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Opportunity for field trips related to the secondary school program in the Quincy Massachusetts schools.

Fox, Robert P.
Boston University

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Thesis

OPPORTUNITY FOR FIELD TRIPS RELATED
TO THE SECONDARY SCIENCE PROGRAM IN THE
QUINCY MASSACHUSETTS SCHOOLS

Submitted by

Robert P. Fox
(A.B., Harvard University, 1950)

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INTRODUCTION
INTRODUCTION

This subject was chosen for a thesis to serve as a possible guide for outdoor education as related to the science courses in the Quincy Massachusetts schools and to be applied in plan, if not in detail, in other areas. Here is found a method whereby the science program of a secondary school can be related to local conditions. This serves to stimulate interest and to offer practical experience with the items studied. Teachers indicated a need for this to fill a vacancy left when Nature Study and field trips fell into disrepute several decades ago. As the author has had a variety of experiences in helping people to see what is around them in the outdoors, it was natural that this interest and experience be applied to the problem of setting up a possible guide. Even if this guide is not used, the opportunities set forth can serve to stimulate teachers to the possibilities offered in this city and probably in many others.

The advantages of field study are legion. Many authors have stated the pros and cons of the idea, but for this work, the following will suffice. Field work offers the student a chance to relate the work of different classes. The interrelations of the sciences and the relation of the science program to the rest of the curriculum take on new meaning in this practical situation. Carrying this point further, the school subjects can be related to the "real world" beyond the school yard. This is most important for the average pupil. Then there is
the individual to be considered. Here is one of the best places to help develop a new interest in a child. A lifelong hobby or a new outlook on school may be developed here. Also, the problem child might be stimulated here where the schoolroom situation has left no impression. It is a known fact that different kinds of learning help individuals - this outdoor form is important but seldom tried. The school program need not be interrupted nor the class taken on ventures that involve great risk. Organization ought not be difficult for an ambitious teacher and certainly the experiences are not beyond any interested teacher. Learning while the event is in progress offers a wholesome attitude to both the class and to the teacher, for no one can hope to be expert in everything. However, as has been said, "a picture is worth a thousand words" and to continue this Chinese proverb - "a field trip is worth a thousand pictures".

This guide is divided into several parts. The two main divisions are study areas and field trips. Some authors would classify the whole idea under the general term, school journey. However, by study area is meant a specific locality that may be frequently visited. This allows a following of projects, an observation of change and a consideration of the many aspects of a region as they inter-related. This report mentions local study areas. These are areas selected for their variety of material and for their proximity to a particular school. No area is more than five minutes walk from the school and so may
be visited even in school time. The city-wide study areas are again places to be visited often but are ones common to the entire city. They offer greater variety coupled with ready accessibility. Field trips, on the other hand, are areas of special interest that are visited once. They may represent a particular part of a subject or an outstanding example of an item studied. They may be in the form of an outdoor tour or in the form of a visit to a building. These two types of field trips are exemplified in this report.

In addition to study areas and field trips, there are special projects that may be done in a particular subject. These are discussed by subject so that a project may be worked up on any of a variety of ideas. Unit projects, Science Club work, or Science Fair exhibits for individuals or groups, may be evolved with the aid of this section. Several types of projects are suggested and possible ways to solve them explained. None involve previous experience and all will lead to interesting, meaningful work on the part of the students. The students will also gain a real comprehension of field work and research, as well as acquiring a greater appreciation for this city in which they live.

Many have discussed how such field trips should be led. A reading of several of the articles referred to in the bibliography will show the diversity of opinion on the subject. This is largely an individual problem, a discussion of which would entail a thesis in itself. Aside from what is stated in this
thesis and alluded to in the literature, a few hints might be in order.

1. Planning is the first essential. What can be seen and how it will help the area being studied is the first consideration. Then comes the fact of where it can be observed.

2. Consideration of the practicality of getting the class there comes next. If the trip, which may be but a ten minute affair to see the tree on the school lawn, seems worth the time, a visit by the teacher should be made to "get the lay of the land".

3. Arrangements should be made to cover release from school, parental permission and other administrative difficulties.

4. The trip. The students, being properly motivated and knowing what they are attempting to do, the group quickly moves to the area. Simple activities in which the students actively participate are best. This can be advanced to the extent that large classes are divided into six-man teams and each team leader has to carry out a project. The results are checked as a group by the teacher at the end.

5. Lastly comes games or social activities planned into extensive trips, for recreation mixed with learning equals an enjoyable, meaningful experience. A summing up of all that has been learned concludes the trip.

As has been said before, field trips offer a valuable tool in teaching. This guide purports to offer possibilities;
actualities are determined by needs and interests.

OUTDOOR EDUCATION DEVELOPMENTS IN THE UNITED STATES

"There should be no fixed pattern in outdoor education today...but each school should take advantage of what it has."¹ This thesis is attempting to show the advantages Quincy possesses. Mr. Shankland goes on to mention that Cincinnati is meeting this need by allowing twelve acres for their school buildings; the British are planning on fifteen acres. He also mentions that learning about the city surrounding the school is most important, and that all phases of the school program are involved. Science education in the outdoors is a significant part.

In the present century there has been an increasing need for outdoor education. The rapid rise of youth programs like the Boy Scouts shows this. Summer camps, both organizational and private, are another reflection of the demand for outdoor training. Low income and high income families can profit by these camps, but the large middle class are dependent upon the school for any of this work.² In two areas of the country, school systems that have tried to meet this problem are Michigan and California.


In Michigan, outdoor education has spread throughout the state as the values were realized by educators. The plans began near to the school, as advised by Conrad, and were later developed. The Kellogg fund helped to support pioneer attempts to prove the advantages of outdoor education. The program began in 1946 with the Clear Lake Camp in Western Michigan housing Junior High pupils and teachers for two week sessions; St. Mary's Lake Camp at Battle Creek did the same for fourth to sixth grade students. Since then, Iron Company has taken over a C. C. C. Camp and others are using state lands. Day camping is being done in Miskegen, Powers, Big Rapids, and Sault St. Marie areas, and school forests are being developed in other areas. Waterford, Michigan is building a school on a thirty acre lot selected for adaption to outdoor education. Still other school districts are employing Travel Camps like the North Michigan trail and the Canal Trip. In all these different expressions of outdoor education, the curriculum emphasizes wildlife and nature. Also included is working with others, handicraft, and appreciation for surroundings.

San Diego, California has also developed an extensive outdoor education project. Begun in 1946, there was planned a one week stay in a neighboring state park for all sixth graders.

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One hundred and twenty-five people were guests per week and the program included trail hikes, use of tools outdoors, arts and crafts, and appreciation of surroundings. The results were highly favorable as judged by community interest and child comments. A second camp is planned.¹

The appendix to this thesis includes a more detailed report on a New England attempt at outdoor education in Newton, Massachusetts. Most of the basic ideas of the Quincy plan can be found in these other attempts to make education real to the students.

CHAPTER I

LOCAL STUDY AREAS
CHAPTER I

LOCAL STUDY AREAS

LOCAL STUDY AREA I

LOCATION: This area is located directly east of Quincy High School and is bounded by Russell Park, Woodward Avenue, Coddington Street, and the Southern Artery.

DESCRIPTION: Here is found a section of filled in land in which the half nearest the school is a field and the parts farther away comprise a freshwater swamp. Grasses and hardy, dry-soil plants cover the first part and a red maple swamp covers the rest. There is a drained marsh between the two where there usually are puddles. This area is particularly good for biology for, even in winter, some one hundred types of plants may be found and some twenty-five species of animals and birds. In the warmer months, this number increases some four fold. Several forms of soil, a variety of local rocks and several land form characteristics make this a possible area for Chemistry and Physiography classes in all seasons. The specific uses in the different sciences will be discussed in some detail now.

BIOLOGY - Botany

Structure of plants and physiology form a necessary section of the Botany studies as taught in the local schools. This study area could aid such studies in several ways.

1. It could serve as a place from which to gather materials. These teaching materials would then be fresh and, of more
importance to the students, the specimens would be local and familiar.

2. It shows the different types of megascopic specimens in the field. More interest and a clearer understanding of local plants would thereby be gained, and association in everyday life would tend to reinforce the knowledge. The students would take on a more scientific interest when seeing the same trees and flowers elsewhere.

Under the subject of external morphology, several items could be taught in this area.

1. Different forms of branching, as well as erect, prostrate, and climbing (grape) shoots can all be seen.

2. Grafting experiments could be tried in the maples and cherries and experiments set up to find the best times for grafting.

3. Types of buds, branching patterns, roots and stem patterns are seen in all the different major forms here and growth experiments might be tried with even better results than in the classroom.

In relation to the study of stems, the growth rings could be examined in several of the red maple stumps. Wood samples of twenty common trees could be obtained. The differences of Monocots and Dicots are seen in Pokeberry, Sumac, Elm and Birch.

This area is not as good for plant associations as others, but the filling has resulted in a great variety of soil conditions. Plant associations for dry soil and for fresh water
maple swamp, characteristic of the South Shore ecological area, are found here.

The second major part of the Botany studies, as are carried on in the local schools, concerns classification. In this study area, there are at least ten varieties of fungi, ten of mosses, twenty-five of ferns and allies, and many hundreds of flowering plants. Good examples of each can be found and their various stages of reproduction observed. The examples of Algae and Fungus are as good as any textbook conceptions and they are often found by anyone in the woods and fields here. Even more is true of the mosses, ferns, and seed plants. Here is a chance to bring botany and nature study together in an enjoyable and lasting form.

**Zoology**

Most of the courses in Zoology divide the study between physiology and survey of the animal kingdom. In relation to the latter study, examples are used to show the various characteristics of the phyla and class. Many of the phyla and classes are represented locally and so these might be used. The study area could help in this.

1. Under Mollusca there are gastropods. These are found in this area as snails and can be observed to move and feed.

2. Annelida are represented by worms in this area.

3. Arthropoda are represented in almost every class: insects are represented in profusion with the typical grasshopper, dragonfly moth and ant. Study of Dutch Elm disease seen in the
area, and several of the periodic blights found here every year will also be of importance. Here is one of the few ways to adequately show some of the common insect borne diseases. Ant colonies can be studied, as can termite homes. Moths can be found at any season and several of the insects may be observed in any month of the year. Collecting, cataloging, or observing can be carried on as a class or individual project. Spiders have at least ten representatives in the area. The dangers of these arachnids could be shown.

4. Naturally, the Chordates are best represented. The most important classes are snakes, birds, and mammals. Several varieties of grass snake are found here and have been used limitedly in relation to some of the biology classes.

a. This area can be used in the study of birds in many ways. A statement of some typical projects that might be carried out here will serve to indicate the range of possibilities. A coordinated study with botany would show the types of food found for birds in the area, and would also show which birds ate different foods. A nesting survey could be made to determine what birds stayed here for the summer and how many birds of what species lived in the area. Ecology, bird densities, and other subjects would come into play. An elementary study of the different bird families could be made and methods of telling the birds would be used. A field trip at any time to the area would show several families, and a study in May would produce a great variety. Identification work could be
carried on for a prolonged period and the results kept in the classroom. Identification on a schooltime visit, individual or group visits to and from school and occasional visits in different seasons all produce satisfactory results. It is most helpful if the observers write a complete description of what is seen for future reference. This critical looking produces a more scientific attitude. Types of projects that might result from such work include many forms of migration studies.

One such study that is simple and effective is a listing of the first date a species is seen in the area. More advanced work includes studies of individual common species and a noting of the following information:

- First seen
- Nested
- Hatched
- Flew

Vagrant birds
Adult Males
Resident Adult Males
Females and immatures
Resident Females
Resident immatures

This form of study would be by individuals that were more advanced. Such studies have been done in the Junior High schools successfully. Other interesting projects, not reported in books, include the time a bird spends feeding per day, and how often he bathes. Such facts may be observed by anyone and represent research not yet reported. This might prove a challenge for real scientific pursuits.

b. Under Mammals, this area has something to offer. Several species of mice live in the grass. Since they are
virtually undisturbed, there is good opportunity to see the runs and nests they have made. Besides studying them in their environment, it would be practical to run a small trap line to collect some. This would have scant effect on the mouse population and would enable students to see how such a project is carried out. The types of mice would be noted and also the dangers of these little animals to humans would be discovered.

PHYSIOGRAPHY AND CHEMISTRY

There are limited opportunities for these studies in this area. Due to the fill, there is a variety of rocks present. They include all the common rocks of the Boston Basin and a few minutes collecting would result in one obtaining the major varieties of Eastern Massachusetts. Exhibits of how rocks are identified, of the local types, or of exhibits of the geologic history of the area are all possible. This could well work into the unit of changes in the earth's crust as taught in the courses in the high school.

In addition, there could be work done on the different soils. Over the area, there is some of the peat left from post glacial plants. Also, there are areas where the soil would test acid and others where the soil is alkaline. A few elementary chemical tests would determine this. The causes for the conditions would lead to some creative thinking.

These earth studies, then, might be made from several points of view. The chemist might find composition. The
physiographer might work on the different types from their origin. This would fit in with units on the Glacial period and Swamps. A third way such work could be viewed is from the botanist's eye. Here plant associations would be found and the immediate causes for the soil conditions located.

In this way, the various sciences taught in the nearby high school could be used in this study area. With this possibility, the area possesses immediate values to various classes. These values might be improved for future use, however, this calls for further consideration.

NATURE TRAIL

A nature trail is easy to make and instructive both during and after the project is completed. The ways in which a trail is laid out are many. A procedure that might be followed is shown:

1. The first thing of importance is to decide who is going to undertake the project. In all probability, interested members of the Biology classes would work with a teacher that would want to supervise the project. A Biology Club might be used or created for the purpose. The assistance of other groups would be requested.

2. Next, a general survey of the area would be made by the students. They would look for the best examples of different objects desired on the trail. A rough map of the areas could be made and the interesting points located. A tentative
trail would then be sketched.

3. Since this progress might have consumed a major part of the quarter, the work could be begun without planning to finish it immediately. Clearing a path could be done easily and some form of markers or guides be instituted. Every nature trail has a different way of marking items of interest and any of the articles referred to in the bibliography would mention satisfactory methods. The trail begun by one group might be completed by another.

4. Additional work might be contemplated after the trail was finished as far as the usual plan was concerned. Common plants found in other South Shore localities might be planted. In this way, a continued interest would be maintained.

LOCAL STUDY AREA II

LOCATION: This area, a small one, is located on the upper reaches of Town River Bay. It may be reached by taking Harrison Street, the third dirt road on the left, as you go south from the Police Station on the Southern Artery. This road comes out at the power station overlooking the salt creek and the Broad Meadows.

DESCRIPTION: Here is a typical salt marsh with a creek flowing through it. A narrow edge of the marsh is on the power station side while the major part is across the creek. To get across, a walk up the creek is taken at high tide, or the creek is jumped at low tide. Since it is near the city, there are
numerous evidences of rubbish but this does not affect the salt marsh habitat. This area is primarily for Zoology, somewhat for Botany, and partially for Physiography and Physics. More detailed projects follow.

**BIOLOGY - Botany**

As in the other area, there is here a chance to study the structure of plants. Many of the hardy composite weeds are found and several trees are seen. This area is unique in that there are several varieties of coniferous trees planted by the power company. The other flowering plants are mainly similar to Area I and can be overlooked. A few of the plants like the sea lavender are interesting structurally and are different from those found near fresh water. Of more importance are the grasses. Many varieties exist and may be collected and identified. Their root structure can be easily studied, if one will dig a little. Test for starch on the stems and roots of these plants is also interesting and will show how these seaside plants differ from the maple swamp plants.

The ecology of the area is both varied and different. Few people, even those who live close to the sea, realize what plants grow in this salt marsh area. A new appreciation for such areas would be had if they tried to:

1. Record the various plant associations present.
2. Experiment transplanting plants from salt to fresh water.
3. Find root patterns whereby such plants can anchor blowing sand. Such work, but sketchily outlined, would be of invaluable help in showing many important plant functions.

**Zoology**

Here are found various organisms but little known to the average citizen. Although clamming could well be considered an important industry of Quincy, only a few people have seen it in operation. A project could be tried to show the various scientific and commercial aspects of this industry. Since the salt water clam is the most familiar mollusk and very easily obtained, this could be collected and studied as representative of this phylum. Looking towards the simpler phyla represented in the area there are:

1. Echinoderm represented by star fish.
2. Coelentrates represented by jellyfish.

The more advanced phyla are also represented.

1. Crustaceans are found in the forms of crabs.
2. Insects of various forms not found in the maple swamp.
3. King crabs offer a good chance to study Arachnida.

These Zoological phyla are included, for it is often desirable to study the environment of the various representatives as well as their body formations. The laboratory and classroom can do the latter better by means of these locally available specimens, and can do the former far better by seeing in the field what is summarized in the books. For reinforcement of knowledge, there is nothing like first hand experience. When this is so easily
obtained with little expenditure of time, it is well to know about it.

PHYSIOGRAPHY AND PHYSICS

Several of the Physiography units could be well illustrated by this area.

1. Here there is a good opportunity to study the tide movements.
   a. Free of waves and other disturbances, tide recording apparatus could be improvised and checked.
   b. A graduated marker placed in the creek bottom would serve effectively as a marker of tide height.
   c. Correlation with the Boston tides might be made.
   d. Daily changes in maximum and minimum tides could be figured by means of floating gauges and variations due to wind and distant storms could be discovered. This form of project would have more value and interest than a chapter in a book which tells about tides in various far away places.

2. In regard to the unit on oceans, a chemical study of the water might prove interesting.
   a. Also, there could be a very helpful project set up to show that the more saline waters are flowing below the surface. This could be done by taking samples, as do oceanographers, of the water on the surface and near the bottom. Salt measurements could be differentiated because there is some fresh water flowing into this creek and it naturally stays on the
surface, thus diluting sufficient water.

b. Shoreline development could be examined by means of models made in the tidal flow. If the tides were considered as currents, most of the shorelines might be recreated using sand and natural clay and organic mud found close at hand.

c. Another unit might illustrate the testing of the muds of the bay as represented in the creek bottom. Sizing, sorting and water deposition could effectively be worked out here with ease and little material. This form of project seems to be of great interest to students whenever it is tried. Before too much work of this sort is undertaken, it would be well to have a test made to ascertain the healthfulness of the material for student use.

LOCAL STUDY AREA III

LOCATION AND DESCRIPTION: This area, not as important as the first two, is the Broad Meadows Flats. These are located behind the Police Station and to the south of Sea street. They may be reached by walking over any of the many vacant lots along Sea street or by crossing the Town River Creek mentioned in Area II. This area is primarily unique for the birds that accumulate on these flats. However, the chemists would be interested in the deposits of the various salts and the botanists in the small, but surprisingly varied cattail marsh on the northwest corner. The physiographers might wish to study how this flat came to be and possibly to take sample cores to see
how it related with glacial times. All these things being easy and useful, they might also want to try some soil or sediment tests.

The ornithologists would gain the most out of this study area for great numbers of shore birds and gulls may be found here until December and from March to June in the spring. Since these birds are not seen as much around homes, they are less well known, but are nevertheless interesting.

1. For the purposes of general knowledge, an introduction to these birds of Quincy, which far outnumber the robins and sparrows seen, would be of interest. Twenty-nine species of shorebirds are found here and fifteen species of gulls and other birds, not to mention several varieties of duck and hawk.

2. Simple migration studies can be made. As these birds are easily seen, they being on barren flats, the arrivals of the different species may be noted. A knowledge that these birds migrate at different times over different routes could be brought out. Several of the textbook favorites, like the Terns and Golden Plover, are found here before they leave for the south, traveling some 8,000 miles without seeing land again.

3. The flight characteristics and plumages of birds may be studied. How birds use their feathers, how they feed, and what they eat may all be included from a short stay watching these birds. In addition, there is usually a dead bird or two around, especially in the winter. This affords an excellent chance to see how these birds look in the hand. The arrangement
and coloration of their feathers, the size and shape of the body as well as how the different parts of the body move, can all be noted. Local conservation practices regarding hunting of birds may be inserted here, producing far more good than the learning of ten conservation laws in the classroom. These are but some of the projects that may be carried out here. More advanced work is included in the section of Special Activities.

LOCAL STUDY AREA IV

LOCATION: Directly behind the Quincy High School is a steep grade that offers a source of study to a science teacher and the students.

USES: After a safe method of getting to and from this area is obtained, projects in Physiography, Physics, and Biology could well be set up. One most valuable project could be the setting up of an erosion study. This would be done employing a coordination of the sciences in one of several ways.

1. How do the shape of the contours of the land affect erosion? Having the material of equal size, one section could be contour plowed and another plowed down the slope. The amount of sediment collecting in a trough put at the bottom would serve to measure the results.

2. What plants can most adequately hold the soil in place? This would be typical of planting of grasses and shrubs on the roadsides. Plants for these study projects could be obtained from wild sources such as the study areas or areas visited on
field trips. This study could be divided into grasses and other plants, thereby giving greater variety to the experiment. After these plants have begun to grow well, they could be used as a source for classroom specimens.

NORTH QUINCY STUDY AREAS

AREA I

LOCATION: On the west side of Hancock Street across the railroad tracks, there is an old road bed that runs out to Sagamore Creek. This is the proposed area and is reached by a short walk from the high school along Hancock Street and over the tracks. There is a path there which leads out to the roadbed.

DESCRIPTION: This area possesses a typical salt marsh appearance broken by the man-made roadbed and a glacial made hummock. The accessibility of the area and its marsh life make it a good study area. It is also good because of the lack of people visiting it and the lack of difficulty with private owners. The area would be good for both branches of Biology and for Physics and General Science as taught in the high school. Specific projects that might be undertaken are suggested in the following sections.

BIOLOGY - Botany

The courses in Botany are divided between morphology and classification. Any other material that appears interesting is included at appropriate places. In relation to this general program, this study area will be of some supplementary help.
1. First in regard to morphology. Differences between trees, shrubs, and herbs can be seen, and the different external forms of each observed enroute to the study area. External morphology can well be observed in the gray birch that is found in the path half way out to the creek, for there all the typical parts of a shoot are easily told. Buds, too, can be looked at and on the way to the area a horse chestnut may be found, to better study this fascinating dormant phase of plant life. The open, undisturbed marsh and hill is an excellent place to set up tropism studies and these experiments in light, gravity and moisture could be observed over an extended period without the use of large amounts of laboratory space. In relation to work with the plant cell the osmotic effects, difficult to explain in class, can be seen operative in the familiar plants outside. Sea water supplies most of the plants of the marsh. Fresh water supplies the few plants on the highest sandy parts. The effects of each in the other's location could be used to show both osmosis and moisture effects in general.

2. In relation to stems, a short visit to this study area will show the three main varieties (dicot trees, plants, and monocot plants). Examples of these are oak, clover, and chicory. The root structure is also important. The size of root structures in particular, can well be shown here. A little digging in the higher sand will uncover many feet of roots that allow the zerophytic plants to get water. The grasses, too, are interesting as they show how roots can form a mat to hold
the soil. While other areas are better for some types, the soil and water relations of plants may be seen, especially on the small glacial hill.

3. Leaves are also able to be profitably studied here. The functions of leaves in the open spaces is seen in the grasses everywhere evident. Glutation studies on these plants and those of other study areas would show how morphology has been adapted to the environment of plants.

4. Seeds, too, are found in profusion in this area. During fall, winter, and early spring, collections of twenty different kinds can be made. These illustrate the different ways of propagation for, in addition to the many adaptions to wind blown seeds, typical of open marshes, there are types requiring animal transportation, such as burdock, and those that hurl forth their seeds like the wild pea. Such interesting facts lend an everlasting fascination to nature study for both students and teachers. Surely, these actual observations will do more than textbook words to show certain phases of botany. Also, it will allow scientific observation and deduction that could be considered a general aim of all science courses.

4. Flowers, a last part of morphology, can also be seen in this study area. The wild rose could serve as a good introduction. Next, might come the various composites and other less well known plants like daisy, milkweed, campion, sea lavender, goldenrod, birch, and oak. The rose, campion and tree flowers of the spring, could be substituted in the fall by chicory,
everlasting, clover, goldenrod, sea lavender and asters. These plants would allow an acquaintance with the parts of familiar flowers and some distinction between the various forms flowers may take. Contrary to the familiar sayings, familiarity with these flowers will bring greater appreciation.

Classification can be greatly visualized by use of this study area. A typical salt marsh ecology, found throughout the South Shore, here shows plants that are both typical and varied. A collecting trip to the study area will discover some one hundred or more plants that can be classified as representative of most of the plant orders. There is a break from the simple plants to the more complex spermatophyta but, nevertheless, there is a great variety. Besides collecting and identifying the plants, basic steps in a science program, there can be work on the plant environments and on the life cycles that may be seen in all stages AT ONE TIME in varying specimens in this study area.

1. Typical plant studies, like parts of a plant or ten plants of the marsh, can be tried as class projects.

2. Collections of the various forms of the plant may be made for a class museum.

3. Habitat exhibits, the coming thing in museum work, can be constructed with pleasure and profit.

An obvious complaint about this system is that not enough scientific knowledge is gained. This can be remedied by using this material as supplementary to regular classroom procedures.
This would, however, serve another great part of the program in relating science to everyday things.

GENERAL SCIENCE AND PHYSICS

Programs for science and physics could well be undertaken here. In addition to the plant and animal types seen here, there could be work on soils, rocks, tides, and light. Since these subjects have been mentioned in other discussions, it will suffice to recount a few of the possibilities.

1. How soil is formed can well be discovered by getting samples in different places in the marsh. The glacial and man-made sand deposits, the sea and river muds, the peat-like humus from the plants and the bog development by grasses are all soil types.

2. Soil making projects might be started using sand, mud and humus, followed by tests and attempts to see what plants grow best in the different soils.

3. Rocks of many varieties from Eastern Massachusetts exist here as a result of the glaciation and may be identified.

4. The differences could be observed and the land form of the glacial hill explored.

5. Tides and salt water studies can also be made in Sagamore Creek. Differences in tide levels, effects of weather and ice, all can be seen in a general way.

6. Differences between river ice and pond ice might be learned in comparing this area with others.
7. Current flow on the Neponset River would be ascertained in true scientific manner for such specific information is only found by experimentation.

8. Air, cloud, and weather movements could be observed. Cloud formations, a part of general science, are easily seen here and usually several types of clouds can be seen from the banks of Sagamore Creek.

These discoveries, at a general science level, would lead to better work at high levels as a result of increased understandings.

LOCAL STUDY AREA II

LOCATION: This area, found in back of the high school, is bounded by Hunt, Price, Kendall, and Batolph Streets and divided by Newbury Street. The western part represents a fresh water waste area with a small pond or marsh on one side. No trees, but many forms of tall plants, grow in this fresh water section. This is doubtless privately owned but unused vacant lots. The eastern section is on the other side of Newbury Street and is a bushy area with cattail in one part and willows in another. A few trails and a long driveway extend through this obviously private land. It is considered by residents as common ground to be used by all, but in the future this may be doubtful. With permission, this area would be a profitable place to operate a field study area.
As salt water plants were found in Area I, this area shows the fresh water varieties. Both the marsh types and the dry land species are seen. As for classification, there are some twenty-five species of trees and over 300 species of plants found in the area. Projects include:

1. Collections of typical plants, begun in the first area could be completed in this. Almost every flower form will be found and almost any form of classification could be used.

2. In trees, the types of wood could be collected, the types of leaves compared, and the general outline regarded.

3. In flowers, an exhibit could be arranged with any of the special parts, like leaves, roots, or flowers. This might be done in one of several ways.

   a. Leaves could be pressed, waxed, or varnished; impressions taken with ink, spatter prints, or plaster casts. Any hint of juvenile work would be lost when the students were trying to preserve certain characteristics that the leaves represented.

   b. Roots could be preserved by being dried or left in bottles. An exhibit could show the different kinds as displayed in a glass-sided box filled with sand.

   c. Flowers could be preserved to show the various types of the area or more scientifically to show the differences in petal, sepal, and stamen arrangement in different flowers. Many of the commonest flowers are good examples of special
exceptions and adaptations of flowers. These exhibits are preserved by careful pressing.

d. A more attractive way to view them for short periods is to use a series of tubes filled with water and displayed in a rack. The flowers could be seen as picked and appropriate labels could be applied.

e. A slightly more permanent arrangement would be to plant a variety of them in a box. This, however, entails difficulties with many of the larger types.

4. Collections could be made of those flowers that may be picked freely and those that should not be disturbed. Both exist in all study areas.

In addition to using this area for collecting and classification purposes, there are many other projects that may be attempted.

1. Make grafting studies and experiments to show how willow shoots germinate into plants. This latter work could be continued to include root formations in several plants and what nutrients are needed to make a plant grow. Cut samples placed in tubes and fed with different liquid fertilizers would show their results soon.

2. Test various roots for starch, fats, and other products. The cattail is an easy and brilliant example.

Zoology

Many of the projects mentioned previously may be adapted to use in this area.
1. Collect and study in the laboratory several elementary forms of life found in the waters.

2. There is an attempt to control the mosquito, and this project might well offer an interesting study to see what method is most effective in control of this obnoxious insect.

3. Identify ten helpful birds. Birds of many forms are found here in spring migration, and some twenty species are likely to nest here each year. Work as described in Area I of the Quincy Division would be applicable here.

All these common forms of wild life can be used to make the picture of the textbook take on life and meaning in the community where the student lives.
CHAPTER II

CITY WIDE STUDY AREAS
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The purpose of city wide study areas is to afford to all the students a chance to work in an area larger and more varied than the local study areas. Merrymount and the Blue Hills were selected for their accessibility and for their variety of flora, fauna, and form. The fact that they are on public land is also helpful.

MERRYMOUNT

LOCATION: This park, located between the two high schools, is bounded by the Shore Boulevard, Furnace Brook Parkway, the Southern Artery, Hancock, and Fenno Streets. It is composed of a brackish creek, salt meadows, several fresh water swamps, and highlands composed of oak, and in one place, pine. Geologically, the area is famous for its kame and kettle topography, an outwash plain and an esker of glacial origin. Several ball fields, an overgrown garden, and a pumping station complete the man-made attractions.

USES: This area, having a variety of biologic environments, offers a good opportunity to try the projects not possible in the smaller study areas. In many cases, projects that could be done in the study area of one school were impossible in the areas of the other. This central study area would serve to eliminate that problem. While the study area could not be visited during the school day under normal conditions, it is
but a short trip at any season of the year.

One excellent project would be the construction of a Nature Trail, as discussed in the Quincy High Area I. Here the trail could be more inclusive for, in addition to fresh water swamp life, found in Merrymount along the south side, there is the oak and pine forest area and the field areas also along the south side and the salt marsh life around Black's Creek.

A half-mile trail could be projected with several hundred interesting items to look at from old stumps that show the climate for the past seventy-five years, to swamp, marsh, and highland flowers that bloom throughout the season. From April to December there are flowers here and even in the winter the bark, stems, and shoots of some fifty trees and shrubs offer a fine chance to study all phases of Botany. For animals, aside from the smaller forms mentioned in other areas, there are woodchucks, skunks, rabbits, and pheasants here and many different species of birds. A Nature Trail showing the homes of these animals and birds, as well as the plant life would make a project worthy of the city wide attention.

Sign making could be in the form of inexpensive tags that are waterproffed and tied on, or they could be small metal plates such as those used in the Public Gardens in Boston. These are painted with provocative labels, as illustrated in the literature mentioned in the bibliography, and wired to the tree or pole. This system, while not the best as far as information goes, has been found most practical in Boston and the National
Parks where sturdy, vandalproof work is needed. A twenty percent loss per season on these metal tags or the "too cheap to be noticed" paper tags is about average. A fact to be remembered in painting metal signs is that outdoor paint must be used and two coats of base applied to metal so it won't peel. Labels should be short and catchy. Several classic examples of different styles are as follows:

This lead pencil tree - the Red Cedar - is the favorite wood for making pencils. It is also used for cedar chests. Smell it.

Bark - like an alligator skin? It's dogwood.

Staghorn Sumac - fruit for a refreshing drink.

Silence - would you hear the thrush
Bell - like in the evening hush.

Leaflets three - let it be! Poison Ivy!

Beside an identification trail where the plants and other items are pointed out and named, there could be a Quiz Trail where items require identification. This can be done by labeling the items and then providing a key at the end, or by having a cover for the answer, printing the answer on the back of the tag, or simply printing the answer in reverse. In addition, there could be a theme trail where one form of nature is stressed. Trees and swamp plants are found along the south side, marine flora and fauna on the east, conservation on the northeast, eroded and burnt over areas. Whatever the purpose, the Nature Trail benefits the makers and those that follow. It creates an appreciation for the out-of-doors to those that might never be
in a science class, and those that pass when you are not present.

Besides Biology, there are Geological and Physiological aspects of the area. All the projects mentioned in the other study areas can be done but, in addition, there is the varied geology. An esker, formed years ago by a river running beneath glacial ice is now seen as the ridge in the center of the park. A small delta at the end is also seen and could be used to show how moving water deposits materials. The geology of much of the northeast North America could be demonstrated in this small area. See field trips - Geology.

BLUE HILLS

The farther parts of the Blue Hills are but eight miles from the high schools, so it is possible to reach an area here in a few minutes. Many roads and public transportation aids in getting there. The Reservation abounds in places for Nature Study. Possible areas could be around Big Blue or any of the hills, even Chickatawbut. This would show the highland life while a swamp, pond, or brook would show the more moist habitats. Chickatawbut and the large cirque depression to the south containing many rare plants, would be one excellent possibility for projects. Big Blue and the Blue Hill River section near Houghton's Pond would be a second very good area. The projects of the other study areas could be expanded here in proportion to the new wealth of material at hand.
Professor Babcock has developed on the west end of Ponkapog Pond in the Blue Hills, an ideal type of outdoor program. This could well serve as a model for what might be done. All are welcome to visit his development, but it is best not to have school classes from all the neighboring districts visit this one locality. He is encouraging teachers and others interested in this program to use the area in hopes that the ideas gained can be developed elsewhere, thus spreading an appreciation for the living world around us.

The area developed by Professor Babcock of the Eastern Nazarene College, contains a cabin as headquarters, a working museum or laboratory, and, beginning beside the cabin, a series of nature trails through the forest and marsh. Here can be found an almost infinite array of ecological material. The balance of nature, from the giant pines to the microscopic algae is seen. Ferns, mosses, pitcher plants and swamp bushes too numerous to mention are all seen in this carefully planned trail. Studies in progress can be observed and charts of material discovered can be referred to when Mr. Babcock has them at the cabin. This area, still in development, is considered by all who have seen it, one of the best in this section. The work being done is truly remarkable, so it is hoped that this area will remain in good condition, not suffering the plight of a free public walk. Cooperation of all teachers is welcome and further information may be had from Professor Babcock.
CHAPTER III

SPECIAL PROJECTS
There are many individual projects in relation to bird study that might be carried on in the Quincy Area. These could be done by one person or by groups. The amount of knowledge of birds need not be great at the beginning of most of the projects but, as they progressed, the students would doubtless be motivated to learn more about the habits of the various birds observed. The following projects need not require anything but a pair of good eyes and an interest. Note-taking would be developed and field glasses, though of help in many cases, are not necessary. The projects that follow are in areas of Ornithology that have not been studied in detail, so any work that was done would benefit science. This would give the projects greater meaning. Interest in these projects might well lead to further endeavors in various fields and would certainly allow use of a scientific method in attacking the problems.

**Starling Roost**

Starlings are familiar to everyone, yet there have been few studies on their habits. Quincy is fortunate, or unfortunate as the case may be, in having a huge starling roost located beneath Fore River Bridge. There have been no studies on Starling Roosts in New England, but a few have been made in England.
There are several interesting projects that might be made on these birds at Fore River.

1. One possibility would be to see if the flocks fluctuated in the different seasons. It is known that they do in England. Here it would involve a few periodic counts. Further work might be done into why these changes, if there are changes, occur.

2. Another possibility would be to study the flight paths the birds take to the roost. First, there would have to be some determination as to the area from which the birds come. Next, their flight routes would be discovered. Are these routes constant? Do the birds use the same route morning and night? At what times and under what conditions do the birds decide to use certain flyways? Such questions and many others could be used to work out a most valuable study of these common birds.

3. Still another possibility would be to study the movement of a small section of the birds. This might be done by any student. Since the birds will greedily come for bread crumbs, they could easily be trapped and marked. Once marked, there could be checks made to see if the birds have certain fixed habits. Times of travel, range of feeding, loss due to natural causes might all be studied. Much work of this sort in this country is being carried on by school students and Bird Banders, all of them amateurs, devoting occasional spare time to such projects. Even now, such bird marking studies are proceeding in Massachusetts with several species of birds. Nothing
however, has been done about the common starling.

**Shore Bird Migrations**

Shorebirds offer another chance for students to explore an interesting and valuable field of Ornithology. Quincy is one of the few good places where shorebirds are found in numbers during migration. The flats by Squantum, the shores of Quincy Bay, the marshes of Merrymount and Broad Meadows of Houghs Neck are some of the best localities for such a study. Parts, or sub-projects would be:

1. Learn to identify the twenty-five or so species of birds that come to these areas. This may be done while the study is in progress.

2. Counting of the numbers of the different species and a recording of the data. A check with older records, as kept by the Massachusetts Audubon Society, might be of help in anticipating these birds. These figures would also give a chance for some comparisons. If checks on one location were made every few days during the peak of the migration, fairly accurate records would be maintained.

3. One report might be made on the count of each species and how this compared to previous reports.

   a. If several areas were studied simultaneously, a comparison of localities would be interesting. If well written up, this work might be published as a contribution to a local area.
b. Of more special interest to general application of information, would be studies on how long individual birds stayed at the area. Since no work has been done on this, it is not known whether the same birds stay in the area, or if they move every night and new ones replace them.

c. Another problem would be how the migrations relate to storms and wind conditions. There have been many speculations but little work done. A comparison of the numbers seen along the coast and out to sea might prove revealing.

This study may be done in spring in May and June for the rapid spring migration, and from the first of August through November for the slower fall flight. The complete period need not be taken if this is unadvisable. A related project might be done at the same time concerning the gulls and terns. The same areas are affected and these studies might try and answer the questions: How many of each species pass through Quincy? What is the ratio of young birds to old in the first part of the migration? the last? Why do these birds stop and gather in Quincy? What do they eat in migration? Does temperature and wind have anything to do with their migrations? Facts of such interest are little known in general, and unknown for the Quincy Area. As such, they would be of value to the student and to others of government and private agencies that are trying to gather information and control the fluctuations in these birds of the coast.
Habits of the Duck in Quincy Bay

This project would be of interest to hunters as well as game conservationists. Accurate information would be of more value than the time devoted to any other form of game control. Several facts could well be explained.

1. A determination would be made of when each species of duck arrived in Quincy Bay. Pond ducks are found near the Air Base at Squantum, while sea ducks congregate around Moon Island and across the whole bay. Since these concentrations are some of the largest in the northeast, this study represents an important part of the regional picture. After the birds are identified and a determination of how many of each specie are present, the next step would be taken.

2. Now it would be of importance to see why they congregate in certain areas. The patterns of where they spend the night, where they feed, or where they go under differing weather conditions would be of interest to the hunter and game protector. The relative benefits of conservation would be graphically displayed. In addition, the effects on the ducks of winter ice and the sewerage pollution could be worked into a study to see how man and nature indirectly control the future of the avian population of our harbor.

Census Work

There has been described in the section on Study Areas, how to undertake a breeding bird census. A short review on this on more general lines is now undertaken. An area may be
selected from an abandoned lot, to a pasture, swamp, or woods. The only feature is that it is easily reached. Next, several trips are made to the area to determine what birds are present. Here, the census work divides, depending on what is being studied. Breeding birds are mapped as to location of nests, singing males, or breeding females. Each species is listed separately. For conclusions, there is discovered how many birds of each species nest per acre, and what seem to be the favorite locations for each. If such projects are done in the same area for several years, changes of environment ought to be reflected in changes on bird populations.

Other projects with individual species might be tried here if there was interest, like discovering what birds used what materials for their nests, how many eggs were deposited and how the young ones developed. Such are some of the possibilities to spring projects.

In the winter, there can be projects of how many birds stay in an area. This is now being done in the form of Christmas Census work by Audubon Societies. Work that has not been begun includes studies of areas to see the range of the birds in winter, the loss of birds due to the winter, and the food eaten during the cold months. This can make for enjoyable work and produce results worthy of any scientific research.
MAMMALS

On the whole, mammals are one of the most difficult forms of wild life to observe. Although they are fairly numerous even in the study areas in the city, there will be few people that will see these wild creatures. There is a joy, then, in discovering the elusive that will make the search for mammals very rewarding. There are many things that the high school student may do in relation to animal study. The harm and danger of rats would make a good project. Reading, plus observation of the animals as found in waste places will lead to public health projects. Many books have been written on how rats spread disease and that rats live in dumps. Rats and mice can be found in several areas: one near the Quincy High School in the waste land off Sea Street, another place is near North Quincy High across Hancock Street near the fire station, and a third place is near the dumps in the Quarry section. Since it is a well known fact that a partial killing of the rats does not effectively eliminate the population, other ideas may be discovered to rid the city of these pests, if that is found to be necessary.

Live Trap Census of an area would reveal the number of animals present and would be one of the few ways of seeing the animals. This would be done with a group of students. After selecting a study area, they would make live animal traps from tin cans, milk bottles, and other easily obtained materials.
Next, they would attract the animals by baiting the traps and laying out a trap line. This line would be systematic and would involve a mapping of the trap locations so that they could be checked. Two trappings leads to a rough estimate of the animals, the small ones, in an area, by using the density formula. This is the number of animals in the second trapping, times the number in the first (these are marked in some fashion) divided by the number of the marked animals in the second trapping. This total project involves several simpler ones that might be tried separately. This census might be done in the study area with fair results, the Blue Hills offering the most variety.

Other projects might include finding the homes of some of the small animals. Another project could be mapping these homes, and this might be continued to see how often the animals entered. Further study could enter into the problem of how far the animals range from their homes, when they travel, do they migrate, what are the dates for their hibernation and how many young do they have. Facts on the local distribution of many animals is poorly known, and their habits are equally fragmentary. Besides providing interesting, easily available work with wild animals, the projects would be of help to many research workers in this field.

Finding evidence of larger animals in the larger areas could be developed into several interesting studies. Tracks of ten animals can easily be found in the Blue Hills and dogs and cats can soon be eliminated. Track casts here offer a chance
to preserve these animal signs and possibly offer something from which to make a collection for an exhibit.

Lastly, there are projects that involve working with the animals themselves. One project would be to see if field mice can be raised in captivity. Since there is a limitless supply of these little animals in the fields and woods, and since there is a reward for such a project by cancer research, this could be most worthwhile. A knowledge of the habits and food of these animals could be gained and a life cycle would be developed while in search for the answer on how to raise the mice. Other projects with animals would be collecting of study skins and possibly some taxidermy. As there is no law against collecting the fast multiplying mice and shrews, this would be a good chance to make such a collection. Another project would be the collection of animal skeletons. Such work could lead to exhibits of the development or specialization of certain parts of the animals.

These special projects can be of great value in fairs, current problem demonstrations, and school museums. The above items may suggest other possibilities like the raising of pheasants for a hunting club. All of the projects, though, are of most value to the individual or individuals participating. Repetition of projects in different years will in no way lessen the value of the work. Knowledge gained here may prove to be a lifelong interest for some members of the class.
INSECTS

Insects offer one of the largest fields for study. Although not as obvious as some other forms of science, insects are everywhere about and can offer fruitful, meaningful projects if studied in the right way. The variety of families can be noticed, their habits and places of occurrence, or the work can be approached from a consumer point of view, and the insects good and bad that affect our world. Blights, tree diseases, spreading of contagious disease, moths that eat food in clothing, annoying insects that bite as well as insects that cause no harm, that are beautiful, that help destroy wastes that man creates, and that exist in every yard in the city, are found by he who searches.

Collections of insects can be undertaken from many aspects. Representative species may be collected, different forms or colors discovered, or one may go to their homes and collect examples of their carpentry and paper-making activities. Other forms of collections could lead to life history studies touching on many interesting aspects, like the yearly Monarch Butterfly migration through Quincy, and the other events of current interest. If a collection of one hundred common species of insects found in Quincy were undertaken, the areas to find insects would have to be known.

1. Grasses and weeds, like the school study areas have many forms of jumping insects and also offer homes for wintering colonies.
2. Trees and shrubs have some of the common "insect ene­mies" in the leaves, the insects that eat leaves and destroy forests. The bark, too, is a source for several prolific forms like the Dutch Elm disease which may be seen in some elms.

3. Dead and rotting trees, stumps, rocks, leaf piles, and the like, harbor beetles of various sorts. The Blue Hills and the study areas have good examples of this habitat.

4. Even gardens, with the flower attracted insects, the plant eating insects (like the rose bug) and the various others that are of constant annoyance to gardeners, may be found throughout the city.

5. Puddles attract butterflies and bees, while ponds, especially Ponkapog in the Blue Hills, contain many forms of water insects revealed only to those who search.

6. A night field trip to an area or to a larger regional study area, would allow collection of nocturnal forms. Light draws insects which may be caught with a net or in a pan of water placed beneath a light into which the insects fall when exhausted.

7. Sugaring is another method commonly employed whereby a small amount of sweet smelling and sweet tasting material is smeared onto branches of trees in the form of a trap line. A return to the line an hour later in the evening will reveal many insects stuck in the sugar, especially if a warm night is chosen. The same thing can be tried in the day with other interesting results.
8. Ground traps and carrion traps are other ways of catching some of the more elusive insects. By these methods and by consulting a simplified Insect Guide Book, collections of one hundred common insects or collections of certain types of insects, are within reach of any interested student. These collections could be worked into community interest projects, museum displays, and various other rewarding forms.

In collecting insects, there are several pieces of home-made equipment that will be needed.

1. Killing jars are one important item in every collector's kit. These are often poisonous, but one non-poisonous type is made with an ordinary pint jar, with either a screw top or a large mouthed jar with a stopper. In the bottom is placed a layer of cotton which is moistened with cleaning fluid. Next, there are several blotters to keep the insects off the cotton. Keep the top on except when depositing insects. Recharge with a few drops of carbon tetrachloride every trip.¹

2. Other items needed in the field, are envelopes or triangles for keeping winged insects like butterflies, and vials of alcohol for shriveling insects like stone flies.

3. Butterfly nets, mounting boards, containers for collections, can be made by consulting some books referred to in the bibliography.

In addition to making collections of different common insects, there are several other valuable projects. Listing or making a census of an area can be fun and profitable, but it is desirable to take a small area, say one hundred square feet. This will show the abundance and variety in the insect world and could be tried in any study area. Sampling the ground insects or surface ones in a foot area also yields fascinating results. After simpler projects have been tried, work could be attempted on life cycle studies. Since there are so many insects, little is known about life cycles of many common species. Here is a chance for some real research. The same may be said for "social life" of insects. Ants and bees, interesting studies in themselves, are fairly well known, but "social life" among other insects is still a mystery to be solved by people out of doors, possessing a sharp pair of eyes and an inquiring mind. Other activities include feeding habits, influence of light and shade on species and effect of wind on winged forms. In relation to insecticides, there is opportunity to do conservation work to determine how effective is an insecticide on different species, or to see if there is an immunity built up in insects. These activities and many more await the attention of any high school student interested in the Insect World.
FLOWERS AND FLOWERLESS PLANTS

This special area includes projects in all the practicable areas of botany except trees and shrubs, which are discussed in another section. Flowers, "weeds", ferns, fungi, mosses, and other growing plants all offer great opportunities for individual projects. Since plants are all around and can be found at any season of the year, projects may be started at any time. The areas offer a good place to begin since they encompass a variety of ecological units. Different habitats are here found, and work relating them to other forms of nature make for interesting projects. These related activities are discussed in the units on study areas.

1. Identification of plants offer many diverse projects. A life list of plants, or other forms under consideration, such as ferns, mosses, or fungi, offer a good beginning. Trips to different habitats will increase the list considerably. One of the first things that will be noted is that the flowers bloom at differing seasons.

a. This fact could result in the construction of a flower calendar. On this calendar could be put the name, date of opening of flower, date of shedding of pollen, date of fading, locality, and discoverer. Many similar charts are suggested in the literature on the subject (q.v.) and this seems the best way to show that the flowers bloom in certain places during certain time periods. The grouping of plants by locality or habitat leads to another form of census.
b. Discover all the plants of a fresh water swamp, sea beach, salt marsh, or fill land to name a few localities, and this results in a form of ecology of plant groups.

c. Lists may be made from actual observation and miniature terrariums might be constructed to bring the classroom samples of these habitats.

d. Charts and diagrams can also be constructed to show the succession of the plants during the season or during development of the area. By that last statement is meant that plants of an area change as the land becomes filled in or recovers from a fire, or a similar long range evolution. These changes will be noted after an examination of a few stable typical areas. Other localities will be seen to represent plants of several habitats, thus showing the past history of the area.

2. Collections offer another chance for learning about local flowers. Good collecting and pressing is an art and should be followed from the start. Flowers that are plentiful only, should be picked and mounted, the rare ones and those poisonous could be recorded on film.

a. Samples of the species that may be unreservedly picked, and those that may be picked in limited numbers, would make a valuable exhibit for conservation societies and garden club work.

b. Collections of seeds could show the many varieties that exist, how a plant grows from a seed, how seeds are spread
and what berries are poisonous. For example, few people recognize the pretty white berry clusters of poison ivy as seen in the winter, or the bright blue berry of the clintonia borialis, found in the Blue Hills and other moist wooded places.

3. Projects of single species offer many possibilities.
   a. A fern from spore to frond would teach more of the life cycle of such plants than many readings of texts.
   Local photos of the result with samples could be worked into an exhibit or class period discussion.
   b. Photos of plants from spring to fall would show the seasonal changes at a glance.
   c. Pollinization studies could be attempted and much gained by those taking part. Wild or cultivated plants could be used and the work carried on in the backyard or study area.
   For explanations of how these and many similar projects are executed, see the books in the bibliography.

TREES AND SHRUBS

An aerial view of Quincy shows it to be covered with trees. Actually, there are far more trees than houses in every part of this city, yet few people know what trees surround them in the city, much less those that are found along country roads. The cherry or apple tree is noted for its bloom and even the wild dogwood is admired by those abroad in the spring, but how many are aware of the beauty of the flowers of the other trees? Although there is much talk about diseases to our city trees, how
many can recognize the disease or know how they spread to ruin whole areas? Why are certain trees planted in the city? How do trees help prevent erosion and what interesting or unusual trees and shrubs live in nearby woods, ever ready to be admired by the public, but subject to ruin by thoughtless folk? By means of special projects with trees and shrubs, such knowledge will be gained by investigators and perhaps passed on to the public.

**City Trees**

Trees of the city may be discovered in several ways.

1. Tree calendar would be one way of studying some of the trees seen daily around the town. Similar to a flower calendar, it would include, in addition to the flower sequence, when leaves opened, when they fell, and when the seeds fell. This could be enlarged to cover several specimens of a variety of trees and a rough estimate of the effects of weather on the development could be noted. This would involve a class project.

2. Mapping or surveying of the trees in an area might be tried. With two people to four blocks, all the trees could quickly be known, samples of unknown trees being brought in for identification. Competition, city maps, diseased trees, and many other projects could stem from such an enterprise. A trip to the Park Department or to the nursery at Hingham would offer a chance to see the different trees used around the city and also to learn certain trees that are more desirable than others.
Native Trees and Shrubs

Our parks, vacant lots, and woodlands, both in the city and throughout the whole South Shore, offer a wonderful place to see and appreciate our local flora.

1. Fifty species of trees and one hundred species of shrubs are common to the area and probably a woodland census, similar to the city tree census, would reveal many more varieties. What are the dominant trees and shrubs of a particular habitat? Do they reach a maximum height or are they killed by other events like fires and disease? How much damage have old forest fires done in an area? Do fires help or hinder tree development? Answers to these and many other questions might be found by a tree census of a habitat. There are many projects in relation to collections that might be done with our local trees, but these will be discussed later.

2. A most valuable project would be to list the trees and shrubs of the South Shore Area. Such present lists are fragmentary at best and none attempt to state commonest of species. Another project along that line would be a key to the trees and shrubs of the area. Since shrubs are difficult, and since they possess differences in different areas, such a key would be a lasting contribution to the knowledge of the area in which we live. Sections could be done by different people, after a few census trips and some collecting had been done to ascertain typical examples and their characteristics.
Collections

Collections offer a wide field of subjects.

1. Most common would be leaf prints done with ink, paint, soot, or other material. These could be of native or city trees and shrubs. The one important thing to remember is to select a typical leaf or spray from the tree. Little trees have big leaves and many shaded trees have deformed leaves.

2. A collection of the different shapes of leaves found on one oak tree would be interesting in itself.

3. Pressing the leaves of the shrubs of the South Shore to serve as a guide to interest the public in the unusual variety represented, is a desirable project.

4. Twig and wood collections, bud studies, bark differences in different trees, characteristic colors in fall foliage, as well as seed collections, winter silhouette photos and collections for different flowers, all would make interesting collections. The value of such collections lies in the fact that the collector gains much in appreciation and methods of investigation of the problem. Hence, such collections ought to be directed to the student and his development, the collecting being done yearly if it seems desirable.
GEOLGY

Geology, or Earth Sciences, although not a course in the present curriculum, is treated as important. This phase of knowledge is coming into school systems ever more widely both as Earth Sciences and as a part of Physical Science. These two programs may make this more important in years to come. Even now, there is emphasis on this in several of the sciences and the course in Physiography deals with phases of it. Pursuing Geology in its ramifications would lead a student to inquire into several of the sciences, namely chemistry, physics, and parts of botany, geography, cartography, and astronomy. Work in geology would cause the observer to appreciate the whole physical environment and to look at the area called Quincy in a new light. Industries, history, future developments never before realized, would be a part of any student in following these geological explorations.

Map of Bedrock Geology of Quincy

This project or portion thereof, includes several steps.

1. First, would come a period of identification of the rocks. After a little familiarity has been obtained, the identification would be begun by means of a field trip. On such a trip, the student would learn what to look for in an outcrop, what an outcrop is, and how to take meaningful notes and samples.
2. A period of observation would follow in which the area
would be covered with an eye to identifying and locating all
the outcrops of the area. These results would be transferred
to a large map of the area. After the evidence was collected,
the interpretation would begin.

3. On a permanent map, would be recorded the location of
each outcrop and colors would be used to designate rock found
there. Correlating the areas of similar rocks, making a sec­tion
to show the relative ages of the rocks, and then inter­preting,
by means of reading, the geologic history of the area
would complete a report of the project. For demonstration pur­poses,
such a museum exhibit could be constructed.

   a. A structure section of the area would show how
the Quincy area would look if a cut was made in the earth.

   b. The rocks collected could be labeled and strings
connecting them to their localities on a simplified map could
be undertaken.

   c. A few pictures of a particular area, together with
samples and a model would show how some of the interpretations
were made.

   d. If there was interest in the reason why the earth
is what it is, there could be experiments showing how the earth
is folded and faulted. This is done with layers of clay and
putty put on a glass and compressed laterally.

   e. Models showing life here in different ages in the
past could be undertaken by means of reading and the results
presented in the form of maps or dioramas. Such are some of the possibilities of this project.

Glaciation in Quincy

This study would include a consideration of the shape of the land today. Ancient and modern glaciation could be studied if desirable. The famous Squantum Tillite, of world wide fame, ought to be known to local residents of the area, and its meaning interpreted. A study of this area could include a map and a few samples of the tillite. Search for Permain glacial striae could be undertaken, there being a reward for each such pebble found. In presenting a report on this ancient glaciation, there could be mention made of how these facts are known and how this affects the modern theories in respect to warmer winters. Proper development would yield informative results of interest to the public at large.

The studies of recent glaciation would probably involve several things.

1. An investigation into the various forms of glacial deposits found in Quincy would be one phase.

2. Mapping and location and history of some of the better examples would serve to acquaint the students and others with Quincy topography. Since most of the hills here are glacial deposits, and since many of the banks cut away for roads and the like are of glacial material, much could be learned about the structure of such deposited. Are there any deltas here?
Where did the material come from? Was it carried by streams? Was there ever a huge lake over Quincy? Such questions and many others would be looked into in such a study with the resultant benefit to the students.
CHAPTER IV

FIELD TRIPS
CHAPTER IV

FIELD TRIPS

SAMPLE FIELD TRIP TO A BUILDING

Harvard Museum

LOCATION: The Harvard Museum can be reached from Quincy Square in about forty-five minutes. If driving, the route is to Harvard Square either through Boston or past Jamaica Pond. In Harvard Square, Massachusetts Avenue is followed clockwise around Harvard Yard, then Kirkland Street is taken by bearing left. This will put Memorial Hall, a large, churchlike building, on the right. Following the second left off Kirkland Street, a parking space will be reached one block on the left beside the museum. The museum is entered from this end, the north wing on Divinity Avenue.

If public transportation is used, a bus is taken to Fields Corner and the subway to Harvard Square. Cutting through Harvard Yard and past Memorial Hall, which is on the right, there is a red light allowing pedestrians to cross to Kirkland Street. Turn right, then take the first left, Divinity Avenue, and one block up will be found the museum. The desired entrance is in the far wing labeled Museum of Comparative Zoology.

NOTE: This trip is arranged from the Divinity Avenue side through to Oxford Street - where the glass flowers are found. If the group enters from Oxford Street, the trip can be reversed. Usually, people come to see some particular feature, like the
glass flowers. Assuming one thing may be most interesting to the group, this trip is planned to outline the highlights throughout the museum.

INTRODUCTION: This museum, founded by the Agassiz family, represents one of the finest collections of its kind in the world. Since the museum was built in the last century, the exhibits are arranged by systematic order and do not attempt to portray scenes as do more modern museums, like the Museum of Science.

**First Floor:** On entering, on the right will be seen a typical fossil graveyard from which the bones of prehistoric animals are recovered to make the models seen in the museum. On the left, is such a model of an ancient elephant of the ice ages.

In the special exhibit room, there is currently on display, re-creations of different types of dinosaurs. A model of old-time collecting of dinosaur bones in the mid-west is exhibited at the entrance. Taking the near door on the right, there are the small fossil forms of the earliest types of life. Beginning at the far cases and working toward the entrance, there are some of the finest specimens known of ancient Trilobites, Brachiopods, Corals, Echinoderms, and other forms. In the middle, there is a case showing how material is fossilized and how the different forms came to be preserved for hundreds of millions of years. This is probably the most interesting case to those unfamiliar with Zoological Evolution.
The next room contains the larger and later animals, marine reptiles, and shells by which the scientists tell what roamed the earth in Coal Age times.

The room to the left shows still later evolution, with fish, birds, and early mammals. The evolution of the horse and the hoof is well shown. Entering the last room, the cycle is brought up to historic times with the climax of the mammals in the elephants, rhinos, and Irish Elk. These species are all extinct but seen by man.

On going up the two flights of stairs to the rest of the museum, there are seen statues of Agassiz, father and son, who made their money in oil, but whose lifelong interest was in Nature. Much of the money for the central part of the museum came from them.

At the top of the stairs is the Charles Phillips collection of horns and antlers. Given to Harvard in 1929, these represent a hunter's dream for a trophy room. Many of these are world's records for size and several are specimens from now extinct animals. This is one of the most complete collections extant.

**Main Floor of Animals:** Entering a room filled with familiar animals, now stuffed and mounted in glass cases, a traveler will proceed to the left hand entrance of the room. Turning around there will be a view of the Systematic Collection of Animals. All the major forms are represented, and all these
animals, on earth today, are arranged in the form of an evolutionary chart. At this point, the traveler is standing at the base of the chart. The top, right hand side being man; as represented by the case on the far right. It will be noted that upstairs around the balcony, birds are represented by families and that three whales are hung from the ceiling.

Ahead, on the right, is one of the more modern room showing Corals. Two models of Coral atolls are seen, as well as representative specimens. Ahead, in the next room, is a later evolutionary development still in existence, the Protozoans and Invertebrates. To the left, in the next room, is a later development with a Synoptic Collection of Fishes, and lastly, there is a collection of Reptiles. Here are seen many of the poisonous snakes of the earth.

Passing through the Systematic Collections of Mammals, there are seen the present mammals and birds of the earth. On the right, in the first room, are the Asian mammals and birds, and the oriental butterflies, a most beautiful sight. In the second room, are South American animals and insects. Returning down the left side there is the African Room, showing the most feared of animals, and the Holartic animals, common to Canada and some parts of the United States. Lynx, bobcat and bear are seen here. Turning back and passing out the Museum of Zoology, the Agassiz Museum is entered. It looks like but another room with a picture of egrets on the right and insect architecture examples placed in cases. Looking to the left, across the
stairs there is seen a collection of Audubon Paintings of animals and an elephant head. Along the near walls are drawings of turtles, homes of birds, and various other items. If the left side is passed by, one enters the Invertebrate room where specimens from South Sea expeditions are found. Old sea collecting apparatus is also displayed. To the left is a room devoted to domestic animals and to breeding. How these animals are bred and how albinism occurs is graphically shown.

The next room is found to be a hall where ten extinct birds are found and three that are near extinction. On the right, in the next room, is the collection of seals, whales and dolphins. On the right, is the room housing the Thayer Collection of North American Birds. Here are all the species found north of the Mexican Border. This famous collector of the last century, for whom several birds were named, left his labeled collection representative of birds of the time. It will be noted that starlings were considered rare, while now they are common. Any birds seen outdoors can be found in this collection. Economic Botany is found in the next room with samples of many fruits, foods and their blights. Rice, coffee, tea, tobacco, sugar, nuts, fruits, and even a collection of fungus are here. Pictures and specimens give a good idea of these products in a very small area.

The main exhibit, and perhaps the most famous, is the glass flowers. These begin in the room to the right at the far side, where models of plant structure are seen. Magnified, the
cells can be identified. The room behind contains representa-
tive plants in glass. This stupendous feat is well worth a
day's study by anyone interested in Botany. The next section
deals with Geology.

Minerals come first, ores are seen near the entrance and
the more complicated silicates are found on the far side. Here
will be found many minerals from Quincy. The Burrage Collection
of gold is seen in part, as are some famous gems in the safes
in the middle corridor. The last rooms visited contain ex-
hibits on weather, meteorites (in the hall), and the room on
the right contains other New England minerals.

The last room on the right has geology exhibits. Rock
forming minerals, models of Boston and of a volcano, new addi-
tions and samples from the atomic explosions in New Mexico are
found. Here the trip will stop as the other wing of the museum
(Peabody) contains Anthroplogic exhibits. The building is
left by the stairs near the glass flowers.

Hours: Weekday 9-4:30 Sunday 1-4:30 Closed July 4 and
December 25.

OUTDOOR FIELD TRIPS

Quincy Geology

A field trip to see points of interest is one form of
visit that may profitably enhance a subject. Transportation
must be secured and the trip planned out. The following is a
sample of a convenient guide to be used in physiography or a
course in the geology of Quincy. This section of the trip includes comments for the leader, directions for finding areas, and distances between the various stops. If this plan is included in such a trip, the leader need not be too expert in the subject. This part of a trip around Quincy leaves from North Quincy High and begins with a discussion of glacial deposits across the marsh to the west.

The Continental Glaciation is an important feature of all the region. This great ice sheet passed over the area 25,000 to 1,000,000 years ago. It had its center, as far as geologists can tell, in Northern Quebec, and spread south as far as Cape Cod and Long Island. The Cape is a result of its action. The ice here was several thousands of feet thick and acted as a gigantic scrape on the land, polishing and wearing down the higher rocks and moving around the soil.

Some obvious forms created from this loose material are drumlins, kettleholes, and eskers. The last two will be seen later and then discussed, but the drumlin is readily observed now. The hills seen across the marsh are examples, as are the islands in Boston Harbor. Note on Milton Hill, the gradual northern slope where the bottom of the ice pushed up the material and the steep southern side where the ice, tiring of making the mound, slid on quickly. These drumlins are composed of sand, pebbles, and boulders thrown together to form hills up to 400 feet high. This material is called till.
0.0 Leaving from Hancock Street, going east on Squantum Street, a red light is reached after a half mile. Turn left and, after several blocks, there is a deserted mansion seen on the right. If one turns down the street beside the house, the kettlehole that forms the backyard can be seen.

0.3 Kettlehole is a depression caused by a mass of buried glacial ice that melted after the other sands had been deposited. The glacial material was deposited on and about this mass of stagnant ice and slumped as the ice melted long afterward. This particular kettlehole is one of the most perfect, being relatively round and symmetrical. There are others in the area but none better than this.

As a result of the widespread till, there are few good places where the bedrock can be seen. The next stops will be to see these scattered portions of the bedrock that reveal the history of this region in the millions of years preceding recent glaciation.

Proceed down to the South Shore Boulevard and turn right to the first stop light. Here turn left and continue on to Squantum Street to its end at Squantum Head.

3.0 Squantum Tillite is exposed here. On walking to the point around the northwest side by the beach or along the road, the tillite is seen. At several places this rock, composed of various sizes of cobbles, shows a series of layers which seem to tip south at some fifty degrees. These layers are usually in the form of a fine grained bed in a coarse, cobbly rock. A
good exposure of this is seen at the extreme western edge.

The rock itself is a solidified mass of glacial material that was left here 200 million years ago. It is believed that an ancient glacier moved down on the area slowly and that before it over-rode the land, it first washed in many pebbles and boulders that formed a conglomerate to be seen later on the trip. After all this conglomerate was laid down, the glacier rode over the area and, on leaving, deposited these angular, scratched stones in a finely ground rock flour. This has since solidified due to pressure that was created by the material that was deposited on top. Following this, later earth movements tipped the rock up to this present angle of fifty degrees.

In the rock, note the angularity of the boulders and cobbles as well as their differing sizes. These rocks do not look like seashore cobbles, but rather like the loose boulders found scattered around much of the land which is till of the recent glaciation. In comparing the old tillite with the recent till, note that both are composed of much fine-grained material, and but a few odd shaped rocks and boulders. This similarity has led to the belief that the tillite, like the till, is the product of glaciation. In this tillite, it will further be noted that a few areas show bedding. This sorted material must have resulted from occasional glacial streams.

Walking back the east side of Squantum Head, a change will be noticed in the area of the old boathouse. The outer side is tillite and the inner side (south) is a finely grained shale-
like rock. Immediately on the inner side of the houseboat will be seen layers of material like the tillite in between the layers of the fine grained shale. As one goes farther along, these beds of tillite become fewer and the shale becomes dominant. These beds of tillite in the well-bedded shale indicate that, following deposition of the glacial material some 200 million years ago, fine grained material was deposited in the sea; water currents sorting out the material and leaving the distinct beds. Occasional masses of ice floated out onto this ancient sea in the long-ago winters and when these masses melted the glacial till, which was on the ice, fell through onto the muds below. As time went on and the ice was farther away, these ice floats were less frequent and soon only fine grained sand and mud was being deposited. The sand layers probably indicate spring seasons, while the finer mud areas indicate a period of little rain when only fine grained particles were carried into the sea.

Many interesting details can be seen by the careful observer, but the major points to note are the dip of the beds (the same as the tillite, hence the shale is younger than the tillite) and north-south cracks through the rock. These cracks were formed after the shale was deposited - probably during the Appalachian Revolution when all the rocks were tipped up at an angle of forty to sixty degrees. These cracks are of help to the geologists for they show that the great earth movements were later than the rock deposition. Going back to Squantum
Street and to the South Shore Boulevard, one turns left to Aptorp Street. This street, on which one turns a few blocks before the yacht club, is the site of an old slate quarry. After one, one-half blocks there is an area of vacant lots on the right and the "slate" can be seen. On entering the old quarry, it will be noted that the major part has been filled in recently, due to the danger of the drownings and accidents to neighboring children.

5.3 Cambridge Argillite or "slate" is seen on the right, a blue gray color with beds rising vertically. This argillite represents a later period in the deposition of the muds that followed the tillite. The rock here dips at a greater angle and is of finer texture, but of the same composition. The finer texture and darker color indicate that the water was deeper than when the sandy shale was deposited. The changing of the mud to shale and then to slate, shows that heat and pressure "metamorphosed" them. This heat and pressure was doubtless of the same period as the cracking and tipping seen throughout the area - the Appalachian Revolution. Thus ends a portion of description of a geologic field trip.
OTHER FIELD TRIPS

There are always places to visit in relation to any science subject. Below are listed a few of the more valuable places to visit. These were selected for their accessibility and interest. It is necessary to contact the person in charge and make arrangements to be shown through in advance of any trip.

### PHYSICS

<table>
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<th>Place</th>
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<tr>
<td>Logan Airport</td>
<td>Charlestown, Mass.</td>
</tr>
<tr>
<td>Cymbals - Zildjian Company</td>
<td>30 Fayette St., No. Quincy</td>
</tr>
<tr>
<td>Electroplating - Quincy Plating Works</td>
<td>138 Washington St., Quincy</td>
</tr>
<tr>
<td>G. &amp; P. Engraving Company</td>
<td>76 Woodbine Street, Quincy</td>
</tr>
<tr>
<td>Ice - Granite City Ice Company</td>
<td>550 Adams Street, Quincy</td>
</tr>
<tr>
<td>Light - Boston Edison Company</td>
<td>Bridge Street, Weymouth</td>
</tr>
<tr>
<td>Printing - Prescott Company</td>
<td>17 Temple Street</td>
</tr>
<tr>
<td>Transmitter - WMEX</td>
<td>Squantum Street, No. Quincy</td>
</tr>
<tr>
<td>Telephone Company</td>
<td>Hancock Street, Quincy</td>
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### PHYSIOGRAPHY

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<tr>
<td>Airport - Logan</td>
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<td>Abrasive Products, Inc.</td>
<td>Pearl Street, Braintree, Mass.</td>
</tr>
<tr>
<td>Blue Hill Observatory</td>
<td>Milton, Mass.</td>
</tr>
<tr>
<td>Crushed Stone, Old Colony</td>
<td>Vernon St., Quincy</td>
</tr>
<tr>
<td>Light - Boston Edison Co.</td>
<td>Bridge St., Weymouth</td>
</tr>
<tr>
<td>Mica, Inc.</td>
<td>182 Washington St.</td>
</tr>
<tr>
<td>Oil - Quincy Oil Company</td>
<td>56 Federal Avenue, Quincy, Mass.</td>
</tr>
<tr>
<td>Coal - Frost Coal and Oil</td>
<td>488 Neponset Avenue, Boston, Mass.</td>
</tr>
<tr>
<td>City Surveyor</td>
<td>City Hall Annex</td>
</tr>
</tbody>
</table>
BIOLOGY
Arnold Arboretum
Forest Hills, Mass.
Candy - Howard Johnson
89 Beale Street
Dairy - White Brothers
50 French St., No. Quincy
Whiting Milk Company
53 Massachusetts Avenue
Sweet Foods - Bustin Pennack & Co.
118 Old Colony Avenue

CHEMISTRY
Beverages - General Seltzer Co.
60 Woodbine Street
Chemicals - Bryant Chemical Corp.
6 North Street
Cymbals - Zildjian Company
39 Fayette St.
North Quincy
Electroplating - Quincy Works
138 Washington Street
Ice - Granite City Ice Co., Inc.
550 Adams St., Quincy

Fertilizer - American Agricultural Chemical
285 River Street, North Weymouth

Gray's Herbarium
near Harvard Square
Greenhouse - Almquist
Penn's Hill
Hospital - Quincy
Hospital Hill
Ice Cream - H. P. Hood
Federal Street, Quincy
Howard Johnson
89 Beale Street
Museums - Harvard
Oxford St., Cambridge
Museum of Science
Science Park, Boston

City Departments like: Sewerage, Disposal, Public Health, Park Department, City Hall, Quincy.
CHAPTER V

CONCLUSIONS
CHAPTER V

CONCLUSIONS

The results of a program as outlined in this thesis are dependent upon initiative and interests involved. Some of the more general objectives that would be accomplished are:

1. Greater interest in the sciences as they affect the community and the individual.

2. Increased appreciation for the land in which we live.

3. Insight into the inter-relations of the different sciences.

4. Development of interests and hobbies.

5. Skill in using the scientific method for solving problems.

6. Pride in accomplishing a worthwhile project.

7. Ability to better work with others.

8. Attitude and appreciation toward conservation.

9. A more vitalized conception of a particular science.

This plan may be begun in any school and in any science subject. This fact will enable any part of the total plan to be tried independently of other sections. To enable the plan to remain in operation, there are several factors to be considered.

1. Conservation must be practiced or areas will be greatly depleted.
2. Nature trails may be set up and improved to lend greater interest and variety.

3. New areas will be developed as they are found to be needed.

Future implication of the plan would be an expansion to include all the sciences as taught in the high school. Extension can then be made to the Junior High and elementary levels. At this time, use can be made of the experiences of other experiments in this field now in progress throughout the United States.
APPENDIX
This outdoor program, operating in 1950 and expanding in 1951 has, so far, dealt with only the elementary schools. Here individual classes, with their teachers, take all day, overnight and even week trips to different areas to study some local feature. These trips culminate a long period of group planning in which the children, with guidance from the teacher, learn about a subject, listen to an outside expert, and finally plan what they want to see on the trip. In most cases, the teacher has attended a workshop and has there learned some of the skills necessary in presenting such an outdoor program. The date being set with the school official in charge of the work, the trip leaves with a suitable complement of adult supervision. It will here be noted that the trips follow a talk with the parents of the class involved, so that any questions may be asked, the purpose explained, and the fees, paid by the parents, cleared. Adult leaders on a day trip to Cedar Hill would include the room teacher, an expert from the school system and usually an outside expert, like an Audubon Worker or parent well versed in the out-of-doors. Often a representative of the Fire Department is present to present the safety factors. Groups from kindergarten to sixth grade have enjoyed day trips to Cedar Hill with a charge of about forty cents to cover food, milk, and transportation. Overnight trips to Mary Day Girl Scout Camp cost under two dollars and offer a longer chance to work. The spring of 1951 will see several week trips to
Peterboro, New Hampshire to Sargent Camps costing about eighteen dollars.

These trips run in school time between April and November, accomplish several things. One of the most important is the experience in working together resulting from long planning of the operation. In addition to this democratic practice, it offers a chance for the teacher and her twenty-five pupils to know one another in a different way and to cement good relations that are of help later in the classroom. A third result is the learning about, appreciation of, and the living in the out-of-door parks around us. A typical program would serve to show this.

The group of twenty-five arrive with the adults at Cedar Hill. After a look around, the group divides into three parts. One group will go with the expert and those eight people will learn the mysteries of birds, their songs and nests, or perhaps will find different plants, animals, or insects. Geology, water life and many other subjects are often covered with an expert to show the small groups the differing wonders of nature. A second group, perhaps with the teacher, will go exploring, play a game or make a search for some specific form of nature. A third group might go with the fire department representative or school expert and learn how to build fires in the woods. After one-half to one hour, the groups change. A meal is later eaten and perhaps the third shift is made. A game, a conclusion and then back home after a well spent day in the woods. Longer
trips may see more projects and often they will visit a town
and study it, or visit an industry such as the maple sugar
plant visited in the spring of 1950 by a group of elementary
school students.

In work of this sort, there is obviously the arguments as
to whether the student would gain more by being in school or
by taking one of these trips. The leaders of the Newton Pro-
ject admit that there is no concrete evidence of the superior
value of this method, but they are sure that the long run aims
are worth the small amount of time involved. The motivating
factor alone, they feel, makes such projects worthwhile. Of
course, this program is restricted to the lower grades where
departmentalization is at a minimum. High school classes, for
the most part, would offer too great an administrative problem.
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SPECIALIZED BIBLIOGRAPHY FOR FIELD STUDY

This special bibliography contains some of the books the author has found most useful in field work. It does not attempt to cover all of the good field guides now in use.

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ABSTRACT

This thesis offers a possible guide to the Quincy Massachusetts schools in particular, and similar systems in general, for developing an outdoor program in relation to the science courses. The benefits of such a program are many and the difficulties few. Developing interests, problem child work, and individual project work are all possible in such a plan. Administrative details are small, and ideas and skill are forthcoming by means of the suggestions proffered in this paper.

A new concept is offered for study areas as contrasted to field trips. A study area is a place, large or small, where projects may be carried on and watched over a period of time. This would necessitate proximity to the schools and would have for advantages frequent visits and more easily scheduled trips. Field trips, on the other hand, are visits to one area to observe a particular subject of outstanding interest, but one that will not be seen twice. These two ideas in outdoor education are exemplified in seven study areas near the two high schools and two study areas common to the city. Plans for use and development are discussed, showing how such work would benefit the science program. Also, it was shown how such work would benefit the community as a whole. Field trips are also included, and two examples are given to outline how such trips can be planned. The two examples were selected to reveal other possibilities in field work. In addition, there is a list by
school subjects of some places where field trips would be profitable.

Another feature of the plan is the Special Project Section. This part is devoted to describing in some detail, projects in a variety of fields that could be undertaken by individuals or groups, either to expand some school subject or to develop as a hobby, special club or fair enterprise. In addition, this area opens to the students opportunities to make contributions to science and to develop projects of interest to many South Shore residents. Knowledge of science and appreciation of city government are coupled as they should be in good science learning.

Lastly, there is a report of the Newton Project and two bibliographies. Newton has begun development of an Outdoor Science Program with great success in the elementary schools. Actualities and eventualities are both stated here. The bibliographies are two in number. The first is general and deals with books pertinent to outdoor education as a whole. The second is related to the specific outdoor subjects discussed in the thesis. Guides found helpful are listed by subject and author. Outdoor education in science is a necessary part of any modern program. This thesis hopes to show some of the ways such a program can be most easily and fully realized.