investigation. In many cases, pupils can do nothing more than study and discuss the problems which come to their attention, but *thoughtful study and discussion persistently followed up develop continuing interest.*

FORESTS

Four-fifths of the original forests of the United States have been cut. Fire, disease, and insects are enemies of the forests, and wasteful methods of lumbering are destructive. Every year far more forests are destroyed than are replaced. The extravagant use and ruthless waste of lumber are not the only deplorable results of lax forest practices. Deforestation is a factor in soil erosion and floods which have brought great loss of life and of millions of dollars' worth of property.

In teaching children the importance of conservation of forests, it is well to help them to learn more about trees and the way they grow, the part they play in the Nation's progress, their importance to industry, and their significance in the conservation of soil and prevention of floods. Attitudes of conservation can be developed through experiences in protecting trees, in helping to preserve forests and the soil and plants in them, and in observing and studying activities of the Government in protecting forests from fires, insects, and diseases.

(1) *Understandings to be developed.*—Children generally become interested in trees first; later, in forests. Nearly all children have some experience with trees, groves, and small woods. They climb trees, walk under them, play in their shade, and recognize some of them by name. A study of trees adds new meaning to familiar experiences. Children can read for information about the way trees grow, their value, and methods of making more prudent use of them; but the study will have most value if adapted to first-hand experiences with trees. Excursions are helpful. Learning about trees leads into a study of forests. Forests are somewhat like woods on farms in a rural community, but much larger. City children can compare the information which they read about forests with what they know about parks. Forests grow. *If the present areas of usable forests should be seriously diminished, they could not be replaced in the present generation.*

In the autumn, colored leaves are interesting to children—the hard maple trees on the school ground, that turn so brilliantly red and yellow. Children quickly notice the difference between these gorgeous trees and the pines which remain green, or the rustling

pale-yellow poplars; and gather leaves to draw or to weave into garlands. Older pupils especially can read to learn why the leaves turn red and yellow, what causes them to fall, why some trees lose their leaves in autumn and others keep them all year long. Both older and younger pupils enjoy increasing their ability to use the leaf as one means of identifying trees. If there is a wood, grove, or park near the school the children naturally will play with the falling leaves, piling them into heaps as they walk along, covering branch houses with them. Ordinary activities of this kind may afford the teacher an opportunity to lead the children into a study of the value of the old dead leaves, and this may lead to the understanding and formulation of definite conservation principles.

If a child offers a suggestion that the leaves be burned, the class can observe the rich, dark soil in the woods and the mouldy and partly decayed leaves and roots, read, and finally decide that humus, our richest plant food, is made partly from leaves and roots. Noting that the layers of leaves are deep, and that they have been embedded in the litter for several years without changing into humus, the children are helped to understand that *humus is made very, very slowly*. To find whether or not humus is good for plants, the class can experiment by comparing plants grown in humus with the less thrifty plants grown in poor soil or pebbles. Thus they learn that the dead leaves are useful in the formation of humus and that usually they should not be burned.

Children who live in cities can study the trees that grow in parks or along the streets, note how they break the sweep of wind or fall of rain and how they retain the soil about their roots. In the floor of a wood, a forest, or the wooded corner of a park, they observe that when it rains, water sinks into the soil and leaves. Pupils observe that streams in woods or parks usually carry very little mud, whereas a stream in a cultivated field is apt to be muddy, and conclude that woodland soil does not wash readily. They can understand how a forest restored might help to maintain the fertility of the soil. Having begun a study of forests with first-hand experiences, the children can study other ways in which forests are useful. They may have noticed that wind blows less severely on the leeward side of the forest or grove, and that a row of trees, a grove, or a forest with some underbrush sometimes causes a wind to continue blowing above the ground for quite a distance before dropping to its former level.

It is only a step to the realization that forests can serve as protection both from wind and from wind erosion. Not only is the forest floor protected thus, but also the land on the leeward side of the trees. In a community where the pupils can compare run-off water from forest land with the run-off from plowed fields, they will be able to make the generalization that forests absorb rainfall and delay the escape of water into streams. The teacher should connect these observations which the children make with articles in the newspapers about floods and help her class gain understanding that *forests are a factor in control of floods.*

If children are curious about a dam or a picture of a dam in which silt has collected, thus decreasing its usefulness, they can study the situation. Where does the silt come from? Could it be prevented from collecting in the dam? The class can discover facts to show that in wooded regions rivers carry less silt. Forests are a help in maintaining the use of water for household purposes, recreation, irrigation, or power for producing electricity.[24]

Children know that many things are made of wood. They understand that forests and trees are being cut. Perhaps the question arises, "Do forests grow as fast as they are being cut?" A search through bulletins and other books will reveal that every year, for example, the Nation cuts a million trees for telephone and telegraph poles. A billion pencils are used annually. A large amount of newsprint is made of wood. Fifty acres of spruce trees are required to provide the pulp for a single Sunday edition of a city daily.[25] Many of the Nation's houses and most furniture are made from wood. On farms, wagons and machinery are made partly of wood. In practically all parts of the country wood is still used for fuel. Much cloth is made of trees, and in the stores one sees hundreds of dresses of rayon, acetate-crepe, and other types of artificial silk for which thousands of trees were cut. Wood is used for gadgets and for toys innumerable. In wooden boxes, products of many kinds are shipped to all parts of the world. Inventors and discoverers are continually thinking of more things to make life more comfortable and many of these must be made of wood. *The failure of many timber operators to practice sound forest principles in meeting the current demand for wood is resulting in the cutting of the forests faster than they can grow.*

[24] Parkins, Almon E., *and* Whitaker, J. R. Our natural resources and their conservation. New York, John Wiley & sons, inc., 1936. p. 399.

[25] Pack, Charles L. The forestry primer. Washington, D. C., American tree association, 1936. p. 4–5.

Water or pond lily, a beautiful wild flower which should be preserved from extinction.

A survey of the forest products which are used in everyday life leads to questions such as, Who owns the forest? or, Does our Government own all the forests? How many acres of forests have we? Through books and bulletins which they are able to collect, the children will learn that 70 percent of the Nation's forests belong to private owners.[26] The forest land now in private ownership is the Nation's best.[27] The rest of it belongs to the States and to the Federal Government. The Federal Government also has set aside comparatively large tracts as national parks. When the English settlers came to America, there were perhaps 820 million acres of virgin forests. Today there are 150 million acres of virgin forest; 90 million acres of merchantable second growth; 200 million acres are slowly growing up again after the first cutting; 100 million acres of cut-over forests are dying. *Less than a fifth of America's original forests are left.*[28]

Every year the Nation uses 400 million trees of average size.

[26] Sears, Paul B. Deserts on the march. New York, Simon and Schuster, 1937. p. 111.

[27] Kylie, Harry R., Hieronymus, G. H., *and* Hall, A. G. C. C. C. forestry. Op. cit., p. 54.

[28] Forest trees and forest regions of the United States. Washington, U. S. Government Printing Office, 1936. 55 p. (United States Department of Agriculture. Miscellaneous publication, No. 217.)

This number of trees will cover 15,600 square miles. By reading and study, children will find details that enable them to understand the significance of this fact. Tables in their geographies contain data from which the class can estimate what States these square miles of forests would cover if they were together in one region.[29] *The forests are rapidly being destroyed; improved laws are necessary, and the areas of forests under scientific management should be increased.*

As the pupils consider the important facts they learn about the destruction of forests, they should be led to raise the question, "What can be done to save the forests, or at least to balance with a new supply the trees which are cut?" They can think of ways of answering the question before they begin to investigate what is being done. Probably the avoidance of waste will occur to them and they will discuss it. They suggest ways in which they can help conserve wood, such as utilizing scraps and using boxes which otherwise would be wasted. Taking proper care of houses, furniture, and other things made of wood is a way of conserving it. Wood can be saved by proper methods of forestry. Once trees were cut high above the ground with higher stumps than necessary, merely for convenience. In some places, this wasteful practice still is followed. Sometimes trees are cut too young; waiting for them to grow would be a saving. Branches and leaves are sometimes unwisely destroyed. Often too few trees are left to produce a full new crop. *There are many ways of avoiding waste in use of forests.*

People could try to do without some of the things which are made of wood, and so limit the amount used to that produced each year. Children can debate the feasibility of this means of conserving the forests. There are two sides to the question. Some things made of wood are absolutely necessary to the Nation's progress. People will not benefit future generations by leaving the forests if in doing so they fail to pass on the highest type of culture possible. *Through their discussion the children should be helped to decide that true conservation of forests does not mean doing without the wood we need, but rather in maintaining a supply of new wood equal to the demand.*

Children who live near forests know something of the destruction caused by forest fires. Newspaper articles, fire prevention week, and safety campaigns stimulate any class to study about

[29] Pack, Charles L. Op. cit., p. 4.

forest losses due to fire. Individuals can study ways in which forest fires begin. They will find such facts as the following: In 1934 forty-two million acres of forest were destroyed by fire. The Forest Service reports causes [30] of forest fires as (1) carelessness due to smoking and to leaving campfires; (2) incendiarism; (3) negligence through brush burning, railroad fires, logging; (4) other preventable fires caused by man; (5) lightning. *To replace the loss by fire would, according to certain estimates, require 450 million dollars' worth of reforestation and 200 years of time.*[31] Burning of forests largely can be prevented. Forest fires, moreover, are not the only kind of fires that destroy wood. Children will find through surveys which the class or individuals carry on that a large quantity of wood is wasted through fires that destroy houses, fences, machinery, and other articles of wood. In fact, the total loss of wood and trees through fire is enormous [32] and most of it is unnecessary.

Pupils who have had experiences with trees may be familiar with some of the harm done by insects—the pine beetle, for example, which causes so much injury to trees in western forests; the bark beetle, which has destroyed quantities of spruce in the Adirondacks; the sawfly, which attacks the larch. Insect enemies are difficult to control, yet the practice of silviculture and a restoration of nature's balance with respect to wildlife will do much to reduce the damage done by insects.[33] Some pupils have knowledge of tree diseases—chestnut blight, for example, a disease which has destroyed the chestnut trees in the northeastern forests. The white pine blister rust is a familiar disease.[34] Both diseases were brought into the United States from other countries. This fact can lead into a study of quarantine laws with which children frequently have some experience and into a study of the forests of other countries. While children may not be familiar with tree diseases as such, they observe that trees are sometimes unhealthy. This observation can be used to lead them into a study of the ravages done by forest diseases and insects and of ways of controlling them. Tree diseases largely can be prevented or controlled,[35] but constant care and attention are required.

[30] Building America, 2: 15, April 1937.
[31] Pack, Charles L. Op. cit., p. 10.
[32] Building America, 2: 15, April 1937.
[33] Kylie, Harry R., Hieronymous, G. H., *and* Hall, A. G. Op. cit., p. 89.
[34] Parkins, Almon E, *and* Whitaker, J. R. Op. cit., p. 280.
[35] Kylie, Harry R., Hieronymous, G. H., *and* Hall, A. G. Op. cit., p. 94–97.

Trees grow slowly. Perhaps to some of the children the trees they planted last year seem to increase but little in size. It required a long while for the large branches and big roots of the tree by the schoolhouse to grow. One child asks how trees grow, or how tall the biggest tree is, and the class reads to find an answer. Through such experiences the children can also decide that forests as well as single trees grow very slowly. Pupils observe that farmers plant new trees for those which they have cut; that dead trees by sidewalks or in parks are replaced by young trees. They read and understand how forests, too, can be replaced, and conclude that *forest replacement takes a long time.*

Do the people whom the pupils know appreciate the value of trees? Do they realize how slowly trees grow and how difficult it is to replace them? By talking with people who cut trees for driveways or trim branches leaving ugly stumps, children form their own conclusions that many people are indifferent to the true value of trees. Some can realize that *children as well as adults can and should influence others to save, appreciate, and protect trees.*

A study of trees and forests in which the children have had many first-hand experiences and have read widely should lead them to investigate activities carried on in different places and by various agencies to save the trees and forests. They will discover protective measures such as the following: Some private lumber companies carry on scientific programs of careful cutting and replanting; the Federal Government has set aside more than a million and a half acres of forest land and is carrying on a program of purchase; the Government employs thousands of trained foresters to care for these national forests and allows trees to be cut only if they are carefully replaced; State governments protect and preserve State parks just as the Federal Government preserves the national parks. *Both State and Federal Governments are carrying on research to find out what can be done to save and protect forests entrusted to them.*

(2) *Participation in activities of conservation.*—Planting trees is a desirable activity for young and old. Planting certain trees is a source of profit for some of the children. Walnut trees are valuable for their wood when allowed to grow large. They are also valuable for their fruit. At present there are not enough walnut trees to bear sufficient fruit for the demand. Planting trees at school can be planned by the whole school. Individual pupils can be encouraged to plant at home trees which they particularly

admire. If there is a tree club in the school the members of the club can try to induce children who do not belong to the club to plant trees, or influence parents to set out more trees or to plant more trees where trees have died. A school situated near a forest can sometimes secure permission from authorities to take charge of a few acres. *The pupils can organize forestry clubs.* They can set out new plantings and record changes they observe. They can establish a nature trail by erecting placards to show the names of trees and plants and by making trail markers to point toward interesting specimens or views. Plants and trees are always changing. The fact that pupils take an excursion to the woods one month need not deter them from going again the second month to observe new flowers and other changes. *Excursions to study trees and forest plants are always interesting and valuable.*

In too many communities there is a practice of cutting Christmas trees from the woods just anywhere. Frequently very fine trees are destroyed in this manner—trees which if allowed to stand would be an addition to the beauty of the hillside or valley. Individual pupils can grow trees for use at Christmas or they can be bought from nurseries. By distributing posters or writing short articles for local papers, children can use their influence to *have the community practice a tree-saving policy at Christmas time.*

(3) *Attitudes and continuing interests.*—Desirable attitudes with respect to the protection of trees and forests and continuing interest in their preservation can be developed in various ways. Different children are often interested in individual trees. Children who are encouraged to select drawings and pictures of beautiful trees grow in appreciation of trees as sources of great beauty. Very simple experiences cultivate regard for the beauty of trees, such as selecting a grove for a picnic or hike or choosing the loveliest of the trees on the school ground to draw or paint. They give reports of trees they have seen and take their classmates to look at them. *There is pleasure in knowing the names, characteristics, and habits of trees seen on the way to school.*

Reading or writing poems about trees leads to appreciation. Kilmer's *Trees;* Morris' *Woodman, Spare that Tree;* Larcom's *Plant a Tree;* and *Shade* by Garrison, are examples of poems which children enjoy. A child who enjoys trying to write poetry might use for a subject some tree which has appealed to him; such as a beautifully shaped oak, a cedar weighted low with snow, or a maple, golden in autumn sunshine. *Trees are inspiration for thoughts that make life more beautiful.*

There is great beauty in wood. If children are accustomed to making things of wood, they can be led to note the beautiful grain of some kinds of wood. A book on woodworking will increase their interest by telling them how the grain of wood is produced and why various kinds of wood have such differently shaped grain. Making things of wood, examining or reading about things which are made of wood, or reading about beautiful furniture will help the children to appreciate wood as raw material for many things they use. *Articles made of wood are often exquisite.*

Appreciation and interest often are increased by activity. Through caring for a tree children learn how slowly it grows, observe new leaves and branches, become interested in other changes which occur from time to time. Protecting trees and learning more about them can become permanent interests. *The collection of books or bulletins on trees and forests, the collection of poems, the painting of trees, and the study of tree seeds are examples of interests that continue to afford enjoyment as children grow older.*

People who are interested in trees do not trample on seedlings that may be partly hidden by grass or weeds. They refrain from whipping saplings and breaking the ends of branches. They do not break or trample hedges. It becomes a habit firmly fixed for one never to drop a lighted match, to extinguish picnic fires, to report bonfires that seem dangerous, and to avoid purchase of illegally harvested Christmas greens.

SOIL [36]

The wastage of the most basic and indispensable resource of the country—the soil—has become one of the most important problems confronting the Nation. From a country with a large proportional area of rich agricultural land we are plunging, almost heedlessly, in the direction of a Nation of predominantly poor agricultural land, as the result of unrestrained erosion.[37]

When the soil is gone, men must go; and the process does not take long.[38]

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[36] Suggestions for developing a study in the conservation of soil are given in Teaching Conservation in Elementary Schools. (See bibliography, p. 75.)

[37] Report of National Resources Board, 1934, p. 161, quoted *in* Person, Harlow S., Little Waters. A study of headwater streams and other little waters, their use and relations to the land. Prepared for Soil Conservation Service, Resettlement Administration, Rural Electrification Administration, Washington, U. S. Government Printing Office, November 1935—Revised April 1936. p. 32.

[38] Theodore Roosevelt. Eighth annual message, Dec. 8, 1908. Quoted, ibid., p. 30.

> One hundred million once-fertile acres of farm land . . . have been essentially destroyed for profitable farming . . . another 125 million acres are seriously impaired . . . another 100 million acres are threatened—all belonging to the best farm lands of the United States.[39]

These and dozens of other equally emphatic and authoritative statements reveal the seriousness of the Nation's erosion problem. Measures must be taken at once to save the soil. Yet it is not a struggle of a few years' duration that the Nation faces, but a persistent, planned program that must continue for decades. Not only does the problem call for a Nation-wide program of immediate conservation, but it calls for a corresponding program of education. Children are ready and eager to help and to learn. The drama and tragedy of excessive soil erosion gives them great concern when their attention is called to its seriousness. What can they do? What can they learn? In the following pages are suggestions.

(1) *Understandings to be developed.*—What is erosion and why are people anxious about it? Is there any erosion in our community? What is being done about it? These are some of the first questions asked, and country and small-town children can find help to answer them by excursions to neighboring farms. City children sometimes observe erosion in a vacant lot or in a park. They note that water is muddy that flows off an ungrassed parkway after a rain. Older pupils can supplement their observation by reading and by conversation with their parents. They learn that *man-made erosion is the washing away of the fertile topsoil; that the topsoil produces the food they eat and all the plants that grow; that the topsoil is the mellow loamy soil above red clay in some sections, and the dark porous soil in others.*[40]

How is the topsoil made? Can the plants and rocks produce more? How long will it take? A few experiments will help the children understand how rocks are split apart and divided into tiny particles. They can crush pieces of limestone and similar stone against one another or between pieces of harder rock. Limestone that has been burned in camp fires is brittle and easily broken as a result of the heat. The class can note the mellowing effect of freezing on soil by molding a handful of mud or clay and allowing it to freeze. They may have observed that pottery

[39] Person, Harlow S. Op. cit., p. 2, reporting studies of specialists.

[40] Topsoil, its preservation. U. S. Department of Agriculture, Soil Conservation Service, Region Five. 1937.

or glass sometimes breaks when water freezes in it. After discovering first hand the effect of crushing rocks against one another, the effect of heat and freezing on soil, children can supplement their observation by reading. They will learn that soil is made by the action of heat, moisture, air, and pressure on rocks, breaking them into tiny particles, and that the *soil made thus becomes fertile by the addition of litter from leaves, roots, and parts of plant and animal life.*

In vacant lots, in parks, or in pastures, pupils can observe soil dug from the earth by gophers. Sometimes the soil that is thrown out of one hole is of different colors. Children can try to explain this. Soils of different colors are often observed on the same farm. After studying the formation of soils the pupils may be able to account for the varieties of colors. Country children can sometimes observe different types and colors in the soil dug from a post hole and try to account for this. In the city an excavation for building reveals layers of topsoil, subsoil, clay, and rock, and makes a good subject for study. Soil varies in color according to the rock that forms its base, the amount of plant food it contains, and amount of annual rainfall.[41]

Nourishment for plants is not the only value of grass or forest litter. Walking through woods, playing with fallen leaves, digging in woodsy soil, and observing litter of roots and tiny broken branches, help children understand how forest litter becomes mixed with tiny particles of rock and forms the forest's topsoil. Digging into grassland, noting how the tiny roots are bound together, sometimes several inches deep in the soil, helps them understand that the *topsoil of grasslands is made more fertile and porous and held in place by the roots of grass.*

Are grass and forest leaves useful to the soil in any way besides producing food for plants, holding the soil, and keeping it in good condition? An excursion after a rain will give the class an opportunity to note that less water runs off a grassy slope than a barren slope. There is moisture in grass after sunshine has completely dried a barren slope nearby. In similar ways the leaves of a forest floor keep the water clear so that it penetrates the soil instead of running away into brooks and creeks. By increasing the porosity of soil in which they finally become disintegrated, they make it possible, also, for more water to sink into the soil

[41] Smith, J. Russell. Men and resources. A study of North America and its place in world geography. New York, Harcourt Brace and Company, 1937. p. 347.

A bantam hen mothers young pheasants.

instead of running away. By digging into the earth children will observe that the soil of a pasture or of the floor of forest or woods is moist, while the soil of a plowed field has already become dry. These and other experiences help pupils to conclude that *forest leaves and grass roots make it possible for rain water to penetrate the soil.*

Water that runs off a newly plowed hill is likely to be muddy. That means that it carries soil away. Soil can be saved by stopping the flow of the water. By experimenting with the surface of soil in a garden, in a vacant lot, or a field, children may discover simple ways of preventing the rapid run-off of water. Hoeing ridges across the slope will help retain the moisture, but such ridges must be carefully made or the water will break through and produce gullies. Heaps of leaves and litter retain water. Experimental sodding of a tiny plot will show how grass prevents run-off. In classrooms in city schools where children have no vacant lot in which to experiment, pupils may arrange different types of soil in boxes in such a way that the surface of each slopes at an angle. With a sprinkler they can moisten the soil and catch the run-off in pans, noting that the rate varies with the slope.

They can invent other ways of estimating amount of erosion. For example, marked stakes can be driven into the ground at different points on slopes. After a rain, pupils will observe that the surface of the ground is farther away from the marks, an indication that erosion has occurred, and that the amount of erosion differs at different places on the slope. It is helpful for city children to plant grass in boxes and observe the effects of the developing roots.[42] Run-off from a sodded box is slow. Run-off from grassland or forestland is also slow. *Water can be both a friend and an enemy to the soil, depending on the way it is used.*

To learn whether or not farms in the community are suffering from erosion, individuals and groups can take excursions. Several trips may be needed to study the various kinds of erosion by water. The most spectacular type is gully erosion. Children observe how gullies begin at places where water collects. Dripping of water from the eaves of a barn may start a gully. Cowpaths form heads of numerous gullies in pasture lands. Furrows plowed up and down the slope and providing channels in which water can run may cause gullies. The pupils can note changes in a gully and see how it grows larger from year to year and often from month to month. They can observe that gullies are of many different shapes, depending on age, soil, and force of water. Another type of erosion occurs when the soil is washed off slopes toward the foot of plowed hills. This is called sheet erosion. Water does not take the soil in great lumps as it does in gully erosion, but rather removes a thin surface, a bit at a time, until in the valley lies a deep collection of silt. Shoestring erosion leaves tiny furrows over a hillside. *In most communities erosion of some type will be observed.*

Is there any way of saving the soil? Can it be held on the land instead of being washed or blown away? Are farmers trying to save their soil? Questions of this kind can be answered in country schools by interviews with farmers who are experimenting in the control of erosion and by excursions to study dams and plantings in gullies, grassed waterways, contour plowing, strip farming, and other methods of controlling erosion. Children probably can secure permission to plant black alder or other shrubs in a gully near the schoolhouse. On the banks of cuts in roadways near the schoolhouse in some communities pupils can set out plants and sow grass seed, thus preventing the

[42] Save the soil. Cornell rural school leaflet, 29: 4–7, March 1936. Ithaca, N. Y., New York State College of Agriculture, Cornell University.

soil from washing onto the roadbed. In town schools children can sometimes secure permission to experiment in a vacant lot. Their experiments will be inadequate to save soil, but they will help the pupils understand a few of the basic facts about soil. Inexpensive Government bulletins can be used as sources of information. *The conclusion should be that so long as there is any topsoil left it can be conserved, but constant effort is required.*

Much of the cropland is eroded by wind. A dust storm is a greater menace than a blizzard. Many children have seen the air grow hazy as the result of a dust storm somewhere, or have observed a whirlwind in the yard. Such experience leads them to learn more about dust storms by reading. Everywhere that the vegetative cover of grass or other crops has been removed there are dust storms—on the Great Plains, in China, in Russia. There is only one way to fight loss of soil by dust storms and other wind erosion, and that is by restoring the grass. It is not sufficient to turn plowed land into pasture unless it is carefully used. Many times pastures are cropped so closely that the surface of the earth is exposed. Especially is this true in the pastures which are cropped by sheep. *Grass and light pasturing are remedies for wind erosion.*

Does the condition of farming land appear to have anything to do with the prosperity of the farm? Pupils in town and country alike, in driving through the community or through neighboring communities, find it interesting to observe the amount of erosion and try to observe the relation between the condition of farms and homesteads and the amount of erosion.[43] What is the condition of homesteads on badly eroded land as compared with those on well-conserved farms with respect to various points which the children consider relevant; such as, condition of barn and house (painted or unpainted, in repair or not, screened, and the like); condition of farm animals (well-fed, healthy-looking); amount of uncontrolled erosion; methods of erosion control and renewal of soil; amount of pasture land in good condition; repair of fences; other items. In discussion pupils can bring out items such as the poor crops on badly eroded land, consequent low income, and lack of money to spend for repair and upkeep of farmstead, and the like. *Farms which have a great amount of erosion without methods of controlling it usually are not profitable.*

[43] Burges, Austin E. Soil erosion control. Atlanta, Ga., Turner E. Smith & Company, 1936. p. 15–17.

Does the prosperity of farming communities affect people who live in cities? is a question which will arise in both country and city schools. Children can be led to plan original studies to answer it. One way [44] of planning is to make a list of the occupations or professions by which people in towns and cities live, such as law, medicine, business, the ministry, teaching, automobile selling, selling farm machinery, implements, and tools. With such a list for guidance the class can proceed to discover ways in which *each man's business or profession is affected by the prosperity or the poverty of the farms.*

How does the prosperity of farmers affect the Nation as a whole? Here again the children can plan their own organization for the study, perhaps making a list of the Nation's industries which depend on farm crops and on the farmer's ability to buy. They will begin with a few of the basic industries, such as manufacturing, transportation, mining, communication, and study each of these in relation to its dependence on farming. Manufacturers of food depend on truck farmers for vegetables and on the wheat farmers for the material of bread, cakes, and cereals. Manufacturers of clothing depend on the cotton farmers, flax growers, and sheep raisers for raw materials of the cloth they make. Transportation industries can enjoy prosperity only so long as the farmers have plentiful crops to ship and sufficient money to buy the manufactured goods which must be shipped back to them. Workers engaged in mining and steel industries depend on farmers for their food and clothing. In fact, the prosperity of the Nation as a whole is dependent on the success and prosperity of the farmers, which in turn depend on saving the land from erosion.

It is often interesting for children in city or country to survey the community or the neighboring community to make a list of all the practices which they observe in the conservation of the soil. They should be able to observe some of the following: Rotation of crops, contour tillage, strip cropping, terraces on slopes, protective woods, rotation of pasture lands, check dams and shrubs as means of gulley control, reservoirs to conserve surplus water, variety of activities for making profit in addition to the regular farm crops such as raising of poultry, fruit, calves, and colts. One member of the class can interview a farmer who has practiced the conservation type of farming and ask him how much the newer methods cost him, whether or not he thinks they pay, how he intends to improve his present methods, and the like. As

[44] Burges, Austin E. Op. cit., p. 18.

a rule, *farmers who practice methods of erosion control raise larger crops per acre than those who allow their soil to wash away.*

Through reading, conversation with farmers, and in other ways, pupils can seek for facts to help them understand that the country once had more soil and produced better crops, with less improved machinery. This leads a class to history. The story of the Nation's soil can be related to the pupils' study of colonial life. They will read about ways of farming in colonial days and learn that when America was discovered, it was a land of abundant natural resources. The soil was so rich and the forests so luxurious that it seemed a land of plenty indeed. Children can learn whether early settlers tried to conserve, or whether all simply moved to new land when the old was depleted. They will learn that a few leaders like Washington and Jefferson are known to have practiced conservation on their lands. Washington has been called the Father of American Agriculture. Although scientific knowledge of that day was limited, and farm machinery was crude, Washington maintained a system of crop rotation and Jefferson a plan of contour plowing that would do credit to most modern farms. The great majority of farmers in early days, however, pressed then as now by the struggle for a living for themselves and families, farmed their soil for the most profit, and *when it was exhausted, moved to new land, which could be had for the clearing.*

Children usually find the story of the westward movement as interesting as a study of colonial days. By relating this to conservation, they learn that prairie soil in earlier days was so rich that it produced abundantly without the use of fertilizer. There were few floods because forests and grass covered the unused land. The prairie soils are not as greatly depleted today as eastern soils, *yet more than 40 percent of the topsoil is gone from Prairie States in the upper Mississippi watershed*, including Iowa with a loss of 57 percent and Missouri with a loss of 75 percent.[45]

A camp of CCC boys in the community is interesting to children. What are they doing and why? Who pays them? Is the work they do worth while? These are questions which can best be answered by visits to a CCC camp and by inviting the boys to come to the school and talk or help with activities. One of the important activities of CCC is giving assistance in control of erosion. An interest in the camp is a lead to a study of the method

[45] Topsoil, its preservation. Op. cit., p. 9.

used to control different kinds of erosion.[46] It is also a lead to a study of different types of Government services in control of erosion.[47] The class can secure information by writing to the Superintendent of Documents, Washington, D. C., for a complete list of publications dealing with soil erosion and its control. In such studies the children can consider the problem of taxation and the use made of the money which their parents pay in taxes. *Farmers can secure advice and aid from the Federal Government.*

Older children will be able to study the watershed in which their community lies. Individuals may follow a small stream or two to the source. A study of a watershed in a community should lead the children to understand that it is more reasonable to control small waters in creeks, brooks, and ponds at their source than lower in the valley where the current is strong. They can follow their observation by reading about efforts made to control floods and will be able to arrive at several conclusions. For example, the building of levees to prevent floods in the lower part of the river valley is costly and not always successful. Control of waters at the source means replanting of forests, restoring grasslands, and filling gullies. It means refraining from draining swamps, and straightening and narrowing the channels of small rivers except with expert advice of engineers and other specialists. Control of waters at the source prevents erosion in upper parts of the watershed. It is not as costly as control in the lower part of the channel; but results of the first method have not been fully proved with respect to large rivers near their mouths in seasons of undue rainfall. *At present the wisest course with respect to flood control is to use all methods possible.*

Questions may arise as to whether or not other countries have soil problems; other States. Searching for information, children will learn that many States have outstanding problems in the control of erosion and the restoration of the soil; and they perhaps will desire to study some of them. Different regions, too, such as New England, the Southeast, the Great Plains, have characteristic problems. In geography and history texts, pupils will learn about soil problems of other countries today and in the

[46] Everett, Marcia. Progress toward integration in a rural county. Educational method, 15:179–91, January 1936.

[47] Topsoil, its preservation. Op. cit.

Ten billion little dams. United States Department of Agriculture, Soil Conservation Service. Washington, D. C., United States Government Printing Office. 17 p.

past and compare them with those of the United States. The study should lead them to the conclusion that *nations which have neglected their soil problems eventually have declined altogether or fail to achieve outstanding progress toward civilization.*

(2) *Participation in activities of soil conservation.*—One of the first things for children to do in the conservation of soil is to avoid destroying it. No child should make a gully broader by pushing in its banks. Refraining from walking across lawns is a habit worth developing. Care should be exercised with respect to newly planted grass.

Posters which children make and display in the windows of small-town stores stimulate interest in conservation of soil in the community. Sketches of community watersheds and the part they play in the control or increase of floods are also useful. Children can contribute to conservation by writing articles for a local paper or for their school paper. Articles of this kind should be tied up as much as possible with soil problems of the local community. *Activities of children have definite value in influencing and informing other people.*

In city and in rural schools alike, older pupils can arrange to keep informed about the Nation's progress in control of erosion developments of particularly interesting Government demonstration areas, for example, control of chinch bugs and grasshoppers, prevention of floods, reforestation, establishment of shelter belts. A definite plan to spread this information through the school and community by means of school papers, posters, exhibits, and programs is a contribution to the Nation's program of soil conservation.

In rural communities, many problems in which adults engage in the conservation of soil are enterprises in which children can help. A class in school, for example, can take charge of a neighbor's gully, plant black alder in it, and erect simple dams with rubbish and stones. Boys who live on a farm have satisfaction in helping their fathers plan for strip farming, contour plowing, and the like. They can report their experiences to the class. In some country schools, *children can keep a record of the progress made on different farms in the control of erosion.* They can make records, for example, of new erosion on closely grazed fields, of sheet erosion in newly plowed fields, of changes in gullies for better or worse, of new trees planted on different farms, of erosion projects undertaken.

It is more difficult for children who live in cities to participate in the conservation of soil. Individuals who are able to visit parks can keep a record of activities carried on in them. If they find signs of erosion they may wish to label them for the information of people who use the parks. They may find it worth while to make posters explaining the work of the CCC in the parks or on the highway. *In towns and small cities it is possible for the school to have charge of a garden and in it try various methods of maintaining fertility of soil and checking erosion.*

(3) *Attitudes and continuing interests.*—Studying about soil and the way it is made, trying to learn what gives it color and regulates its texture, what makes it fertile and how different soils have become fertile, and the like, may lead to an interest in soils and a curiosity about them that will continue through life. A study of different kinds of soils characteristic of different localities contributes to a wholesome interest in soil. Through a study of different kinds of soil erosion children develop concern for the soil. Erosion has a dramatic appeal which enlists the sympathies of children toward its control. For example, when children learn that a gully steals tons of fertile soil from the fields nearby they are shocked at the waste. They gain satisfaction in attempting to fill the gully by planting shrubs or throwing in rubbish and are encouraged when they see their efforts successful. *Pupils read that the science of controlling erosion is still in its infancy and are interested in noting the success of various methods used by farmers in their community.*

Reading about floods in other communities and realizing that failure to control the small waters in the home community may be partly responsible for the floods helps children feel their responsibility for the welfare of people in other communities. Children who live in communities where there are no dust storms can to some extent gain a sensitiveness vicariously to the hardships which dust storms bring to those people who live in arid regions, and this should be followed up by efforts to do something in the way of relief if it is only an effort to influence the community to send aid. In similar ways pupils become sensitive to the problems of soil conservation with which those who live in other parts of the country have to deal. When children read about the significance of soil erosion in other countries, past and present, *they become more concerned about soil erosion in our own country and more tolerant and understanding of the problems of others.*

Wild animals are not all extinct. Here is a grizzly, roaming the woods in Wyoming.

OTHER NATURAL RESOURCES

Just as, for the purpose of illustration, content and a few desirable results have been sketched in the foregoing pages for teaching conservation of wildlife, including birds and flowers, mineral resources, water, forests, and soil, so content and results can be planned for teaching conservation of other forms of wildlife; of national parks; of historical landmarks and other records of culture; of health and home life; of natural products used in industry. Such a preview of curriculum content usually helps the teacher with her preparation, planning, and teaching.

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