

Rowan University

Rowan Digital Works

Theses and Dissertations

12-12-1995

Walking lightly on the planet: a curriculum enrichment for the Pinelands Science Unit of the Cherry Hill Environmental Education Residency Program on Pinelands ecology

Elaine Ruth Miller

Rowan College of New Jersey

Follow this and additional works at: <https://rdw.rowan.edu/etd>



Part of the [Science and Mathematics Education Commons](#)

Recommended Citation

Miller, Elaine Ruth, "Walking lightly on the planet: a curriculum enrichment for the Pinelands Science Unit of the Cherry Hill Environmental Education Residency Program on Pinelands ecology" (1995). *Theses and Dissertations*. 2270.

<https://rdw.rowan.edu/etd/2270>

This Thesis is brought to you for free and open access by Rowan Digital Works. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Rowan Digital Works. For more information, please contact graduateresearch@rowan.edu.

WALKING LIGHTLY ON THE PLANET: A CURRICULUM ENRICHMENT FOR
THE PINELANDS SCIENCE UNIT OF THE CHERRY HILL ENVIRONMENTAL
EDUCATION RESIDENCY PROGRAM ON PINELANDS ECOLOGY

by
Elaine Ruth Miller

A THESIS

Submitted in partial fulfillment of the requirements of the Master of Arts
Degree in the Graduate Division of Rowan College of New Jersey
December 1995

Approved by

Professor

Date Approved

12/12/95

ABSTRACT

Miller, Elaine, Ruth

Walking Lightly on the Planet: A Curriculum Enrichment for the Pinelands Science Unit of the Cherry Hill Environmental Education Residency Program on Pinelands Ecology.
December 1995.
Thesis Advisor: F. G. Patterson,
Professor of Environmental Education

This thesis project is designed to produce written curriculum materials in Pinelands ecology. The written curriculum materials produced is intended to be implemented as part of the Pinelands Science Unit of the Cherry Hill Environmental Education Residency Program, also known as CHEER.

The written curriculum materials will include pre-trip, resident trip, and follow up assessment materials and activities that follow the given format for all Cherry Hill science units. The structure of such a program will allow, if desired, interdisciplinary coordination between science, math, English and ecology that correlate with the existing CHEER program. Through this experience it is expected that the sixth grade students in residence at the "site specific" location of Mt. Misery in the Pinelands National Reserve will develop greater first hand knowledge about Pinelands ecology. This will enable the student to be a more informed, responsible, and active citizen in the defense of the environment.

MINI - ABSTRACT

Elaine Ruth Miller

Walking Lightly on the Planet: A Curriculum Enrichment for the Pinelands Science Unit of the Cherry Hill Environmental Education Residency Program on Pinelands Ecology.
December 1995.
Thesis Advisor: F. G. Patterson,
Professor of Environmental Education

This thesis project consists of pre-trip, residence, and follow up assessment materials and activities designed for the Cherry Hill Environmental Education Residency Program, also known as CHEER.

The purpose of this thesis is to develop written curriculum materials that correlate with the existing CHEER program which teaches Pinelands ecology to sixth grade students in residence at the "site-specific" location of Mt. Misery in the Pinelands National Reserve.

ACKNOWLEDGEMENTS

The writer of this thesis project wishes to acknowledge the following people:

Dan Slocum, Kathleen Thomas, Joanne Macchione, Scott VerSprill and Dolores Washick of United Jersey Bank for recognizing the importance of higher education.

Terry Patton, Environmental Education Coordinator of the Cherry Hill Public Schools, for giving me the opportunity of a life time. Your words of wisdom I shall always remember.

Dr. Joanne Scott, Professor of Sciences at Rowan College of New Jersey, for your support and belief in me.

Jo Walton for your endless support and love.

Undergraduate Biology Club for your support and for your unforgettable memories.

Professor Gary Patterson, Rowan College Graduate Advisor, for selecting me to become the first graduate assistant of CHEER.

My parents, Leo and Patricia Miller, for always believing in your daughter.

Anthony J. DiAmore, my partner in life. We did it! I love you, thanks.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION.....	1
	Statement of the Problem.....	2
	Statement of the Purpose.....	2
	Significance of the Study.....	3
	Assumptions of the Project.....	4
	Limitations of the Project.....	4
	Definition of terms.....	4
II.	Review of Related Literature.....	9
	Environmental Education.....	9
	Curriculum Development.....	14
	Attitudes and Values.....	18
	Teaching Techniques and Strategies.....	26
	Environmental Residential Experiences.....	32
	Review of Related Written Curriculum	34
III.	Design of the Project.....	40
	Introduction.....	40
	Methodology.....	40
	Procedures.....	41
	Sources of Data.....	43
	Background of the Researcher.....	44
IV.	The Project.....	45
	Introduction and Format.....	45
	Topics and Lessons.....	46

	Pre-trip.....	47
	Resident Trip.....	75
	Assessment Materials and Activities.....	82
V.	Summary.....	86
	Concluding Statements.....	87
	Suggestions for Further Study.....	88
VI.	Appendix.....	89
	Letter from Terry Patton.....	90
	Vocabulary Words.....	91
VII.	Bibliography.....	97
VIII.	Quote.....	103

CHAPTER ONE

INTRODUCTION

Nearly three-fourth of American children live in cities and suburbs of large metropolitan areas, unaware of basic ecological relationships in the world around them because their experiences with natural environments are limited" (Cole, 1992, p. 285).

The state of New Jersey, is the fourth smallest and most densely populated state in the nation which causes many environmental issues to surface. "It takes an educated citizenry capable of wise decisions to secure the future of New Jersey's environment and the quality of life". These educated citizens that will be the future decision makers are currently being taught throughout New Jersey's school systems (Kane, 1992, p. X).

Through environmental education, children are being taught about an ecosystem that is unique and internationally renown. This system is known as the New Jersey Pinelands.

The Pinelands is 1.1 million acre of vast forested areas that stretches into the following seven counties: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean (Cherry Hill Pub. Science Unit, 1992). It consists ecologically of sandy, generally flat, acidic, and sterile soils of the most extensive wilderness treatise along the middle Atlantic seaboard (Boyd, 1991).

The Pinelands lacks industrialization, "although much exploited by man over the past 300 yrs" and remains a true, natural area (Boyd, 1991,

p. 4). Its unusual features of ecology provide an unique plant and animal ecosystem.

The Cherry Hill Environmental Education Residency Program, also known as CHEER, has been in existence for twenty-seven years. The program provides for an interaction between teachers and students through lesson activities, scheduled meals, evening programs, and cabin supervision over a five day stay in the Pinelands.

The "site-specific" location of CHEER resides at Mt. Misery, which is part of the Pinelands National Reserve. This unique area provides the sixth graders "opportunities for out-of-classroom educational experiences that can be unforgettable" (Hogenbirk, 1990, p. 27).

Statement of the Problem

There is a need, according to Environmental Education Coordinator, Terry Patton (see appendix A) to produce written curriculum materials for the existing classroom Pinelands science unit which will be the foundation in the development of an environmental lesson for the Cherry Hill Environmental Education Residency Program.

Statement of Purpose

The purpose of this thesis project was to develop written curriculum materials that correlate with the existing CHEER program which would teach Pinelands ecology to sixth grade students in residence at the "site-specific" location of Mt. Misery in the Pinelands National Reserve.

The written curriculum materials will include pre-trip, resident trip,

and assessment materials and activities that follow the given format for all Cherry Hill Public School Science Units.

Significance of the Study

In 1978, the New Jersey Pinelands was declared by Congress as a National Reserve. "Innovative means were designed to protect its unique resources from the encroachments of modern life" (Collins, 1988, p. XIII).

The "site-specific" location of the Pinelands National Reserve itself provides CHEER with a diverse composition of tree, shrubs, plants, reptiles, mammals, and birds as well as much historical information (Kane, 1992). Therefore, based upon Mt. Misery being representative of the Pinelands diversity, written curriculum materials were developed for the major science program of the Pinelands classroom unit to reflect this diversity.

The Environmental Education Coordinator, Terry Patton, is aware and supports the effort to develop curriculum enrichment materials on the Pinelands ecology portion of the CHEER program. By recognizing this need, Mr. Patton realizes the significant value of the ecology and understands the importance of educating future generations about "one of the world's unique natural areas" (Boyd, 1991, p. 2).

The Pinelands ecology experiences will be "designed to foster the children's awareness of important ecological" environments by being "developmentally appropriate, occur across real settings, and involve the child's active exploration" (Cohen, 1990, p. 304).

Assumptions of the Project

It is assumed that:

1. The writer has adequate knowledge in curriculum development and Pinelands ecology.
2. The pre-trip activities will lead the learner into the "site-specific" activities.
3. The follow up activities properly follow in sequence to the "site-specific" activities.
4. The written curriculum materials developed will coincide with the existing Cherry Hill Public School Pinelands Science Unit.
5. The written curriculum materials will be written with the assumption that the learner has little knowledge about Pinelands ecology.

Limitations of the Project

This project will be limited by the following factors:

1. "Site-specific" to the area of Mt. Misery.
2. To the sixth grade students of the Cherry Hill Public School district.
3. To the seasonal climate.
4. The lesson is achievable within a time frame of approximately 2 to 2 1/2 hours.

Definition of Terms

1. Biosphere Reserve - Designated a "biosphere reserve" in 1983 by the United Nations Educational, Scientific and Cultural Organization (UNESCO), New Jersey's Pinelands contains a sparsely populated and

forested Preservation Area surrounded by a more heavily populated Protection Area. Scientists from around the world plan to study the impact of human activity on the unique ecosystem of the Preservation Area (Cherry Hill Pub. School Science Glossary, 1992, p. 2).

2. Commission - A group of people elected or appointed with the authority to do certain things such as the New Jersey Pinelands Commission that is responsible for overseeing the management of the 1.1 million acre Pinelands National Reserve (Cherry Hill Pub. School Glossary, 1992, 3).
3. Cooperative Learning - Replaces independent seatwork with cooperative learning activities in which small groups work together on practice or application exercises. It can be used to teach both basic skills and other higher level skills by expressing group goals, individual accountability, and by providing equal opportunity for success (Kauchak & Eggen, 1993).
4. Critical Thinking - Is the ability to think critically on a cognitive level (Good, 1988).
5. Curriculum - Is a combination of learning experiences planned and unplanned along with the course content, and course study that promotes the growth and learning of its students (Parkay, 1992).
6. Discovery Learning - Learners are exposed to experiences and guidance designed to lead students to discover the target principal (Good, 1990).
7. Ecology - Is basically the study of the interrelationships of living organisms to one another and their environment (Southwick, 1976).

8. Ecosystem - The living and non-living things in the environment of a given area which affect each other (Cherry Hill Pub. School Science Glossary, 1992, p. 4).
9. Environmental Education - "Is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (Disinger, 1985, p. 62 quoting Stapp, 69).
10. Group Investigation - Involves cooperative learning by using a scientific method of research (Sharan, 1994).
11. Inquiry Method - Is a process for answering questions and solving problems based on facts and observations. It poses questions or problems to be solved from the students by involving them in the collection and analysis of data (Kauchak & Eggen, 1993).
12. Instruction - Organized plans for teaching curriculum content (Doll, 1989).
13. Instructional Activity - The building blocks to knowledge. Instructional activities are constructed around concepts, measured in learner outcomes, and grouped into study units (Link, 1987).
14. Instructional Strategy - The teaching procedures of a lesson plan. They describe what students will be doing and how the lesson will proceed (Rockler, 1988).
15. Pine Barrens - The name given by early settlers to more than a million acres of the Atlantic or Outer Coastal Plain in southern New Jersey. The

settlers called the area the "barrens" because most agricultural crops could not grow in its sandy, nutrient-poor soils (Cherry Hill Pub. School Science Glossary, 1992, p. 7).

16. Pinelands - A more recent name for the Pine Barrens, covers essentially the same geographical area as the Pine Barrens. The region is 1.1 million acres in size and includes portions of seven New Jersey counties: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean (Cherry Hill Pub. School Science Glossary, 1992, p. 8).
17. Pinelands National Reserve - Established by the National Parks and Recreation Act of 1978. Generally, the Reserve includes the state designated Preservation and Protection Areas as well as certain coastal areas protected under New Jersey's Coastal Areas Facility Review Act. In a national reserve, local, state, and federal governments cooperate to protect natural and historical resources and traditional lifestyles while providing for development in environmentally suitable locations (Cherry Hill Pub. School Science Glossary, 1992, p. 9).
18. Preservation Area - An area whose boundaries are defined by New Jersey's Pinelands Protection Act. It is the area of the Pinelands that has been least developed and it includes 368,000 acres of semi-wilderness (Cherry Hill Pub. School Science Glossary, 1992, p. 10).
19. Protection Area - An area whose boundaries are defined by the New Jersey Pinelands Protection Act. It is the 565,000 acre area surrounding the Preservation Area. It is divided into six management areas where the use of land is determined by how it would affect the environmental

resources (Cherry Hill Pub. School Glossary, 1992, p. 10).

20. Simulation and Gaming - Is used to promote discovery learning by providing a risk-free environment for analysis of new information and decisions (Rockler, 1988).
21. Residence Program - Is typically a class divided into heterogeneous cabin groups that is representative of the total class in one given area for at least three days and two nights (Conservation & Env. Studies Center, 1970).

CHAPTER TWO

A REVIEW OF THE RELATED LITERATURE

The writer of this curriculum project will review related literature in the five separate sections stated below:

- I. Environmental Education
- II. Curriculum Development
- III. Attitudes and Values
- IV. Teaching Techniques and Strategies
- V. Environmental Residential Experiences
- VI. Review of Related Written Curriculum Materials

I. Environmental Education

The need for environmental awareness is alarming. In today's society, environmental problems are not a priority. Dominating issues of concern are focused primarily around inflation and unemployment, as well as, international tension of war and nuclear threat (Dunlap, Gallup & Gallup, 1993).

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), environmental education and training in today's society has a very low status. UNESCO states that the reason for having such a low status can be reflected particularly by current politics and social trends which are being conveyed through the media (Kastenholz & Erdmann, 1994). In order to promote an environmental awareness and conscious behavior, there needs to be more

communication of humanistic artistry such as social responsibility, nonviolence, compassion and equality which will in return raise the student commitment toward environmental protection of their planet.

Within the school systems of the United States there has been an increasing awareness for the need of environmental education, but the implementation of environmental education has not been easy (Lewis, 1990). Environmental Education has no uniformly accepted definition, and depending on the community and its needs the definition can be created and/or altered. The author of this curriculum project will now list several Environmental Education definitions, some which have many similarities and others which may vary greatly.

The Environmental Quality Education Act, commonly called the Environmental Education Act (U.S. Public Law 91-516, 1970) defined environmental education as follows: "means the educational process dealing with man's relationship with his natural and manmade surroundings, and includes the relation of population, conservation, transportation, technology, and urban and regional planning to the total human environment" (Disinger, 1985, p. 63).

The implementation of the Environmental Education Act-Public Law 91-516 was the starting point for many school systems throughout the nation. It enacted the development of guidelines to inspire an orthodoxed environmental education program.

An earlier concise definition of environmental education was developed from the Department of Resource Conservation and Planning

of the University of Michigan's School of Natural Resources under the leadership of William Stapp which states "Environmental Education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (Disinger, 1985, p. 63).

Along with this Environmental Education definition, the major objectives of environmental education are to help individuals acquire:

1. A clear understanding that man is an inseparable part of a system, consisting of man, culture, and the biophysical environment, and the man has the ability to alter the interrelationships of this system.
2. A broad understanding of the biophysical environment, both natural and manmade, and its role in contemporary society.
3. A fundamental understanding of the biophysical environmental problems confronting man, and how these problems can be solved, and the responsibility of citizens and government to work toward their solution.
4. Attitudes of concern for the quality of the biophysical environment which will motivate citizens to participate in biophysical environmental problem solving (Disinger, 1985, p. 62).

Stapp's 1969 environmental education definition was the basis for many subsequent efforts such as Robert Roth's 1970 "Fundamental Concepts for Environmental Management Education, K-16." Roth modified Stapp's definition by stressing the management dimension of both the biophysical and sociocultural environments. Environmental management education is the process of developing a citizenry that is:

1. Knowledgeable of the interrelated biophysical and

2. sociocultural environments of which man is a part. Aware of the associated environmental problems and management alternatives of use in solving these problems.
3. Motivated to work toward the maintenance and further development of diverse environments that are optimum for living (Disinger, 1985, p. 62).

Environmental education is a subject that can be taught in a classroom setting, outside using the immediate surroundings of the school, in the community, and in natural areas. But in order for the full effect of environmental education to take place, it is important to have environmental experiences in natural settings on a continual basis (Hungerford & Volk, 1990). This will allow for positive hands-on experiences that the student will remember.

Through natural outdoor education, the students will hopefully shift their way of thinking from a cognitive point of view toward a more affective point of view with the formation of their attitudes. This type of educational setting enables the students to develop an "appreciation for land management" (Kirk, 1977, p. 6).

Environmental education has had many synonymic titles over the past few decades. Each program varies in meaning, but they all emphasize the character, degree, functions, and influences of natural resources. There has been no general agreement as to the coverage of the many title used, but explanations can be produced from the following compendiums:

- A. Conservation Education - In the early 1900's the focus of the conservation movement in the U. S. was on the

conservation of human resources (Disinger, 1985).

- B. Earth Education - Developing a sense of relationship with the earth using emotional attachments and firsthand contact (Van Matre, 1990).
- C. Nature Study - A movement developed during the latter part of the 19th century. It was basically rote learning of knowledge through books and lectures (Disinger, 1984).
- D. Outdoor Education - Takes place outdoors where all subjects can be taught as a curriculum enrichment. It does not indicate a set of objectives or body of knowledge (Disinger, 1993).

Other definitions of Environmental Education that are similar in content meaning, but vary in the degree of participation are Brennan's 1970 definition and Disinger's 1993 definition. Brennan states that "Environmental Education develops in man the recognition of his interdependence with all life and a recognition of his responsibility to maintain the environment through the development of understanding and attitudes" as quoted by Disinger (1985, p. 62). Brennan's definition reflects only an individual's responsibility where as Disinger indicates not only working cooperatively, but worldly by stating "Environmental Education is a world process developing an awareness and concerns about the total environment with its associated problems through knowledge, attitudes, motivations, commitments and skills by working individually and collectively to find solutions to current problems and the

prevention of new ones" (Disinger, 1993, p. 23).

Environmental education is evolving from an antropocentric view point to an ecocentric world view (Miller, 1995). It is important to have an interactive interrelationship between humans and their environment (Disinger, 1993).

New Jersey's 1994 Plan of Action recognizes the importance of environmental awareness. The goal of the proposed "Environmental Education in New Jersey: A Plan of Action" will be to develop in the citizens of the state the knowledge, attitudes, values, skills and behaviors needed to maintain, protect and improve the environment (1994, p. 2).

From all of the definitions mentioned in this chapter, hopefully the uses of resources in and out of the classroom will help those to become environmentally knowledgeable and skillful (Engleson, 1991).

II. Curriculum Development

Curriculum is a combination of learning experiences planned and unplanned along with the course content, and course study that promotes the growth and learning of its students (Parkay, 1992).

In order to implement environmental education units into an already established curricula, the use of the immediate surroundings of the school can set the stage. This along with supplemental materials such as Project Wild or Project Learning Tree use cooperative learning approaches that replace independent work. This in part encourages the practice and application exercises by working together (Estes, 1993).

With environmental issues, the "educators have to recognize that

the environment can and does serve as an important societal and relevant educational context for learning science and mathematics” (Marcinkowski, 1994, p. 5). The knowledge obtained through environmental issues can also be promoted through the cooperation of such subjects as geography, chemistry, and social sciences which in return can form the basis of environmentally conscious behavior. This in part will allow students to learn the content of the lesson through personal experiences by being connected to the knowledge they gain. The understanding that all living things are connected can be obtained through hands-on techniques which often heightens the effective learning by being in a natural setting with nature itself as the subject (Kane, 1992 & Project Aquatic, 1992).

In the development of environmental education, it is “one part of the curriculum battlefield on which everyone might be willing to fight on the same side” (Lewis, 1990, p.581). It will allow students to have the knowledge and tools necessary to motivate responsible environmental action through hands-on activities and problem solving of all the subject disciplines.

According to Thomas Good, author of Educational Psychology, the three general principles for using instructional objectives are as follows:

1. State a few major objectives rather than a great many trivial ones for a given unit.
2. Do not be unnecessarily behavioral or precise.
3. Do not be overly rigid in using objectives to guide

instruction (1990).

UNESCO has indicated that the implication of the following goals and objectives will enable a better understanding of environmental issues for the students:

1. The knowledge of science content areas of ecology and environmental science.
2. The knowledge of science inquiry from the development of skills and strategies for investigating problems and issues.
3. The knowledge of citizenship responsibilities from the development of skills, strategies, and affective dispositions for citizenship involvement in the resolution of such problems and issues (Marcinkowski, 1994).

For the teacher, it is important to provide both affective and cognitive objectives in order for the students to adopt an environmentally conscious attitude. The following criteria allows for the successfulness of the teacher:

1. Knowledge about oneself which is the analysis of one's own educational contribution to the educational process.
2. Knowledge about the child which recognizes that the child is learning, dependent on guidance, and is formed by the education itself.
3. Knowledge about the world which is the analysis of present events and their implications on educational interaction (Kastenholz & Erdmann, 1994).

According to some curriculum specialists, it is generally agreed that goals are needed to provide a sense of direction for curriculum development and instruction. The primary objectives focus on assisting students to acquire knowledge, skills and attitudes. There was a lack of emphasis upon objectives which focused on helping students actually solve environmental problems and the development of problem solving skills. Hungerford and Peyton state environmental curriculum to be the "sum total of all the experiences learners have under the auspice of the school that relate to the knowledge, skills, attitudes and human behaviors associated with the acquisition of an environmentally appropriate life style" (1984, p. 11).

Hungerford, Peyton and Wilke provide a four level sample model of curriculum development in environmental education:

Level I: Ecological Foundations - This level seeks to prepare the receiver with the knowledge necessary to make ecologically sound decisions with respect to environmental issues.

Level II: Conceptual Awareness - This level seeks to guide the development of a conceptual awareness of how individual and collective actions may influence the environment and how environmental issues must be resolved with respect to investigation, evaluation, values clarification, decision making, and citizenship action.

Level III: Investigation and Evaluation - This level provides for the

development of knowledge and skills necessary to allow the receivers to investigate environmental issues, how evaluate solutions, and value clarification.

Level IV: Environmental Action Skills - This level seeks to guide the development of those skills necessary for the receivers to take an environmental action that is positive for the purpose of taking responsible citizen action (Hungerford & Peyton, 1984)

III. Attitudes and Values

“Attitudes toward nature are set by the time children reach fourth grade” (Estates, 1993, p. K6). Developing an environmental ethic at an early age will hopefully install the attitudes necessary to turn around our throw-away society so that the link between education, the economy and the environment can reach an equilibrium to sustain all life. A problem to overcome during this development is our human-centered perspective that we are separate from the environment. There needs to be a breakdown of our self-centeredness through environmental education that show “the individual connections to today’s environmental problems.” The education obtained “should help individuals learn what they can and should do to improve the environment and create a desire in each person to take actions, including those that require individual sacrifice” (Gigliotti, 1994, p. 25). But to convince someone of the interrelations between humans and the environment, there has to be a major shift in the relationship through a long term societal effort in environmental education (Cortese, 1991). Once this has been

established, hopefully a non anthropocentric approach can be adopted which can develop an ethical perspective toward human abilities so that historical achievements can be established for future generations to follow.

Research indicated that there are five general categories of teaching strategies for value development:

1. Awareness
2. Values Clarification Strategies
3. Values Analysis Strategies
4. Social Action Activities
5. Cognitive Moral Development Strategies (Engleson, 1985).

Awareness activities help to develop the student's sensitivity to the existence of certain stimuli. They provide the student with methods of perceiving the world and responding to it. The Activities often involve created experience so that the student can more easily differentiate the existence of things in the environment and the feelings these things stimulate in oneself (Engleson, 1985).

The awareness is generally associated with the first and second levels of affective development. These levels share an emphasis upon perception and understanding as the starting point for value development.

Values clarification strategies emphasize valuing, series of processes and sub processes:

- Choosing: 1. Making choices freely.
2. Discovering, examining, and choosing from alternatives.
3. Considering thoughtfully the consequences of each alternative.
- Prizing: 4. Prizing and cherishing choices
5. Affirming choices publicly.
- Acting: 6. Acting, behaving, and living in accordance with choices.
7. Acting repeatedly on choices, in some pattern of life (Caudto, 1985).

By increasing the students self-awareness, values clarification activities can often disclose a student to inexpedient between preferred attitudes and actual behavior. Through first-hand experience, students gain skills and knowledge in group organization and interpersonal relations. Values Clarification can help learners:

- A. to become aware of and identify their own values and those of others.
- B. to communicate openly and honestly with others about their values.
- C. to use both rational thinking and emotional awareness to examine their personal feelings, values and behavior patterns (Caudto, 1985).

Values clarification strategies combined a wide variety of

techniques for value development. Strategies may include the following:

- * large and small group discussions
- * individual and group work
- * hypothetical and real dilemmas
- * rank order and forced choices
- * sensitivity and listening techniques
- * songs, artwork, games and simulations
- * personal journals and interviews (Engleson, 1985).

“Teachers using values clarification strategies should respond to students in ways which encourage students to consider their own choices, value decisions, and actions” (Engleson, 1985, p. 30).

Value Analysis Strategies, like values clarification, emphasizes rational and logical decision making. Value analysis is organized as a six step process:

1. Identify and clarify the value question.
2. Gather and organize facts or statements claimed to be facts about the value question.
3. Assess the validity of facts.
4. Determine that the facts are related to the value question.
5. Arrive at a possible decision or solution.
6. Decide if the possible solution or decision is acceptable to the individual or individuals making the decision (Engleson, 1985).

Value analysis differs from that of values clarification strategies by

emphasizing the subordination of feelings and emotions to reasoning and comprehension. It is "less focused on self-awareness and more focused on on the resolution of value conflicts or social issues according to logic, science, and rationality" (Engleson, 1985, p. 33).

Social action activities stress community based learning rather than classroom-based. The activities supply chances for students to operate on the value decisions they have produced and make positive alternatives in their environment. For value development, social action approach can be applied by the following six steps:

1. Become aware of the problem or issue.
2. Understand the problem or issue and take a position.
3. Decide whether to act.
4. Plan strategies and take action.
5. Implement strategies and actions.
6. Reflect on actions taken and consider next steps

(Engleson, 1985).

For social action activities, environmental issues or problems provide a natural focus. It provides the students with an opportunity to participate as active citizens in not only their schools, but also in the community which enables the student to gain practice in important political participation skills. "Social action activities are potentially the most valuable learning experiences students can have" (Engleson, 1985, p. 36).

Cognitive moral development strategies are a six step process that

involves movement through each stage which roughly correspond to the four levels of cognitive development identified by Piaget. The transformation from one stage to another is motivated by recognition of the "inadequacies of reasoning or the presence of cognitive conflict at a current stage reasoning and seeing greater adequacy of another higher level of reasoning" (Engleson, 1985, p. 37). The six stages of cognitive moral development strategies are as follows:

1. Because of the physical form or the consequences of the act, motives of an act are ignored in judging the goodness or badness of the act.
2. An act is judged on its instrumental value rather than on its consequences.
3. An act is evaluated on the basis of the type of individual likely to perform the act.
4. An act is always wrong, regardless of motives or circumstances, if it violates a rule or law and does foreseeable harm to others.
5. Although circumstance or motive may modify disapproval, as a general rule the ends do not justify the means.
6. An act is right if it results from a decision to follow general, self chosen principles.

The six step process of value analysis provides a succeeding guide to investigation, analysis, and logical decision making. It is useful in interdisciplinary studies (Engleson, 1985).

Social action activities allows the student an opportunity to process the value decisions they have made by making positive changes in their environment. The activities “stress a community rather than a classroom-based learning” (Engleson, 1985, p. 36).

Social action activities is a six step process to help develop values:

1. Become aware of the problem or issue.
2. Understand the problem or issue and take a position.
3. Decide whether to act.
4. Plan strategies and action steps.
5. Implement strategies and take action.
6. Reflect on the actions taken and consider next steps (Engleson, 1985).

Environmental issue or problems provide a natural focus for social action activities. It is “potentially the most valuable learning experiences students can have” by providing opportunities to participate as “active citizens in their school or community” (Engleson, 1985, p. 36).

Cognitive moral development strategies are based on Lawrence Kohlberg’s theory of cognitive moral development. It states that moral development is a “long-term process and involves movement through six stages which roughly correspond to the four levels of cognitive development identified by Jean Piaget” (Engleson, 1985, p. 38).

The six stages of cognitive moral development strategies enables the student to move from one stage to the next through stimulating the

recognition of insufficiencies of reasoning and/or the existence of cognitive conflict at the present stage by visualizing a greater sufficiency at a high stage of reasoning. The six stages are as follows:

- Stage I: Motivation of an act are ignored in the judging of goodness or badness of the act, because of the physical form or the consequences of the act.
- Stage II: Judgments are made on the instrumental value instead of on its consequences.
- Stage III: The type of person likely to perform the act is how the basis of evaluation is formed.
- Stage IV: If an act violates a rule or law, and if it does foreseeable harm to others it is always wrong, regardless of the motivations or circumstances.
- Stage V: When as a general rule the ends do not justify the means, although circumstances or motives may modify disapproval.
- Stage VI: A violation of the rules may be justifiable if the choices are between deviation and concrete principle. The act is right if the results from the decision follow general, self chosen principals (Engleson, 1985).

When implementing values education, it must first be taught on a small scale teaching empathy toward ones immediate environment.

"Values are in turn formed by a meld of closely aligned

attitudes. A value is an enduring conviction that a specific mode of conduct or end state of existence is personally or socially preferable to an opposite mode of conduct or end state of existence" (Caudto, 1985, p. 18).

IV. Teaching Techniques and Strategies

Utilizing the use of nature itself, one becomes more aware of the surrounding ecology. The "hands-on leads the students to understand and remember important concepts of the environment" (Project Aquatic, 1992, p. 201).

According to Bridges to the Natural World, becoming involved is the key to knowledge and understanding of the natural world (1992).

This is a four stage activity that is easy to follow:

- Stage I: Transition activity - The first initial step into the outdoors.
- Stage II: Discovery activity - Takes place by getting involved with the natural habitats.
- Stage III: Classification activity - Allows the sorting out process to take place.
- Stage IV: Developing an environmental ethic - Walking lightly on the planet. This is the final stage, which I felt is the most important.

There are many different teaching techniques and strategies that can be employed during environmental education. The author of this curriculum project will now discuss the following techniques and

strategies:

1. Cooperative Learning
2. Discovery Learning
3. Simulation and Gaming
4. Group Investigation
5. Inquiry Method
6. Critical Thinking

Cooperative learning approaches replace independent seatwork with cooperative learning activities in which small groups work together on practice or application exercises (Good, 1990). The methods involved with cooperative learning are as follows:

1. Small groups of four to six students work together on learning activities.
2. Assignments require that students help one another while working on a group project.
3. In competitive arrangements, groups may compete against one another.
4. Group members contribute to group goals according to their talents, interests, and abilities (Parkay, 1992).

With cooperative learning there are four basic elements:

- A. Positive interdependence
- B. Face-to-face interaction among group members
- C. Individual accountability for mastering assigned material
- D. Instruction of students in appropriate interpersonal and

small-group skills (Good, 1990).

Cooperative learning arrangements have been found to promote friendship choices and pro social patterns of interaction among students who differ in gender, race, achievement, and ethnocentrism.

Cooperative learning also promotes the acceptance of mainstreamed handicapped students by their non handicapped classmates.

Frequently, cooperative learning has had some positive effects on affective outcomes such as self-esteem, academic self-confidence, liking for the class, liking and feeling liked by classmates, empathy, and social cooperation (Good, 1990).

In discovery learning, learners are exposed to experiences and guidance designed to lead the students to discover the target principal. The approach to discovery learning involves a ten step instructional strategy as follows:

1. Selecting positive and negative examples.
2. Varying case studies systematically
3. Selecting counter examples.
4. Generating hypothetical cases.
5. Forming hypotheses.
6. Testing hypotheses.
7. Considering alternative predictions.
8. Entrapping students.
9. Tracing consequences to a contradiction.
10. Questioning authority (Good, 1990).

Discovery learning approaches were first created from the basis that learning occurs through self-motivation and active exploring of areas of personal interest. Although there has been extensive exception of discovery learning approaches, there has not been an overwhelming acceptance of discovery learning principals as the primary approach to instruction. The following are limitations on discovery learning:

1. True discoveries are rare, and most of them are made by the brightest and most motivated students.
2. Discovery learning is uncertain and inefficient compared to more direct instruction.
3. It places the teacher in the unnatural role of withholding information from students who are experiencing frustration.
4. It needs careful planning and structuring (Good, 1990).

Simulation and games can be used to promote discovery learning.

Some activities involve role-playing based on actual events. Students generally respond exuberantly to simulation games. Simulation and gaming provides a risk-free environment for analysis of new information and decisions. Students learn to probe various points of view, as well as, enhancing their understanding of their personal relationship to life's processes and systems (Rockler, 1988).

Simulation exercises can include; but not be limited to; simulation games, full-scale drama, role play, and other "major productions" (i.e. the use of fantasy or imagination to expand their thinking on the content material). With practice and application activities, any content area of instruction can be

presented as a game by turning ordinary seatwork assignments into "test-yourself" challenges, puzzles, or brainteasers (Good, 1990, p. 482).

Research suggests that most students enjoy activities that allow the interaction of peers. Simulation and games can involve such activities as discussion, debate, and role play simulation by allowing students to work together in pairs or small groups. This allows the students to tutor one another, develop suggested solutions to problems, discuss issues, or to work as a team to prepare for competition (Good, 1990).

Group investigation involves cooperative learning by using a scientific method of research (Sharan, 1994). Students form a two to six member group that works together using cooperative inquiry, group discussion, and cooperative planning.

Through group investigation, the students choose subtopics from a unit of content studied by the whole class. The group then separates into individual tasks and carries out the activities needed to prepare the group report or presentation on the subtopic chosen (Good, 1990).

Group investigation conditions are created "that allow students to bring their entire range of personal abilities" (Sharan, 1994, p. 54). Students are challenged by molding, analyzing, and synthesizing bodies of information by using their own experiences to develop a defensible solution to a problem or issue.

The Inquiry method of teaching techniques appears to be beneficial when implemented properly. It allows students who are cognitively mature to pursue more complex content. Students are prepared to explore and discover

on their own (Good, 1990). The following five phase inquiry training teaches and motivates inquiry learning:

1. Presentation of puzzling stimuli.
2. The gathering of data.
3. Experimentation among the students.
4. The explanation of the problem.
5. The consolidation of the problem.

The students first learn how to “establish the facts, then determine relevant questions, and then develop ways to pursue those questions and build explanations for the results they discovered” (Good, 1990, p. 2).

When implementing inquiry activities, the teacher structures the learning environment and governs the activities, but allows the students to manipulate the intellectual development by using their ideas on the problem or issue. The following suggestions are beneficial for educators when implementing the inquiry method:

1. Encourage students to ask questions that can be answered with a yes or no. More general questions are harder to verify.
2. When students raise open questions, ask them to rephrase the question in terms that can be verified.
3. Help the students to recognize when they make statements that have not been verified.
4. Use and encourage the use of inquiry language (i.e., call informed guesses hypotheses, describe student’s explanations as theories).

5. Do not approve or reject students' theories.
6. Encourage the students to state their theories and assumption clearly to formulate specific plans for testing them.
7. Encourage the interaction among students (Good, 1990).

Critical thinking is the ability to think critically on a cognitive level. It should be an ongoing procedure that is encouraged at all levels of education.

The following five types of learning strategies enhances critical thinking:

- I. Rehearsal strategies - Involve actively repeating material or focusing on key concepts.
- II. Elaboration strategies - Involve formulating connections between the new material and the familiar material.
- III. Organizational strategies - Involve imposing structure on the material by dividing it into modules and identifying the superordinate-subordinate relationships.
- IV. Comprehension monitoring strategies - Involve remaining aware of what the student is trying to accomplish by keeping track of the strategies the student uses and the success achieved with them, and adjusting behavior accordingly.
- V. Affective strategies - Include establishing and maintaining motivation, focusing attention, maintaining concentration, managing performance anxiety, and managing time effectively (Good, 1990).

V. Environmental Residential Experiences

"Environmental education anywhere seeks to create a concern for

all environments that leads to a commitment to preserve optimum environments and improve less desirable environments. The resident environment education program affords this opportunity for one or more environments" (Conservation & Env. Studies Center, 1970, p. X).

An environmental educational residence program offers two notable advantages:

1. The social relationships among students and between students and teachers are strengthened.
2. The opportunity for a more intensified study by having a dawn to bedtime schedule (Conservation & Env. Studies Center, 1970).

Although environmental education begins in a classroom, residential programs offer a more meaningful experience. A residential outdoor educational program as defined by William Hammermann, the Director of Field Services for the School of Education at San Francisco State University, states it to be "an educational program that is conducted at a residential outdoor school (i.e., at a camp, conference ground or environmental center) for a time period of usually at least three days and two nights, and designed to facilitate and enrich learning goals related to the school curriculum" (Hammermann & Shenery 1984-85, p. 35).

An advantage of environmental residential experiences is designed to promote student's recognition of substantial ecological issues by being directly involved with real surroundings to promote the student's active exploration. Environmental residential experiences also directly involve the "understanding of the order and interrelationships among physical entities is a natural outcome

of ecological activities that are developmentally appropriate" (Cohen, 1990, p. 310).

VI. Review of Related Written Curriculum Materials

There are many written curriculum materials that have been considered more valuable than others by the writer. The author has assessed this value in respect to her direct application and/or probable use. The following is a brief analysis of these written curriculum materials.

Project Wild is an interdisciplinary, supplementary environmental education and conservation program designed for educators of grades kindergarten through high school. It is sponsored by the Western Association of Fish and Wildlife Agencies and the Western Environmental Education Council.

PROJECT WILD is based on the premise that young people and their educators have a vital interest in learning about the earth as home for people and wildlife. The program emphasizes wildlife as a way to understand our responsibilities to all living things.

Educators may use one or many PROJECT WILD activities. The activities may be integrated into existing written curriculum, or the entire set may serve as the basis for a course of study.

The fundamental goal of PROJECT WILD was to develop awareness, knowledge skills, and commitment; which will result in informed decisions, responsible behavior, and constructive actions for wildlife and the environment upon which all life depends (Western Regional Env. Ed. Council, 1992). The major sections of Project Wild's framework included:

Section One:	Awareness and Appreciation of Wildlife
Section Two:	Diversity of Wildlife Issues
Section Three:	Ecological Principles

Section Four: Management and Conservation
Section Five: People, Culture and Wildlife
Section Six: Trends, Issues and Consequences
Section Seven: Responsible Human Actions (Western Regional Env.
Ed. Council, 1992, p. Xii).

Bridges to the Natural World was developed to assist New Jersey educators in leading students to a better comprehension of their indigenous natural environment. It is sponsored by New Jersey Audubon Society and is intended for grades kindergarten through sixth.

BRIDGES TO THE NATURAL WORLD offered hands-on experiences that could be performed within the boundaries of the classroom or outside using the environment itself as the classroom.

The essential goal of this book was to develop an awareness that all living things are connected and that humans are not the possessors of the earth, but part of the earth (Kane, 1992). The major sections included:

Section One: Habitats of New Jersey
Section Two: Natural History Activities
Section Three: Helpful Hints
Section Four: Appendices and References.

Project Learning Tree, also known as PLT, is a supplemental program in environmental education that can be easily integrated into the regular curriculum. PLT is jointly sponsored by the American Forest Institute and the Western Regional Environmental Education Council.

The written materials consisted of two activity guides, kindergarten through sixth and seventh through twelfth, containing a total of 177 multidisciplinary activities. The primary initiative in the development of the PLT materials was environmental awareness. The curriculum was written by

classroom educators, with assistance from the above organizations.

An extensive bibliography categorizes books and articles for educators and students, along with films, pamphlets and other related curriculum materials. Each guide also provided a glossary of environmental terms. The activities may take in a variety of learning environments; within the classroom, outdoors, schoolyard and community surroundings.

Creative, Hands-On Science Experiences was written for people of all ages and for those in any occupation. The major emphasis was placed on beginner activities. These activities were designed to prompt children to ask "Why" or "What would happen if" type questions about science events through the use of exploration.

This book used customary English measurements, with metric measurements in parentheses and focused on interdisciplinary activities. The development of the activities placed an emphasis on touching and valuing through the use of investigation.

The contents of this book included a suggested "Scope and Sequence" for kindergarten through sixth grade in Chapter One that included Biological, Physical, and Earth & Space Science concepts.

Teaching Workshop Handbook For Resident Environmental Education Programs was designed by the staff of the Conservation and Environmental Studies Center under the guidance and supervision of Dr. V. Eugene Vivian.

The design of the handbook enabled educators to obtain a worthwhile illustration of the variety of activities and programs used in a resident program for environmental education. The handbook provided information and

guidelines about the following significant items:

1. The role of teachers who participate in resident programs.
2. Preparation and planning of resident programs.
3. Use of the natural outdoor as a learning environment.
4. Written curriculum materials suitable for an environmental resident program.
5. The goals and objectives of an environmental resident program.
6. The evaluation of an environmental resident program.

The New Jersey Pinelands, Our Country's First National Reserve: A Curriculum Guide was developed in 1986 by Elizabeth Anderson, Clifford Daniels, Richard Fursich, Per Ower and George Young for the Pinelands Commission and funded by a grant from the Geraldene R. Dodge Foundation and the Victoria Foundation.

There were two curriculum guides developed, one for grades fourth through sixth and the other for grades seventh through eighth. Both are an extension of an audio-visual program of the same name. The information and activities in both were designed to:

- * Develop an appreciation of the uniqueness, complexity and ecological sensitivity of New Jersey's Pinelands.
- * Encourage further investigation of the New Jersey Pinelands.
- * Nurture an environmental ethic as it relates to the New Jersey Pinelands.
- * Promote recognition of the need for careful land use management that will preserve, conserve, and maintain this unique habitat.

The curriculum guides consisted of a General Information Unit and topic units including Pinelands Soil, Pinelands Fire, Pinelands Water, Pinelands Plants and Pinelands People. The activities in the units were easy to follow and

could be used unequivocally or partially.

Audio-Visual Program - The New Jersey Pinelands, Our Country's First National Reserve is a seventeen minute audio-visual program that consisted of eighty color slides accompanied by local music, natural sounds, and narration. The program presented an overview of the ecology and cultural history of the unique Pinelands area. Viewers are introduced to the region's natural resources, cranberry and blueberry agriculture, rare plants and animals, and human's historic use of the resources for early industries. Scenic views, applicable graphic slides and maps are also included. Finally, features of the Pinelands Comprehensive Management Plan are discussed.

Wow! : The Wonders of Wetlands was designed for grades kindergarten through twelfth. Each unit focused on different topics pertaining to the wetlands. Some of the lessons were borrowed from other curriculum or supplementary sources such as PROJECT WILD.

The beginning of this guide contained background information with a list of resources at the end for educators. The last unit contained a "Restoration and Action" guide which suggested projects for students to practice and reinforce what they have learned in the previous units.

Keepers of the Earth is a two hundred and nine page collection of Native American stories and activities designed to educate people about the nature of Earth and human society, and how people can live within the means that surround them. The book used an interdisciplinary approach for grades kindergarten through sixth.

In conclusion, all of the written curriculum materials reviewed in this

section emphasized an interdisciplinary approach. The need of effective environmental education following updated-goals, curriculum guides, and materials are integral components to a successful program. Measured gains of knowledge and positive attitude toward the environment are usually achieved if this type of encompassing written curriculum material is utilized. This author will implement the interdisciplinary approach, in developing her written curriculum materials. The written curriculum materials developed will follow the given format for all Cherry Hill Science Units.

CHAPTER THREE

DESIGN OF THIS PROJECT

The Cherry Hill Environmental Education Residency Program, also known as CHEER, has been in existence for twenty-seven years. The program provided an interaction between teachers and students through lesson activities, scheduled meals, evening programs, and cabin supervision over a five day residence stay at the "site-specific" location of Mt. Misery in the Pinelands National Reserve.

This thesis project was designed to develop written curriculum materials to be used solely by the Cherry Hill Public School's sixth grade students. The written curriculum materials developed correlated with the existing classroom Pinelands science unit which would be the foundation in the ramification of an environmental lesson for the resident program.

The written curriculum materials included interdisciplinary pre-trip, resident trip, and assessment materials and activities on Pinelands ecology. Such subject areas as ecology, math, chemistry, science, social studies, and language arts were developed to include both cognitive and affective objectives that followed the criteria of the given format for all Cherry Hill Public School Science Units.

Methodology

The present sixth grade science unit on Pinelands ecology at Cherry Hill Public School was evaluated. A need was recognized by Environmental Education Coordinator, Terry Patton, to produce written curriculum materials for the existing classroom Pinelands Science Unit which will be the foundation in

the development of an environmental lesson for the resident program (see appendix A).

The author used pedagogical techniques such as hands-on activities, cooperative learning, discovery, group investigation, inquiry method, and critical thinking in the development of the written curriculum materials.

A hands-on approach was utilized to complete the majority of the written curriculum materials on Pinelands ecology. The lessons involved activities that promoted interaction among the students, and among students and teachers. The lessons helped to establish an initial awareness of the environment that surrounds the students and how they are a living component of that environment.

Procedures

The procedures used to develop the written curriculum materials followed the given format of all Cherry Hill Public science units. The Cherry Hill Public Schools Elementary Science Unit Grade Six - The Pinelands is as follows:

CHERRY HILL LESSON FORMAT

LESSONS:	Each lesson will present a topic and include the components listed below.
CONCEPT:	The major concept to be developed through the lesson is stated.
OBJECTIVE:	Each lesson includes a statement of the objective to be accomplished by each student.
VOCABULARY:	The terms and vocabulary to be introduced to the students through the lesson are listed.
PROBLEM:	Following scientific procedures, each concept to be developed is presented as a problem.
HYPOTHESIS:	Based on the problem presented, a hypothesis is either stated by the teacher or developed by the class.
MATERIALS:	A list of supplies needed to conduct the basic lesson is included.
PROCEDURES:	A suggested sequence to follow while conducting the lesson is included. All lessons require an introduction and follow-up question.
ACTIVITY SHEETS:	Record sheets are included for students to record lesson activities, observations, and procedures.
CONCLUSION:	A statement is included which serves to verify or change the stated hypothesis.
ASSESSMENT:	Observation of groups working cooperatively, recording data collected, proper care and return of equipment.
EXTENDED ACTIVITY:	Activities for a more in-depth study of the lesson concept are included at the end of each lesson.
COGNITIVE SKILLS:	Cognitive skills related to the tasks students are to perform are listed for each lesson.

Sources of Data

Through the Graduate Assistantship with the Cherry Hill Public Schools, the author experienced Pinelands ecology lessons at Mt. Misery. The author participated as a supplemental teacher and taught the lesson on Pinelands ecology, as well as, observed the lesson being taught by other instructors.

Through the author's experience and the observation of the Pinelands ecology lesson, the author was able to determine the strengths and weaknesses of the lesson.

From the evaluations of the Pinelands ecology lesson, the author was able to develop written curriculum materials that followed the given format of all the Cherry Hill Science Units.

An extensive variety of sources were used to produce the written curriculum materials which included both published and unpublished materials.

The author used the existing Pinelands science unit of the Cherry Hill Environmental Education Residency Program as a guideline, as well as, the given format for all Cherry Hill Science Units.

The author also utilized information gathered from libraries such as Rowan College Library, Burlington County and Burlington Community Libraries, reference materials from the CHEER program of Cherry Hill Public Schools and from Cherry Hill East High school Resource Room, books and other reference materials including New Jersey Pinelands: Comprehensive Management Plan, Environmental Education in New Jersey: A Plan of Action, Pine Barrens of New Jersey: A study of Significance, and the locations of the Conservation and Environmental Studies Center, the P.I.N.E.S. Institute located at Whitesbog,

New Jersey, and the grounds of Mt. Misery in the Pinelands National Reserve.

The information gathered, facilities visited and reports viewed were used in the development of the written curriculum materials in chapter four of this thesis project.

Background of the Researcher

The author graduated Rowan College of New Jersey with a Bachelors of Biological Science and has successfully completed most of the pedagogy classes needed for certification in secondary education.

The author is a current matriculated student of the Environmental Education and Conservation Master of Arts program at Rowan College of New Jersey and also, has been awarded a Graduate Assistant position at Rowan College of New Jersey for the P.I.N.E.S. Project.

The author is directly involved with the CHEER program for one school calender year. During that one year, the author was a supplemental teacher at Mt. Misery and taught a variety of environmental lessons for the CHEER program. The author was also actively involved with the educational lessons taught at the P.I.N.E.S. Institute located at Whitesbog, New Jersey.

CHAPTER FOUR

THE PROJECT

This chapter presents the written curriculum materials in accordance with the purpose stated in Chapter One. All vocabulary words discussed were taken from the Cherry Hill Public School Science Unit Glossary and can be found in appendix A. The lessons are presented in the following given format of all Cherry Hill Public School Science Units:

- LESSONS:** Each lesson will present a topic and include the components listed below.
- CONCEPT:** The major concept to be developed through the lesson is stated.
- OBJECTIVE:** Each lesson includes a statement of the objective to be accomplished by each student.
- VOCABULARY:** The terms and vocabulary to be introduced to the students through the lesson are listed.
- PROBLEM:** Following scientific procedures, each concept to be developed is presented as a problem.
- HYPOTHESIS:** Based on the problem presented, a hypothesis is either stated by the teacher or developed by the class.
- MATERIALS:** A list of supplies needed to conduct the basic lesson is included.
- PROCEDURES:** A suggested sequence to follow while conducting the lesson is included. All lessons require an introduction and follow up.
- ACTIVITY SHEET:** Record sheets are included for students to record lesson activities, observations, and procedures.

CONCLUSION:	Statement is included which serves to verify or change the stated hypothesis.
ASSESSMENT:	Observation of groups working cooperatively, recording data collected, proper care and return of equipment.
EXTENDED ACTIVITY:	Activities for a more in-depth study of the lesson concept are included at the end of each lesson.
COGNITIVE SKILLS:	Cognitive skills related to the tasks students are to perform are listed for each lesson.

The written curriculum materials are divided into the following topics and lessons:

Pre-trip lessons

Pinelands Soil

Pinelands Plant Profile

Animal Habitats

Pinelands Fire Ecology

Resident trip lesson

Pinelands Ecology - A Quest for Knowledge

Assessment Materials and Activities

Pinelands Patchwork

Pinelands Comparison

The pre-trip written curriculum materials were derived from the existing Cherry Hill Public Schools Science Unit - Grade Six: The Pinelands of New Jersey and are as follows:

LESSON: PINELANDS SOIL

CONCEPT: Although the predominant sandy soil of the Pinelands is largely infertile, it supports a variety of life.

OBJECTIVE: Given a set of experiments, the students will be able to compare and contrast Pinelands soil of Cherry Hill.

VOcabULARY: Aquifer, percolation, leaching, porous, topographic, disposition, retention

PROBLEM: What are the basic characteristics of Pinelands soil?

HYPOTHESIS: The Pinelands soil is predominantly sand. It has little water retention, is acidic, and lacks the fertility to grow most crops.

MATERIALS:	Fact sheet	Activity sheets
	pH soil kit	2 packets of Kool Aid
	Pinelands soil	Cherry Hill soil
	2 coffee cans	2 coffee cans with holes punched in bottom

PROCEDURE: Introduce problem and place hypothesis on board.

Divide students into three groups.

Hand out activity sheets with soil experiments.

Experiments can be done as class demonstrations or each group could be assigned an experiment to share with the class.

As a class, discuss and share the written results.

Distribute the fact sheet for students to verify the results of the experiments.
Discussion of Lakehurst soil profile can lead to the extended activity.

CONCLUSION: Pinelands soil, which is predominantly sand, has little water retention ability. Therefore, it dries out quickly, has a fast percolation rate, and because there are large spaces between sand particles, dissolved nutrients and pollutants can easily move to the water table.

ASSESSMENT: The observation of the group working together cooperatively, recording data collected, proper care and return of equipment used.

EXTENDED ACTIVITY: Prepare a soil profile of two different soils in Cherry Hill. Dig between 12 inches and 24 inches into the ground. Dry each sample. Using white glue, sprinkle the different horizons (layers) of soil on a piece of oak tag paper. On the paper give the soil's location, the depth of each soil horizon, and try to identify its type (sand, clay, gravel, silt, etc.). If students can not identify the soil, they could describe it with the use of a hand lens.

COGNITIVE SKILLS:

Task
hypothesis
discuss
review
experiment
observe
explain
conclude

Skill
synthesize
synthesize
knowledge
application
knowledge
comprehension
evaluate

ACTIVITY SHEET

PINELANDS SOIL

Station One: SOIL PERCOLATION

Materials: 500 ml beaker
water
coffee can with holes punched in bottom
coffee can without holes punched in bottom
dry Pinelands and dry Cherry Hill soil

Directions: Answer Pinelands soil percolation question one

1. Fill the coffee can with holes punched in bottom with 500 ml of Pinelands soil.
2. Holding soil filled can over the empty coffee pan, pour 250 ml of water into the soil filled can.
3. Allow the water to soak through the sand and drip out the drainage holes into the empty can.
4. Use a watch or clock with a second hand to measure how long it takes the water to soak through and "stop" dripping. ("stop" dripping would be 10 seconds between drips or a maximum of 5 minutes). This is called the percolation rate. Occasionally move can to distribute evenly as it flows through the soil.
5. measure how much water dripped into the can using the empty 500 ml beaker. The "lost" water is referred to as water retention.
6. Repeat steps one through five using the Cherry Hill soil.

ACTIVITY SHEET - PINELANDS SOIL PERCOLATION

Questions for station one:

1. Predict how long it will take the water to "stop" dripping through the
Pinelands soil _____ Cherry Hill soil _____
2. Were your predictions correct? _____
3. What was the percolation rate?
Pinelands soil _____ Cherry Hill soil _____
4. How much water dripped through?
Pinelands soil _____ Cherry Hill soil _____
5. Where is the "lost" water? _____
6. Place **P** before the statement that is true for Pinelands soil and **C**
before the statement that is true for the Cherry Hill soil.

- _____ 1. Can percolate a lot of water quickly.
- _____ 2. Can percolate a lot of water slowly.
- _____ 3. Has little space between particle for water to pass through.
- _____ 4. Has a lot of space between particle for water to pass through.
- _____ 5. Retains much water.
- _____ 6. Retains little water.
- _____ 7. Dries out quickly.
- _____ 8. Dries out slowly.
- _____ 9. Does not filter out pollutants effectively.
- _____ 10. Does filter out pollutants effectively.

ACTIVITY SHEET - PINELANDS SOIL

Station Two: SOIL INFILTRATION

Materials: Pinelands soil Kool Aid
 500 ml beaker water
 coffee can with holes punched in bottom
 coffee can without holes punched in bottom

Directions: Read all the question and answer question one.

1. Place 500 ml of Pinelands soil into the coffee can with holes punched in bottom.
2. Sprinkle 1 full package of Kool Aid over the top of the soil and pour 250 ml of water into the Pinelands soil filled can.
3. Hold the soil filled can over the empty can and collect water for a maximum of 5 minutes.

Questions:

1. Predict what will happen to the water poured through the soil. _____

2. Was your prediction correct? _____
3. How much water percolated through? _____
4. What could the Kool Aid represent? _____
5. How would development of the Pinelands affect the quality of the water? _____

Extended: Allow the soil to dry for several days and then pour 250 ml of water through again. Note the color _____

What does this tell you about pollutant that get into the water? _____

ACTIVITY SHEET

PINELANDS SOIL

Station Three: SOIL pH

Materials: Soil pH test kit
Pinelands and Cherry Hill soil samples

Directions: See and follow directions in the soil pH test kit

Questions:

1. What is the value of knowing the pH of the soil? _____

2. Is it normal for Pinelands soil to be acid or basic? _____

3. Compare the two samples of soil (color, texture, etc.) _____

4. Explain this phrase, "soil, we need it to grow". _____

FACT SHEET - PINELANDS SOIL

Much of the land within the Pinelands National reserve contains soils developed from the Cohansey geologic formation. These soils are mostly medium to coarse grain sands, although some thin clay soil layers are present. This geologic formation was deposited on the ocean floor between thirteen and twenty-five million years ago, during a time that geologists call the Miocene period.

The soils developed from the Cohansey formation are very porous and infertile. The greater proportion of coarse particles in a soil the less it is able to retain water and nutrients. Thus, even though the Pinelands may receive the same amount of rainfall as land along the Delaware River or land in northern New Jersey, the water moves so rapidly through the sandy soil that little moisture and a few nutrients are kept.

Pollutants, like large quantities of water soluble chemicals in liquid form, are able to move quickly through the sandy soil to the water table. It is important to remember this when determining the amount of chemicals that may safely be used on both agricultural and residential land. Without careful planning, it would be easy for pollutants to reach the water table and harm the water supply.

Soils are grouped into series according to the geologic material from which they develop, as well as the makeup of their topsoil. Water tables and topographic positions can vary. The soils with the higher fluctuating water table tend to be situated in low level areas that have the ground water table near the surface. There is virtually no surface runoff

in the Pinelands.

Water table depth has a major effect on the sandy Pinelands soils as they develop from the parent material. The kinds of trees and shrubs that grow in different parts of the Pinelands are related to water table depth.

When settlers first came to the region during the 1600's and 1700's, they discovered most of the regions soils would not support cattle and the agriculture. For this reason, they named the region the "Pine Barrens". Since the 1800's and early 1900's, cranberries and blueberries (both requiring highly organic surface soil, a relatively high water table, and acidic conditions) have been cultivated and grown on a commercial basis. Today, these crops are an important part of New Jersey's agricultural industry. Although the sandy soil of the Pinelands is largely infertile, it does support a variety of life.

FACT SHEET
SOIL PROFILE FOR PINELANDS LAKEHURST SAND

<u>Horizons</u>	<u>Depth</u>	<u>Leaf litter and duff</u>
A₁	2"	soil particles: sand grey color
A₂	11"	soil particle: sand grey to black color
B	32"	soil particles: sand color: dark brown to light yellowish-brown with light gray mottles
C	60"	soil particles: sands light gray color

- A₁** horizon: Surface layer is from a dark grey to a black because of organic matter.
- A₂** horizon: Subsurface is a lighter color than surface and zone of removed nutrients.
- B** horizon: Dark iron color, finer components from subsurface, and may contain clay
- C** horizon: Substratum is lighter in color and contains sand, clay, and mineral particles.

LESSON:	PINELANDS PLANT PROFILE
CONCEPTS:	Water table depth influences the type of plant community. The vegetation of the Pinelands consists of: Layers of trees, a lower growing shrub layer, and a ground cover of herbaceous plants.
OBJECTIVES:	Given a video on the Pinelands, the students will be able to develop a list of plants by categories (tree, shrubs, or herbaceous plants) and habitat (upland, lowland, or bog).
VOCABULARY:	Herbaceous, shrub, upland, wetland, and bog
PROBLEM:	What determines the vegetation that grows in the Pinelands?
HYPOTHESIS:	Water, fire, soil, and man determine the vegetation of the Pinelands. Upland areas are above the sea level and have low water table. Wetland areas are lowlands that are mostly swampy due to the fact that the water table is at or near the surface. Bog areas have spongy soil and are mostly in the water table.
MATERIALS:	Video: The New Jersey Pinelands: Our Country's First National Reserve Pinelands Profile and Pinelands Plant List Plant field guide (optional)
PROCEDURE:	Divide the class into groups (according to class size). Distribute the fact sheet: Pinelands Profile and Plant List. Have the groups discuss the difference between trees, shrubs, and herbaceous plants. Using the plant list, have the groups discuss and determine the habitat for each plant. In pencil, place a "U" for upland and a "W" for wetland, before each plant. Some plants may grow in both areas.

Inform the groups that they are going to see the video, *The New Jersey Pinelands: Our Country's First National Reserve*, for the second time. As they watch the video, have keep in mind the two major areas of the Pinelands (uplands and wetlands) and the plants that live in each.

After showing the video, have each group check and revise their list. A plant field guide may be used to check their decision.

As a class, have the groups share their lists. Have each group describe and depict either an upland or wetland environment to be shared with the class.

CONCLUSION: Trees, shrubs, and herbaceous plants of the Pinelands grow either on the dry areas of the uplands or the water saturated soils of the wetlands.

The abundance of moisture in the wetlands supports dense vegetation and reduces the chances of fire.

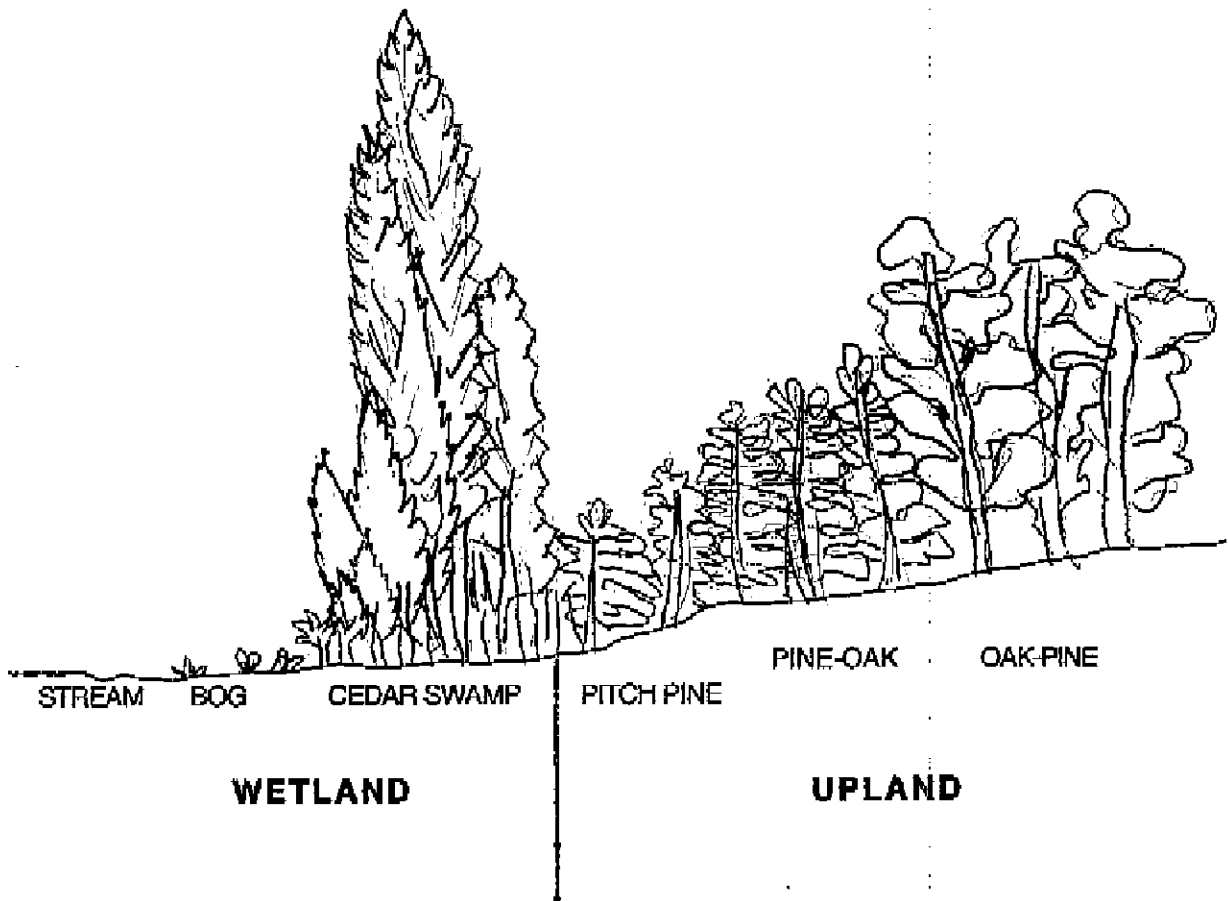
ASSESSMENT: The observation of groups working cooperatively recording data collected, proper care and return of equipment.

EXTENDED ACTIVITY: Supply each group with poster paper, magazines, glue, and scissors. Have each group design a collage of either an upland or wetland plant environment.

COGNITIVE SKILLS:	<u>Task</u>	<u>Skill</u>
	hypothesis	synthesize
	classify	comprehension
	describe/depict	comprehension
	conclude	evaluate

PINELANDS PLANT PROFILE

PROFILE OF PINELANDS UPLAND AND WETLAND VEGETATION



PINELANDS PLANT LIST

TREES

- _____ pitch pine - *Pinus rigida*
- _____ Atlantic white cedar
- _____ red (swamp) maple
- _____ scrub oak - *Quercus ilicifolia*
- _____ blackjack oak - *Quercus marilandica*
- _____ chestnut oak - *Quercus prinus*
- _____ swamp magnolia - *Magnolia virginiana*

SHRUBS

- _____ high bush blueberry - *Vaccinium corymbosum*
- _____ low bush blueberry - *Vaccinium vacillans*
- _____ swamp azalea - *Rhododendron viscosum*
- _____ Bayberry - *Myrica pensylvanica*
- _____ cranberry - *Vaccinium macrocarpon*
- _____ leather leaf - *Chamaedaphne calyculata*
- _____ mountain laurel - *Kalmia latifolia*
- _____ sheep laurel - *Kalmia angustifolia*
- _____ pinebarrens heather - *Hudsonia ericoides*

HERBACEOUS PLANTS

- _____ lichens - *Cladonia* spp.
- _____ pitcher plant - *Sarracenia purpurea*
- _____ water lily - *Nymphaea odorata*
- _____ round leaf sundew - *Drosera rotundifolia*
- _____ wintergreen (Teaberry) - *Gaultheria procumbens*

FERNS

- _____ bracken fern - *Pteridium aquilinum*
- _____ cinamon fern - *Osmunda cinnamomea*

LESSON: ANIMAL HABITATS

CONCEPTS: An animal's habitat is determined by the kind and amount of living space, food, shelter, air quality, and water it must have in order to survive.

New Jersey's Pinelands provides a variety of habitats that meet the survival needs of many animals.

OBJECTIVE: Given a game on animal habitats, the student will compile the correct answers to the game in order to learn about animal survival needs and Pinelands' animal habitats.

VOCABULARY: Bog, carnivore, habitat, herbivore, lowland, omnivore, pond, scavenger, space upland.

PROBLEMS: What is an animal habitat?

HYPOTHESES: A habitat is a place that has everything a life form needs in order to survive.

Habitats found in the Pinelands include: uplands (pitch pine and oak forests), wetlands (cedar swamps, marshes), cranberry bogs, rivers lakes/reservoirs, and streams.

MATERIALS: Question and answer cards, paper, writing utensil

PROCEDURE: Distribute to each student a numbered question and answer card for the game, "Do You Know?". Each card contains a single question with its answer. The numbered question is on one side of the card and the answer is on the reverse side (Fold card on dotted line to separate question for answer).

Explain to students that every card is numbered and that numerical order will follow in playing the game. Each student, based on the numerical order of his/her card, will ask the class a question.

Student answers will be elicited and written on the chalkboard. After an answer has been compiled, the student questioner will read the correct answer supplied on the back of his/her card.

Incorrect answers will be changed.

CONCLUSION: Ask students to copy the questions and correct answers.

ASSESSMENT: Observation of students working cooperatively recording data collected, proper care and return of equipment.

EXTENDED ACTIVITY: Computer program: "Oh Deer" MECC. A simulation of deer management.

Have each student select an animal of the Pinelands, research the animal's habitat, and write a brief report for an oral presentation.

COGNITIVE SKILLS:

<u>Task</u>	<u>Skill</u>
hypothesize	synthesize
recall	knowledge
discuss	synthesize
conclude	evaluate

ANIMAL HABITAT - QUESTIONS AND ANSWERS

DO YOU KNOW?

1. **QUESTION:** What is a habitat?

ANSWER: A habitat is a place that has everything a living thing needs to survive.

2. **QUESTION:** What are some of the things that people must have in order to live?

ANSWER: People need food, water, shelter, air, clothing, and tools in order to live.

3. **QUESTION:** What do animals need in order to live?

ANSWER: Animals need food, water, air, shelter, and space in order to live.

4. **QUESTION:** Why does an animal need food?

ANSWER: An animal needs food so that it can grow and have energy for movement and other body activities.

5. **QUESTION:** What is an animal called that eats only plants?

ANSWER: An animal that eats only plants is called a herbivore.

6. **QUESTION:** Where does an animal get food?

ANSWER: An animal gets food from its environment. Some animals eat only plants. Other animals eat only animals. Still, some animals eat both plants and animals. Finally, some animals eat dead or decaying animals.

7. **QUESTION:** What is an animal called that eats other animals?

ANSWER: An animal that eats other animals is called a carnivore.

8. **QUESTION:** What is an animal called that eats both plants and animals?

ANSWER: An omnivore is an animal that eats both plants and animals. An example is a red fox.

9. **QUESTION:** What is an animal called that eats dead or decaying animals?

ANSWER: A scavenger is an animal that eats dead or decaying animals?

10. **QUESTION:** Why does an animal need water?

ANSWER: Animals such as fish, beavers, some frogs, turtles, snakes, and insect larvae need water for their homes. Animals also drink water, find their food in water, clean their food with water (raccoons), and wash themselves with water.

11. **QUESTION:** Where can an animal get water in its habitat?

ANSWER: An animal can get water by drinking it from a stream, pond, or depression in which water collects. Also, an animal can get water by eating plants or other animals.

12. QUESTION: Why does an animal need shelter?

ANSWER: An animal needs shelter for a place to rest, a place to bear and raise its young, a place to store food, as well as a place to protect itself from enemies and inclement weather.

13. QUESTION: Why does an animal need space?

ANSWER: An animal needs space to find food, raise its young, exercise, and rest. Each kind of animal requires a different amount of space.

14. QUESTION: What are some of the habitats found in the Pinelands?

ANSWER: There are many different habitats in the Pinelands. These include uplands (pitch pine and oak forests), wetlands (cedar swamps, marshes, cranberry bogs), and bodies of water (rivers, streams, lakes/reservoirs).

15. QUESTION: What is an upland area?

ANSWER: An upland is relatively high in elevation and dry. Dry uplands cover about three quarters of the Pinelands. Some trees and shrubs that grow in it are pitch pine, chestnut oak, post oak, scrub oak, laurel, blueberries, and some myrtle.

16. QUESTION: What is a bog?

ANSWER: A bog is a wet area with spongy soil in which the water table is at or near the earth's surface. Cranberries are an agricultural crop that need an abundant, pure water supply; therefore, they are grown in bogs.

17. **QUESTION:** What is a swamp?

ANSWER: A swamp is a low lying ground in which water collects. Cedar trees or red (swamp) maple trees may grow in a swamp.

18. **QUESTION:** What is a pond?

ANSWER: A pond is a still body of water that is smaller than a lake. Ponds are often man-made and may be stocked with fish.

19. **QUESTION:** What is a stream?

ANSWER: A stream is a narrow body of water that flows into a larger body of water.

20. **QUESTION:** What is a river?

ANSWER: A river is a body of water that is larger than a stream and flows into a lake or ocean.

21. **QUESTION:** What are evidences of animals?

ANSWER: We can identify animals through sightings, track, droppings (scats), gnawing, songs, sounds, homes, runways, and rubbings.

22. **QUESTION:** What is the difference between a predator and prey?

ANSWER: A predator seeks and stalks an animal to eat. Prey is the animal hunted by a predator.

23. **QUESTION:** How does an animal protect itself from predators?

ANSWER: Animals protect themselves from predators through coloration, flight, confrontation, shape/size, and natural defense systems.

24. **QUESTION:** What is an ecosystem?

ANSWER: An ecosystem is a community of living (plants and animals) and nonliving (soil, weather, etc.) objects.

25. **QUESTION:** What is a food chain?

ANSWER: A food chain is a basic pattern within an ecosystem with green plants at one end of the chain, herbivores in the middle, and a few carnivores at the other end, with a variety of omnivores throughout the chain.

26. **QUESTION:** What is a food web?

ANSWER: A food web is a network of food chains within an ecosystem.

27. **QUESTION:** Why do animals communicate?

ANSWER: Animals communicate to mark territory, warn of danger, attract a mate, and instruct young.

28. **QUESTION:** How do animals communicate?

ANSWER: Animals communicate through scents, songs/sounds, and body posturing.

29. **QUESTION:** Why do some animals live in social groups?

ANSWER: Animals live in social groups for protection, obtaining food, and caring for young.

30. **QUESTION:** What information can you get from an animal track?

ANSWER: Animal tracks tell where an animal lives, what it can do best, its size, and its behavior.

LESSON:	PINELANDS ECOLOGY - FIRE
CONCEPT:	Fire in the Pinelands favors the development of pine trees.
OBJECTIVE:	Given the conditions for the germination of angiosperms and gymnosperm, the students will understand how fire alters normal forest succession.
VOCABULARY:	Serotinous, angiosperm, gymnosperm, germination, duff, deciduous, conifers, cambium, hardwoods, dormant, forest succession
PROBLEM:	Why are the Pinelands, the Pinelands?
HYPOTHESIS:	The frequency of killing fires in the Pinelands eliminates most species of trees except pitch pine. Pitch pine have a thick bark that protects their cambium from fire damage. The remaining ash from the ground debris favors the germination of pines (gymnosperm).
MATERIALS:	Bag marked "A" with assorted pine cones: An open one, a closed (serotinous) one, and one eaten by a squirrel. Bag marked "B" with assorted acorns Activity sheet and fact sheet Hot plate and disposable metal pan
PROCEDURE:	Divide the class into groups. Give each group a bag with an assortment of pine cones and acorns. Ask students to answer question one through four on the Pinelands ecology activity sheet. For question five, place a closed pine cone in a pan or metal pie plate and heat it on the hot plate. It will

open and deposit seeds (teacher demonstration).

For question six, discuss that the pine seed is a naked seed, a gymnosperm, and must be planted in soil to germinate. the acorn, an angiosperm, can germinate above the ground, because the food inside the acorn provides nutrients for the seed to germinate and to establish itself in the ground.

Have the students complete the rest of the question cooperatively, with the help of the Pinelands ecology fact sheet.

CONCLUSION: The forest succession is altered due to the conditions of the pine trees during a fire.

ASSESSMENT: The observation of groups working cooperatively recording data collected, proper care and return of equipment.

EXTENDED ACTIVITY: Research what has happened to Yellowstone National Park since its fires of 1989.

Pine Cone Sculptures

MATERIALS: pine cones, white glue, crayons or markers, pencils, string or thread, paper, scissors

PROCEDURES: Pine cones should be dry and free of dirt.

Cut out odd shapes and designs from your paper.

Add decorations to shapes with pencils, markers, and crayons.

Attach shapes to pine cone with white glue and let dry.

Hang up pine cones sculpture with string or thread.

VARIATIONS: Make a pine cone person or make a mobile by hanging several pine cones from a stick.

**COGNITIVE
SKILLS:**

Task

hypothesize
examine
discuss
identify
demonstrate
conclude

Skill

synthesize
analyze
knowledge
knowledge
comprehension
evaluate

ACTIVITY SHEET - PINELANDS ECOLOGY

Directions: Examine the contents of bags "A" and "B". With your group, complete the answers for questions one through four:

1. Identify A. _____ B. _____
2. Where do these come from?
A. _____
B. _____
3. What is inside?
A. _____
B. _____
4. How are these beneficial to animals?
A. _____
B. _____
5. How does nature open the items in Bag "A"?
(teacher demonstration)

Using the Pinelands ecology fact sheet, read discuss, and answer in groups the following questions:

6. Why are pine trees the dominant tree in the Pinelands? _____

7. Oaks are angiosperms and produce an enclosed seed called an acorn. What condition do they need for germination? _____

8. Pines are gymnosperm and produce naked seeds in a pine cone. What conditions do pine seeds need for germination? _____

9. What method do forest rangers use for the continuation of pines?

FACT SHEET - PINELANDS FIRE FACTS

Forest succession on cleared lands starts with softwood trees such as pines, and is followed by hardwood trees such as oaks. Hardwood trees eventually shade out the pines and can live longer than pines. Because a climax (older) forest has a lot more ground cover and debris, it favors the germination of hardwoods such as oaks.

Oak trees are angiosperms. Angiosperms are plants that have true flowers and have seeds which are found inside their fruit. Acorns are the fruited seed of an oak and can germinate on top of debris and ground cover. The seed gets food from the fruit to germinate. A shoot is sent into the ground, as the beginning of a root system.

Pine trees are gymnosperm. Gymnosperms have naked seeds, which means they are not enclosed in a fruit. For most gymnosperms, seeds are produced on female cones. Seeds inside pine cones are naked seeds, and they germinate best in loose fine soil.



ACORN - ANGIOSPERM

PINE SEED - GYMnosperm

The Pinelands of New Jersey does not follow normal forest succession. Nutrient poor soil, acidic water, and dry soil conditions are three major factors that affect forest succession of the Pinelands. They influence the kinds of vegetation that thrive in the fire prone forest. Some of the reasons these conditions support the growth of fire prone vegetation include:

Pinelands soils are acidic. As forest litter accumulates it does not easily decompose. This prevents nutrients from entering the upper layers of soil. These layers usually supply the nutrients to plants.

The acidic soils in the Pinelands have a low water retention (water holding) capacity. This often results in dry soil conditions.

With little decomposed litter, the region's soil is nutrient poor and often dry. Only vegetation like highly flammable pitch pine, can thrive under these conditions.

As a result of the presence of highly flammable vegetation, the build up of dry forest litter, and dry soil conditions, the upland forests of the Pinelands are fire prone.

After the duff has burned, the soil of the Pinelands no longer provides fuel for forest fires. Much of the vegetation in the Pinelands has developed adaptations to survive frequent fires. These include:

Thick bark of pitch pines prevents fire from destroying the living tissue inside the trees.

Newer trees sprout for the stumps of burned pitch pine and oaks after the tree has burned.

Serotinous (closed) cones of the pitch pine open up from the heat of the fire and the new seeds fall into the loose fine ash.

Rhizomes (underground stem running parallel to the ground) send up new leafy shoots on plants such as blueberries and bracken ferns.

Fire favors the development of pine trees. As long as there are fires, pine trees will be the dominant tree of the Pinelands.

FACT SHEET - PINELANDS ECOLOGY

The Lenape Indians burned the Pinelands forests to improve hunting and traveling. This burning eliminated small shrubs and other undergrowth.

During the 1700's and 1800's, common causes of forest fires included sparks from furnaces, forges, and passing trains. Other causes were human carelessness, arson, and lightening. Sometimes these fires destroy entire communities.

In New Jersey, 99% of all forest fires are set by people. Causes include:

Arson - 52.9% These fires are set willfully for a variety of reasons including spite, revenge, and economic gain.

Child related accidents - 14.6% Children playing with matches is a major cause of forest fires.

Smoking related fires - 11.9% Many fires are caused by matches and cigarettes that are carelessly discarded before they are completely extinguished.

Miscellaneous causes - 9.3% Examples of these are a building fire that spreads, or a fire started by an automobile accident.

Campfires (recreation) - 3.5% Fires of this type occur because the fire is too close to flammable material, or left untended.

Equipment use - 2.8% Fires of this type result from the careless use of chain saws, cutting torches, and earth moving equipment.

Debris burning (leaves, trash) - 1.6% Fires from burning debris have been greatly reduced since the state banned burning in 1972.

Frequent forest fires in New Jersey's Pinelands often prevent normal succession and development of a climax forest.

Animals that live in the Pinelands have adapted to, or are already

suited to the region's fire prone ecosystems.

Foresters often conduct prescribed burns in the winter to remove accumulated fuel. This intentional and controlled setting of fire removes forest litter and debris, which is the basic fuel for a forest fire. Controlled burning provided conditions suitable for the growth of pitch pines and other fire adapted plants.

A series of wildfires in the Pinelands burned over 183,000 acres during a weekend in April, 1963. As of 1990, this was the largest wildfire in the history of the region.

NAME THE PARTS OF A FIRE TRIANGLE



The resident trip written curriculum materials were derived from the existing Cherry Hill Public Schools Science Unit-Grade Six and developed by the author to be used solely by the CHEER program. All written curriculum materials followed the given format of all Cherry Hill Public Schools Science Units and are as follows:

LESSON: PINELANDS ECOLOGY - A QUEST FOR KNOWLEDGE

- CONCEPT:** The environments of the Pinelands consist of uplands areas and lowlands areas such as ponds, bogs, and swamps.
- Each environment has its own unique community of plants and animals that are dependent on one another.
- People's use of the Pinelands contributes to, modifies, destroys or maintains its environments.
- OBJECTIVE:** Given an uplands and lowlands area of the Pinelands to monitor and record data, the students will be able to describe each environment's soil, plant vegetation, animal life, and influences of man or nature.
- VOCABULARY:** Uplands, lowlands, wetland, bog, herbaceous, shrub, angiosperm, gymnosperm, germination, duff, serotinous, deciduous, conifers, cambium, hardwood, dormant, forest succession
- PROBLEM:** What determines uplands and lowlands environments of the Pinelands?
- HYPOTHESIS:** The vegetation of uplands and lowlands environments of the Pinelands is determined by water, fire, soil, and human influences.
- Uplands areas are above sea level and have a low water table. The low water table makes the uplands

area more prone to forest fires.

Lowlands areas such as ponds, bogs, and swamps have a water table that is at or near the surface.

MATERIALS:

Each group will receive a knapp sack of the following items:

Soil pH kit	Soil thermometers
Soil sample tube	Soil moisture meter
Sling-psychrometer	Clip board
A copy of Howard Boyd's Book: <u>A Field Guide To The Pine Barrens Of New Jersey</u>	
A copy of the Mt. Misery Orientation Guide	

Each student will receive the following:

- Pinelands uplands data sheet
- Pinelands lowlands data sheet
- Conclusions on Pinelands ecology study

PROCEDURE:

Divide the class into groups of three or four (each group should have at least three students and no more than five students).

Explain to the students that they are researchers that have been picked to explore uncharted areas of the Pinelands.

Distribute the Pinelands uplands data sheet, Pinelands lowlands data sheet, and the conclusions on Pinelands ecology study.

Using one of the knapp sacks an example, discuss the contents and the objectives stated above.

Distribute a knapp sack to each group. Now ask for volunteers for the following assignments: recorder (the recorder is the only person who takes the Pinelands uplands and lowlands data sheets to each station), soil pH testers, moisture meter and sling-psychrometer testers, soil sampler and temperature testers, plant and animal sighers (use reference materials)

NOTE: Sometimes it is better to ask for the volunteer before the assignment. The delegation of responsibilities will depend on each group size.

As a class, each group will visit two locations of the Pinelands, an uplands area and a lowlands area. The locations chosen will depend upon time of season, availability of site, amount of rainfall, and time allocated.

At each location, use the data sheets to collect the information needed.

When the data has been collected from both locations, return to initial meeting place.

Have each recorder write the data collected on the chalk board provided. Each student is only responsible for the information collected from their group. Discuss the findings.

As a group, answer the Conclusions on Pinelands ecology study sheet.

CONCLUSION: The environments of the Pinelands uplands areas and lowlands areas such as ponds, bogs, and swamps are unique communities of plant vegetation and animals that are dependent on one another.

ASSESSMENT: Observation of groups working cooperatively recording data collected, proper care and return of equipment.

EXTENDED ACTIVITY: While at the uplands location, choose a pitch pine tree and use an increment bore (teacher demonstration). This is another way to determine the age of the tree and whether there was a fire.

Take along a box for each group and collect various treasures of each location (pine cones, acorns, leaves, pine needles, branches, etc.). The items can be taken back to the school and used at a later date.

**COGNITIVE
SKILLS:**

Task
hypothesize
recall
experiment
identify
analyze
demonstrate
discuss
conclude

Skill
synthesize
knowledge
application
knowledge
analyze
comprehension
synthesize
evaluate

PINELANDS ECOLOGY - A QUEST FOR KNOWLEDGE

UPLANDS DATA SHEET

Physical Description: Soil Analysis

Composition of soil _____

pH _____ Temperature (°C) _____

Color _____ Moisture _____

Sling-psychrometer reading _____

Dominant Plant Life:

Trees

Shrubs

Ground Cover

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Animals and evidence (scats, tracks, homes, nests, sounds, or sightings)

Evidence of human influences or intrusions _____

Evidence of Fire _____

BONUS: Age of pines since last fire _____ years.

PINELANDS ECOLOGY - A QUEST FOR KNOWLEDGE
LOWLANDS DATA SHEET

Physical Description: **Soil Analysis**

Composition of soil _____

pH _____ Temperature (°C) _____

Color _____ Moisture _____

Sling-psychrometer reading _____

Dominant Plant Life

Trees

Shrubs

Ground Cover

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Animals and evidence (Scats, tracks, homes, nests, sounds, or sightings)

Evidence of human influences or intrusion _____

BONUS: Is there evidence of fire? Why or why not? _____

**PINELANDS ECOLOGY - A QUEST FOR KNOWLEDGE
CONCLUSION ON PINELANDS ECOLOGY STUDY**

1. What animal or animal evidence did you find?
2. How do animals depend on plants and/or other animals in your study area?
3. What plants grow best in each study area and explain why?

Uplands (trees)

Lowlands (trees)
4. What is the soil composition in each study area?

Uplands

Lowlands
5. What evidence of fire was found?
6. Was fire a benefit or destroyer of the study area? Explain your answer.
7. What effect do humans have on the study area? Explain your answer.

The assessment materials and activities were developed as follow-up written curriculum materials and followed the given format of all Cherry Hill Public Schools Science Units:

- LESSON:** **PINELANDS PATCHWORK**
- CONCEPT:** The natural resources of the Pinelands can be utilized in nondestructive ways.
- OBJECTIVE:** Providing the extended activity was completed from the lesson "Pinelands Ecology - A Quest For Knowledge" the students will be able to complete a nature scene from the materials gathered.
- VOCABULARY:** None
- PROBLEM:** How is it possible to develop a nature scene either from the materials collected during residence or from outside using the school grounds?
- HYPOTHESIS:** The Pinelands offers a variety of natural resources.
The school grounds offers a variety of natural resources.
- MATERIALS:** White glue, paper, scissors, markers or crayons, paints and paint brushes, any natural resources (a piece of wood or log, pine cones, acorns, pitch pine needles, rocks, leaves, branches, etc.).
- PROCEDURE:** Glue natural objects such as pine cones and leaves or small branches on a piece of wood.
Use paints or markers to add design. Cut out paper and glue onto the art design, if desired.
- CONCLUSION:** It is possible to utilize the natural resources of the Pinelands and school grounds in a nondestructive way.
- ASSESSMENT:** Observation of individuals working cooperatively,

proper care and return of equipment.

**EXTENDED
ACTIVITY:**

Use branches and pine cones to represent grass and trees.

Use paints to create rivers or lakes and add cut-out Pinelands animals to add.

**COGNITIVE
SKILLS:**

Task

construct
identify
present

Skill

synthesize
knowledge
comprehension

LESSON:	PINELANDS COMPARISON
CONCEPT:	The Pinelands uplands areas and lowland areas have their own unique community of plant vegetation and animals.
OBJECTIVE:	From the resident trip lesson "Pinelands Ecology - A Quest For Knowledge" the students will be able to compare and contrast the uplands areas and lowland areas of the Pinelands in written and oral form.
VOCABULARY:	All vocabulary words from previous lessons
PROBLEM:	Is it possible to compare and contrast the uplands areas and lowland areas of the Pinelands?
HYPOTHESIS:	The vegetation of the Pinelands consists of: Layers of trees, a lower growing shrub layer, and a ground cover of herbaceous plants. Water, fire, soil, and man influences determine the vegetation and animal habitation in the Pinelands.
MATERIALS:	Uplands data sheet Lowlands data sheet Conclusion on Ecology study Sheet Writing utensil Reference Materials Poster Paper Magazines and newspapers scissors Glue and/or tape
PROCEDURES:	Have each student prepare a paper comparing the uplands areas and lowland areas of the Pinelands from the information gathered during their residence stay at Mt. Misery.
CONCLUSION:	The Pinelands of New Jersey has unique uplands areas and lowland areas.

ASSESSMENT: Observation of individuals working cooperatively, proper care and return of equipment.

EXTENDED ACTIVITY: Divide the class into groups. Have each group design a collage of a Pinelands uplands area, lowlands area, and of human influences.

Have each group orally present their collage.

COGNITIVE SKILLS:

<u>Task</u>	<u>Skills</u>
discuss	synthesize
conclude	evaluate
compare	synthesize
describe/depict	comprehension
classify	comprehension
analyze	analyze

CHAPTER FIVE

Summary

This thesis project was designed to produce written curriculum materials that correlated with the existing Cherry Hill Environmental Education Residency Program which would teach Pinelands ecology to sixth grade students in residence at the "site-specific" location of Mt. Misery located in the Pinelands National Reserve. The written curriculum materials developed included pre-trip, resident trip and assessment materials and activities that followed the given format for all Cherry Hill Public School Science Units.

The written curriculum materials were developed to have students learn primarily through an interdisciplinary approach using hands-on experiences. Other different and appropriate learning strategies were incorporated into the written curriculum materials.

This thesis project is applicable to the current stated, subject-grade level, curriculum guidelines of the Cherry Hill Public Schools. It was especially correlated to those students of the CHEER program.

The written curriculum materials presented lessons and activities which were designed to promote environmental awareness and concern and ultimately have students demonstrate some type of action toward improving their own environment.

Writing this thesis project proved to be very rewarding to the author. A professional interest in environmental education, ecology and a personal interest in nature were incorporated to produce the written

curriculum materials.

Concluding Statements

This author suggests that the following steps be taken to implement the written curriculum materials into the Cherry Hill Environmental Education Residency Program on Pinelands ecology.

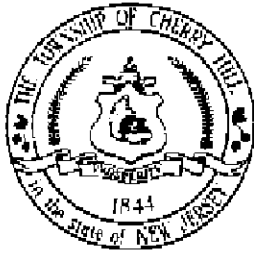
1. The Pinelands ecology unit should start at an earlier elementary grade level.
2. A teacher workshop should be held at the start of the school year. This workshop would explain the purpose of the CHEER program and answer any teacher questions and concerns about the program. The teacher workshop should also explain the importance of the pre-trip written curriculum materials and when it is appropriate to teach the pre-trip written curriculum.
3. The residency program should be extended to earlier elementary grade levels.
4. The Pinelands ecology unit of the Cherry Hill Public School Science Unit should be extended beyond the "site-specific" location of Mt. Misery.
5. Educators should be encouraged to investigate further research in the area of Pinelands ecology. A listings of varied Pinelands ecology references and their sources should be compiled.

Suggestions for Further Study

The following is a list of suggested areas of further study related to the topics covered in this thesis project.

1. Research and develop written curriculum materials on Pinelands ecology for earlier elementary grade levels.
2. Develop written curriculum materials of various elementary levels on Pinelands ecology topics, that may be integrated into the science/social studies curricular areas of Cherry Hill Public Schools.
3. Research and report upon other resident programs existing and being utilized in New Jersey.
4. Compile a Pinelands ecology written curriculum reference library, easily accessible to all educators of Cherry Hill Public Schools.
5. Research and develop an on-site Pinelands ecology laboratory at any or all of the schools in Cherry Hill Public Schools.
6. Devise Pinelands ecology community projects to illicit adult citizenry interest.

APPENDIX A



Cherry Hill Public Schools

Central Administration — Heritage School
Browning Lane, P.O. Box 5015
Cherry Hill, New Jersey 08034
(609) 429-5600

October 7, 1994

Gary Patterson
Biological Sciences Department
Rowan College of New Jersey
Glassboro, New Jersey 08028-1701

Dear Gary:

I'm pleased to write this letter on behalf of Elaine Miller. As part of Elaine's graduate assistance program with Rowan College's Master of Arts Degree in Environmental Education and Conservation, she has been employed as a supplemental teacher for Cherry Hill's environmental resident program. Cherry Hill's environmental resident program is a week long residency where teachers live with sixth grade students and provide an interdisciplinary environmental education program. Lessons use a discovery approach and organize students in small cooperative groups. The program is scheduled for 12 complete weeks for the Spring and Fall of the 1994-95 school year.

Elaine has successfully taught a water quality study of Mount Misery creek, lake, and pond. She has also taught an orientation program to the Pinelands of New Jersey and a comparison study of the Pinelands to a barrier beach. Besides her teaching duties Elaine has become part of evening programs on the Pinelands plus providing 24 hour coverage of students.

I am aware and support Elaine Miller's effort to develop enrichment materials for Cherry Hill's environmental resident program on Pinelands ecology. There is a need to produce written curriculum for the existing classroom Pinelands science unit which will be the foundation in the development of an environmental lesson for the resident program. In this effort Elaine would be responsible for pre-trip, resident trip, and assessment materials and activities on Pinelands ecology. It would be expected that she follow the given format for all Cherry Hill science units.

Sincerely,

Terry Patton
Environmental Education Coordinator

VOCABULARY WORDS

The vocabulary introduced in the written curriculum materials located in chapter four were derived from the Cherry Hill Public School Science Unit

Glossary and are as follows:

1. Acidic - Soil or water that has a pH value of less than 7, a high concentration of hydrogen ions and contains very few nutrients.
2. Adaptations - Changes an organism makes to adjust to different conditions in its environment.
3. Algae - Very tiny green water plants with no true stems or leaves that can use sunlight to combine carbon dioxide and water to produce oxygen and sugar.
4. Angiosperms - A subdivision of plants having its seeds enclosed in an ovary or fruit. An example of an angiosperm would be an acorn produced on oak trees.
5. Annual ring - Is a circular mark inside the trunk of a tree. When a tree is cut down, the annual rings can be clearly seen on the cut surface. Each ring shows the growth of the tree in one year. A tree's age can therefore be determined by counting the annual rings.
6. Arson (incendary) - A fire set unlawfully.
7. Atmosphere - The layer of air above us.
8. Bark - Is the outer covering of the trunks and stems of trees and shrubs. Bark may be hard, soft, or flaky depending upon the species of tree. Sometimes bark has bumps or ridges, but it can also be smooth. Bark is made up of cells produced by the growing cells beneath. Bark protects

trees from very cold or very hot temperatures, from fire damage and from animal attack.

9. Biosphere - Is the portion of the earth and its atmosphere capable of supporting life.
10. Biosphere Reserve - Designated a "biosphere reserve" in 1983 by the United Nations Educational, Scientific and Cultural Organization (UNESCO), New Jersey's Pinelands contains a sparsely populated and forested Preservation Area surrounded by a more heavily populated Protection Area. Scientists from around the world plan to study the impact of human activity on the unique ecosystem of the Preservation Area.
11. Bog - A wet, level area with spongy soil where the water table is at or very near the Earth's surface.
12. Cambium - Layer of cells between the bark and the wood of a tree. The cells in the cambium layer produce new bark or new annual rings for woody plants.
13. Cedar swamp - a swamp or bog near cedar trees.
14. Climate - The average daily weather condition in a given place over a long period of time.
15. Climax community - The last community in the development stages of succession.
16. Commission - a group of people elected or appointed with the authority to do certain things such as the New Jersey Pinelands Commission that is responsible for overseeing the management of the 1.1 million acre

Pinelands National Reserve.

17. Compatible - Able to get along well together; able to agree.
18. Coniferous - Cone bearing tree; commonly known as an evergreen even though it loses about 1/3 of its leaves every season.
19. Crown - The upper portion of a tree.
20. Deciduous - A plant that loses its leaves in the autumn.
21. Decompose - Decayed, rotted.
22. Drought - A time when there is little or no precipitation such as rain or snow.
23. Duff - Partially decayed organic material on the forest floor.
24. Ecology - Is basically the study of the interrelationships of living organisms to one another and their environment.
25. Ecosystem - The living and non-living things in the environment of a given area which affect each other.
26. Fire prone - An environment such as a forest that burns easily.
27. Food chain - A "chain" of plants and animals in which each depends on the next as a source of food.
28. Germinate - Begin to grow or develop; sprout.
29. Gymnosperm - A subdivision of plants having exposed (naked) seeds which are not enclosed on an ovary or fruit. An example of a gymnosperm would be the Pine tree producing naked seeds within a cone.
30. Habitats - Places where plant or animal naturally lives or grows.
31. Hardwood swamp - A swamp or bog near hardwood tree, such as oaks.

32. Head fire - A fire that burns in the same direction as the blowing wind.
33. Horizons - Soil layers that are generally parallel to the Earth's surface. Each horizon contains certain similarities that have to do with color or texture and are a result of the soil forming process.
34. Humates - Brown or black materials formed from the partial decomposition of plant and animal matter.
35. Humidity - Moisture (H₂O) in the air, usually measured in percentage.
36. Humus - Plant and animal tissue that has decomposed to the point that the original material can't be identified.
37. Leaching - The downward movement through the soil of nutrients and chemicals that are dissolved in water.
38. Litter - Debris such as twigs, branches, and recently fallen deciduous leaves and pine needles that compose the top layer of the forest floor.
39. Niche - The physical space where a species lives as well as what a species does in the ecosystem.
40. Nutrients - Foods; nourishing substances.
41. Organic - Soil that is rich in decayed plants, manure, or peat moss.
42. pH - A measure of the strength of an acidic or basic substance.
43. Pine Barrens - The name given by early settlers to more than a million acres of the Atlantic or Outer Coastal Plain in southern New Jersey. The settlers called the area the "barrens" because most agricultural crops could not grow in its sandy, nutrient-poor soils.
44. Pinelands - a more recent name for the Pine Barrens, covers essentially the same geographical area as the Pine Barrens. The region is 1.1

million acres in size and includes portions of seven New Jersey counties: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean.

45. Pinelands National Reserve - Established by the National Parks and Recreation Act of 1978. Generally, the Reserve includes the state designated Preservation and Protection Areas as well as certain coastal areas protected under New Jersey's Coastal Areas Facility Review Act. In a national reserve, local, state, and federal governments cooperate to protect natural and historical resources and traditional lifestyles while providing for development in environmentally suitable locations.
46. Prescribed Burn - a fire set by foresters to remove accumulated underbrush or litter. This reduces the possibility of wildfires.
47. Preservation Area - An area whose boundaries are defined by New Jersey's Pinelands Protection Act. It is the area of the Pinelands that has been least developed and it includes 368,000 acres of semi-wilderness.
48. Protection Area - An area whose boundaries are defined by the New Jersey Pinelands Protection Act. It is the 565,000 acre area surrounding the Preservation Area. It is divided into six management areas where the use of land is determined by how it would affect the environmental resources.
49. Rare - Uncommon; scarce; in short supply.
50. Resprout - To produce plant shoots once more.
51. Serotinous Cones - A closed pine cone that may be opened, to release its seeds, by the heat of fire.

52. Species - A population of plants and or animals capable of reproducing among themselves.
53. Stand - A group of plants of the same species, same size, and same age.
54. Stump Sprouting - Dormant buds at the base of pitch pines and some oaks, that are capable of active growth when stimulated by a disturbance such as fire or cutting.
55. Subsoil - Horizon B, the layer in a soil that is below the topsoil, usually containing less humus and more clay and silt particles than the topsoil Horizon A.
56. Substratum - Horizon C, the layer below the subsoil, where very little soil formation has occurred.
57. Succession - A predictable and orderly change in a plant community that occurs over a period of time.
58. Topography - The height and slope of the land's surface.
59. Topsoil - Horizon A, the soil on the Earth's surface containing relatively large amounts of organic matter and plant nutrients.
60. Unique - Quite different or one of a kind.
61. Upland - High land or land well above sea level generally with a low water table.
62. Weather - The conditions of the atmosphere at any given time.
63. Wetlands - Land that is usually wet such as a bog, swamp, or the banks of a stream or river.
64. Wildfire - Quick moving fire that is out of control.

BIBLIOGRAPHY

Books

- Boyd, Howard. Pine Barrens of New Jersey: A Field Guide. Medford: Plexus Publishing, Inc., 1991.
- Cauduto, M. & Bruchac, J. "Teaching Through Imagination and Action: Stories and Activities". Keepers of the Earth Teacher's Guide. Golden, Colorado: Fulcrum Publishing, 1988.
- Cherry Hill Public Schools. Science Unit-Grade Six: The Pinelands of New Jersey. Cherry Hill School District, 1992.
- Cherry Hill Public Schools. Science Unit-Grade Six The Pinelands of New Jersey Glossary. Cherry Hill School District, 1992.
- Collins, B.R. & Russell, E. Protecting the New Jersey Pinelands: A New Direction in Land-Use Management. New Brunswick: Rutgers University Press, 1988.
- Conservation and Environmental Studies Center. Teacher's Workshop Handbook: For Resident Environmental Education Programs. Browns Mills: CESC, Inc., 1970.
- De Bruin, Jerry. Creative, Hands-On Science Experiences. Carthage, IL: Good Apple, Inc., 1980.
- Doll, Ronald C. Curriculum Improvement - Decision Making and Process. Needham Heights, Mass.: Allyn and Bacon, 1989.
- Good, T.L. & Brophy, J. Educational Psychology: A Realistic Approach (4th ed). New York: Longman Publishing, 1990.
- Johnson, J.A., Collins, H.W., Dupuis, V.L., and Johansen, J.H. Introduction to the Foundations of American Education-8th ed. Boston: Allyn and Bacon, 1991.
- Kane, P.F., Rosselet, D. & Anderson, K. Bridges to the Natural World. Franklin Lakes: New Jersey Audubon Society, 1992.
- Kauchak, D. P. & Eggen, P. D. Learning and Teaching: Research-Based Methods-2nd ed. Needham Heights: Allyn and Bacon, 1993.

- Kelly, James L. The Successful Teacher. Ames: The Iowa State University press, 1982.
- Kucera, Clair, L. The Challenge of Ecology. Saint Louis: The C.V. Mosby CO., 1973.
- Link, Michael. Outdoor Education. New York: Prentice Hall Press, 1987.
- Mager, Robert F. Preparing Instructional Objectives. Belmont, California: Fearon-Pitman Publishers, Inc., 1975.
- Notary, George. I Do and I Understand. John's Island, South Carolina: George Notary, 1983.
- Olive, Peter F. Developing the Curriculum. Boston: Little, Brown & CO., 1992.
- Parkay, F. W. & Hardcastle Stanford, B. Becoming a Teacher (2nd ed.). Massachusetts: Allyn and Bacon, 1992.
- Prentice Hall General Reference. Ecology and Plant Life Illustrated Dictionary. New York: Merlion Publishing Ltd., 1993.
- Rockler, Michael J. Innovative Teaching Strategies. Scottsdale, Arizona: Gorsuch Scarisbrick, 1988.
- Sharan, Yael and S. Sharan. Expanding Cooperative Learning Through Group Investigation. New York: Teachers College Press, 1982.
- Sharan, Shlomo. Handbook of Cooperative Learning Methods. Connecticut: greenwood Press, 1994.
- Slattery, Britt E. Wow! : The Wonders of Wetlands. St. Michael, Maryland: Environmental Concern, Inc., 1991.
- Southwick, Charles, H. Ecology and the Quality of Our Environment. (2nd ed). New York: D. Van Nostrand CO., 1976.
- Western Association of Fish and Wildlife and the Western Regional Environmental Education Council, Inc. Project Aquatic. Bethesda, MD: Project Wild, 1992.

Western Association of Fish and Wildlife and the Western Regional Environmental Education Council, Inc. Project Wild. Bethesda, MD: Project Wild, 1992.

Western Regional Environmental Education Council and the American Forest Foundation. Project Learning Tree. Washington, DC: American Forest Foundation, 1993.

Periodicals

Cantrill, J. (1994). Understanding environmental advocacy: Research and the role of cognition. Journal of Environmental Education, pp. 35-42.

Caudto, M. J. (1985). A guide on environmental values education. Environmental Education, Series 13, pp. 1-3, 23-26, 36-37, & 42.

Cohen, S. (1990). This land is our land: Promoting ecological awareness in young children. Childhood Education, pp. 304-312.

Cole, E. (1992). Art and learning Fostering ecological awareness. Childhood Education, pp. 285-290.

Cortese, A. D. (1991, Sept/Oct). Training professionals toward environmental responsibility. EPA Journal, pp. 31-34.

Disinger, J. F. (1993). Environment in the K-12 curriculum: An overview. In Richard J. Wilke (Ed.). Environmental Education Teacher Resource Handbook, pp. 23-43.

Disinger, J. F. (1985, Jan) Environmental Education's Definitional Problem. School Science and Mathematics, pp. 59-65.

Disinger, J. F. (1984, Feb). What research says: Learning in the environment. School Science and Mathematics. Vol. 84, p. 159.

Dunlap, R. E., Gallup, G. H., & Gallup, A. M. (1993, Nov). Of global concern: Results of the health of the planet survey. Environment, pp. 7-15, 33-39.

Engleson, D. C. (1985). A Guide to Curriculum Planning in Environmental Education. Madison, WI: Department of Public

Instruction, ED 264 134.

- Estes, Y.B. (1993, May). Environmental education: Bring children and nature together. Phi Delta Kappan pp. K1-K12.
- Gigliotti, L. M. (1994). Environmental attitudes: 20 years of change? Journal of Environmental Education, pp. 15-26.
- Hammermann, W. and M. Shenery. (1984-85, winter). Current practice in the evaluation of resident outdoor education programs: Report of a national survey. Journal of Environmental Education, Vol. 16.
- Hogenbirk, C. (1990, March/April). Getting sand in their shoes. New Jersey Outdoors, pp. 27-29.
- Hungerford, H. R. & Volk, T. L. (1990). Changing learner behavior through environmental education. Journal of Environmental Education, pp. 8-12.
- Kastenholz, H. G. & Erdmann, K. (1994). Education for responsibility within the framework of UNESCO. Journal of Environmental Education, pp. 15-20.
- Kirk, J. (1977). The quantum theory of environmental education. National Association for Environmental Education, pp. 1-9.
- Lewis, A. C. (1990, April). Education and the environment. Washington Commentary, pp. 580-581.
- Marcinkowski, T. J. (1994). America 2000 and reform in science education: Where does EE fit? Journal of Environmental Education, pp. 5-9.
- Smith, J. W. (1957). Outdoor Education for American Youth. Washington, D.C.: American Association for health Physical Education and Recreation.
- Van Matre, S. (1990). Earth Education: A new beginning. Greenville, IN: The American Camping Association.
- Vivian, V. E. (1973). Sourcebook of Environmental Education. Saint Louis: The Mosby Company.

Reports

Academy of Natural Sciences of Philadelphia. Pine Barrens of New Jersey: A Study of Significance. 1967.

New Jersey Environmental Education Commission. Environmental Education in New Jersey: A Plan of Action. New Jersey Department of Environmental Protection, 1994.

Pinelands Commission. New Jersey Pinelands: Comprehensive Management Plan, 1980.

Master Thesis Projects

Austin, John, P. III. May 1983, Thesis for Glassboro State College, "An Environmental Education Curriculum for Ninth Grade Students of the Edgewood Junior High School with Special Emphasis on the Pine Barrens".

Delaney, Patricia, F. April, 1990, Thesis for Glassboro State College, "A Curriculum Guide in Pine Barrens Studies at the Primary Level for the Pinelands Institute for Natural and Environmental Studies".

Gruber, Thomas, K. April, 1990, Thesis for Glassboro State College, "A Curriculum Guide in Environmental Issues"

Patton, George, T. May, 1973, Thesis for Glassboro State College, "Outdoor Instructional Packets for Individualized Learning of Basic Skills in the Sixth Grade of Cherry Hill, N.J."

Taylor, Lorraine, J. May, 1990, Thesis for Glassboro State College, "A Nature Lesson Program for the Scotland Run Nature Center" (Grades 4-6).

Young, George, E. May, 1990, Thesis for Glassboro State College, "A Resident Environmental Education Program for Pinelands Regional High School: A Handbook for Administrators and Teachers"

Additional Sources

Herman, Marina, L., Passineau, J. F., Schimpf, A.L. & Treuer, P.

Teaching Kids to Love the Earth. West Michigan: Pfeiffer-Hamilton Publishers, 1991.

Kohl, MaryAnn & Gainer, C. Good Earth Art: Environmental Art for Kids. Bellingham, WA: Bright Ring Publishing, 1991.

Petrash, Carol. Earthways: Simple Environmental Activities for Young Children. Mt. Rainier, MD: Gryphon House, Inc., 1992.

"In the end, we will conserve what we love,
we love what we understand,
and understand what we are taught"
(Estes, 1993, p. 6).