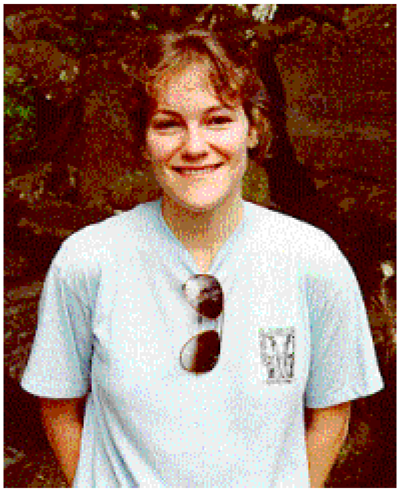
Mary Griffin



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My project for the Earth Science Research Project is to develop a Self Guided Science walk to the Kettle Hole Trail. The research paper is at this link. The Guide is at this link.

Kettle Hole Trail: Suffolk County Community College Eastern Campus at Riverhead

Abstract

The New York State Department of Education offers a modified version of the Regents Earth Science Curriculum, with guidelines for a long-term student research project. The objective of the research project is to introduce students to the procedures involved in scientific research, including forming a hypothesis or question, then proposing a method to support their hypothesis or answer their question. Their proposal should involve the scientific procedure they will use for generating data, how they will collect it, analyze it, and use it to support their hypothesis, or answer their question.

Teachers should have locations available, which their students can use to set up and perform a valid scientific procedure or experiment, that would satisfy all of the specifications of the long-term research project. Locations with self guided nature walks, including pamphlets or booklets keyed to numbered signs are excellent resource areas. The pamphlets/booklets would have information available that teachers and students could use to both form valid scientific projects, and use as a reference. In addition, self-guided nature walks are good destinations for field trips from a number of different science courses. Finally, self-guided nature walks are good ways for the general public to learn about the environment around them.

The purpose of my project was to find a location that fit these criteria, map out a trail and write a guide for it. The location that I chose, the "Kettle Hole Trail", is part of the Long Island Greenbelt Pine trail system that winds through the Pine barrens, and climbs from a glacial topography of outwash plain to a hummocky terminal moraine. The outcome of my project was a field guide with numbered stops and a suggested list of research topics and projects.

Science Education Goals

The New York State Department of Education is responding to the call for new standards in teaching science at the high school level by rewriting it's curriculum to reflect a more inquiry based approach to learning (NSES, 1995; NSTA, 1998). This shift in policy reflects the attitude that "Scientific literacy-which encompasses mathematics and technology as well as the natural and social sciences-has many facets. These include being familiar with the natural world and respecting it's unity; being aware of some of the important ways in which mathematics, technology, and the sciences depend upon one another; understanding some of the key concepts and principles of science; having a capacity for scientific ways of thinking; knowing that science, mathematics, and technology are human enterprises, and knowing what that implies about their strengths and limitations; and being able to use scientific knowledge and ways of thinking for personal and social purposes." (Rutherford & Ahlgren, 1990). Central to this approach is to have students involved with "hands on science" instead of rote textbook learning (Kramer, 1997; NSES, 1995), because "students in a hands on science program will remember the material better, feel a sense of accomplishment when the task is completed, and be able to transfer that experience easier to other learning situations." (Haury and Rillero, 1994).

Hands on learning, also called Inquiry or Discovery learning, is accomplished by breaking down a lesson into three dimensions: the inquiry dimension, the structure dimension, and the experimental dimension (Haury & Rillero, 1994). The inquiry dimension occurs when a student uses activities to make a discovery, while the experimental dimension allows the student to prove a discovery through experimentation and research. The structure dimension of hands on learning involves the amount of guidance given to students as they conduct their activities and projects (Haury & Rillero, 1994). In the modified Regents Earth Science curriculum, a long-term research project for students has been added which allows for the implementation of these three dimensions and therefore satisfies the requirements of inquiry based science instruction that the new educational standards are calling for.

The long-term research project is structured so that it may be completely teacher designed, or developed based upon the interests and abilities of individual students (Kramer, 1997). Whether the project is teacher or student designed, a key aspect of it must be to capture and hold a students attention, while providing enough opportunities for exploration, experimentation and learning. One of the most successful methods of achieving student involvement and interest is by taking them on field trips (Collette & Chiappetta, 1984). Field trips designed to broaden or support the Earth Science curriculum can also be used to generate questions from students, which can then be adapted into the foundation of a long-term project. Also, field trip experiences, even without the goal of setting up a research project or experience, are invaluable components of inquiry based science instruction. They allow students to examine the world in it's natural state (something that cannot be done in a classroom setting) and tend to make the subject under study more meaningful (Collette & Chiappetta, 1984).

In order for field trips to be an integral part of the curriculum, they must be very well planned. The point that the teacher is trying to make and the connection to the topic being studied should be clear to the students. The examples that the teacher wants the students to see should all be carefully orchestrated so that time is not wasted in the field. Also, a well planned field trip will keep the students from becoming confused and inattentive-it will have the ability to generate questions (and perhaps answers) which could be used to structure a long term research project. As part of the course work for a graduate course in geology, "Research for Earth Science Teachers", offered at State University of New York, Stony Brook, I had to pick an area that would be useful for teachers as a field trip destination. I then had to devise a plan to transform it into an extension of the classroom for earth science teachers; with enough versatility so that it would also be useful to teachers of other science disciplines. Finally, the area and attendant field-guide were not to be geared for use by schools only-they were to be designed to appeal to the general public as well.

The Kettle Hole Trail

An ideal place for a field trip concerned with exploring the natural world should be easily accessible to school groups and be versatile enough to encourage teachers of many different subject areas to use it. An added bonus would be available background information about the area that the teacher could use to plan lessons or structure research projects. A "self-guided" nature walk (one that has a printed guide of some type), located centrally to many school districts, would fulfill these requirements. My first goal then, was to find such a location. Once found, I had to map out a nature trail and write a pamphlet keyed to numbered stops. I also needed to include a suggested list of projects and experiments for long-term research projects that could be done within the trail region. The location I chose which fit these specifications was "The Kettle Hole Trail", a pre-existing woodland pathway in Riverhead, New York.

The Kettle Hole trail begins at the Kiosk on the northwest corner of the Peconic Building parking lot, Suffolk County Community College, Riverhead, NY (fig. 1). It is a portion of a series of blazed trails in the area that are part of the Long Island Greenbelt's *Pine barrens Trail* network, and is currently earmarked for expansion and improvement by the National Forestry Service. A guide was written during the early 1980's for the section of the trail that crosses land owned by Suffolk Community College (Keatts, Lomaga & Cox, 1982). However few copies of this guide are left. Also, many of the numbered signposts have rotted away, and the information concerning some of the stops is no longer relevant or accurate. Although the trail is somewhat overgrown in sections, it is still easily hikable. It is located near several school districts and is within the "day trip" range of many more. There is access for buses, nearby bathroom facilities and emergency services (on the college campus).

The Trail Environment and Geology

The trail winds through the ecologically significant Pine Barrens-a rare ecosystem that once covered much of Long Island, but has now been reduced to about 100,000 acres (fig. 2). The Pine Barrens is ecologically significant because it contains one of the greatest concentrations of rare and endangered species (both plant and animal) in New York State. It is also one the largest recharge areas of the vast underground aquifers that maintain the water level for a series of bogs, ponds and other assorted wetlands where many of these rare and endangered species are found (Hastings, 1978; Suffolk County Water Authority, 1997). Many of it's unique combination of plants and animals are specially adapted to the harsh growing conditions that exist within the Barrens (Villani, 1997; Hastings, 1978; NCFS, 1998). These conditions are a direct result of the underlying dry sandy soil. This soil, layered over a strata of coarser sand and gravel, is mostly silica, very acidic, nutrient poor and extremely dry. Plants that grow in the Pine Barrens are specially adapted to overcome the lack of moisture. They are also specially adapted to withstand the frequent fires that sweep through these dry woods. The fires are important components in maintaining the delicate ecological balance of the Barrens because they keep out more robust growing, but less fire resistant plant-life (Jorgensen, 1978; Kimmerer, 1998; Cornett, 1997).

The dry, sandy soil of the Pine Barrens was deposited during the Pleistocene Era, when the great continental glaciers that covered much of North America reached as far south as Long Island (Fig. 3)-at that time no more than a portion of the Atlantic Coastal Plain (DeLaguna, 1963). When the glaciers moved northward, they carried vast quantities of sediments along with them. At certain times, the ice front was at a stillstand-a period of equilibrium when the glacier both melted and froze at the same rate (Boggs, 1987). This caused sediments to be picked up and carried forward from the frozen north to be deposited at the melting southern edge. The unconsolidated and unsorted mix of sediments deposited formed high ridges called moraines (fig. 4). Glacial tectonics; the force of the massive ice front shoveling and pushing sediments ahead of it, and or the weight of the ice itself bearing down on the unconsolidated, easily deformed sediments beneath it; also contributed to moraine formation and shaping. At least two moraines are found on Long Island-the Ronkonkoma and the Harbor Hill Moraines-that were most likely formed by a combination of these processes (Isachsen et al, 1991). In addition, as the glaciers melted, streams of sediment-laden water flowed southward, fanning out in broad arcs as velocity diminished (Boggs, Jr., 1987). The overlapping fans formed a vast outwash plain to the south of each moraine (Sirkin, 1995; Isachsen et al, 1991). The outwash plains are the major underlying geology of the Pine Barrens.

The Kettle Hole trail begins on the northern edge of the outwash plains and eventually climbs onto the Ronkonkoma Moraine, in an area that has been described at classically knob and kettle (Fuller, 1914). The steep hills and deep holes are geomorphic features called kames (hills) and kettles (holes) (Sirkin, 1995). Kames are formed when sediments collected in openings of stagnant ice, are left behind as steep sided hills. Kettles are formed when large blocks of ice, left behind from the receding glacier, are covered by outwash sediments. The ice blocks eventually melt, causing the overlying sediments to collapse and form depressions (fig. 5). If the depressions are below the level of the surrounding water table, the melting ice will not drain, and a kettle lake will form. The Kettle Hole Trail, as the name implies, descends into a large oval kettle hole within the surrounding outwash. It eventually climbs out of the depression and up onto the moraine. The change from outwash plain to moraine is clearly reflected in the changes of geology, topography and plant life in each depositional environment.

The Trail As A Classroom Resource

Because the Kettle Hole Trail passes through the ecological important and unique Pine Barrens; because it passes over geology that is a spectacular representation of glacial geology; and finally, because both the environmental and geological settings offer a view into the past history of the formation and maturation of Long Island, it should be considered as a prime destination for a high school field trip. Portions of the trail can be used to illustrate topics covered in biology, ecology and chemistry as well as in earth science courses. For this report, I will concentrate on how it can be used as a valuable resource for earth science classes.

There is an incredible amount of written information available for students who wish to do background research on the Pine Barrens or on Long Island's glacial geology. This is especially important for students who are involved with the Long Term Research Project called for in the modified Regents Earth Science curriculum (Kramer, 1997). The diverse nature of the Kettle Hole Trails geology and ecology can be used to set up many different types of experiments that students could easily set up and monitor on their own (see appendix I, project list). The pamphlet/field guide is set up so that each stop is given some background information. Then, a question (or series of questions) is posed that is designed to make the students examine the site in more detail and challenge them to make inferences based on their observations. Some of the questions or information written in the field guide may also stimulate student curiosity, and therefore could be used as a starting point for developing a research project.

The pamphlet/field guide is not only designed for use with the modified earth science curriculum or, specifically the long-term research project component of it. As stated earlier, field trips are important learning experiences for students, especially when the field trip is able to illustrate or support a topic being studied in the classroom (Collette & Chiappetta, 1984). Many of the sites (with accompanying information and questions) keyed in the guide were chosen to compliment the unmodified Earth Science Curriculum (State Ed. Dept., 1987). Teachers may use the trail as a field trip early in the year to give a brief overview of the upcoming topics, or they may come some time after the school year has begun to support what has already been taught. Also, because the trail and pamphlet were designed to be self-guiding, students may be directed to the location to explore the sites on their own. This is especially useful for teachers who are unable to take their students on field trips, but would still like to use some of the sites as examples or for correlation purposes.

The Methods For Science Walk Construction

Creating a science walk is not as simple as it would seem. First, and most importantly, a good location must be found-so good that it would entice teachers to take 20 to 40 students for approximately an hour long excursion into a non classroom setting. It also must be broad enough in it's appeal for use by the general public. When the location is decided, a comprehensive, accurate and versatile guide must be written in such a manner that it is easily readable and interesting for a range of ages. Finally, a method of site marking or numbering must be implemented that is easily followed, but not overwhelming or intrusive to it's surroundings.

I chose my site, the Kettle Hole trail, for location and convenience reasons discussed above (under topic heading "The Kettle Hole Trail") and because it fit the criteria of what I felt would make a good science walk. The trail was already cut through the woods, with plans for expansion and maintenance in the near future-an important feature that would ensure access over a long period of time. I felt it was ecologically and geologically diverse enough to support a fair amount of numbered sites. There was an abundance of information available about the locale for anyone (including myself) who was interested in doing background research.

The first step in trail development must be to obtain permission for site access and alterations from who ever owns the land. In the case of the Kettle Hole Trail, Suffolk Community College was the owner of the land over which the Kettle Hole trail passed. After permission to use the land is obtained, a plan must be organized that clearly defines the objectives concerning the trail, and how to go about obtaining those objectives. *Steps In Self Guided Trail Development,* an outline written by Gary Lawton, New York State Parks Dept., is an excellent synopsis of the steps involved in nature trail development. According to Lawton, part of getting organized is making contacts with people who are familiar with the area of consideration, and who are willing to share their knowledge and expertise in various areas (geology, ecology, etc.).

When I decided on using the Kettle Hole Trail as the location of my project, I contacted Ken Ettlinger, the science department chairman of Suffolk Community College, eastern campus for information. Professor Ettlinger, who teaches geology and botany at the college, informed me about the trail's past history, present state and future development. He also walked through the trail with me and pointed out many of the interesting features that could be found. Professor Ettlinger explained that the National Forestry Service had funded a grant to improve the trail by widening it and, and to hang enamel signs of cartoon ecology creatures designed by noted children's author, Judy Blume. In addition, he arranged a meeting between the person who was responsible for the planned improvements and myself. Professor Ettlinger's was an excellent resource person for me because his advice, assistance and expert knowledge of the area were extremely helpful in shaping the form and direction of my project.

The first time that I walked through the trail, I made detailed notes about any area that could be a potential "learning site". I then took this information and researched it in depth. My research included reading articles from scientific journals concerned with the geology and ecology of the area. I also read pocket field guides on plants, trees, geology and wildlife and some natural history volumes that were written about Long Island and it's ecosystems. Finally, I found interesting, informative and topical articles about all aspects of my project on the Internet (appendix II, Additional Sources). My research was not only concerned with the natural setting of my trail area, but was also geared to learning how I could structure the sites to support (but not be limited to) topics covered in the Regents Earth Science Syllabus (NY State Dept. Ed, 1987).

The geology of the area, specifically the geomorphic aspect of it, was another important component to factor into my field guide. In order to do this, I needed maps that showed the location and the topography clearly and concisely. The maps I used were United States Geological Survey, 15 minute series topographic maps, 5 foot contour, topographic maps from the New York State Department of Public Works, and both topographic and planimetric maps generated from a software program at SUNY, Stony Brook, Department of Geosciences. I used these maps to get an image of the overall local geology and how my particular site related to it (my site as a comprehensive "miniature model" of the surrounding terrain). I also used the maps to determine if the underlying geology influenced the overall ecology of the trail (i.e. my site passed from outwash, through a Kettle, onto a moraine-all with a discrete, but clearly notable corresponding change in biota). In addition to giving me information about my location, the maps I used were important for designing a simple trail map for use with the field guide.

My discussion about resources would not be complete unless I mentioned State University of New York, Stony Brook, particularly the geoscience department. The library has a comprehensive bibliography of Long Island Geology, with many of the listed articles and literature on campus. Maps and air photos are available for viewing at both the geoscience and the main libraries. There is a small science museum in the geoscience building devoted to Long Island's natural history. Finally, there are faculty members who have studied Long Island's geology, ecology and marine environments, and who are generously willing to share their expertise and knowledge-making them excellent contacts for regional information. Their knowledge is not just limited to Long Island either. Many teach courses or lead seminars on a variety of "natural science" topics that are geared for a wide range of interests, abilities and backgrounds. The course, *Research For Earth Science Teachers*, (for which my trail guide and this report were written) led by Professor of Geology Gilbert Hanson, was an especially rich resource. It offered pertinent scientific information, examples of existing nature walks, suggestions of people and places to contact as additional resources, and, perhaps most important, feedback on developing projects.

Conclusions

Choosing an area apropos to Long Island's natural history and conducting research on it merely supplied the foundation of my project. My goal was to produce a field guide that was accurate, readable, entertaining and which could be used as an educational supplement for a variety of science courses. The way I chose to accomplish this was to write my field-guide so that it was informative and thought provoking. My method was to list basic information about each site that would prompt the reader into making detailed observations about it, then posing a question, or series of questions, which would require the reader to make inferences based upon those observations. This is one of the methods recommended for encouraging scientific or constructivist thinking, rather than passive learning (Bybee, R., et al, 1990).

Finally, construction of a nature trail and completion of a field guide can only be considered an initial step in the development of a nature walk. A well written guide on an ecologically rich area are of no use to anyone unless potential users are aware of them. The least expensive and perhaps most far reaching method of accomplishing this was to post any information concerning the project; field guide, report and directions along with any other pertinent information; on the Internet. Internet posting also allows for periodic updating for feedback from students, teachers and interested parties. Most importantly it enables anyone to effortlessly gather resources that would enable them to "experience the richness and excitement of knowing about and understanding the natural world" (NSES, 1995).

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