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Abstract Papers

ters are obtained; while one dipped in potassium thiocyanate gives red letters. The production of colored metallic sulfides by hydrogen sulfide in solutions of metallic ions also gives visual evidence of a chemical reaction. Burning solid alcohol generates sufficient heat to produce the gas hydrogen sulfide from the commercial product, Aitchtuess, in less than a minute. A small amount of the gas above solutions of lead nitrate, antimony chloride, cadmium nitrate and zinc nitrate quickly produces precipitates of black, orange, yellow and white sulfides.

The sight of flames seems to arouse the greatest interest in an audience. With the production of visible fire by unusual means this series of experiments may be brought to a close. Three c. c. of carbon disulfide are placed on a watch glass. A glass rod is heated slightly and held immediately above the liquid. The liquid catches fire; when blown out can be relit several times with the glass rod. In another experiment of a somewhat similar nature a ball of excelsior about five centimeters high is placed on an asbestos mat. Two grams of sodium peroxide are placed on top of the mass. When three drops of water are added, the excelsior bursts into a ball of fire.

The members of the audience generally agree that this group of demonstrations has proved very interesting. It is possible then to teach a few chemical truths and at the same time give the public a type of entertainment that it likes.

THE GENERAL SCIENCE WORKSHOP OF THE MANKATO STATE TEACHERS COLLEGE

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ABSTRACT

The junior and senior high school science teachers of south central Minnesota have for many years been organized for the purpose of exchanging ideas and discussing mutual problems. While they have found their four or five meetings a year very helpful, they have felt a growing need for longer and more concentrated periods of working together. As a result the Workshop at Mankato State Teachers College was established, a two weeks course followed by two or three conferences in the next school year.

Problems studied included (1) a restudy of the science curriculum of the junior and senior high school with the evaluation and distribution of units, (2) the scientific method, (3) the resources and industries of the community in relation to science, and (4) the various forms of visual aids. Special attention was given to the

study of individual units together with the methods and techniques of teaching them.

The objectives decided upon were as follows:

1. To equip the pupil with the scientific method for interpreting the world and its problems.
2. To develop scientific attitudes in the pupil; openmindedness, questioning attitude, understanding the relationship between causes and effects, respect for truth, initiative and independence.
3. To give him a command of facts and knowledge of his environment to enable him to adapt himself to his environment.

Proposed work for the Seventh, Eighth, and Ninth Grades, as related to the major objectives:

Seventh Grade. Getting acquainted with the scientific aspects of our environment.

Eighth Grade. Understanding the materials and forces of nature and how they function in their natural setting.

Ninth Grade. Learning how man applies the materials and forces of nature.

After this phase of the work had been agreed upon, those members who taught in the seventh, eighth, and ninth grades, respectively, worked together in preparing units on the various topics along with visual aids and field trips which would tend to vitalize their teaching.

THE MANKATO STATE TEACHERS COLLEGE PHYSICS TESTING PROGRAM 1935–1940

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ABSTRACT

The customary quizzes and examinations used by individual instructors in General College Physics Classes often prove inadequate. In order to meet the need for a more complete testing program it was decided to use additional, standardized tests, which would provide for a representative sampling of the expressed aims and objectives of the course, and which would make it possible to determine the students' individual and average ratings on a national as well as on a local scale. For the past five years the College Physics tests issued by the Cooperative Test Service with the cooperation of the Committee on tests of the American Association of Physics Teachers have been adopted. These tests cover the topics taught, viz., Mechanics, Heat, Sound, Light, Electricity, and Modern Physics. Each test was given as soon as that particular topic

had been completed. On several occasions pre-tests were given also.

A comparison of the performance of Mankato State Teachers College Physics Classes with the National Norms for men may be summarized as follows:

1. The highest scores were made by the class which had the lowest enrollment. (In this class a pre-test was used and the students who did poorly dropped the course.)
2. The lowest scores were made by the classes which had the largest enrollments.
3. The classes which ranked lowest had the largest percentage of women students. (Our women students would have received somewhat higher ratings if their performance had been compared with the National Norms for women instead of with those for men.)
4. The scores obtained in the Cooperative Tests on Mechanics, Heat, and Light over a five year period were above the national average for men.
5. The scores obtained in the Cooperative Tests on Sound and Modern Physics were slightly below the national average for men.
6. The scores obtained in all the Cooperative Tests tend to show that our physics classes ranked somewhat above the national average for men.

SYMPOSIUM: AIDS TO SCIENCE TEACHING IN MINNESOTA

SUGGESTIONS FOR VITALIZATION OF SCIENCE TEACHING IN MINNESOTA

E. M. FREEMAN
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ABSTRACT

I. One of the fundamental needs of science teaching, especially on the secondary school level, is "vitalization" of science, meaning thereby that the science taught, both as to subject-matter and methods of teaching, be made as far as possible of vital or living importance to the student. This does not mean that it is to be made merely practical, but that science and scientific facts be related to as many angles of living and to other subject-matter areas as possible. The importance of science as a basis for many of these other subject-matter areas is extremely great and should be emphasized.

II. Concrete and specific needs for science teaching include:
   1. A survey or inventory of the available facilities existing for the vitalization of science teaching.

2. The integration of activities to increase the availability of such existing facilities.
3. Cooperative efforts in increasing these and in originating new facilities.

III. Suggestions for inventory of existing facilities.

Organization of the science teachers, first of all, for the purpose of cooperative effort in the improvement of science teaching can be first expressed in collaboration in listing, and making public and more available, the existing facilities and opportunities. Following are some suggested categories:

1. Museums, exhibits, collections, etc.: Minnesota Museum of Natural History, St. Paul Art Institute, divisional exhibits at University Farm, etc.
2. Herbaria and taxonomic collections of various sorts: University, University Farm, etc.
3. Arboreta, permanent gardens, important collections of plants, trees, or shrubs: Carleton College arboretum, certain nurseries, etc.
4. Native areas set aside for preservation: Itasca, Cedar Creek bog, Nerstrand Woods, etc.
5. Federal and state parks: Superior National, Chippewa National, Jay Cooke, etc.
6. Local collecting and nature study grounds of unusual or characteristic quality: Could be worked up in each high school or cooperatively between neighboring high schools for each locality. These could be classified to show types of vegetation and ecologic characteristics; for instance, a typical prairie, bog, sandy areas, jack pine land, big woods, etc. This would also include information and suggestions from such departments as State Conservation as to localities for observing and finding wild animal life, mammals, birds, fish, etc.
7. Process and manufacturing industries. Those outstanding ones to which trips could be made for observation of processes: packing plant at Austin; mills at Minneapolis; linseed manufacturing, Minneapolis; sugar factories, Chaska; canning at LeSueur and other places; packing companies, South St. Paul; wood using industries at Cloquet, International Falls, Little Falls; etc.
8. Experiment stations and research centers: University Farm, Crookston, Morris, Grand Rapids, Duluth, Waseca, Excelsior (Fruit Breeding Farm), Coon Creek, Itasca Park, and so on.
9. Visual aids: Addresses and available services from various centers including cooperative borrowing, photographs, movies, loanable specimens, etc.: Minnesota Museum, Univer-

sity Visual Education Service, University Committee on Public Information, etc.

10. Library and literature facilities: Loan libraries, cooperative exchange, etc.

The following exist only in limited form. They might well be cooperatively fostered and used:

11. Science groups. Continue and develop the present activities. Develop at least one day in the year for a presentation to the community of the importance of science in daily life.
12. Exchange of materials: Cooperative exchange, for instance, from the big woods section to the prairie section, should be fostered. Cooperative collection and centralized collection agency could be set up somewhere in the University; for instance, seed collections, weed plant collections, identification center, etc.
13. Radio. A cooperative program through the use of the radio for possibly classroom instruction and also for other purposes.
14. State guide books: Promote the development and publication of guide books of use to student and teacher tourists traveling through the state, calling attention to vegetation, animal life, geologic features, and so on.
15. Nature study schools:
    a) Biological Station at Itasca Park. It might be possible to add other courses of special value to science teachers to the courses now offered.
    b) Stations in other states, especially those with significantly different conditions, for instance, mountains or seashore.
    c) Possible cooperative summer camps of brief duration, one or two weeks, organized and attended by groups of science teachers; for instance, in the Superior Forest, along Lake Superior, in Houston County, in the Red River Valley, etc.
    d) A possible permanent nature study school at Itasca for use of transient tourists, trips every day, and offering one-week "Schools" each month from June to August inclusive.
    e) Summer tours of Minnesota, cooperatively organized; one week trips or possibly longer, somewhat in the manner of the Historical Society trips.

IV. The above objectives cannot be reached nor can much else be done for teachers of science unless they organize and actively promote their cooperative enterprises. The most obvious and most effective center for doing this seems to be in the science teaching section of the Minnesota Academy of Science. According to the organization of the sections, each section has a

chairman and a secretary. These positions are somewhat honorary and change each year, which destroys continuity and throws all responsibility on the officers. It is suggested that the science teachers, including the teachers of biological and physical sciences, the agricultral high school teachers, possibly home economics teachers, etc., organize a committee or board of directors within the section. This board could be organized to effect continuity and could be composed of a considerable number of representatives from the various groups interested, perhaps each elected for a three year period. The board could organize definitely for the promotion and the development of the projects mentioned under inventory above.

The inventory facilities were not worked out above for all of the interested groups, for instance, agricultural high school teachers, physics and chemistry, geology and other sciences.

Agricultural teachers: It seems probable that the agricultural teachers would be interested in a similar cooperative attack on the available opportunities in the state; for instance, an inventory of the agricultural areas, outstanding farms that would illustrate these, prominent pure bred herds, areas for cooperative observation, experimental farms, federal cooperative control areas such as soil conservation, soil erosion, experiment stations. In a similar way, physics and chemistry teachers could be interested. Here the inventory would include much more in the way of industries of many kinds.

MUSEUMS OF NATURAL HISTORY AND THEIR USE IN SCIENCE TEACHING

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Minnesota Museum of Natural History

ABSTRACT

The term, "natural history," is very broad and may include all biological fields, paleontology, geology, astronomy, and certain branches of physics and chemistry. It is evident immediately that only the largest museums can cover all these fields, and it follows that each small museum must choose one subject or a few subjects to be treated in order to avoid becoming a hodgepodge assembly of heterogeneous material. Consequently most museums are not standardized institutions. The source of funds usually governs the nature of a museum. Publicly supported ones develop their activities and exhibits to appeal to the greatest number of tax payers supporting them. Museums financed by individuals or organizations with special interests present these special subjects to their

patrons. Directors of such private museums assume the responsibility of shaping public interest instead of allowing their institution to be shaped by the whims of the public.

Since natural history museums do not constitute a required part of most educational systems, but are really additional opportunities offered for furthering the interests and education of students, it follows that the best use of the facilities comes only with the voluntary cooperation of the teachers concerned.

Many teachers simply announce to their pupils the presence of museum collections and invite them to become acquainted with these materials. Other teachers arrange group visits to museums for more or less random inspection trips. Their time would be much more effectively spent if a tour were arranged wherein the exhibits are explained by a museum staff member.

Some teachers prepare mimeographed questions about materials in the museum pertinent to classroom studies and allow the pupils time during visits to search out their answers.

Loan materials are usually available in natural history museums. The pupils profit much more by having materials they can actually touch and handle than by being shown these same objects back of glass. This means the damaging of some material and, except with specimens readily replaced, this direct contact with the material is often not permitted. Some museums protect their bird and mammal study skins by placing them permanently in transparent plastic tubes.

Since the business of museums includes the constructing and arranging of exhibit materials and, since one of the most effective means of teaching is the technique of allowing pupils to construct and arrange their own exhibits, it follows that the teacher may get valuable suggestions from the museum staff members.

Every museum has its own arrangement concerning lecturers available to schools. These possibilities should be inquired into as a part of the teachers' cooperation with the museums.

Most active museums sponsor lecture series and these programs should be carefully followed and pupils urged to attend such of these as might apply to their particular fields and abilities.

PRAIRIE, FOREST, AND PARK FACILITIES AND THEIR USE IN TEACHING NATURAL SCIENCE

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ABSTRACT

The use of prairie, forest and park facilities in the teaching of natural science has many advantages in arousing student interest, in coordinating book-learning with nature-learning, in encouraging

observation and in stimulating thought on the make-up and maintenance of plant, animal and human societies. Class visits to even very small natural areas can be used to impress the students not only with life histories and habits, but also with the interrelationships within natural communities, particularly if the visits are recurrent and related. These studies can be extended beyond the school year with projects undertaken by individual students or by groups. Permanent quadrant studies are especially suitable for this purpose.

Minnesota was once covered with three principal types of vegetation, the coniferous forest, the deciduous forest, and the prairie, the limits of each being determined by natural conditions of climate and soil. Each region had its characteristic plant and animal life, and each made its distinct contribution to the history and economics of Minnesota.[1]

Although large areas of forest or prairie that have remained in nearly the original condition are now rare, small areas that are still more or less in their natural condition are much more common and can often be found fairly close to towns. Original prairie, unplowed and ungrazed, is most easily found along railroad rights-of-way. Natural woodland conditions are best found in woods that have not been heavily pastured. Excellent examples of natural conditions are preserved in some of the state parks, of which there are nineteen exclusive of wayside areas and memorials.[2] These parks range in size from 110 to 31,816 acres. Certain high schools already conduct summer trips by school bus to these parks.

The use of Minnesota prairies, forests, and parks in the study of natural science would be facilitated if there were available a guide to the natural history of the state, containing summary chapters on such subjects as the geology, soils, flowers, trees, fishes, birds, and mammals, the location of natural areas, and a bibliography of more detailed publications.

RADIO AND SCIENCE EDUCATION

BURTON PAULU
Radio Station WLB

ABSTRACT

The adoption of radio programs for classroom use has usually been slow, but a rapidly increasing number of teachers are employing them. We have found that when good programs are made available and brought to the attention of progressive teachers, they will

[1] C. O. Rosendahl, "Minnesota." In *Naturalists' Guide to the Americas,* Baltimore, 1926.

[2] State Parks of Minnesota. *Contribution of the Division of State Parks.* Department of Conservation, State of Minnesota.

be used; and presently teachers who are reluctant to adopt new techniques will employ them as a matter of course.

The University of Minnesota Radio Station has been devoting much time to developing the Minnesota School of the Air. An indication of the growth of the programs may be derived from the following figures: —during the first semester of programs in the fall of 1938 about 20,000 students used the programs every week; during the fall semester of 1940–1941, 75,000 students heard the programs.

Through radio the presentations of master teachers can be brought to many students, and special illustrative materials become available. For example, foreign language programs illustrate proper pronunciation of French and German, Representative Authors programs dramatize stories of a scale which a single school system could not afford, and Music Appreciation programs are based upon a phonograph record library which most schools do not have.

WLB now (at time of publication) has a science broadcast every Wednesday from 2:00 to 2:15, as a part of the Minnesota School of the Air. These programs have been organized with the assistance of people who have had practical experience in teaching sciences.

If radio programs are to be used effectively in the classroom, they must be integrated with other class procedures, with preparatory activities before the broadcasts, and follow-up discussions afterwards. It is suggested that students listen in groups of average class size; the reception of radio programs in school assemblies is not usually satisfactory. The best radio set possible should be used, and it should be properly tuned and adjusted.

POSSIBLE CONTRIBUTIONS OF THE STATE CONSERVATION DEPARTMENT TO SCIENCE TEACHING IN MINNESOTA

P. R. HIGHBY
Minnesota Department of Conservation

ABSTRACT

The Department is in favor of a thorough educational program regarding its present activities and its projects planned for the future. Its official bulletin, the "Conservation Volunteer" goes to Minnesota schools and public libraries as well as to sportsmen and groups interested in conservation. The May, 1941, issue of the "Volunteer," on pages 77–79, lists many other conservation publications available for free distribution by the Bureau of Information. These publications are supplemented by newspaper and magazine articles, radio programs, movie films, organized lectures, meetings

and personal contacts. Some field work has been done with 4-H club members and boy scout troops, and this type of project might well be extended. The importance of observations in the field, supervised by an experienced leader familiar with local conditions cannot be overestimated.

Mr. George W. Friedrich's fifty-six page pamphlet "The Study of Conservation" published by the Departments of Conservation and Education in 1940, warrants very special recommendation to teachers of conservation courses. Its list of references to the literature will acquaint teachers with the best available source materials.

The Department could offer limited assistance in the editing of manuscripts on conservational materials prepared by educators for presentation in the schools. In this way a study of present conservation problems could be woven into the school program.

The publication of a technical journal is being considered.

MOTION PICTURES IN SCIENCE TEACHING

HAROLD B. JENSEN
University of Minnesota

ABSTRACT

Since 1921 the University of Minnesota, through its Bureau of Visual Instruction, has been serving the schools of Minnesota with educational films, and today the University owns and distributes over 1,000 reels of 16mm. film, on almost every conceivable subject from Anthropology to Zoology.

Stop-motion and slow-motion photography are readily adaptable to the study of many scientific subjects. Processes which progress too slowly or too rapidly, respectively, to be studied at their normal speed, can thus be shown on the screen at a rate which allows close observation by students. The former technique is especially useful for recording growth of plants, unfolding of flowers, etc., and the film library contains over 30 films on plant life. Another special motion picture technique, animation, solves many problems for science teachers. Through the use of animated drawings the explanation and demonstration of such varied subjects as sound wave characteristics, anatomical features, and physiological processes, are very greatly simplified.

Contrary to general impression, the use of motion pictures definitely requires more work and preparation by the teacher than is required in traditional teaching methods. The teacher who is to find the use of films effective must preview each film to determine exactly what it will contribute to his classwork. Before the picture is shown in the classroom the students should be prepared for it by some such means as discussion, field trips, or experiment. After

the showing the picture should be discussed while it is still "hot". And then it may be profitable to show the film a second time or even a third time.

The films of the University Film Library are available to all teachers in Minnesota and the surrounding states, and the Bureau of Visual Instruction will send a film catalog to any teacher who requests one. Mr. M. I. Smith of Hibbing has selected the films which can appropriately be used in connection with each chapter of the General Science textbooks in use in Minnesota, and he will send the mimeographed list to any teacher who sends in a request.

UTILIZATION OF NATURAL RESOURCES IN THE PHYSICAL SCIENCES

SHAILER A. PETERSON
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ABSTRACT

For many years Minnesota teachers have been discussing in state and sectional meetings such topics as "the adequacy of our state course of study," "individual laboratory vs. lecture demonstrations," "projects for science," "visual aids in science," etc. Although these discussions add to the teacher's professional interest and growth, few actually contribute tangible helpful suggestions relating to specific school situations.

Teachers of biological as well as of physical sciences have decided that they might well have round table discussions in which each could submit his experiences, original experiments, familiarity with various resources, etc. In this way a host of interesting and valuable material would be made available to all teachers. In addition teachers using ideas derived from this source could make them even more valuable by reporting alterations they found desirable.

Often the valuable natural resources of a community have been neglected, either because the teacher did not know of their existence or because he had too little time for the necessary organization of the available material. Whenever a teacher does some original investigation of such resources and finds material valuable for his purposes, it might well be that his notes and recommendations would prove profitable to other teachers.

Various suggestions have been made as to the best method of distributing these ideas. It is not probable that any journal would undertake to publish them. As a solution many Minnesota teachers have organized a Statewide Science Organization whose function shall be to duplicate and distribute teaching units, teaching plans, descriptions of experiments and demonstrations, and other materials that could prove useful to teachers.

NATURE AND SCIENCE IN THE ELEMENTARY SCHOOL—THE PLACE WHERE SCIENCE EDUCATION BEGINS

MAUD B. LOWEN
Minnehaha School, Minneapolis

ABSTRACT

(1) The importance of science to the elementary school child.

The elementary school child is full of wonder and curiosity about his environment. His exploratory instincts lead him to conduct crude experiments, make collections, and form simple deductions from his observations. His interest shifts rapidly from one field of science to another, and for this reason he should be given a beginning knowledge and appreciation of science in general, and his interest should be guided by intelligent questioning regarding easily observable phenomena in his environment.

(2) What is available in this locality for the teaching of science to such a child?

In or near Minneapolis are such features as the Mississippi River as an influence in the historical and economic development of this section; the trees and forests; samples of soils, such natural features of the region as prairie, peat bogs, dunes, and examples of erosion; the central market and truck gardens; industries such as flour mills, creameries and garment factories; the transportation centers, broadcasting stations, the state capitol, historical museum, and the state university.

(3) How can the resources of the state and of the university be utilized for this work?

The university could serve as a central bureau to which children and teachers could appeal for information, perhaps by means of a bibliography of available reading material, carefully graded and sometimes rewritten for simplicity. Small exhibits on many subjects could be sent to schools, as are Dr. Roberts's cases of birds at the present time. A clearing house for suggesting and arranging trips of scientific interest from one school or locality to another would be very valuable.

POSSIBILITIES FOR COOPERATION BY MINNESOTA AGRICULTURE TEACHERS

LEIGH H. HARDEN
University of Minnesota

ABSTRACT

High school agriculture teachers have been using local resources as aids to instruction for many years and are cognizant of their

functionality in relating instruction to the lives of their pupils by bridging the gap between the community and the school. With constant social and economic changes, the agriculture teacher today has a sharpened recognition of interrelationships in the modern world and of the need for relating his instruction not only to the problems of the local community but to those of the region, state, and nation. It is in this broader need that the local teacher of agriculture senses the mutual benefit that would arise from a program making available to him a knowledge of teaching aids relating to the regional and state problems, in addition to those that he has been utilizing in his own community.

A systematic inventory of these teaching resources and aids might serve the teacher in two ways: first, to enlarge his own background of information which he may relay to his pupils; and second, to provide opportunity for his pupils to learn for themselves through concrete, meaningful experience and observation.

Such an inventory of resources could well be undertaken by the existing excellently organized association of agriculture teachers as a cooperative project, or by committees cooperating with the Academy.

The potential teaching aids that might be discovered and classified in such an inventory are too numerous to include in this abstract. Reciprocal exchange of information with other science groups would provide a much needed and highly desirable educational tool which in its use would aid materially in the development of new information, interests, appreciation, habits, and attitudes on the part of our boys and girls. Through it the classroom might include the whole state.

ORGANIZATION OF TEACHERS OF SCIENCE TO EFFECT THE GREATEST USE OF STATE RESOURCES

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ABSTRACT

Many organizations are now available for science teachers of Minnesota, but there still exists a need for some definite organization to effect the greatest possible use of our state resources in science education. The following questions arise. First, what organizations now exist for Minnesota science teachers? Second, which of these groups, if any, could meet this specific need?

The National Committee on Science Teaching and the American Association for the Advancement of Science are carrying on certain cooperative undertakings of value to Minnesota science teachers,

but our problem is not likely to be solved through any national organization, as it is one that must be met largely through the activities of state, sectional, and local teachers' groups, and by the teachers themselves. State-wide organizations such as the Minnesota Education Association, the Minnesota Wildlife Federation, and the Senior and Junior Academies of Science, contribute toward meeting specific needs of science teachers, offering them an opportunity to exchange experiences and keep in touch with recent advances in their fields. Smaller sectional and local science teachers' clubs are in existence in many parts of Minnesota, and it is most essential that these smaller groups continue their efforts to discover the resources of their respective sections of the state. But at the same time there is a definite need for one all-inclusive organization to integrate the activities of the smaller units. This larger organization should serve science teaching at all levels from grade school through adult education, and in all fields of scientific knowledge.

Such an organization is already in existence. The Minnesota Academy of Science is an all-inclusive, state-wide organization. Consequently it seems proper that from the Science Education section of the Academy there should emanate a central activating and coordinating committee to direct the cooperation of all the science teachers of the state in their task of making available to the teachers themselves all the resources of Minnesota.

AIDS FOR TEACHERS OF PLANT SCIENCES IN SECONDARY SCHOOLS

A. H. LARSON
University of Minnesota

REPORT OF THE SECTION CHAIRMAN

A PLAN FOR INCREASING THE AVAILABILITY OF SCIENCE TEACHING AIDS IN MINNESOTA

E. M. FREEMAN
University of Minnesota

ABSTRACT

The Science Education Section at the close of its meeting voted to sponsor a plan to centralize and promote the use of natural resources of the State in science teaching. The primary objective behind the framing of the symposium and the formation of a centralizing and promoting bureau was to consider the form of organization desirable for carrying out this plan. Teachers of science

should of course attempt to do something through their own organizations, but the Science Education Section of the Minnesota Academy could probably be very effectively organized to do the work.

I have appointed the following men to act as members of a central continuing committee: Palmer O. Johnson (chairman), Walter J. Breckenridge, Leigh H. Harden, Shailer A. Peterson, Ian Tervet, and H. K. Wilson. This small group located at the University is to consider itself a nucleus of activity appointed for an indefinite length of time. The final expanded organization eventually required should be formed very carefully and gradually.

The first step by the newly appointed committee might well be the assembling of a larger bureau to consist of cooperating members selected perhaps on one, two, or three year bases. Care should be taken in selection to include interested, enthusiastic, and active persons from all of the various groups involved. Perhaps three ultimate units will need to be developed: (1) a directing nucleus largely concerned with the centralization of the work in the University or Twin City area; (2) a slightly larger group small enough to be mobile; and (3) the larger group of cooperators who would seldom be brought together in a meeting but who would function in close touch with some members of the small committee or the intermediate bureau. This proposed method of organization is to be considered merely as a suggestion. The outlining of a very ambitious program is desirable, with of course the understanding that not all of the objectives can be reached or even attempted at the present time. It would seem quite possible, as we attempted to do in the symposium, to set up certain categories of obvious available aids and to focus attention on each one of these and to assign to certain individuals in the state the job of promotion for each category on which active work is to be begun. The contents of the papers on the symposium, which appear here in abstract form, are suggestive. On some of these topics work is already being promoted actively.

I am personally greatly impressed with the possibilities of the science teachers' utilizing to greater advantage the Lake Itasca Biological Station facilities and the establishment of summer groups or tours.

In appointing the committee, I am turning over the whole proposed plan outlined above. I am convinced that splendid progress can be made and that the objectives are well worth every effort. Research in science is, of course, the well from which science flows. Most of this research, however, lies unused unless education in some form or other steps in to distribute it to the areas which it must reach to be useful. One of the obstacles is the problem of expense involved in publication, clerical help, etc., but there are various feasible means of meeting this situation.