Increasing the Use of East Bethel/Cedar Creek Community Schools’ Nature Area Sites by St. Francis # 15 Teachers Enrolled in an On-site, Outdoor, Nature Study Group

By

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Abstract

Creating a sense of place and preserving a sense of wonder in children is an important step to using the outdoors as a context for learning and gaining environmental literacy. Research has revealed guided investigation in a natural setting is concrete, sensory and thus developmentally appropriate. Bonding with nature is key to feeling ownership of local landscape. Frequent access to nature has been identified as one of the major predictors of environmental sensitivity and responsible land stewardship. Over a ten-year period, a core of “Green Team” teachers, administrators, and parents established East Bethel/Cedar Creek Community Schools’ diverse Nature Area Sites. This project was designed to increase use of sites, reveal the value of using the outdoors as a context for learning and gaining environmental literacy. Twenty-two teachers, grades K-8, participated in professional development. The fall Nature Study Group provided experience using the on-site, outdoor nature areas. Exploration infused *Minnesota Academic Standards in Science* (2004) and *Environmental Literacy Scope and Sequence for Minnesota* (2003). Inquiry and student management techniques were demonstrated. Site-specific environmental education materials were acquired for use and review.

St. Francis District # 15 Teacher Academy provided monetary motivation for professional development. Participants filled out pre and post surveys to determine site use, barriers inhibiting use, and knowledge of state environmental literacy and science standards. An evaluation questionnaire and participant’s comments, revealed teachers felt more confident in taking students outdoors, wanted more outdoor classes in the future, valued connecting children to nature, were thankful for materials and the opportunity to share ideas. Participants planned to infuse use of the EBCS/CCCS Nature Area Sites into their curriculum in the future. Survey results indicated barriers to using the EBCS/CCCS Nature Area Sites, such as student behavior, Minnesota Academic Standards, EE knowledge, and EE resources, had decreased. Lack of time remained a barrier. Comments and post survey results suggested participants had increased the use of the EBCS/CCCS Nature Area Sites, during the 2004-2005 school years.
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Fellow “Green Team” members, thank you for the years of planning and hard work to develop the outdoor nature sites at East Bethel/Cedar Creek Community Schools. May our passion for connecting children with nature be regenerated as others ramble and explore the paths we cleared into the oak forest behind our schools.
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Chapter 1

Introduction

The Research Problem Statement

The purpose of this project is to increase use of East Bethel/Cedar Creek Community Schools' Nature Area Sites by St. Francis District #15 teachers enrolled in an on-site, outdoor, Nature Study Group.

The Sub-problems

1. Access to and safety aspects of the East Bethel/Cedar Creek Community Schools Nature Area sites will require maintenance before teachers will increase use with their students.
2. Create interest and motivation for staff development on use of the nature sites.
3. Apply to Independent School District # 15 Teacher Academy for permission and accreditation of the Nature Study Group as part of the 32 hour contracted Individual Professional Development Program.
4. Create an outline of study for the teachers enrolled in the Nature Study Group that will demonstrate techniques of managing students outdoors, incorporate inquiry techniques and correlates with the Minnesota Academic Standards in Science (2004) and Environmental Literacy Scope and Sequence for Minnesota.
5. Implement the ten hours of outdoor, on-site, Nature Study Group so it interfaces with other School District #15 Teacher Academy classes for the 2004-2005 school year.
6. Research and acquire quality environmental education materials for use and review during each Nature Study Group session.
7. Develop a pre and post survey of nature trail use by the Nature Study Group teacher participants.
8. Develop a Nature Study Group evaluation for St. Francis Teacher Academy that demonstrates 10 hours participating in the study group warrant credit and generates direction for environmental education in St. Francis District #15.
The Hypothesis

1. The correlation of the Minnesota Academic Standards for Science and Environmental Literacy Scope and Sequence with outdoor, nature trail activities will increase use of the East Bethel and Cedar Creek Community Schools’ outdoor learning sites.

2. Teachers enrolled in the ten-hour Nature Study Group will increase their use of the East Bethel/Cedar Creek Community Schools’ Nature Area Sites after exposure to techniques in teaching outdoors while using quality environmental education (EE) materials presented in a hands-on inquiry based manner.

3. Teachers enrolled in the ten-hour Nature Study Group, will increase their use of the East Bethel/Cedar Creek Community Schools’ Nature Sites as teaching tools when the overall connective nature of environmental education is exposed through the concepts demonstrated of interdependence, cycles, energy flow, and change over time, are revealed.

4. A Nature Study Group comprised of teachers from kindergarten through junior high school can work together to overcome some of the perceived barriers of using the outdoor nature sites at East Bethel and Cedar Creek Community Schools.

5. Increased use of the East Bethel/Cedar Creek Community Schools’ Nature Area sites by teachers enrolled in Nature Study Group will allow their students more time to spend outdoors building the important pre-requisite empathetic view leading to environmental literacy, awareness and sensitivity.

Significance of the Problem

Teachers fortunate enough to be working at East Bethel and Cedar Creek Community Schools have an opportunity to embrace the decision to lead their students down a trail heading toward a sustainable future. The land is ready for environmental discovery. The most significant part of the problem is that teachers need to be connected
and comfortable with the land, specifically East Bethel/Cedar Creeks Community Schools Nature Area Sites, to increase their use of the sites with their students.

Steps away from their classrooms are tall red pines whose fallen needles have created a soft path into the wonder of nature. Indian pipe, elderberry, jack-in-the-pulpit, and cinnamon ferns line the edge. Red squirrels and crows scold from the treetops. Sized just right for sensing by elementary students are young, white pines, which have been filling in the gaps between the patterned rows in openings of the pine plantation. As the trail crosses a sunny opening, East Bethel and Cedar Creek Community Schools’ nature trail heads into old oak woods that skirt the banks of clear deep, Cedar Creek. In the center of these 160 acres of outwash plain are two ponds, where in April spring peepers and chorus frogs call. Macro invertebrates continue cycles, Blanding turtles calmly sun on the log islands, and wood ducks, mallards, and muskrats go about their business. Aspen along the banks of the pond whisper the direction toward the restored prairie where fritillaries and painted ladies sip nectar from blazing star and boneset. Eagles are now circling above this prairie. This patch of earth is all there for teachers to discovery with their students. All they need is the compass of purpose and a connection to the land and the curriculum.

These teachers are dedicated and toil for hours to do their best job for the students of Independent District #15 of St. Francis, Minnesota. With leadership vision and working as a team we can unfold the delights of the nature trail sites to our students. Teachers connected and comfortable with the sites will be able to let their students sip the nectar of nature over their short educational time with us. With pinesap and dirt on their fingers, peaceful feelings in their hearts, and time to become intimate with their place, the teachers and students will acquire awareness and sensitivity to nature and cannot but help work toward a sustainable future for all creatures of the land. This is the reason for environmental education.

The second part of the problem’s significance is that the State of Minnesota does not mandate addressing environmental education (EE) standards. The state does have an environmental literacy scope and sequence as of March 2002, delineated in *Environmental Literacy Scope and Sequence, Providing a Systems Approach to Environmental Education in Minnesota*. Several state mandated science standards do
incorporate aspects of EE. The state does have a *Green Print for Minnesota*, (2000) which lists the goals for EE.

Unfortunately, St. Francis #15 School District does not have written EE goals, but intends to follow the 2004 Minnesota Academic Standards for science. East Bethel and Cedar Creek Schools do have basic EE goals that were written with the creation of activity guides for the trail system.

Cedar Creek and East Bethel Community School EE goals were written in 1997, as part of the Partnership Grant program facilitated by School Nature Area Project (SNAP) formerly connected with St. Olaf College of Northfield, Minnesota. A core group of teachers from the two school schools received EE training, wrote goals, and developed a curriculum guide for utilizing the diverse outdoor setting of the 160 acres of oak woods, pine plantations, ponds, old fields, and edges. The core group then worked to create three outdoor learning classroom-gathering sites connected by a trail system that has posted learning stops.

Teachers from both schools have had short in-services on trail and guide use. An evolving core of teachers, called the Green Team, facilitated the in-services. Green Team members are approaching the age of retirement. A new group of teachers needs to be motivated and trained. Past in-service of teachers was sporadic and not correlated to Minnesota Academic Standards. The Nature Study Group will make use of the *Minnesota Academic 2004 Standards* for science and the new *Environmental Literacy Scope and Sequence*, 2002. The Nature Study Group will continue over a two-month time period from September 20, 2004 through October 18, 2004.

Teachers at both schools feel battered by ever-expanding curriculum and stressed by the time constraints of the Minnesota Academic Standards. Many feel that taking children outside on the nature trail is to be reserved as a fun outing or an end of the year scavenger hunt. Many teachers fear ticks, mosquitoes, and poison ivy. They want more natural history knowledge about what is growing out there. East Bethel and Cedar Creek Community School teachers feel their classes may not behave.

These are some of the same barriers found by the Harmony Foundation, 2003, as reported in a reconnaissance survey and recommendations for action report. They found lack of support for EE, lack of interest in EE by teachers, teacher overload; lack of
time, lack of training in EE, and lack of classroom-ready environmental teaching resources were the main obstacles. Saskatchewan’s Harmony Foundation, 2003, recommendations for action were, to provide more training and support through professional development days.

Teachers at East Bethel/Cedar Creek Community Schools, as well as all teachers in Independent School District #15, have been offered the means to overcome some of the barriers regarding the use of the outdoor teaching sites. The recommendations for overcoming barriers to EE can be followed by providing training and support through professional development. ISD # 15 has provided the monetary compensation and outdoor sites for the training. University of Wisconsin-Stevens Point environmental education program has exposed the researcher to vast amounts of environmental education resources and materials. These teacher-ready materials and activities can be presented to Nature Study Group K-8 teachers for their consideration and use.

East Bethel and Cedar Creek Community Schools are fortunate to have a diverse outdoor site within steps of their classrooms. This immediacy is developmentally entwined with the students. Young children need time to bond with the natural world in the here and now, to learn to feel comfortable, explore it and know it before being asked to fix it. Sobel (1996).

Findings of Hungerford and Volk (1990) revealed, environmental sensitivity is nurtured through positive experiences in non-formal outdoor settings over long periods of time. Combined with the importance of teachers in a formal setting, who are sensitive and willing to act as a positive role model, environmental sensitivity will further develop. Environmental sensitivity will contribute to appropriate future environmental behaviors.

Braced by the Minnesota Academic Standards for Science, 2004 and the Environmental Scope and Sequence, 2002, connected through experience, materials, communication, and inspired by a vision of a sustainable future, perhaps these teachers will take the first small steps outdoors. Once outdoors, these teachers will start nurturing the foundation of environmental awareness and sensitivity in their students.
Limitations

This study will not attempt to determine the success of the students in acquiring knowledge contained in the goals for environmental education, direct science experience, and improved valuing of nature through the use of the site. This study will only attempt to determine increased use by teachers enrolled in the Nature Study Group.

Definition of Terms

Cedar Creek Community School is an elementary school housing 1,100 students, grades 3-6 in a rural suburban area of East Bethel, Minnesota, which has a population of about 12,000.

East Bethel Community School is located adjacent to Cedar Creek Community School and houses 900 kindergarten through second grade students.

Environmental Sensitivity is defined as an empathetic perspective toward the environment. It is the one entry-level variable that has shown a dramatic relationship to behavior in research. Hungerford & Volk, (1990).

Outdoor Nature Area Sites include the pine plantations, deciduous forests, two pond areas, a butterfly garden, three benched teaching sites suitable for classroom seating, an arbor of native trees connecting the two schools, and one acre of restored prairie.

Study Group is part of the Professional Development plan created by the Teacher Academy of Independent School District #15 of St. Francis, Minnesota. Study groups are open to all teachers. Each teacher needs to consider the relevance of content before registering. At the time of registering, teachers have a choice of using the ten hours to fulfill part of their 32-hour professional development requirement or receive one lane change credit. In either case, participating teachers are expected to satisfactorily complete the study group.

Assumptions

The teachers enrolled in the on site, Outdoor Nature Study Group at East Bethel and Cedar Creek Community Schools’ chose to participation this group. Therefore, it can
be assumed that they already have an interest in using the nature trail sites at East Bethel and Cedar Creek Community Schools. Two teachers enrolled in the class do not have direct access to the site. They do have a small pond and tree area near St. Francis Junior High. The use of their site would be taken as increased use.
Chapter 2

Literature Review

The literature relating to the increased utilization of the East Bethel/Cedar Creek Community Schools’ outdoor teaching sites has been reported in the following sections:

3. Advancing Education Through Use of Outdoor Learning Sites

Establishing the Benefits of Utilization of Outdoor Teaching Sites

The benefits of using the outdoors, as a context for learning and gaining environmental literacy are numerous. The importance of creating a sense of place and preserving a sense of wonder in the young child is one of those benefits. Another beneficial aspect of using the outdoors as a context for learning is to allow awareness and sensitivity to become established at an early age and thus result in positive responsible environmental behavior as adults. Using the outdoors nature sites will also be linked to improved test scores, stronger knowledge of and empathy toward environmental issues and a willingness to protect the environment.

Since the days of John Dewey (1938), the father of modern education, teachers have been urged to take children out of the classroom and learn from the community first hand in a natural, inquiry based manner. Experiences connect students to learning. Forty years later, Gardner, Schierloh, and Yockers (1978) stated that outdoor teaching sites possessed the promise of fulfilling three areas. Outdoor site use could: (a) help expand environmental perceptivity, (b) help promote a natural–world “psyche”, and (c) help develop community cognizance. Individuals who achieve perceptivity, a natural-world psyche and community cognizance will be better able to cope with the realities of an adult citizen.

Coping with the realities of an adult citizen, promoting a natural world psyche, and being perceptive of nature can be associated with the poetic words of Rachel Carson,
when she wished to instill "a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantments of later years, the sterile preoccupation with things that are artificial, the alienation from the sources of our strength" (1956). Rachel Carson carefully described the "fertile soil" of young explorers of the outdoors that readily sprouts into that "sense of wonder" if children are guided through nature and left to amble in inquiry as she did with her niece and nephew along the shore of their immediate environment.

Holtz (1994) believes that children need guided exposure to the natural environment in a meaningful way to develop Rachel Carson's "sense of wonder". The great diversity of life should unfold naturally for students and be experienced with all their acute senses. They will later value habitat and feel connected enough to act responsibly as adults.

Wilson (1993) extols the benefits of interaction with the natural world for the young child because it enriches not only learning but also, the quality of life. All children need a basic understanding of and exposure to the natural environment so they know they are part of nature and dependent on the natural environment. When young children have positive experiences with the nature, their attitudes, values, and behaviors are seeded to have a long lasting impact. It registers that nature matters and human actions affect the natural world along with the quality of life for future generations.

Cohen (1994) voiced children's environmental knowledge should be developmentally appropriate and involve active participation in natural settings with both living things and physical systems in a concrete, stable, continuous, and personally relevant. Their own school nature sites meet these criteria.

Exposure to natural environments, such as outdoor teaching sites, can contribute to children developing the "sense of place" which Holveck (2001) defines as a "child's emotional connection with the natural world and the built environment over a period of time from earliest developmental stages through adulthood". Connection to place is key to understanding how land and natural resources fit into our lives and will lead to a sense of well-being and sustainable communities of the future.

Sanger (1997) defined sense of place as an experientially-based intimacy with the natural processes, community, and history of one's place. His viewpoint is that even
environmental educators marginalize students’ relationship with their place. The absence of connecting to the child’s natural surroundings implies that it is uninteresting and unimportant. This results in a marginal quality of environment. He believes that by taking students outside to experience the natural processes around them, it not only promotes a sense of place, but also is good education. To his thinking, students need practice in investigating the environment around them and the action that allows them to be part of the change process. “The solution is consistent with building a sense of place: knowledge, practice, empowerment, ownership in the learning process and the land, and direct involvement in their place as part of a community (1997, p.5).”

Continual exposure to outdoor nature sites will result in it being personalized for individuals and provide rich experiences in habitats that are complex and diverse. Immersed youth will have opportunities to explore, manipulate, and be shaped by the environment (Lutts, 1985). This chance to explore pleasing natural environments will affect young children’s attitudes and produce values that reflect the role of caretakers of the land (Nabban & Trimble, 1994).

Chawla (1996) summarized that frequent access to specific natural areas during childhood has been identified as one of the major predictors of environmental sensitivity and responsible land stewardship. When children actively use, change, and explore a site it becomes exciting, memorable, and patterns of change and sameness are internalized, and foster a sense of place.

Wilson (1997) believes the healthy development of environmental awareness and connection results from a “feeling response” to nature. The feeling comes from firsthand delightful experiences in the out-of-doors. The creating a sense of place experience for young children will instill a lifelong commitment to the natural environment.

The connection between place attachment and environmentally responsible behavior (ERB) was examined by Vaske and Kobran (2001). Place attachment was defined as natural settings being imbued with meanings that create an emotional tie such as place dependence and place identity. Place dependence reflects the function of a natural area for proving amenities necessary for desired activities such as hiking or kayaking. Place identity is an emotional attachment after repeated exposure to a natural setting. Their finding supported that frequency of visitation to a natural resource
increases dependence on the setting and ultimately leads to emotional attachment to an area. Teens from 14-17 years old, who participated in a natural-resource based work program in their own communities, encouraged ERB in everyday life. ERB was demonstrated when participants were observed talking about environmental issues with friends and conserving water. Vaske and Kobran (2001) concluded that individuals develop an emotional connection to their local natural resources and appear to act responsible in day-to-day activities as well as in the setting.

Sobel (1996) has observed and documented the close relationship children develop to natural areas near their home and school. He urges adults to capitalize on this stage of development, ages 7-11, and help create environmentally aware and empowered students by providing them with chances to explore the “here and now” of the natural world. Guided they can learn to bond with the natural world and feel comfortable with it before “asking them to cure the ills of the world (p.10).” He fears that to invoke knowledge and responsibility before a personal connection to land develops will result in ecophobi, which is a fear of ecological problems and the natural world. Sobel suggests, “We need to cultivate sensitivity to the developmental geography of childhood. Appropriate curriculum at this age will capitalize on the child’s innate drive to explore the nearby world (p.19).” Immersion in the local landscape and experience with local creatures will allow them to be protective of their world.

Hungerford and Volk (1990) reported environmental sensitivity as being a major entry-level variable in their classic review of the variables leading to responsible environmental behavior. Environmental sensitivity is defined as an empathetic perspective toward the environment. To maximize opportunities to change learner behavior Hungerford and Volk listed environmental sensitivity as second to teaching ecological concepts and environmental interrelationships. Their summary of the research showed it to have a dramatic relationship as a predictor of responsible citizen behavior. They proposed, “Educators provide carefully designed and in-depth opportunities for learners to achieve some level of environmental sensitivity that will promote a desire to behave in appropriate ways (p. 296).”

Hungerford and Volk (1990) believed, considerable attention should be given by educators to the variable of environmental sensitivity. They reported that positive
activities in the outdoors over a long period of time develop environmental sensitivity. They called for teachers to be environmentally sensitive and willing to act as positive role models to learners. Their research concluded that following environmental sensitivity, ecological foundations, and issue awareness, students should also be given opportunity to develop a sense of ownership that results in empowerment to result change by their actions. This sense of ownership and opportunity to act environmentally could develop naturally right outdoors in outdoor learning sites.

Bora Simmons and Trudi Volk (2002) interviewed Dr. Harold Hungerford for The Journal of Environmental Education. Hungerford was one of the original authors of the Goals for Curriculum Development in Environmental Education, which attempted to carry out the objectives of the Tbilisi Declaration. When reflecting back on the appropriateness of the goals twenty years later, Hungerford stated, “I think I would also give more prominence to environmental sensitivity. Research suggests that it is very important predictor for responsible environmental behavior (p. 5).” He felt it warranted more attention. He himself had gained environmental sensitivity while hunting, fishing and trapping in rural Kankakee, Illinois.

Orr (1992) straightforwardly calls for an “uncompromising commitment to life and its preservation” as a means for education to point true in the direction of sustainability. Students need to understand the world of nature and to develop competence in thinking about natural systems. For students to understand that we are part of the larger whole of nature they need to come out of the “mind-debilitating” cocoon of electronics, the indoor classroom, and television. Knowledge of the natural world needs to be connected to other disciplines to cure pervasive anthropocentrism “that magnifies the role of humans and their ideas, art, institutions, and technology relative to soil, water, climate, wildlife, resources, geography, energy, disease, and ecosystem stability (p.135)”.

He calls for the study of natural history because it is concrete and requires direct involvement with nature. Orr believes firsthand knowledge of trees, animals, plants, birds, and aquatic life to be an antidote to the abstract overly quantified, computerized world as well as the romantic view of nature. The study of natural history promotes the capacity to observe with care, understanding and pleasure.
To gain environmental literacy Orr (1992) believes we must recognize that all education is environmental education. By what is included or excluded from study students learn they are apart or a part of the natural world. Experience in the natural world is essential to understanding and thinking about the environment. Experience trains the intellect to observe the land and recognize health from an unhealthy environment. “Ecological literacy is becoming more difficult...because there is less opportunity for direct experience of it (p.89)”.

Kenney, Militana, & Donohue (2003) found a positive impact on students’ attitude toward the environment of their school’s backyard. The Watershed Learning Center Program (WLC) utilized a 3-year grant to develop and implement environmental education. The WLC program was designed to teach critical thinking skills along with hands-on exercises and field experiences. Other goals were to increase students’ respect and sense of responsibility to nature, and bring together community organizations and schools to broaden community stewardship for the environment. Surveys, interviews, and focus group discussions were used to measure the effects of knowledge, skills, and attitudes. The WLC program was very successful in improving knowledge, skills, and attitudes as documented quantitatively on improved t-tests and qualitatively through observations, interviews, and open-ended questions. The children thought the lessons were fun. They enjoyed being outside using all their senses to explore, and better appreciated plants and animals. They had an increased respect for habitat in the schoolyard. The students’ teachers commented that WLC program outdoor lessons helped students understand scientific method, made connections to real life, made use of different learning styles, employed process skill for science, and did use higher level thinking skills.

Ohana (2005) introduced the theme of Learning from Nature in the February 2005 issue of Science and Children as a “never ending resource for science learning”. Her belief is that environmental education addresses many aspect of quality learning. The first being it is local and meaningful to students. Nature is always interesting and complex. Nature study straddles all the science disciplines and touches on economics, political science, history, and culture. Nature study is the “ultimate environment” for problem solving skills necessary for science.
Minnesota's Environmental Education Goals

In preparation for preparing a relevant on-site, Outdoor Nature Study Group for K-8, St. Francis District #15 teachers, was to establish a link between environmental education and state and national science standards. What are the current goals for environmental education in the State of Minnesota and is there a curriculum scope and sequence? Are Minnesota’s Academic Standards for Science compatible with environmental education? Do the National Science Education Standards created by the National Academy of Sciences (1996) support environmental education?

The document, *Green Print, Second Edition, State Plan for Environmental Education*, was published in August of 2000, by the Minnesota Office of Environmental Assistance (OEA). The purpose of this document was to outline strategies for achieving EE goals. A *Green Print of Minnesota Second Edition, 2000*, offers guidance to individuals, organizations, and agencies that deliver or support EE to lead Minnesota citizens closer to achieving the state goals. These goals are listed under Minn. Sta. 115A.073 (1998):

Pupils and citizens should be able to apply informed decision-making processes to maintain a sustainable lifestyle. *Green Print of Minnesota, 2000*, summarized the concepts to be understood. In order to do so, citizens should:

a. understand ecological systems;

b. understand cause and effect relationship between human attitudes and behavior and the environment;

c. be able to evaluate alternative responses to environmental issues before deciding on alternative courses of action and

d. understand the effects of multiple uses of the environment.

*Green Print, Second Edition, State Plan for Environmental Education*, encouraged teachers to “integrate EE throughout the PreK-12 curriculum...with units that are interdisciplinary, conceptually and technically accurate, and developmentally appropriate and integrated across the curriculum (p.17).”
As part of the implementation plan Green Print, 2000 delineated, in part, the following guidelines:

Deliver programs that provide students with hands-on experiences with environmental issues. Provide schools the resources, including access, programs and facilities, to provide out-of-classroom EE experiences at all grade-levels. Develop inter-generation EE programs and projects using community members. (p.51)

The scope and sequence for the above goals are defined and listed in Environmental Literacy Scope and Sequence, Providing a systems approach to environmental education in Minnesota, 2002. Helping learners and educators understand that interdependency is the key precept in environmental education, led to two major ideas presented in the document. The first is, “The concept of systems as a way to take apart and study the idea of connectedness and interdependency,” and secondly, “The reality that natural and human social systems are constantly and intricately interacting (p.1)”.

The Environmental Literacy Benchmarks and Concepts chosen by grade bands are listed in this systems approach to environmental education for the State of Minnesota.

Grades PreK-2 Benchmarks:

a. Social systems and natural systems are made of parts
b. Social systems and natural systems may not continue to function if some of their parts are missing.
c. When the parts of social systems and natural system are put together, they can do things they couldn’t do by themselves.

Grades PreK-2 Key Concepts:

a. Parts and objects, individuals, groups, ideas and concepts, biotic factors, abiotic factors, similarities and differences, properties
b. Interactions and relationships, structure, function

Grades 3-5 Benchmarks:

a. In social and natural systems that consist of many parts, the parts usually influence one another.
b. Social and natural systems may not function as well if parts are missing, damaged, mismatched or misconnected.

Grades 3-5 Key Concepts:
   a. Parts and objects, similarities and differences
   b. Interactions and relationships, structure, function, patterns, trophic level, cycles, change and constancy, migration, predation, feedback, communication

Grades 6-8 Benchmarks:
   a. Social and natural systems can include processes as well as things.
   b. The output from a social or natural system can become the input to other parts of social and natural systems
   c. Social and natural systems are connected to each other and to other larger or smaller systems

Grades 6-8 Key Concepts:
   a. Interactions and relationships, populations, structure, functions, change and constancy, cycles, ideal and real, formal and nonformal, trophic level, feedback, reciprocity, predation, migration communication
   b. Subsystems, habitat, biome, boundary, scale, family and kinship, stratification, politics, economic, religion, language, niche, communities
   c. Inputs and outputs, artifact, waste, technology, instruction
   d. Change over time, diversity, rate, ideas and concepts, geomorphism, accumulation, threshold, mutation, evolution, extinction, knowledge, innovation and invention, species

The goals, benchmarks, and concepts of Minnesota are a starting point for environmental literacy. A comprehensive, detailed, integrated and explained analysis of environmental literacy is found in *Excellence in Environmental Education-Guidelines for Learning*, (1999). The guidelines reiterate that children in grades K-4 are concrete thinkers. They have a natural curiosity about the world around them, especially the
natural world close to home. Experience and observing the local environment is essential to help learners build a strong foundation of skills and knowledge that will lead to larger conceptual understandings that environmental literacy demands. K-4 learners are need to have direct experience in the environment to foster the awareness and appreciation that motivate learners to further, questioning, understanding, and appropriate concern and action.

The North American Association for Environmental Education (2000) definition of environmental literacy consists of four essential aspects:

a. Developing inquiry, investigative, and analysis skills.
b. Acquiring knowledge of environmental processes and human systems.
c. Developing skills for understanding and addressing environmental issues.
d. Practicing personal and civic responsibilities for environmental decisions.

Minnesota Academic Standards/Science K-12

The Minnesota Academic Standards for Science will be the primary means of integrating the environment into the existing curriculum for and increasing use of the East Bethel and Cedar Creek Community Schools’ Nature Sites. The researcher fully realizes that the environment is the great integrator and should be integrated across all curricular areas. The Nature Study Group was given credit status by the St. Francis Teacher Academy as a means of addressing the Minnesota Academic Standards for Science.

Minnesota Academic Standards for Science are listed under four strands.

1. History and Nature or Science
2. Physical Science
3. Earth and Space Science
4. Life Science

Careful scrutiny of the sub-strands and standards reveals that all major strands can be addressed or enhanced by all grades levels in whole or part by teachers in the outdoor learning sites. The sub-strands of scientific inquiry, structure of mater, forces of nature, the water cycle, weather, diversity of organisms, flow of matter and energy,
human organism, scientific world view, heredity, biological populations change over
time, and most significantly interdependence of life can be discovered, explored,
analyzed outdoors in the East Bethel/Cedar Creek Nature Area. See Appendix (A), for
the entire Minnesota Academic Standards for Science K-12.

*NSTA Pathways To the Science Standards* (2000) published by the National
Science Teachers Association formulates and describes the “guidelines for moving the
vision into practice” of achieving the science teaching standards, professional
development standards, and content standards. The Life Science Content Standard for K-
4 focuses on three aspect of living organisms: their characteristics, their cycles, and their
environments. The standard for grades 5-8 includes some beginning explorations into the
ideas of populations and ecosystems. Throughout the elementary grades, giving students
direct experience with living organisms is desirable in school and an outdoor setting. The
nature of instruction described in by NSTA promotes students using a variety of
ecosystems such as ponds, grassy areas, wetlands, deserts, and forests to identify different
species and their interaction and dependence of the species in an environment.

Life Science Content Standards for grades 5-8 deal with populations and
ecosystems, diversity, and use the ecological concepts of producers, consumers, and
decomposers. Energy flow between members of a community and factors that affect the
balance of an ecosystem should be investigated by a variety of instructional experiences
such as field trips to ponds, rivers, wildlife areas, or environments on the school grounds.
*NSTA Pathways To the Science Standards*, (2000).

*NSTA Pathways to the Science Standards*, (2000) summaries Earth and Space
Content standards for grades K-4. Students should learn about the Earth and sky by
making observations as they explore, collect, describe, and record information. Students
investigate the properties of water, rocks, minerals, and soil. Students should observe
natural changes of all kinds, including cyclical changes, such as the movements of the
Sun and moon, and variable changes, like the weather.

Science and Technology Content Standards connect science in a personal and
social perspective. Ideas and investigations related to health, populations, resources, and
the environment prepare students for understanding science-related issues in grades 5-6.
“Promoting science and technology skills and knowledge will facilitate students’ future
develop as scientifically and technologically literate citizens who will protect the environment, conserve natural resources, and develop greater social harmony in the community and the world *NSTA Pathways To the Science Standards, (2000)*.

Support for environmental education from the National Science Education Standards and the Internet was predicted to have a significant impact on the future of environmental education by Moore and Huber, (2001). These educators believe that the EE community must recognize its responsibility to work with the rest of the educational structures to improve opportunities for K-12 students. They encourage the EE community to back the reform initiatives and believe environmental education goals and objectives can be furthered, by embracing initiatives spawned by NSTA. Many National Science Education Standards demonstrates the relevance of EE. Moore and Huber gleaned that the National Science Education Standards support a vision of K-12 students working in enriched learning environments, such as the outdoors, where students are engaged in inquiry driven, experiential, hands-on, and minds-on learning activities directed toward the goal of scientific literacy for all students. The central goal of scientific literacy which break down into objectives that “closely match those of EE, More, Huber, (2001)”.

**Summary**

Minnesota’s goals for environmental education are established in *Green Print*, (2000) calls for pupils and citizens to be able to make informed decisions to maintain a sustainable life style. This should be accomplished through inquiry driven, hands-on, out of classroom experiences for all grade levels. Minnesota’s concepts and benchmarks for environmental education are established in *The Environmental Literacy Scope and Sequence, Providing a Systems Approach to Environmental Education in Minnesota*, (2002). This scope and sequence helps educators see the interdependence and connective nature of human and natural systems.
Chapter III

Methods

Introduction

The purpose of this project is to increase use of East Bethel/Cedar Creek Community Schools’ Nature Area Sites by St. Francis District #15 teachers enrolled in an on-site, outdoor, Nature Study Group. The East Bethel/Cedar Creek Community Schools’ Nature Area Sites are located directly behind the two elementary schools. East Bethel and Cedar Creek Community Schools are part of the St. Francis School District and both schools are located in the community of East Bethel, Minnesota. East Bethel has a population of 10,271. The city of East Bethel is transforming from rural to a suburban, area 40 miles North of Minneapolis.

Teachers, students, and community members, are fortunate to have access to a jewel of 160 acres of diverse lands encompassing the East Bethel/Cedar Creek Community Schools’ Nature Area Sites. The EBCS/CCCS Nature Area Sites include pine plantations, two pond areas, old fields, an extensive butterfly garden, an arboretum of trees connecting the two schools, four native plantings of shrubs and trees, tulip and perennial gardens, oak woods, and one acre of restored prairie. Birch, aspen, cherry, tamarack, and cedar tree stands provide food and habitat. All these nature area sites are connected with a signed trail system. Cedar Creek frames the western boundary of the property.

Amy Donlin works for the nature interpretive program at Wargo Nature Center in Centerville, Minnesota. After hiking our site in the spring of 2004, she enthusiastically exclaimed, “It was one of my very favorite school sites in the state. It is beautiful, well planned, and uncommon in its diversity of settings. You are so lucky to have it. I’m glad to hear that teachers use it too.” There is a core of teachers who do use the EBCS/CCCS Nature Area Sites. This core of teachers who are nature sensitive and willingly “act as positive role models for learners”(Hungerford & Volk 1990) needs to be expanded to more teachers and thus to their students. The dedicated few need to pass on the passion for nature.
The methods and process of this project are entwined with the history of the East Bethel/Cedar Creek Community Schools’ Nature Area Sites along with the needs and talents of the teachers of East Bethel/Cedar Creek Community Schools. Adaptations and opportunities that have presented themselves to the researcher and fellow teachers will be illustrated and connected by a timeline included in this chapter.

The researcher has formed a close attachment to the school’s nature area sites as a result being part of the original planning and ongoing maintenance of the sites. Garden carts have hauled prairie seed, shovels, shears, watering cans, and spraying apparatus from one end of the site to others. Co-authoring the Nature Trail Guide in 1998 was an opportunity to identify most of the plants and trees of the site. Hiking the trail system every few days throughout the seasons, with the help of Larry Weber’s Backyard Almanac (1996) unfolds yearly phenology. Old friends like marsh marigolds, hoary puccoon, nodding trillium, and blue-eyed grass, greet frequent visitors.

I have shared many a whole class gasp of awe at the marvels of nature. One such gasp of appreciation occurred in October of 2004. We had trekked the edge of the old field and were rounding the corner into the woods when all were delighted with a sugar maple glowing bright yellow before us. Unison choruses of appreciative gasps are moments illustrating students valuing nature. I have had treasure after natural treasure thrust in my face by children eager to share their delights. Numerous times we have lain down under the immense white pine together and I have watched their earnest faces send wishes that make the needles tremble up on their way to the blue Minnesota ski. Watching students’ delight in nature grow has been going on since 1980. The land itself has been a source of my inspiration and being connected to all aspects of it has shaped the methodology of this project.

**Sub-problem One Methodology**

Access to and safety aspects of the East Bethel/Cedar Creek Community Schools Nature Area sites will require maintenance before teachers will increase use with their students.
The researcher will team up with community scout groups and parent volunteers to clear the trail of excess brush and poison ivy in the fall of 2003 and again before the Outdoor Nature Study Group in the fall of 2004.

Sub-problem Two Methodology

Create interest and motivation for staff development on use of the nature sites.

Green Team members had determined there was an interest in training on use of the East Bethel/ Cedar Creek Community Schools’ Nature Area Sites from a survey distributed in 2002 (Appendix). The researcher will plan short in-services for teachers at Cedar Creek and teachers new to East Bethel Community School for Nature Site introductions in the fall of 2003. The researcher also continued to write article of students and teachers using the EBCS/CCCS Nature Area Sites for the Courier. (Appendix B)

Sub-problem Three Methodology

Apply to Independent School District # 15 Teacher Academy for permission and accreditation of the Nature Study Group as part of the 32 hour contracted Individual Professional Development Program.

As part of the Master Agreement, between Independent School District#15 of St. Francis, Minnesota and Education Minnesota St. Francis provides 32 hours of individual professional development. All teachers have the option of selecting Teacher Academy activities as a way of fulfilling their 32 hours. The District Professional Development Committee was seeking individuals or groups who wished to develop and offer study groups during the 2004-2005 school year. Teachers who participate have the option of fulfilling individual professional development hours or receiving Teacher Academy credit (one credit for each ten hours of study group attended).
In the spring of 2003 the researcher intends to submit an application to facilitate an Outdoor Nature Study Group for the fall of 2004 for the purpose of exposing the teachers to methods, materials, participation in using the Nature Area Sites of East Bethel/Cedar Creek Community Schools.

**Sub-Problem Four Methodology**

Create an outline of study for the teachers enrolled in the Nature Study Group that will demonstrate techniques of managing students outdoors, incorporate inquiry techniques and use the Minnesota Academic Standards in Science and Environmental Literacy Scope and Sequence for Minnesota.

The Request for Teacher Academy Study Group application will provide an outline of the Nature Study Group. The Study Group Plan of Topic will be developed in August of 2004. The Study Group Plan of Topics will be a statement of the goals and provide a syllabus for the Nature Study Group.


Current copies of the *Minnesota Academic Standards for Science* (2003) and the *Environmental Literacy Scope and Sequence: Providing a Systems approach to Environmental Education in Minnesota* (2002) will be obtained for each of the participants on-line and from the Minnesota Office of Environmental Assistance in the summer of 2004.

**Sub-Problem Five Methodology**

Implement the ten hours of outdoor, on-site, Nature Study Group so it interfaces with other District # 15 Academy classes for the 2004-05, school year.
The Nature Study Group will be held on Mondays and Tuesdays during the fall of 2004. The Nature Study Group will be held from 4:30 to 6:30 on September 20th, September 27th, October 5th, October 11th and October 18th.

Mary Wherry and Randy Keillor created a Master Calendar for Independent School District # 15 which scheduled the five study groups and five Teacher Academy classes for the 2004 and 2005 School year in the spring of 2004.

**Sub-problem Six Methodology**

Research and acquire quality environmental education materials for use and review during each Nature Study Group session.

The researcher will use the summers of 2003 and 2004 to compile environmental education materials using the Wisconsin Center for Environmental Education Learning Resource Center at the University of Wisconsin-Stevens Point, materials from the Minnesota Department of Natural Resources, and Minnesota’s online source SEEK.

**Sub-problem Seven Methodology**

Develop a pre and post survey of East Bethel/Cedar Creek Community Schools’ Nature Area Sites Use by the Nature Study Group participants.

The pre and post surveys will be developed during the summer of 2004. The surveys will be short and easy to fill out. The surveys will be designed to determine current number of visits to the Nature Area Sites and subsequent visits at the end of the sessions. Both pre and post surveys will survey curricular uses of the site visits. The surveys will try to determine the participants’ initial knowledge of the Minnesota Academic Standards for Science and the Environmental Literacy Benchmarks of Minnesota and acquired knowledge of the same after completion of the Outdoor Nature Study Group five sessions. The surveys will also ask the participants to rank the barriers inhibiting the use of the Nature Area Sites in a Likert-type scale.
Sub-problem Eight Methodology

Develop a Nature Study Group Evaluation for the St. Francis Teacher Academy that demonstrates 10 hours participating in the study group warrant credit and creates a direction for environmental education in St. Francis District #15.

The Nature Study Group Summary of Topics and the evaluation will be completed in the fall of 2004 and is required by the Teacher Academy to insure the participants received one lane change credit or board credit for attending all sessions of the Nature Study Group. Results from pre and post surveys along with the evaluation will be used to seek direction for environmental education in the district and incorporate participants’ ideas into improving future offerings in environmental education.


1993 Project schools of East Bethel and Cedar Creek Community Schools begin their environmental education journey by participating with Tree Trust in the planting of an arboretum connecting the two schools and by planting four native tree plantings on the schools’ grounds.

1994 Teachers from Cedar Creek and East Bethel Community Schools (EBCS/CCCS) participate in Project Learning Tree.

1995 Project schools of EBCS/CCCS form Green Teams to apply for a SNAP Partnership Grant. Grant is awarded and Green Teams attend Wolf Ridge Environmental Center to set goals, and plan site enhancements. Teams participate in environmental classes and compile guides for use on sites.

1996 Trail is cut through school property, one acre of prairie is planted, and outdoor, benched, learning areas are established.

1997 East Bethel Green Team receives a SNAP Project Grant. The butterfly garden is planted, prairie burned, and trial is signed and posted.


1999-2001
Researcher gives introduction to the prairie and trail-use workshops for East Bethel and Cedar Creek Community School teachers.

2000-2002

Prairie continues to be expanded and trail sites maintained by East Bethel Community School Green Team with community help. The researcher begins writing articles to draw attention to the community of the importance and use of the East Bethel/Cedar Creek Community Nature Area Sites.

Increase of Nature Area Sites by East Bethel and Cedar Creek Community School Teachers Project Formation

October 2002

Researcher and Green Team members from East Bethel create a survey to determine trail site use and plan for teachers’ environmental education needs. Leadership courses at University of Wisconsin Stevens Point suggested a team approach to initiate change or to start a new project.

February 2003

Researcher plans to create a guide for K-3 teachers on prairie and butterfly garden use and compiles teacher materials.

May 2003

Project Vision Changed

Researcher transferred to Cedar Creek Community and formulates plan to increase all nature area sites use for both East Bethel and Cedar Creek Community Schools. Articles written by researcher illustrating use of East Bethel/ Cedar Creek Community Schools’ Nature Area Sites for the local paper continue.

September 2003

Trail enhancement at Cedar Creek Community School to increase use.

October 2003

Introduce East Bethel/Cedar Creek Nature Area Sites to new teachers and provide materials.

November 2003

26
Researcher leads six classes and their teachers in prairie seed collection and distribution at East Bethel/Cedar Creek Prairie.

Researcher instructs Cedar Creek Community School teachers in prairie and butterfly garden planting techniques at faculty meeting and distributes native seed planting survey interest.

December-May 2004

Researcher piloted, MinnAqua, created by the Minnesota Department of Natural Resources. This water stewardship plan could be used as a resource to increase pond site use.

May 2004

Apply to IDS #15 Teacher Academy for permission to lead a Nature Study Group comprised of K-6 teachers. Permission is granted and Nature Study Group is open to all St. Francis District #15 teachers K-12 and put on the district Calendar for the fall, of 2004.

June 2004


July-August 2004

Prepare lessons and research materials for East Bethel/Cedar Creek Community Schools’ Nature Area Sites Study Group Use. Prepare pre and post survey of site use by the 23, K-8, Nature Study Group teachers. Spray for poison ivy again.

September –October 2004

Implement the five, two hour, on site, outdoor study group for ISD#15 enrolled teachers. Researcher teaches the lessons chosen for Nature Study Group to the three science classes as a result of team teaching. Prepare Nature Study Group binders with dividers to contain study group materials appropriate for East Bethel/Cedar Creek Community Schools’ Nature Area Sites.

November 2004

Tabulate Pre Trail Use Survey and write summary of course evaluation for the St. Francis District #15 Teacher Academy so participants in Nature Study Group will
receive credit.

Researcher, Gwen Dillenburg, and Darin Hahn, principals of EBCS/CCCS respectively, give a presentation to District #15 School Board asking permission to apply for membership to the DNR's School Forest Program. Permission is unanimously given.

September-2004-May -2005

Researcher continues to support teachers in their use of the East Bethel /Cedar Creek Community Schools' Nature Area Sites through emails of ideas and notification of phenology on the sites. Many Nature Study Group Participants would like a winter introduction to snowshoeing and additional winter and spring session on using the EBCS/CCCS Nature Area Sites. East Bethel and Cedar Creek Community Schools are now part of the Minnesota School Forest Program and Project Wet, Project Learning Tree, and Project Learning Tree will be offered to Independent District #15 Teachers on August 22 and 23, 2005.

April 27. 28 First School Forest Planning Meeting and Second Prairie Burn
On becoming a Minnesota School Forest the DNR provides consultation with Art Widerstrom, an Anoka County forester. We walked the trail system and viewed the nature area sites. He suggested a burn to the prairie and arranged it for the next day. It was the same day as ten parents had volunteered to dig the 500 holes for tree planting on Arbor Day.

April 29 2005 Arbor Day
Fifteen classroom teachers from grades 3-5 at Cedar Creek celebrate Arbor Day by planting 650 white pine and red oak trees on site. Outdoor learning sites are set up for the day and many teachers enjoy the Nature Area Sites with their classes the entire day.

May 2005
All of second grade at East Bethel Community School participate in planting 300 white pines as part of Arbor Month in Minnesota. The second grade also participates in two days of outdoor learning stations teamed with Wargo Nature Center.
Implement the Post Use Survey with Nature Study Group participants to determine increase of use of the East Bethel/ Cedar Creek Community Schools' Nature Area Site. Researcher will offer one spring EBCS/CCCS Nature Area Sites workshop for Nature Study Group participants as well as any other EBCS/CCCS teachers.

**Summary**

The strong attachment to the EBCS/CCCS Nature Area Sites through years of maintenance, development, collaboration, delightful use with students and personal enjoyment has shaped the development and outcome of this project, which is to increase the utilization of this wonderful outdoor nature area by fellow teachers at East Bethel and Cedar Creek Community Schools. The methods used to address sub-problems were grounded in the needs of the teachers, inspiration from the Wisconsin Center for Environmental Education at University of Wisconsin-Stevens Point, and directed by the Minnesota Academic Standards and Environmental Literacy Benchmarks. Independent School District #15 Teacher Academy provided the monetary motivation for teachers to participate in the Nature Study Group. Implementation of the Nature Study Group was the method of increasing use of the East Bethel/Cedar Creek Community Schools' Nature Area Sites. Implementation of the Nature Study Group was a result of over ten years of collaboration and fortunate events, as the preceding timeline revealed.
Chapter 4

Results

Introduction

This chapter will describe the activities and events leading up to the implementation of the five, two-hour Nature Study Group sessions. Increased use of the Nature Area Sites on the 160 acres of school land behind East Bethel and Cedar Creek Community Schools was the primary intent of the project. The results of pre and post surveys will be displayed and discussed. Teacher comments will round out the results discussion.

Sub-problem One

Access to and safety aspects of the East Bethel/Cedar Creek Community Schools Nature Area sites will require maintenance before teachers will increase use with their students.

Community members, students, and Boy Scout troops from Cedar Creek Community School joined Carol Krupke and the researcher, one Saturday morning in the fall of 2003, to clear the trail of brush and cut down overhanging branches around White Pine Pond. The researcher had sprayed the areas of poison ivy daily over a period of three days the week before. The volunteers worked for four hours and were delighted to hear that classrooms would be using the section of the trail system they had cleared for environmental education activities. A newspaper article picturing and thanking the workers for their community service was written for the Courier. (Appendix B)

After the trail clean up, many teachers from both Cedar Creek and East Bethel Community Schools commented on how thankful they were to be able to access the trail and pond again.

Poison ivy had returned in abundant amounts in the August of 2004. The Friday before teachers returned to school, the researcher applied Round UP. East Bethel and Cedar Creek Community School faculty were alerted to avoid the area until after it had died. St. Francis grounds keepers were called in to mow tall weeds on the trail and define
the route. Access to the pond was cut again prior to the Nature Study Group using White Pine Pond for investigation.

**Sub-problem Two**

Create interest and motivation for staff development on use of the nature sites.

Green Team members had determined there was an interest in training on use of the East Bethel/ Cedar Creek Community Schools’ Nature Area Sites from a survey distributed in 2002 (Appendix C). The researcher gave three one hour, after school, introductions to the EBCS/CCCS Nature Area Sites with new teachers during the fall of 2003. These site hikes and informal introductions were well received by the teachers involved. It was on their suggestion that the Nature Study Group was developed.

The researcher prepared and presented a Power Point presentation on the benefits of planting a butterfly garden or prairie with students and demonstrated seed gathering techniques as part of a faculty meeting in November of 2003. An interest survey was given out at the faculty meeting. (Appendix D)

Enthusiasm for native seed gathering and prairie exploration was further generated by the researcher inviting several fourth grades classes and their teachers to join hers in gathering prairie seeds during the fall of 2003. The researcher also continued to write article of students and teachers using the EBCS/CCCS Nature Area Sites for the Courier. (Appendix B)

**Sub-problem Three**

Apply to Independent School District # 15 Teacher Academy for permission and accreditation of the Nature Study Group as part of the 32 hour contracted Individual Professional Development Program.

As part of the Master Agreement, between Independent School District #15 of St. Francis, Minnesota and Education Minnesota, St. Francis provides 32 hours of individual professional development. All teachers have the option of selecting Teacher Academy activities as a way of fulfilling their 32 hours. The District Professional Development Committee was seeking individuals or groups who wished to develop
and offer study groups during the 2004-2005 school year. Staff who participated had
the option of fulfilling individual professional development hours or receiving Teacher
Academy credit (one credit for each ten hours of study group attended). The request
for the Nature Study Group was made and returned to Mary Wherry and Randy
Keillor before April 15, 2004. The District Professional Development Committee
approved the Nature Study Group on April 22, 2004. Original Request for Teacher
Academy Study Group application, Study Group Facilitators Guidelines, and the
Policy on Study Group Attendance can be viewed in (Appendix E).

**Sub-Problem Four**

Create an outline of study for the teachers enrolled in the Nature Study
Group that will demonstrate techniques of managing students outdoors, incorporate
inquiry techniques and use the Minnesota Academic Standards in Science and
Environmental Literacy Scope and Sequence for Minnesota.

The Teacher Academy Study Group application required an outline of the Nature
Study Group. The Study Group Plan of Topics was also a statement of the goals and a
syllabus for the Nature Study Group. It was the first page of the participants Nature
Group binder and gave suggestions for dressing and my school and home phone
numbers for the participants. (Appendix F)

**Sub-Problem Five**

Implement the ten hours of outdoor, on-site, Nature Study Group so it interfaces
with other District # 15 Academy classes for the 2004-5 school year.

The Nature Study Group was held on Mondays and Tuesdays during the fall of
2004. The Nature Study Group was held from 4:30 to 6:30 on September 20th, September
27th, October 5th, October 11th and October 18th. Mary Wherry and Randy Keillor created a
Master Calendar for Independent School District # 15 which scheduled the five study
groups and five Teacher Academy classes for the 2004-05, school year.
September 18, 2004 was the date of the first Nature Study Group. Twenty-two participants from grades K-7 were signed up for the five two hour sessions. The majority of participants were from the K-3 building, East Bethel Community School. Two participants were science teachers from the Jr. High School in St. Francis. The remaining eight teachers taught grades 3-6 at Cedar Creek Community School. One was an art teacher and one taught remedial reading. The group was diverse in terms of environmental education knowledge and essential science concept knowledge.

The intent of the Nature Study Groups was to increase use of the Nature Area Sites by the teachers and thus their students. The sessions started indoors but we quickly dispatched to the outdoors. The tips for taking students outside were used and modeled with the teacher participants. The agenda and plans for the sessions were followed, yet as Nalani McCutcheon stated in *Tips and Tricks for Taking Kids Outside* (2001), the opportunity for teachable moments and sharing were not wasted. Natural lesson outdoors were sometimes “more compelling than the task at hand.”

Each session was started with a healthy snack, a plan for the evening, sharing of ideas, and dissemination of quality EE materials appropriate to the site. An effort was made to have materials for each grade level. The EE materials had been previously hole punched and each session inserted into a binder each participant was given at the first session. Publications from conservation groups and the Minnesota Department of Natural Resources were also part of the materials presented. Teacher input was constant during each session. Emails and notes about the sessions honed the following sessions. Teachers needed to feel comfortable navigating the trail system, be introduced to the natural wonders, and as I soon found out, need instruction in essential science concepts. Minnesota State Standards for Science and Minnesota’s environmental literacy plan were the structure for each session.
Nature Study Group Topics Completed  
Fall 2004

The 2004 fall Nature Study Group brought together District #15 K-teachers to share activities, lessons, techniques of outdoor student management, and inquiry technique outside, in the Cedar Creek/East Bethel Community Schools’ Nature Areas. Site specific, environmental teaching resources were distributed, and assembled into a usable binder. Each participant was given the *Minnesota Academic Standards, Science K-12, 2004*. These standards were highlighted and incorporated into use for all the nature areas. A copy of *Environmental Literacy Scope and Sequence, 2002*, was given to all participants. These Minnesota grade level standards and benchmarks were reviewed. The science background needed to incorporate the standards was inserted into each outdoor outing for the participants. The importance of exposing students to outdoor sites for learning was revealed through direct experience. Teachers shared their enthusiasm for the nature areas and made a connection to the land. Comments made by the participants and the Nature Study Group Evaluation form revealed, the main goal, increased use by teachers and their classrooms of the E.B.C.S./C.C.C.S. Nature Area sites, was beginning to be accomplished.

**Trees on Site** (Monday, September 20th) 2004

Teachers completed the Nature Trail Use Survey #1 (Appendix H) to determine the 2003 school year use of the nature areas, reasons for use, barriers to use, and knowledge of the *Minnesota Academic Standards, Science K-12, 2004*, and the *Environmental Literacy Scope And Sequence, 2002*. Attendance requirements were reviewed at this first session. Tips for introducing students to the nature trail and the use of a nature journal were demonstrated. Teachers made drawings and practiced inquiry by using all of their senses. The science concepts of, photosynthesis, decomposition, and the interdependence of organisms, were stressed. Tree resources were distributed.
Pond Study (Monday, September 27th) 2004

Teachers collected aquatic invertebrates with a dip net at the White Pine Pond. They sorted, identified, and drew their findings. Materials from the DNR’s MinAqua program and various other pond resources were used and distributed. Techniques for safety and follow up lessons were shared. Review of the flow of energy and importance of plants in the pond was recapped at the October 5th session.

Trail Use and History and Forest Resources of Minnesota (October 5th) 2004

Participants discussed and highlighted the Minnesota Academic Standards for Science at their grade level that were enhanced or could be covered outdoors by nature site use. Participants requested more time be spent this session studying trees on site. The science concepts of visible light, chlorophyll absorption, and revealing of color changes in leaves were reviewed while examining red oak and box elder trees. Bottle gentian was examined on the trail and its interdependence with the bumblebee was discussed. Golden rod galls were examined and dissected as a part of direct observation. Tamarack, white pine, ginkgo, white spruce and aspen as wood resources today and in the past were detailed. Drawing and painting sites for students were pointed out.

Evaluation Process, Sharing, Sumac Lemonade, and Individual Interests (October 11th) 2004

The participants shared the success of nature trail outings with their classes. Staghorn sumac was used to make lemonade as a taste of the wild for participants and a connection to history and physical science. The study group discussed adding a winter and spring session and topics for evaluating the sessions. Teachers dispersed to walk the trail and work together on individual and grade level interests. Resources on prairie plants, mushrooms, and lessons from Project Bluestem were distributed.

Environmental Literacy Scope and Sequence for Minnesota, Evaluation, and Prairie (October 18th) 2004

Teachers completed the evaluation form that was created as a result of their input. The document, Environmental Literacy Scope and Sequence Providing a Systems
Approach to Environmental Education in Minnesota, was examined. Grade level benchmarks were highlighted. Participants were pleased to discover they were meeting most of the benchmarks by using the nature area sites. The Power Point presentation presented to the board on the virtues of our site becoming a School Forest was shared with participants. Teachers walked out to the butterfly garden to identify plants and gather seeds. These flower seeds were sown into the prairie. Prairie grasses were identified. Seed was gathered and sown into the gopher mounds on the return trip. The importance and cycle of native plants was the science concept experienced this session.

**Sub-problem Six**

Research and acquire quality environmental education materials for use and review during each Nature Study Group session.

The environmental education materials used for each topic have been referred to in the previous section. The materials were selected from the Wisconsin Center for Environmental Education housed at the University Wisconsin- Stevens Point, Wisconsin. During the previous school year, I had piloted *MinnAqua*, (2005) a curriculum guide created by the Minnesota Department of Resources to promote water stewardship through fishing. The chapter on pond plants and animals was particularly useful for the session on pond study. Site specific materials created for use in sessions can be found in (Appendix G).

**Sub-problem Seven**

Develop a pre and post survey of East Bethel/Cedar Creek Community Schools’ Nature Area Sites Use by the Nature Study Group participants

Survey # 1(Appendix H) was developed prior to the Nature Study Group sessions. Dr. Dennis Yockers of the University Wisconsin/Stevens Point reviewed the survey. The survey prefaced with an introductory statement of the value of sharing group experiences, activities, and methods to generated enthusiasm and increase usage by teachers of the EBCS/CCCS Nature Area Sites. The importance of linking students to the natural world...
and thus gaining environmental awareness and sensitivity was stated. The survey developed consisted of five questions. The first question asked participants to check of the number of times they had visited the various nature sited during the 2003-04, school year. The second question asked participants to check of the primary use(s) of the EBCS/CCCS Nature Area Sites they had infused environmental education into. The third question asked participants to rate the common barriers inhibiting them from using the nature areas on a Likert type scale from 1-5, where (1) was not a barrier and (5) being a strong barrier. The barriers to rank were: Lack of Time, Student Behavior, Environmental Knowledge, State Academic Standards, Administrative Support, and Environmental Teaching resources. The fourth question asked participants to list Minnesota State Science Standards they had addressed while using the EBCS/CCCS Nature Area Sites. The last question, question number five, asked participants to list the Minnesota Environmental Literacy Benchmarks they had addressed while using the nature sites.

During the first Nature Study Group session, September 18, 2004, participants filled out Survey #1 (pre survey). The intent of the survey was to determine the use of each nature site, what curricular areas teachers enhanced by using the Nature Area Sites, and what barriers to using the Nature Area Sites were most inhibiting to the participants. The participants were also asked to list what Minnesota State Science Standards were addressed by using the Nature Areas Sites. Finally, the participants were asked what Minnesota Environmental Literacy Benchmarks had they addressed in 2003-2004 as a result of taking their students outside and using the Nature Area Sites. For specific content and summary of scoring see example in (Appendix H).

The first question on each survey was: During the 2003-04 or 2004-05 school years, how many times did you use the following outdoor resources to enhance curricula? The outdoor resources were nature trail, ponds, butterfly garden, prairie, and other. The results can be viewed in Figure 4.1 and Figure 4.2.
The results of question one, site usage, in Survey #1 are unclear due to the (0-1) choice given to participants. Figure 4.1 reveals high tallies for the (0-1) choice. In reality many participants' use of the site was zero times. This design flaw resulted in difficulty determining increased use of sites when compared to the post survey or Survey #2.

Survey #2 (Appendix H) was delivered to the participants' mailboxes on May 1, 2005. The intent of Survey #2 was also to determine use, barriers to use, and curricular infusion of environmental education, by using the Nature Area sites during the 2004-5 school year. Again the participants were asked to list the Minnesota State Science Standards.
The results of comparing Survey #1, September 2004 to Survey #2, of May 2005 are difficult to interpret because of the category of (0-1) uses. The researcher can guess which teachers were using the sites zero times by knowing the participants, but the data is not clear. There seems to be an increase in the number of teachers using the sites a higher number of times. Teachers commented many had marked the (0-1) category as (0) the first time and (1) on Survey #2. Four teachers also reported via email when they had used the trail for the first time. The (0-1) category should note have been used.
Question number two on each survey asked what curricular subject areas participants infused environmental education into. The percentage of increased infusion of environmental education into the of curriculum areas chosen tended to increase after participation in the on-site, outdoor Nature Study Group. The following table and charts illustrate the results.

Table 4.1 Curricular Infusion of Environmental Education of Nature Sites

<table>
<thead>
<tr>
<th>Curricular Area</th>
<th>Science</th>
<th>Math</th>
<th>Social Studies</th>
<th>Language Arts</th>
<th>Nature Study/Enjoyment</th>
<th>Recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey #1</td>
<td>17</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Sept., 2004</td>
<td>(85%)</td>
<td>(15%)</td>
<td>(0%)</td>
<td>(0%)</td>
<td>(45%)</td>
<td>(20%)</td>
</tr>
<tr>
<td>N = 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey #2</td>
<td>14</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>May 2005</td>
<td>(74%)</td>
<td>(21%)</td>
<td>(.05%)</td>
<td>(32%)</td>
<td>(74%)</td>
<td>(21%)</td>
</tr>
<tr>
<td>N = 19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change</td>
<td>-11%</td>
<td>+6%</td>
<td>.05%</td>
<td>+32%</td>
<td>+29%</td>
<td>+21%</td>
</tr>
</tbody>
</table>

Survey #2 (post survey) results of primary use of curricular infusion of the outdoor sites shows the greatest increase of use was for nature study/enjoyment. This was the main focus of our Nature Study Group outings. There was also and increase of the sites for language arts infusion.
The following figures (4.3 compared to 4.4) show that there was increase in the East Bethel/Cedar Creek Community Schools’ Nature Area Sites for the infusion of environmental education into the curricular area of language arts and art. The figure also shows an increase in nature study/enjoyment.

Survey #2 was given to the participants in the Nature Study Group in the spring of 2005 to determine Nature Area Site use. The following (Figure 4.3) illustrates the primary use of infusing environmental education after completion of the five sessions of on-site, outdoor, inquiry-based, professional development designed to increase use of the Nature Area Sites.

**Figure 4.3 Infusion of Environmental Education into Curricular Areas (2004)**

![Survey #1 (2004)- Primary Uses of Nature Sites](image)

Figure 4.4 illustrates the change in primary infusion of environmental education by the participants after participation in the on-site, outdoor Nature Study Group. The results are from Survey #2 (Appendix H).
The third aspect of each survey dealt with barriers inhibiting the use of the East Bethel/Cedar Creek Community Schools' Nature Area Sites. The 22 participants were very generous in sharing the results of their outings with students during the Nature Study Group sessions. A decrease in the average for Student Behavior as being a barrier was a result of discussions and tips shared by participants and researcher. Several participants noted that using a journal kept the students on task and made them feel like real scientists. Stating the objectives and expected behavior before the outing was particularly helpful to the teachers in establishing class control.

The following table (4.2) results were obtained from averaging the rankings of the barriers by the participants. A ranking of a barrier of (1) meant it was not a barrier. A ranking of (5) meant it was a strong barrier. Most of the barriers inhibiting use of the Nature Area Sites seemed to have lessened after participation in the Nature Study Group. Student Behavior, State Academic Standards, Environmental Knowledge, and to a larger extent Lack of Environmental Knowledge were ranked lowered by average than on Survey # 1.
Table 4.2 Barriers Inhibiting Use of Nature Areas Sites Comparison 2004 Vs. 2005

<table>
<thead>
<tr>
<th>Barriers</th>
<th>September 2004</th>
<th>May 2005</th>
<th>Amount Average Increased</th>
<th>Amount Average Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Time</td>
<td>3.4</td>
<td>3.8</td>
<td>.4 (12%)</td>
<td>.7 (23%)</td>
</tr>
<tr>
<td>Student Behavior</td>
<td>3.0</td>
<td>2.3</td>
<td>.7 (23%)</td>
<td>.6 (31%)</td>
</tr>
<tr>
<td>State Standards</td>
<td>1.9</td>
<td>1.3</td>
<td>.6 (24%)</td>
<td>.6 (24%)</td>
</tr>
<tr>
<td>Environmental Knowledge</td>
<td>2.9</td>
<td>2.3</td>
<td>.6 (24%)</td>
<td>.6 (24%)</td>
</tr>
<tr>
<td>Environmental Education Resources</td>
<td>2.9</td>
<td>1.5</td>
<td>1.4 (48%)</td>
<td></td>
</tr>
<tr>
<td>Administrative Support</td>
<td>1.1</td>
<td>1.0</td>
<td>.1 (.09%)</td>
<td></td>
</tr>
<tr>
<td>Other: Large Class size, weather</td>
<td>Two participants rated class size as a 5</td>
<td>One participant rated weather as a 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following figure 4.4 graphically illustrates a decrease in all of the barriers to inhibiting use of the East Bethel/Cedar Creek Community School Nature Area Sites except for Lack of Time. Lack of Time increased as a barrier inhibiting use. This increase could have been a result of increased enthusiasm for using the sites by the participants. After exposure to hands-on activities and exploring the sites, perhaps the teachers wanted more time outside with their students. Another reason for an increase of the barrier Lack of Time could be that the EBCS/CCCS Nature Site is so large. It takes time to walk out to sites with young children. Participants commented on scheduling as being a barrier to use not Lack of Time. Several participants felt they needed 1 to 2 hours outdoors to complete activities. The junior high participants who had use of a small site did not think Lack of Time was a barrier.
Nature Study Group participants rated the selected barriers from (1 to 5) with (5) being the strongest barrier and (1) not a barrier for using the Nature Area Sites. The averages of the most of the barriers decreased. Figure 4.4 reveals, Environmental Educational Resources decreased in average from 3.9 to 2.3. This decrease was due to the large amount of site-specific materials the teachers were given at each session.

Figure 4.4 also illustrates that Environmental Knowledge, as a barrier to using the Nature Area Sites decreased. Each session was intent on the teachers experiencing specific flora and fauna of the sites for observation and connection to curriculum. Participants shared their expertise and discoveries during each outing.

State Academic Standards for Science were the framework during each outdoor session. The teachers had very little knowledge of the Minnesota Academic Standards for Science as indicated by Survey #1 (Appendix H) completed on September 18, 2004. The two junior high science teachers were able to list a total of six between them. Most teachers completed the answer by writing a question mark for State Academic Standards.
for Science they addressed while using the Nature Area Sites. One wrote, “Beats me!” Three listed the subjects of pond study and insects. Three participants listed diversity of organisms, inquiry, and categorizations, as State Academic Standards for Science. Many were very pleased to find out they were meeting several of the Minnesota Academic Standards for Science by using the Nature Area sites.

The participants were given a copy of the *K-8 Minnesota Academic Standards for Science* (2003) for their notebooks during the first session. After several class sessions participants used highlighters to mark the standards covered. The decrease in State Standards as being a barrier on Survey #2 seems positive to the researcher. On Survey #2, May 2005, 17 out of 19 participants listed at least three specific science standards they had covered while using the Nature Area Sites.

The second grade teachers in particular knew and listed most of their Minnesota Academic Standards for Science. The researcher is their district science representative. I was happy to discover this increased knowledge of the science standards. The art and remedial reading teachers were the only teachers who did not list state science standards addressed while using the Nature Area Sites. The junior high teachers listed eight specific standards on the second survey.

Survey #2 completed in May of 2005, indicated all but five participants could list several Minnesota environmental Literacy Benchmarks they had addressed while using the EB/CCCS Nature Area Sites. The two junior high science teachers could each list three specific Environmental Literacy Benchmarks along with the key systems concepts and supporting concepts. Both junior high science teachers were unable to list any Environmental Literacy Benchmarks on Survey #1 in September of 2004.

**Sub-problem Eight**

*Develop a Nature Study Group Evaluation for the St. Francis Teacher Academy that demonstrates 10 hours participating in the study group warrant credit and creates a direction for environmental education in St. Francis District #15.*
A Nature Study Group Evaluation was created in October of 2004. Information
gathered on Survey #1 and comments made by participants during the sessions also helped
form the questions asked on the evaluation. To view the entire evaluation form see
(Appendix I).

**Nature Study Group Evaluation**

The Nature Study Group Evaluation was completed during the last Study Group
session. The participants had just returned from outdoors and the sum total of the
experience was fresh in their minds. Perhaps this evaluation was more reliable than
comparing Survey #1 and Survey #2.

Participants’ comments written on the Nature Study Group Evaluation were very
positive. The first question asked if the strongest barriers inhibiting their use of the Nature
Area Sites, they had ranked from Survey #1, had lessened. The barriers were of lack of
time, student behavior, environmental teaching resources, and environmental knowledge.
The affect of the barriers to use of the Nature Area sites had lessened. The following
comments are typical answers.

A kindergarten teacher wrote, “My environmental knowledge has increased and I
feel more confident to share information with students. I have also been inspired by my
instructor to expose students to the natural beauty outside even though time is limited.”

A first grade teacher wrote, “Teaching of the science standards outside has
lessened the barrier of time.”

A second grade teacher wrote concerning behavior,” There were a lot of good
suggestions as what students could do, hands-on, outside. Having each child have a
clipboard with paper and pencil activities was like having a classroom outdoors. It helped
with behaviors.”

Another second grade teacher wrote about resources and time, “We now have great
environmental teaching resources and my knowledge has grown drastically. Compacting
the curriculum was an idea that has helped alleviate time constraints.”

Yet another second grade teacher commented, “This class has greatly increased my
environmental knowledge and how to share these ideas with kids. This class has taught me
how to take kids in the forest with purpose, focus, and meaning.
A fifth grade teacher commented about behavior, "Yes, the barriers lessened. I went out, made it clear about behavior and had a good time enjoying the fall foliage. We used it as a writing experience."

A sixth grade teacher thought, "The resources were plentiful. It's nice to have you as a site resource. Your emails were a great source to get me out with kids on a nice day."

The seventh grade science teachers from the junior high thought they could expand the site at St. Francis Jr. High or bring their students over to East Bethel/Cedar Creek Community Schools' Nature Area Sites, now that they knew it so well. One wrote, "Lack of time is no longer a barrier. I decided it was important enough to make time and incorporate curriculum outside. I found many reasons to go outside this fall. Thanks for getting me back into nature."

The second question on the Nature Study Group Evaluation asked if participation in this study group enhanced the study of science/nature study enjoyment. Science and nature study enjoyment had been listed as the most common reason for using the Nature Area Sites on Survey #1. Comments were positive and the following examples are reflective of the common thread.

The art teacher wrote, "It enhanced my desire to incorporate nature more into the art curriculum."

A veteran sixth grade teacher wrote, "It has contributed to nature study considerably. Even if I never taught a lesson in science, I would use the trail as a source of encouraging the enjoyment and appreciation of God's creation."

Another sixth grade teacher wrote, "Yes, I went back and reworked a lesson I had done in the classroom to adapt it to the outside area."

A fourth grade teacher wrote, "Yes, I have been out four times with my class since I've started the classes."

Second grade teachers commented, "Absolutely, our facilitator has a passion that helps the rest of us get out. I've learned to appreciate it."

"Yes, a person can enjoy nature more when there is some knowledge. It's nice to be able to look for things we know the names of and are familiar with."

"A first grade teacher commented, "We have used the nature trail to relax and enjoy our senses, look at small things like the needles on the ground. Simple is good."
The kindergarten teacher wrote, “I have a better understanding of common science concepts relating to trees as a result of this class and resources given us through the class. Pam did an excellent job of giving us resources related to the Trail.”

Question three on the Nature Study Group Evaluation asked: Has exposure to the *Minnesota Academic Standards K-12 Science Standards* and the *Minnesota Environmental Literacy Scope and Sequence* while participating in this study group been connected to your use of the EBCS/CCCS Nature Sites? The participants expressed a general assertion that they had. A few typical comments were,

“I’m trying to incorporate some of the standards like, observe plant and animal life, needs, interactions.”

“It has made me more aware of what I should be covering with the new standards.”

“Students have been careful observers.”

“Yes, it was good to go through them together so we could see the connection.”

“Yes. It helped me understand that I am teaching to the standards, even when we are having fun.”

“It has been very valuable to see how we can cover the standards at our grade level by using the nature site.”

“Adopt a science curriculum that encourages use of nature sites.”

Questions #4, #5, and #6 on the Nature Study Group Evaluation dealt with ways to improve the Nature Study Group if it were offered in the future. A common suggestion was to offer the Nature Study Group throughout all the seasons. Many participants wanted to share snowshoeing expertise and winter activities. Several wanted to meet again in the spring. Many suggested I continue sending out emails about the trail and perhaps writing a “Green Team Newsletter on what are happening, general use guidelines, and tips for outdoor classroom.”

Many wanted the Nature Study Group offered again with other areas of the curriculum being emphasized. They thought our core group involved in the Nature Study Group would increase use of the sites, “Just awareness and word of mouth will encourage other teachers. If they see it being used, they will try it. Time-Time-Time!!”
The researcher remembered to ask the participants to comment on the sessions after the first two outings. The comments were motivating. The following are examples showing that participants in the Nature Study Group valued the idea of themselves and students making a connection to nature. Their comments via email also showed they liked procedural and science information. Participants were thankful for the materials.

"I enjoyed the class tremendously. Doing and in-depth study, (needles, bark, sap, cones, seeds, root systems, and involving the other senses) reinforced thoughts of taking nature seriously and hopefully creating a personal appreciation in children was evident in your presentation. I am very excited to take my class out to just instill these ideas. Children need to form an alliance with nature to protect it in the future."

"I enjoyed the class tree-mendously. It was a perfect afternoon to go exploring and learning down the path. It made me feel relaxed after a busy day and in awe of the wonderful living things around me."

"My thoughts...Great to see teachers interested in the outdoor classroom. Great to become aware we do not need to purchase a science kit, we have a great kit right outside our doors! Great to see curriculum discussion. Great resource for art and math."

"I liked the little tidbits of information that you shared. I appreciate getting tips for handling students outdoors. I will definitely try having them sketch when we go out to look at trees. I can see that getting them out as often as you do probably helps control the wildness of just being in a new place. Thanks for all the time you put into organizing things for us."

"The class was excellent. I learned some new things that I can use with my trees science unit for kindergarten. I liked how you pointed out the use of procedures with the class. So often with hands-on activities it is hard to always know how to organize each detail—with kindergarten there seem to be so many details!"
"I thought you had great command of the knowledge and vocabulary and showed a tremendous amount of enthusiasm for the topic. You allowed time for individuals to come to their own conclusions and to become owners of the information. You are very motivated by the subject and convey that in a way that is contagious to others. Thank you for being a great resource and so generous with materials."

**Summary**

Personal comments by e-mail and from the final Nature Study Group Evaluation revealed that use had increased along with knowledge of the *Minnesota Academic Standards K-12 for Science* and *Minnesota Environmental Literacy Scope and Sequence* while participating in the study group. I would agree with the general suggestion of offering the Nature Study Group throughout all the seasons. I plan on continuing to be an environmental education resource for the site.

The land itself caught the teachers in its peaceful snare and I was lucky enough to witness an attachment to the land grow and a sense of caring and exploration develop amongst the participants.
Chapter 5
Conclusions and Recommendations

Benefits of Increasing Use of East Bethel/Cedar Creek Community Schools’ Nature Area Sites

Review of the literature has revealed that positive environmental behavior sprouts from environmental sensitivity. Environmental sensitivity is defined as an empathetic perspective toward the environment. Engleson & Yockers (1994) summarized several generators of the development of environmental sensitivity. The first being frequent interaction with natural pristine habitats by playing and exploring. Another factor is having role models such as family members or teachers who encouraged and fostered environmental sensitivity. It naturally follows that teachers using the East Bethel/Cedar Creek Community Schools’ Nature Area Sites often and throughout the seasons with their students could nudge the growth of environmental sensitivity in their students.

Increased use of nature area site by teachers can contribute to children developing a “sense of place”, improve the quality of life, help children realize they are part of and dependent on the natural environment, and creates an opportunity for the diversity of life to emerge naturally. Connecting children over a continuous time to their natural surroundings builds knowledge, ownership, and empowerment to affect change and perhaps lead them to become caretakers of the land.

A connection to the land also improves test scores and behavior. Bell (2001) has found that in a study of 40 schools in the United States using hands-on outdoor learning sites as an integrated context for learning, students’ performance improved in standardized test scores, grade point averages, willingness to stay on task, adaptability to learning styles, and problem solving.

As Sobel, (1996) conveyed, children need time to bond with their immediate, natural world. They need to explore nature in the “here and now” and feel comfortable with it before being asked to fix it. “Here” is the East Bethel/Cedar Creek Community Schools’ Nature Area Sites and “now” is their elementary school experience.
Pre and Post Survey Comparison

Use of Outdoor Resources

Teacher participants increased their use of the EBCS/CCCS Nature Area Sites by using certain sites more often. The comparison of Survey #1 (Appendix H) to Survey #2 (Appendix H) showed the pond area, nature trail, and prairie sites increased in the number of times Nature Study Group participants used the sites from 2004 to 2005. More of an increase could have shown up if the category of (0-1) on the use question would not have been used. Many participants acknowledged they had used the sites (0) times in 2004 school year. These same participants proudly announced they had used several sites for the first time and marked (1) to record their use on Survey #2, in 2005. This recording design flaw of distinguishing between (0) and (1) on Survey #1 and Survey #2 to determine increase of site use made the results unclear.

Teachers from East Bethel Community School had to pack and box all their school materials and supplies because of repairs to the building's roof in the spring of 2005. Perhaps this caused them to rush on filling out Survey #2 and further flaw the data.

Primary Use of East Bethel/Cedar Creek Community Schools' Nature Area Sites

After participating in the on-site, outdoor, Nature Study Group more teachers were using the Nature Area Sites for nature study/enjoyment. Nature study/enjoyment use showed an increase of 29%. Language arts and math infusion also increased as a result of participation in the Nature Study Group.

Barriers Inhibiting Use of East Bethel/Cedar Creek Community Schools’ Nature Area Sites

Comparing Survey #1 to Survey #2 showed barriers inhibiting use of EBCS/CCCS Nature Area Sites had all decreased except for the barrier of Lack of Time. Participants were asked to rank the barriers from (1-5). Rating a (1) was not a barrier, while rating (5) was a strong barrier. The responses were averaged. Student Behavior
dropped as an average of (3.0) on Survey #1 to and average of (2.3). State Standards average changed from (1.9) to (1.3) as a barrier. Lack of Environmental Knowledge dropped from an average of (2.9) to (2.3). Lack of Environmental Education Resources dropped the most from (2.9) to (1.5) average. Perhaps Lack of Time increased as a barrier from (3.4) to (3.8) because participants became aware of all they could do outdoors on the nature sites and wanted more time to do more. Another reason Lack of Time as a barrier increased is because East Bethel/Cedar Creek Community Schools’ Nature Area Sites are located on 160 acres. In particular teachers talked as scheduling as the barrier to walking the distance to further sites.

Conclusions

Written comments on the Nature Study Group Evaluation and participants’ emails to the researcher did reveal an increase use of the sites. Quotes of comments in the previous chapter show participants seemed to value the use of the outdoors as a context for learning. Several felt it was important to be flexible with schedules and found the time to connect their students with nature. Examination of the comments written on the Nature Study Group Evaluation revealed the participation enjoyed the outdoor sessions, felt their environmental knowledge had increased, and were appreciative of the environmental resources that were particularly useful to the East Bethel/Cedar Creek Community Schools’ Nature Area Sites. Many participants wanted more outdoor, on-site, environmental classes offered in the future.

Teacher participants demonstrated more knowledge of the Minnesota Academic Standards K-12 for Science and the Environmental Literacy Scope and Sequence for Minnesota after participation in the five, two-hour, outdoor Nature Study Group sessions. They demonstrated this by being able to list more standards and benchmarks on completion of Survey # 2.

Participants commented often about the benefits of working with other classroom teachers from different grade levels in the Nature Study Group. This experience helped them see the connection to what they were doing at their grade level to increase use of the Nature Area Sites. Second grade participants were the most enthusiastic about
participating in the Nature Study Group. The five participants went on to organize two
days of outdoor site use for the entire grade level at East Bethel Community School. On
June 2 and 3, 2005, ten, second grade classrooms were outdoors using nature area sites.
The enthusiasm started in the fall for connecting students to a natural setting had
continued to the last day of school.

**Recommendations**

**Continual Need for Site Maintenance**

The process to arrive at this project, to increase use of the East Bethel/ Cedar
Creek Community Schools’ Nature Area Sites has taken place over a number of years
and has been the result of efforts and talents of many. Several of the project issues will
require ongoing attention. Access to and safety aspects of the EBCS/CCCS Nature Area
Sites will require future maintenance. Brush grows and poison ivy thrives. Weeds invade
the butterfly garden and the prairie needs burning every few years. This maintenance
problem has primarily fallen on the researcher and Green Team members from East
Bethel. Ground crews need to be involved on a routine schedule. Scout groups have been
an asset over the years and will continue to be a great help in maintenance of the site.

Chris Bartz is high school student. He will be completing work on repairing 10
vandalized benches in one of the outdoor classroom sites as part of his Eagle Scout
requirements in August of 2005.

The researcher has made contact and walked the site with Terry Allen who is head
of Parks and Recreation for the City of East Bethel. He was impressed with the site and
wants to try and help with maintenance.

Forester, Art Widerstrom from the Minnesota Department of Natural Resources,
has worked with Cedar Creek and East Bethel Community Schools since 1993. He
guided the first tree plantings in connection with Tree Trust. In the spring of 2005 Art
Widerstrom walked the site with the researcher and was amazed at the work we have
done over the years. Art has a conservation crew at his disposal. This crew completed the
second burn of the prairie on April 28, 2005. Art Widerstrom will work with the newly
established School Forest team to formulate a forestry plan for the site.
Continued Professional Development in Environmental Education for Teachers

Now that EBCS and CCCS are both Minnesota School Forests we are able to offer environmental education classes such as Project Wild and Project Wet to teachers in St. Francis District # 15. Two days of instruction by Beth Gerard and April Rust of the DNR have already been scheduled for August 22, 23, 2005. Twenty-five teachers have already registered. This will continue to create interest and motivation for teachers to use the Nature Area Sites.

Wargo Nature Center will offer the Aldo Leopold Project in 2006. Minn Aqua, a DNR water stewardship program, under the direction of Michelle Kelly is eager to offer the training at our site. The researcher will be leading a Science Study Group in 2005-2006 as part of the new science adoption training. An outdoor element will be added to each session.

Continue Special Outdoor Events

Fifteen classrooms from Cedar Creek participated in an Arbor Day celebration on April 29, 2005. Teams of teachers planned the outdoor environmental activities, coordinated the planting of 600 red oak and white pine seedling in an old field south west of Cedar Creek, and with parent help dug the holes for the trees the day before. Each class creating a standard to carry in the Arbor Day Parade preceded the tree-planting event. The parade route circled White Pine Pond. It was thrilling to watch 450 students wind their way through the trail. The classes’ standards, similar to May Poles, were then secured in the ground and marked the area of planting for each class. Several teachers had never walked on the nature trail until that special event and ended up spending a large part of the day outdoors with their students participating in the activities that had been set up.

Continue Communication with Teachers and Community
Newspaper articles written for the Courier highlighting students' use of the Nature Area Sites have become quite popular with St. Francis District # 15 School Board Members and Administrators. These short articles also help advertise the outdoor trail system as a community resource.

Several Nature Study Group participants liked updates on trail phenology and encouragement to use the Nature Area Sites during the 2004-05, school year. These updates could be placed on the Electronic Bulletin Board for both schools.

St. Francis District # 15 and the State of Minnesota Need to Back the Importance of Environmental Education

The researcher is a member of St. Francis District # 15 Science Learning Area Committee for science. A call for incorporating the Environmental Literacy Scope and Sequence for Minnesota into the writing of the updated science curriculum was turned down by the group. Their reason being infusion of environmental education was not required by the state of Minnesota.

Participants were given a copy Environmental Literacy Scope and Sequence (2003) as a step in moving toward environmental literacy. “It defines what students should know and be able to do to be environmentally literate. It is a guide for building a curriculum from pre-kindergarten to adult levels that should enable the learner who has mastered it to make informed environmental decisions.”

Continue Modeling Use of the East Bethel/Cedar Creek Community Schools’ Nature Area Sites

Since the researcher was transferred to Cedar Creek Community School in 2003 more teachers at CCCS have started using the outdoors as a context for learning or have returned to using the Nature Area Sites. I am fortunate to work in a team situation. I am responsible for science and social studies instruction for three third-grade classes. Student enthusiasm for being exposed to our diverse natural setting on a regular basis has a way of rippling through the building. Hopefully more of the 1100 students at Cedar Creek Community School and the 990 at East Bethel Community School will be aloud to make a connection with nature. This project is the first pebble in the pond.
Implications

Participants in the Nature Study Group became connected and comfortable using to East Bethel/Cedar Creek Community Schools' Nature Area Sites. They were exposed to techniques in teaching outdoors, environmental education materials suited for the site and their interests. Participants correlated the Minnesota Academic Standards for Science and Environmental Literacy Scope and Sequence with outdoor activities in a hands-on inquiry based manner. Kindergarten through junior high school teachers worked together to overcome perceived barriers to using the outdoor sites at East Bethel/Cedar Creek Community School. Future study groups for teachers incorporating exposure to the East Bethel/Cedar Creek Community Schools Nature Areas Sites have been created. Twenty-two participants have started using the diverse natural classroom steps away from their classroom doors. This gave their students more time outdoors to start building the important pre-requisite empathetic view leading to environmental literacy, awareness and sensitivity.

Participants' late afternoons in nature developed in them an awe and sense of exploration. Rachel Carlson (1956) reflected on the value of strengthening the sense of awe and wonder in exploring the natural world as something beyond a pleasant way to spend the hours of childhood and decided it was lasting and deeper. “Those who dwell, as scientists or laymen, among the beauties and mysteries of the earth are never alone or weary of life. Whatever the vexations or concerns of their personal lives, their thoughts can find paths that lead to inner contentment and to renewed excitement in living. Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts.”
Bell, Al (2001). *The pedagogical potential of school grounds*. In T. Grant & G. Littlejohn (Eds.), *Greening school grounds* (pp. 9-10). Toronto, ON: New Society.


NSTA (2000) *Pathways*


Appendix A

Minnesota Academic Standards for Science
### Minnesota Academic Standards
#### Science K-12

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Strand</th>
<th>Sub-Strand</th>
<th>Standard</th>
<th>Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>KINDER GARTEN</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>B. Scientific Inquiry</td>
<td>The student will raise questions about the natural world.</td>
<td>1. The student will observe and describe common objects using simple tools.</td>
</tr>
<tr>
<td>KINDER GARTEN</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>B. The Water Cycle, Weather and Climate</td>
<td>The student will observe weather changes.</td>
<td>1. The student will describe daily and seasonal changes in weather.</td>
</tr>
<tr>
<td>KINDER GARTEN</td>
<td>IV. LIFE SCIENCE</td>
<td>B. Diversity of Organisms</td>
<td>The student will understand that there are living and nonliving things.</td>
<td>1. The student will compare and contrast living and nonliving things. 2. The student will know simple ways that living things can be grouped.</td>
</tr>
<tr>
<td>KINDER GARTEN</td>
<td>IV. LIFE SCIENCE</td>
<td>G. Human Organism</td>
<td>The student will understand that people have five senses that can be used to learn about the environment.</td>
<td>1. The student will observe and describe the environment using the five senses.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>B. Scientific Inquiry</td>
<td>The student will raise questions about the natural world, make careful observations, and seek answers.</td>
<td>1. The student will observe, describe, measure, compare and contrast common objects, using simple tools including but not limited to ruler, thermometer and balance.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>II. PHYSICAL SCIENCE</td>
<td>A. Structure of Matter</td>
<td>The student will understand that objects have physical properties.</td>
<td>1. The student will describe objects in terms of color, size, shape, weight, texture, flexibility and attraction to magnets.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>II. PHYSICAL SCIENCE</td>
<td>E. Forces of Nature</td>
<td>The student will understand that forces can act at a distance.</td>
<td>1. The student will know that magnets can be used to make some things move without direct contact. 2. The student will know that things near the Earth fall to the ground unless something holds them up.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>B. The Water Cycle, Weather and Climate</td>
<td>The student will investigate weather cycles.</td>
<td>1. The student will observe, record and describe characteristics in daily weather and seasonal cycles.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>C. The Universe</td>
<td>Student will recognize the changes that occur in the sky in a 24-hour day.</td>
<td>1. The student will observe and describe the changes in the position of the sun and the moon.</td>
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<tr>
<td>GRADE 1</td>
<td>IV. LIFE SCIENCE</td>
<td>B. Organisms</td>
<td>The student will observe plant and animal life cycles.</td>
<td>1. The student will observe and describe how plants and animals grow and change.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>IV. LIFE SCIENCE</td>
<td>D. Heredity</td>
<td>The student will understand that there is variation among individuals of one kind within a population.</td>
<td>1. The student will describe ways in which many plants and animals closely resemble but are not identical to their parents. 2. The student will match adult animals and plants to their offspring.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>IV. LIFE SCIENCE</td>
<td>F. Flow of Matter and Energy</td>
<td>The student will understand that organisms have basic needs.</td>
<td>1. The student will know that animals need air, water and food and that plants require air, water, nutrients and light.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>IV. LIFE SCIENCE</td>
<td>G. Human Organism</td>
<td>The student will know that the human body is made up of parts.</td>
<td>1. The student will observe and describe major parts of the body including, but not limited to, eyes, nose, heart, skin, arms, legs and muscles.</td>
</tr>
<tr>
<td>GRADE 1</td>
<td>IV. LIFE SCIENCE</td>
<td>G. Human Organism</td>
<td>The student will learn that some diseases are caused by germs.</td>
<td>1. The student will know that diseases caused by germs can be spread from person to person; the number of germs can be reduced by personal behavior.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>A. Scientific World View</td>
<td>The student will understand that science is a human endeavor practiced throughout the world.</td>
<td>1. The student will recognize that repeating a scientific investigation will lead to very similar results. 2. The student will recognize that scientific investigations generally work the same way in different places. 3. The student will give examples of scientific advances throughout history. 4. The student will recognize that everyone can do science and invent things and ideas.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>B. Scientific Inquiry</td>
<td>The student will raise questions about the natural world, make careful observations and seek answers.</td>
<td>1. The student will use appropriate tools to gather and organize data. 2. The student will recognize and describe patterns in data.</td>
</tr>
<tr>
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<tr>
<td>GRADE 2</td>
<td>II. PHYSICAL SCIENCE</td>
<td>A. Structure of Matter</td>
<td>The student will understand that objects can be sorted and classified based on their properties.</td>
<td>1. The student will sort and classify objects in terms of color, size, shape, weight, texture, flexibility and attraction to magnets. 2. The student will classify a substance as a solid, liquid or gas. 3. The student will know that solids have a definite shape and that liquids take the shape of their container. 4. The student will observe that water can be a solid or liquid and can change from one state to the other.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>II. PHYSICAL SCIENCE</td>
<td>D. Motion</td>
<td>The student will know that objects move in various ways.</td>
<td>1. The student will observe and describe how objects move in a variety of ways, including, but not limited to, a straight line, a curve, a circle, back and forth and at different speeds. 2. The student will observe that push and pull forces can make objects move.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>A. Earth Structure and Processes</td>
<td>The student will recognize basic Earth materials.</td>
<td>1. The student will observe and describe rocks, soils, water and air.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>IV. LIFE SCIENCE</td>
<td>B. Diversity of Organisms</td>
<td>The student will recognize that plants and animals have life cycles.</td>
<td>1. The student will describe life cycles of plants and animals.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>IV. LIFE SCIENCE</td>
<td>C. Interdependence of Life</td>
<td>The student will understand that organisms live in different environments.</td>
<td>1. The student will observe and describe some features of plants and animals that allow them to live in specific environments.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>IV. LIFE SCIENCE</td>
<td>E. Biological Populations Change Over Time</td>
<td>The student will understand that biological populations change over time.</td>
<td>1. The student will know that some kinds of organisms that once lived on Earth are now extinct, including, but not limited to, dinosaurs, trilobites, mammoths, giant tree ferns and horsetail trees.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>IV. LIFE SCIENCE</td>
<td>F. Flow of Matter and Energy</td>
<td>The student will investigate feeding relationships among organisms.</td>
<td>1. The student will observe and describe predator and prey relationships. 2. The student will compare and contrast plant eaters and meat eaters.</td>
</tr>
<tr>
<td>GRADE 2</td>
<td>IV. LIFE SCIENCE</td>
<td>G. Human Organism</td>
<td>The student will recognize that people have basic needs.</td>
<td>1. The student will know that people need water, food, air, waste removal and a particular range of temperature in their environment, just like other animals.</td>
</tr>
<tr>
<td>GRADE 3</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>A. Scientific World View</td>
<td>The student will understand the use of science as a tool to examine the natural world.</td>
<td>1. The student will explore the use of science as a tool that can help investigate and answer questions about the environment.</td>
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</table>
| GRADE 3     | I. HISTORY AND NATURE OF SCIENCE | B. Scientific Inquiry | The student will understand the nature of scientific investigations. | 1. The student will ask questions about the natural world that can be investigated scientifically.  
2. The student will participate in a scientific investigation using appropriate tools.  
3. The student will know that scientists use different kinds of investigations depending on the questions they are trying to answer. |
| GRADE 3     | II. PHYSICAL SCIENCE | C. Energy Transformation | The student will explore the characteristics and properties of sound and light. | 1. The student will investigate how sounds are made when objects vibrate.  
2. The student will know that light tends to maintain its direction of motion until it is absorbed, refracted, or reflected by an object. |
| GRADE 3     | III. EARTH AND SPACE SCIENCE | B. The Water Cycle, Weather and Climate | The student will investigate weather conditions. | 1. The student will measure, record, and describe weather conditions using common instruments.  
2. The student will identify cumulus, cirrus and stratus clouds. |
| GRADE 3     | III. EARTH AND SPACE SCIENCE | C. The Universe | The student will understand the characteristics and relationships of objects in the solar system. | 1. The student will recognize the difference between rotation and revolution and their connection to day, night, seasons and the year.  
2. The student will identify the planets in the solar system and their relative sizes, distances and basic characteristics.  
3. The student will observe that the sun supplies heat and light to the Earth.  
4. The student will know that planets look like stars, but over time they move differently than stars. |
| GRADE 3     | IV. LIFE SCIENCE | B. Diversity of Organisms | The student will recognize that plants and animals have different structures that serve various functions. | 1. The student will describe the structures that serve different functions in growth, survival and reproduction for plants and animals.  
2. The student will know that plants have different structures from animals that serve the same necessary functions in growth, survival and reproduction. |
| GRADE 3     | IV. LIFE SCIENCE | C. Interdependence of Life | The student will understand that an organism's patterns of behavior are related to the nature of its environment. | 1. The student will know that organisms interact with one another in various ways besides providing food.  
2. The student will know that changes in a habitat can be beneficial or harmful to an organism. |
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<tr>
<td>GRADE 3</td>
<td>IV. LIFE SCIENCE</td>
<td>D. Heredity</td>
<td>The student will understand that many characteristics of an organism are inherited from its parents, but that other characteristics result from an individual's interactions with the environment.</td>
<td>1. The student will observe and differentiate between characteristics of organisms that are inherited and characteristics that are acquired. 2. The student will identify similarities and differences between parent and offspring.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>A. Scientific World View</td>
<td>The student will understand how science is used to investigate interactions between people and the natural world.</td>
<td>1. The student will explore the uses and effects of science in our interaction with the natural world. 2. The student will discuss the responsible use of science. 3. The student will recognize the impact of scientific and technological activities on the natural world.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>B. Scientific Inquiry</td>
<td>The student will participate in a controlled scientific investigation.</td>
<td>1. The student will recognize when comparisons might not be fair because some conditions are not kept the same. 2. The student will collect, organize, analyze and present data from a controlled experiment. 3. The student will recognize that evidence and logic are necessary to support scientific understandings.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>II. PHYSICAL SCIENCE</td>
<td>A. Structure of Matter</td>
<td>The student will know that heating and cooling may cause changes to the properties of a substance.</td>
<td>1. The student will observe that heating and cooling can cause changes in state. 2. The student will describe the changes in the properties of a substance when it is heated or cooled. 3. The student will compare and contrast the mass, shape and volume of solids, liquids and gases.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>II. PHYSICAL SCIENCE</td>
<td>C. Energy Transformations</td>
<td>The student will understand basic electricity and its application in everyday life.</td>
<td>1. The student will explore simple electrical circuits using components such as wires, batteries and bulbs. 2. The student will investigate static electricity. 3. The student will identify objects and materials that conduct electricity and those that are insulators.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>II. PHYSICAL SCIENCE</td>
<td>E. Forces of Nature</td>
<td>The student will understand that a relationship exists between electricity and magnetism.</td>
<td>1. The student will demonstrate how a wire and magnet can be used to generate an electric current. 2. The student will demonstrate how an electric current can make an iron object magnetic.</td>
</tr>
<tr>
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<tr>
<td>GRADE 4</td>
<td>III EARTH AND SPACE SCIENCE</td>
<td>A. Earth Structure and Processes</td>
<td>The student will investigate the impact humans have on the environment.</td>
<td>1. The student will identify and investigate environmental issues and potential solutions.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>B. The Water Cycle, Weather and Climate</td>
<td>The student will recognize that water on Earth cycles and exists in many forms.</td>
<td>1. The student will describe the water cycle involving the processes of evaporation, condensation, precipitation and collection. 2. The student will identify where water exists on Earth.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>C. The Universe</td>
<td>The student will identify the patterns and movements of celestial objects.</td>
<td>1. The student will recognize that the stars in the sky appear to slowly move from east to west. 2. The student will identify the sun as an average-sized star and that the other stars are so far away that they look like points of light. 3. The student will know that telescopes magnify distant objects in the sky and dramatically increase the number of stars we can see.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>IV. LIFE SCIENCE</td>
<td>A. Cells</td>
<td>The student will know that all organisms are composed of cells, which are the fundamental units of life.</td>
<td>1. The student will recognize that cells are very small, and that all living things consist of one or more cells. 2. The student will recognize that cells need: food, water and air, a way to dispose of waste, and an environment in which they can live.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>IV. LIFE SCIENCE</td>
<td>B. Diversity of Organisms</td>
<td>The student will know that living things can be sorted into groups in many ways according to their characteristics, structures and behaviors.</td>
<td>1. The student will classify plants and animals according to their physical characteristics. 2. The student will learn that the characteristics used for grouping depend on the purpose of the grouping.</td>
</tr>
<tr>
<td>GRADE 4</td>
<td>IV. LIFE SCIENCE</td>
<td>G. Human Organism</td>
<td>The student will know the structures that serve various functions in the human body, including protection from disease.</td>
<td>1. The student will understand that humans have structures that serve functions in growth, survival and reproduction. 2. The student will know that germs entering the body can cause disease, and that the body has defenses against these germs. 3. The student will know that there are many diseases that can be prevented by vaccination.</td>
</tr>
<tr>
<td>GRADE 5</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>A. Scientific World View</td>
<td>The student will understand that communication is essential to science.</td>
<td>1. The student will know that current scientific knowledge and understanding guide scientific investigation. 2. The student will recognize that clear communication of methods, findings and critical review is an essential part of doing science.</td>
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The table lists the standards and benchmarks for various strands and sub-strands across different grade levels. Each standard is accompanied by benchmarks that detail the expected outcomes and learning objectives.
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</table>
| GRADE 5     | I. HISTORY AND NATURE OF SCIENCE | B. Scientific Inquiry | The student will understand the process of scientific investigations. | 1. The student will perform a controlled experiment using a specific step-by-step procedure and present conclusions supported by the evidence.
2. The student will observe that when a science investigation or experiment is repeated, a similar result is expected. |
| GRADE 5     | I. HISTORY AND NATURE OF SCIENCE | C. Scientific Enterprise | The student will recognize that science and technology involve different kinds of work and engages men and women of all backgrounds. | 1. The student will describe different kinds of work done in science and technology.
2. The student will identify men and women of various backgrounds and ages who have been involved in science and technology, both past and present. |
| GRADE 5     | II. PHYSICAL SCIENCE | D. Motion | The student will understand that changes in speed or direction of motion are caused by forces. | 1. The student will investigate the use of a lever, inclined plane and wheel and axle to move objects.
2. The student will demonstrate that the greater the force applied, the greater the change in motion. |
| GRADE 5     | III. EARTH AND SPACE SCIENCE | A. Earth Structure and Processes | The student will explore the structures and functions of Earth systems. | 1. The student will recognize the natural processes that cause rocks to break down into smaller pieces and eventually into soil.
2. The student will investigate the formation, composition and properties of soil.
3. The student will describe how waves, wind, water and ice shape and reshape the Earth's surface.
4. The student will describe the impact of floods, tornadoes, earthquakes and volcanoes on the Earth.
5. The student will explore the interaction of the lithosphere, atmosphere, biosphere, hydrosphere and space. |
| GRADE 5     | IV. LIFE SCIENCE | E. Biological Populations Change Over Time | The student will know that biological populations change over time. | 1. The student will recognize that individuals of the same species differ in their characteristics and that sometimes the differences give individuals an advantage in surviving and reproducing.
2. The student will recognize that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.
3. The student will compare the structure of fossils to one another and to living organisms. |
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</table>
| GRADE 5     | IV. LIFE SCIENCE      | F. Flow of Matter and Energy | The student will know that matter and energy flow into, out of, and within a biological system.                                                                                                          | 1. The student will recognize that organisms need energy to stay alive and grow, and that this energy originates from the sun.  
2. The student will use food webs to describe the relationships among producers, consumers, and decomposers in an ecosystem in Minnesota.  
3. The student will recognize that organisms are growing, dying and decaying, and that their matter is recycled. |
| GRADE 6     | I. HISTORY AND SCIENCE | A. Scientific World View | The student will understand that science is a way of knowing about the world that is characterized by empirical criteria, logical argument and skeptical review.                                             | 1. The student will distinguish between scientific evidence and personal opinion.  
2. The student will explain why scientists often repeat investigations to be sure of the results.  
3. The student will recognize that scientists assume that the laws of nature are the same everywhere and that they are understandable and predictable.  
4. The student will define scientific facts, laws and theories. |
| GRADE 6     | I. HISTORY AND SCIENCE | B. Scientific Inquiry    | The student will understand that scientific inquiry is used in systematic ways to investigate the natural world.                                                                                         | 1. The student will identify questions that can be answered through scientific investigation and those that cannot.  
2. The student will distinguish among observation, prediction and inference.  
3. The student will use appropriate tools and Système International (SI) units for measuring length, time, mass, volume and temperature with suitable precision and accuracy.  
4. The student will present and explain data and findings from controlled experiments using multiple representations including tables, graphs, physical models and demonstrations. |
| GRADE 6     | I. HISTORY AND SCIENCE | C. Scientific Enterprise | The student will know that science and technology are human efforts that both influence and are influenced by society.                                                                                  | 1. The student will describe the types of questions asked, the products, and the methods of investigation used to distinguish science from technology.  
2. The student will explain why scientists may work in teams or work alone, can collaborate and, at times, compete. |
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</table>
| GRADE 6     | II. PHYSICAL SCIENCE       | A. Structure of Matter| The student will understand that matter is made of small particles and this explains the properties of matter. | 1. The student will know that there are more than 100 different elements with unique properties.  
2. The student will use evidence to explain that matter is made of small particles called atoms or molecules which are too small to see.  
3. The student will know that the mass of a substance remains constant whether it is together, in parts or in a different state.  
4. The student will describe the states of matter in terms of the space between particles.  
5. The student will distinguish between volume, mass and density.  
6. The student will use the characteristic properties of density, melting point, boiling point and solubility to identify and distinguish mixtures and pure substances.  
7. The student will know that atoms are the smallest unit of an element that maintains the characteristics of the element. |
| GRADE 6     | II. PHYSICAL SCIENCE       | B. Chemical Reactions | The student will differentiate between chemical and physical changes.                          | 1. The student will define chemical and physical changes.  
2. The student will observe that substances react chemically with other substances to form new substances with different characteristic properties.  
3. The student will give examples and classify substances as mixtures or pure substances. |
| GRADE 6     | II. PHYSICAL SCIENCE       | C. Energy Transformations | The student will understand that energy exists in many forms and can be transferred in many ways. | 1. The student will compare and contrast heat, chemical, mechanical and electrical energy and identify transformations of energy from one form to another in everyday situations.  
2. The student will recognize that heat is transferred by convection, conduction and radiation from warmer objects to cooler ones until both reach the same temperature.  
3. The student will demonstrate that visible light from the sun or reflected by objects may be made up of a mixture of many different colors of light.  
4. The student will recognize the relationship between light and heat.  
5. The student will describe waves in terms of speed, frequency and wave length.  
6. The student will recognize that vibrations such as sound and earthquakes move in waves and that waves move at different speeds in different materials. |
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</table>
| GRADE 6     | II. PHYSICAL SCIENCE    | D. Motion  | The student will describe the motion of objects.                                               | 1. The student will use a frame of reference to describe the position, speed, and acceleration of an object.  
2. The student will measure and graph the positions and speed of an object.  
3. The student will recognize that unbalanced forces acting on an object change the object's speed and/or direction.                      |
| GRADE 6     | II. PHYSICAL SCIENCE    | E. Forces of Nature | The student will understand that a variety of forces govern the structure and motion of objects in the universe. | 1. The student will know that electric currents and magnets can exert a force on certain objects and each other.  
2. The student will know that there are positive and negative charges and that like charges repel one another and opposite charges attract. |
| GRADE 7     | I. HISTORY AND NATURE OF SCIENCE | A. Scientific World View | The student will understand that science is a way of knowing about the world that is characterized by empirical criteria, logical argument and skeptical review. | 1. The student will recognize how scientific knowledge is subject to change as new evidence becomes available, or as new theories cause scientists to look at old observations differently.  
2. The student will explain natural phenomena by using appropriate physical, conceptual and mathematical models. |
| GRADE 7     | I. HISTORY AND NATURE OF SCIENCE | B. Scientific Inquiry | The student will design and conduct scientific investigations.                               | 1. The student will formulate a testable hypothesis based on prior knowledge.  
2. The student will recognize that a variable is a condition that may influence the outcome of an investigation and know the importance of manipulating one variable at a time.  
3. The student will write a specific step-by-step procedure for a scientific investigation.  
4. The student will explain how classroom scientific investigations relate to established scientific principles.                                    |
<p>| GRADE 7     | I. HISTORY AND NATURE OF SCIENCE | C. Scientific Enterprise | The student will know that science and technology are human efforts that both influence, and are influenced by, society. | 1. The student will give examples of the development of technology influencing scientific knowledge, and investigation and scientific knowledge influencing the development of technology. |</p>
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<td>GRADE 7</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>D. Historic Perspectives</td>
<td>The student will understand how scientific discovery, culture, societal norms and technology have influenced one another in different time periods.</td>
<td>1. The student will cite examples of individuals throughout history who made discoveries and contributions in science and technology. 2. The student will cite examples of how culture influences scientific and technological advances.</td>
</tr>
<tr>
<td>GRADE 7</td>
<td>IV. LIFE SCIENCE</td>
<td>A. Cells</td>
<td>The student will understand that all organisms are composed of cells that carry on the many functions needed to sustain life.</td>
<td>1. The student will know that cells are the fundamental units of life. 2. The student will distinguish between single-cellular and multi-cellular organisms. 3. The student will distinguish between plant and animal cells. 4. The student will recognize that cells repeatedly divide for growth and repair. 5. The student will recognize that cells convert energy from food for the production of molecules necessary for life, and for life processes including cell growth and cell division. 6. The student will recognize that specialized cells in multi-cellular organisms perform specialized functions.</td>
</tr>
<tr>
<td>GRADE 7</td>
<td>IV. LIFE SCIENCE</td>
<td>B. Diversity of Organisms</td>
<td>The student will understand that living systems, at every level of organization, demonstrate the complementary nature of structure and function.</td>
<td>1. The student will explain that individuals are composed of specialized cells, tissues, organs and organ systems that perform specialized functions. 2. The student will recognize that an organism’s body plan and its ability to regulate its internal environment enable it to make or find food, grow and reproduce in a constantly changing environment. 3. The student will recognize that behavioral responses of organisms may be determined by heredity and past experience. 4. The student will use and create dichotomous keys. 5. The student will use the characteristics of an organism to identify the kingdom to which it belongs.</td>
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| GRADE 7     | IV. LIFE       | C. Interdependence                  | The student will understand that within ecosystems, complex interactions exist between organisms and the physical environment.                                                                                       | 1. The student will provide examples of the potentially irreversible effects of human activity on ecosystems.  
2. The student will define a population as all individuals of a species that exist together at a given place and time.  
3. The student will define an ecosystem as all populations living together and the physical factors with which they interact.  
4. The student will explain the factors that affect the number and types of organisms an ecosystem can support, including available resources, abiotic and biotic factors and disease.                                                                                                                                                                                                 |
|             | SCIENCE        | of Life                             |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| GRADE 7     | IV. LIFE       | D. Heredity                          | The student will understand that heredity information is contained in genes which are inherited through both sexual and asexual reproduction.                                                                  | 1. The student will recognize that inherited traits result from information contained in genes, which are located on chromosomes of each cell.  
2. The student will recognize that each gene carries a single unit of information and can influence more than one trait.  
3. The student will explain how inherited traits can be determined by one or many genes.  
4. The student will comprehend that interactions with the environment affect some inherited traits.  
5. The student will comprehend that reproduction is essential for the continuation of a species.  
6. The student will compare and contrast the advantages and disadvantages of sexual and asexual reproduction.                                                                                                                                                                                                                                                           |
|             | SCIENCE        |                                     |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| GRADE 7     | IV. LIFE       | E. Biological                        | The student will understand how biological evolution provides a scientific explanation for the fossil record of ancient life forms, as well as for the striking similarities observed among the diverse species of living organisms.                                                                 | 1. The student will recognize extinction is a common event.  
2. The student will describe how the fossil record documents the appearance and diversification of many life forms.  
3. The student will explain how biological adaptations in structure, function and behavior enhance the reproductive success and survival of a species in a particular environment.  
4. The student will recognize that scientific evidence can be used to infer common ancestry among some organisms.  
5. The student will explain how diversity of species develops through gradual processes over generations.                                                                                                                                                                                                                                                                                                                                                               |
<p>|             | SCIENCE        | Populations Change                  |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|             |                 | Over Time                           |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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</table>
| GRADE 7 | IV. LIFE SCIENCE           | F. Flow of Matter and Energy    | The student will understand how the flow of energy and the recycling of matter contribute to a stable ecosystem. | 1. The student will know that plants use the energy in light to make sugars out of carbon dioxide and water.  
2. The student will explain how energy is transferred through food chains and food webs in an ecosystem.  
3. The student will explain how the amount of usable energy available to organisms decreases as it passes through a food chain and/or food web.  
4. The student will know that the total amount of matter in a closed system remains the same as it is transferred between organisms and the physical environment even though its location or form changes.  
5. The student will compare and contrast predator/prey, parasite/host and producer/consumer/decomposer relationships. |
| GRADE 7 | IV. LIFE SCIENCE           | G. Human Organism               | The student will understand human body systems and their relationship to disease. | 1. The student will recognize that disease can be caused by genetics, infection by other organisms, exposure to environmental factors or a combination of these.  
2. The student will identify risks associated with natural, chemical and biological hazards.  
3. The student will describe the structure and function of systems for digestion, respiration, reproduction, circulation, excretion, movement, control and coordination and for protection from disease, in the human organism. |
| GRADE 8 | I. HISTORY AND NATURE OF SCIENCE | A. Scientific World View       | The student will understand that science is a way of knowing about the world that is characterized by empirical criteria, logical argument and skeptical review. | 1. The student will explain and give examples of how science can be used to make informed ethical decisions by identifying likely consequences of particular actions.  
2. The student will explain the development, usefulness and limitations of scientific models in the explanation and prediction of natural phenomena. |
| GRADE 8 | I. HISTORY AND NATURE OF SCIENCE | B. Scientific Inquiry           | The student will understand that scientific inquiry is used by scientists to investigate the natural world in systematic ways. | 1. The student will know that scientific investigations involve the common elements of systematic observations, the careful collection of relevant evidence, logical reasoning and innovation in developing hypotheses and explanations.  
2. The student will describe how scientists can conduct investigations in a simple system and make generalizations to more complex systems. |
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</table>
| GRADE 8     | I. HISTORY AND NATURE OF SCIENCE            | B. Scientific Inquiry | The student will use multiple skills to design and conduct scientific investigations. | 1. The student will specify variables to be changed, controlled and measured.  
1. The student will evaluate the credibility and validity of scientific and technological information from various sources. |
| GRADE 8     | I. HISTORY AND NATURE OF SCIENCE            | C. Scientific Enterprise | The student will know that science and technology are human efforts that both influence and are influenced by civilizations and cultures worldwide. | 1. The student will relate personal experiences in scientific investigation to the experiences of scientists throughout history.  
2. The student will cite examples of how science and technology contributed to changes in agriculture, manufacturing, sanitation, medicine, warfare, transportation, information processing or communication. |
| GRADE 8     | I. HISTORY AND NATURE OF SCIENCE            | D. Historic Perspectives | The student will understand how scientific discovery, culture, societal norms and technology have influenced one another in different time periods. | 1. The student will explain how earthquakes, volcanoes, sea-floor spreading and mountain building are evidence of the movement of crustal plates.  
2. The student will describe how features on the Earth’s surface are created and constantly changing through a combination of slow and rapid processes of weathering, erosion, sediment deposition, landslides, volcanic eruptions and earthquakes.  
3. The student will describe the various processes and interactions of the rock cycle.  
4. The student will interpret successive layers of sedimentary rocks and their fossils to document the age and history of the Earth.  
5. The student will recognize that constructive and destructive Earth processes can affect the evidence of Earth’s history.  
6. The student will classify and identify rocks and minerals using characteristics including but not limited to density, hardness and streak. |
<p>| GRADE 8     | III. EARTH AND SPACE SCIENCE                | A. Earth Structure and Processes | The student will identify Earth’s composition, structure and processes. | 1. The student will identify and research an environmental issue and evaluate its impact. |</p>
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<tr>
<td>GRADE 8</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>B. The Water Cycle, Weather and Climate</td>
<td>The student will investigate how the atmosphere interacts with the Earth system.</td>
</tr>
<tr>
<td>GRADE 8</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>C. The Universe</td>
<td>The student will compare objects in the solar system and explain their interactions with the Earth.</td>
</tr>
<tr>
<td>GRADE 8</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>C. The Universe</td>
<td>The student will describe the composition and structure of the universe.</td>
</tr>
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</table>

**Benchmarks**

1. The student will define radiation, conduction and convection and explain their effects on weather and climate.
2. The student will identify the forces that create currents and layers in the Earth’s atmosphere and water systems.
3. The student will describe the effect of Earth’s rotation on the winds and ocean currents.
4. The student will collect and use data to predict the weather.
5. The student will identify the composition and structures of the atmosphere.
6. The student will describe climate changes that have occurred over time.

1. The student will recognize that the sun is the principal energy source for the solar system and that this energy is transferred in the form of radiation.
2. The student will explain how the combination of the Earth's tilted axis and revolution around the sun causes the progression of seasons and weather patterns.
3. The student will compare and contrast the planets, taking into account their composition, mass and distance from the sun and recognize the conditions that have allowed life to flourish on Earth.
4. The student will use the predictability of the motions of the Earth, and sun to explain the length of day, length of year, phases of the moon, eclipses, tides and shadows.

1. The student will recognize that the universe consists of many billions of galaxies, each containing many billions of stars and that there are vast distances that separate these galaxies and stars from one another.
2. The student will recognize that the sun is a medium-sized star and is the closest star to Earth. It is the central and largest body in the solar system and is one of billions of stars in the Milky Way Galaxy.
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</table>
| GRADE 9-12  | I. HISTORY AND NATURE OF SCIENCE | A. Scientific World View | The student will understand the nature of scientific ways of thinking and that scientific knowledge changes and accumulates over time.                                                                  | 1. The student will be able to distinguish among hypothesis, theory and law as scientific terms and how they are used to answer a specific question.  
2. The student will be able to explain how scientific and technological innovations as well as new evidence can challenge portions of or entire accepted theories and models including but not limited to cell theory, atomic theory, theory of evolution, plate tectonic theory, germ theory of disease and big bang theory.  
3. The student will recognize that in order to be valid, scientific knowledge must meet certain criteria including that it: be consistent with experimental, observational and inferential evidence about nature; follow rules of logic and reporting both methods and procedures; and, be falsifiable and open to criticism.  
4. The student will explain how traditions of ethics, peer review, conflict and general consensus influences the conduct of science.  
5. The student will recognize that some scientific ideas are incomplete, and opportunity exists in these areas for new advances. |
| GRADE 9-12  | I. HISTORY AND NATURE OF SCIENCE | B. Scientific Inquiry | The student will design and conduct a scientific investigation.                                                                                                                                         | 1. The student will design and complete a scientific experiment using scientific methods by determining a testable question, making a hypothesis, designing a scientific investigation with appropriate controls, analyzing data, making conclusions based on evidence and comparing conclusions to the original hypothesis and prior knowledge.  
2. The student will distinguish between qualitative and quantitative data.  
3. The student will apply mathematics and models to analyze data and support conclusions.  
4. The student will identify possible sources of error and their effects on results.  
5. The student will know that professional scientists and engineers have ethical codes.  
6. The student will give examples of how different domains of science use different bodies of scientific knowledge and employ different methods to investigate questions. |
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<tr>
<td>GRADE 9-12</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>C. Scientific Enterprise</td>
<td>The student will understand the relationship between science and technology and how both are used.</td>
<td>1. The student will compare and contrast the purposes and career opportunities of engineering, technology and science. 2. The student will provide an example of a need or problem identified by science and solved by engineering or technology. 3. The student will provide an example of how technology facilitates new discoveries and the development of scientific knowledge. 4. The student will know that technological changes and scientific advances are often accompanied by social, political, environmental and economic changes. 5. The student will recognize that science and technology are influenced by cultural backgrounds and beliefs and by social needs, attitudes, values and limitations.</td>
</tr>
<tr>
<td>GRADE 9-12</td>
<td>I. HISTORY AND NATURE OF SCIENCE</td>
<td>D. Historic Perspectives</td>
<td>The student will recognize the historical and cultural context of scientific endeavors and how they influence each other.</td>
<td>1. The student will be able to trace the development of a scientific advancement, invention or theory and its impact on society. 2. The student will provide examples of scientific advancements contributed by other civilizations and cultures. 3. The student will compare and contrast the differences between scientific theories and theories from other bodies of knowledge, and the importance of each in a science discussion.</td>
</tr>
<tr>
<td>GRADE 9-12</td>
<td>II. PHYSICAL SCIENCE</td>
<td>A. Structure of Matter</td>
<td>The student will understand the nature of matter including its forms, properties and interactions.</td>
<td>1. The student will identify protons, neutrons and electrons as the major components of the atom, their mass relative to one another, their arrangement and their charge. 2. The student will be able to explain the relationship of an element's position on the periodic table to its atomic number and atomic mass. 3. The student will compare and contrast the properties of an element and its isotopes, and describe how isotopes can be used in research, medicine and industry. 4. The student will use the periodic table to identify regions, families, groups and periods. 5. The student will explain how neutral atoms become ions. 6. The student will be able to explain how atoms form compounds through bonding. 7. The student will compare and contrast the states of matter in terms of interactions between particles. 8. The student will differentiate between an atom and a molecule. 9. The student will differentiate between an element and a compound.</td>
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| GRADE 9-12  | II. PHYSICAL SCIENCE    | B. Chemical         | The student will describe chemical reactions and the factors that influence them. | 1. The student will describe chemical reactions using words and symbolic equations.  
2. The student will explain the influence of temperature, surface area, agitation and catalysts on the rate of a reaction.  
3. The student will distinguish between a chemical reaction and a nuclear reaction.  
4. The student will explain how the rearrangement of atoms and molecules in a chemical reaction illustrates conservation of mass.  
5. The student will describe how combining acids and bases produce a neutral solution. |
| GRADE 9-12  | II. PHYSICAL SCIENCE    | C. Energy           | The student will understand energy forms, transformations and transfers. | 1. The student will know that potential energy is stored energy and is associated with gravitational or electrical force, mechanical position or chemical composition.  
2. The student will differentiate between kinetic and potential energy and identify situations where kinetic energy is converted into potential energy and vice versa.  
3. The student will differentiate between AC and DC current.  
4. The student will describe the production, storage and transmission of electricity.  
5. The student will be able to describe physical and chemical changes in terms of the law of conservation of energy.  
6. The student will compare and contrast the amount of energy released through chemical reactions and nuclear fission and fusion.  
7. The student will describe the risks and benefits of fossil fuels, renewable sources and nuclear power as sources of usable energy.  
8. The student will describe applications of the different wavelengths of the electromagnetic spectrum.  
9. The student will describe energy, work and power both conceptually and quantitatively. |
| GRADE 9-12  | II. PHYSICAL SCIENCE    | D. Motion           | The student will understand the nature of force and motion.               | 1. The student will use Newton's three laws of motion to qualitatively and quantitatively describe the interaction of objects.  
2. The student will describe the effect of friction and gravity on the motion of an object.                                                                                                                  |
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<tr>
<td>GRADE 9-12</td>
<td>II. PHYSICAL SCIENCE</td>
<td>E. Forces of Nature</td>
<td>The student will understand the forces of nature and their application.</td>
<td>1. The student will recognize the factors that affect the presence and magnitude of gravitational, electromagnetic, weak and strong nuclear forces. 2. The student will identify the dominant force or forces in a variety of interactions.</td>
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<td>GRADE 9-12</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>A. Earth Structure and Processes</td>
<td>The student will understand that the interactions of the atmosphere, biosphere, lithosphere, hydrosphere and space have resulted in ongoing change of the Earth system over geologic time.</td>
<td>1. The student will identify the internal and external sources of energy for the Earth. 2. The student will apply the laws of thermodynamics to explain the cycling of materials and transfer of energy in the Earth system. 3. The student will illustrate how biological processes have played significant roles in determining the character of the atmosphere, biosphere, hydrosphere and lithosphere over time. 4. The student will use the theory of plate tectonics to analyze relationships among earthquakes, volcanoes, mountains, fossil deposits, rock layers and ocean features. 5. The student will describe how glaciers, gravity, wind, temperature changes, waves and rivers cause weathering and erosion. 6. The student will describe the rock cycle and compare and contrast the processes responsible for the formation of igneous, sedimentary and metamorphic rocks. 7. The student will use evidence found in fossils, rock layers, ice cores, radiometric dating and globally gathered data to explain how Earth has changed over short and long periods of time.</td>
</tr>
<tr>
<td>GRADE 9-12</td>
<td>III. EARTH AND SPACE SCIENCE</td>
<td>A. Earth Structure and Processes</td>
<td>The student will investigate the impact humans have on the environment.</td>
<td>1. The student will identify and research an environmental issue and evaluate its impact.</td>
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| GRADE 9-12  | III. EARTH AND SPACE SCIENCE | B. The Water Cycle, Weather and Climate | The student will explain the causes and effects of the Earth's atmospheric and hydrologic processes. | 1. The student will explain how the transfer of energy and motions of the Earth contribute to global climatic processes including wind, waves and ocean currents.  
2. The student will trace the cyclical movement of carbon and water through the lithosphere, hydrosphere, atmosphere and biosphere.  
3. The student will demonstrate the effect of the Earth's tilt, rotation and revolution on the seasons, day length and tides.  
4. The student will identify, predict and investigate the factors that influence the quality of water and how it can be reused, recycled and conserved.  
5. The student will discuss the impact of the use of natural resources and other human activities on the Earth's climate. |
| GRADE 9-12  | III. EARTH AND SPACE SCIENCE | C. The Universe | The student will relate the formation and components of our solar system to the conditions necessary for life. | 1. The student will explain how the sun, Earth and solar system formed.  
2. The student will compare the characteristics of Earth with the characteristics and movement patterns of the other planets, their satellites and other objects in our solar system.  
3. The student will compare and contrast the environmental parameters that make life possible on Earth with conditions found on the other planets of our solar system. |
| GRADE 9-12  | III. EARTH AND SPACE SCIENCE | C. The Universe | The student will use astronomical data to reveal the structure, scale, and changes in the stars, galaxies and universe over time. | 1. The student will identify different types of stars and galaxies and describe how stars, galaxies and the universe change over time.  
2. The student will explain how nuclear fusion produces energy and other elements.  
3. The student will describe the evidence from current technologies that has been used to understand the composition and the early history of the universe.  
4. The student will explain how Doppler evidence indicates our universe is expanding in all directions. |
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</table>
| GRADE IV   | IV. LIFE SCIENCE | A. Cells    | The student will comprehend that all living things are composed of cells, and that the life processes in a cell are based on molecular interactions. | 1. The student will relate cellular structures to their functions.  
2. The student will compare and contrast the structures found in typical plant, animal and bacterial cells.  
3. The student will explain the role of the cell membrane as a highly selective barrier in diffusion, osmosis and active transport.  
4. The student will describe the role of enzymes as catalysts in metabolism and cellular synthesis of new molecules.  
5. The student will differentiate between the processes of photosynthesis and respiration in terms of energy flow, reactants and products.  
6. The student will describe and compare the processes of mitosis and meiosis and their roles in the cell cycle. |
| 9–12       | IV. LIFE SCIENCE | B. Diversity of Organisms | The student will classify, compare and contrast the diversity of organisms on Earth and their modes of accommodating the requirements for life. | 1. The student will relate the structure, complexity and organization of organ systems to the methods of obtaining, transforming, releasing and eliminating the matter and energy used to sustain the organism.  
2. The student will recognize that organisms have both innate and learned behavioral responses to internal and external stimuli, including the tropic responses in plants.  
3. The student will use scientific evidence, including the fossil record, homologous structures, embryological development or biochemical similarities, to classify organisms in order to show probable evolutionary relationships and common ancestry. |
| 9–12       | IV. LIFE SCIENCE | C. Interdependence of Life | The student will describe how the environment and interactions between organisms can affect the number of species and the diversity of species in an ecosystem. | 1. The student will describe the factors related to matter and energy in an ecosystem that both influence fluctuations in population size and determine the carrying capacity of a population.  
2. The student will explain how adaptations of species and co-evolution with other species are related to success in an ecosystem.  
3. The student will identify examples of mutualism, commensalism, and parasitism in a stable ecosystem.  
4. The student will predict and analyze how a change in an ecosystem, resulting from natural causes, changes in climate, human activity or introduction of invasive species, can affect both the number of organisms in a population and the biodiversity of species in the ecosystem. |
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</table>
| GRADE 9-12 | IV. LIFE SCIENCE | D. Heredity | The student will explain how inherited characteristics are encoded by genes.                                                                                                                                  | 1. The student will explain that the instructions for the characteristics of all organisms are carried in nucleic acids.  
2. The student will define the relationship between DNA, genes and chromosomes.  
3. The student will describe the structure and function of DNA and distinguish between replication, transcription and translation.  
4. The student will know that different species of multicellular organisms have a characteristic number of chromosomes, and that in typical humans there are 22 autosomal pairs and 2 sex chromosomes.  
5. The student will describe how genetic information is transmitted from parents to offspring through the processes of meiosis and fertilization as they relate to chromosome recombination and sexual reproduction.  
6. The student will use Mendel's laws of segregation and independent assortment to determine the genotype and phenotype of a monohybrid cross.  
7. The student will differentiate between dominant, recessive, co-dominant, incompletely dominant, polygenic and sex-linked traits.                                                                                                                                                                                                                                                                                  |
| GRADE 9-12 | IV. LIFE SCIENCE | E. Biological Populations Change Over Time | The student will understand how biological evolution provides a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms. | 1. The student will understand that species change over time and the term biological evolution is used to describe this process.  
2. The student will use the principles of natural selection to explain the differential survival of groups of organisms as a consequence of:  
   - The potential for a species to increase its numbers;  
   - The genetic variability of offspring due to mutation and recombination of genes;  
   - A finite supply of the resources required for life; and,  
   - The ensuing selection based on environmental factors of those offspring better able to survive and produce reproductively successful offspring.  
3. The student will describe how genetic variation between populations is due to different selective pressures acting on each population, which can lead to a new species.  
4. The student will use biological evolution to explain the diversity of species.                                                                                                                                                                                                                                                                                                                                                                                                            |
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<td>GRADE IV. LIFE SCIENCE</td>
<td>F. Flow of Matter and Energy</td>
<td>The student will describe and explain the cycling of matter and flow of energy through an ecosystem’s living and non-living components.</td>
<td>1. The student will explain the relationship between abiotic and biotic components of an ecosystem in terms of the cycling of water, carbon, oxygen and nitrogen. 2. The student will know that all matter tends to become more disorganized over time, and that living systems require a continuous input of energy in order to maintain their chemical and physical organizations and prevent death. 3. The student will explain that sunlight is transformed into chemical energy by photosynthetic organisms. 4. The student will explain that respiration releases chemical energy through the breakdown of molecules. 5. The student will understand that matter and energy flow through different levels of organization of living systems, from cells to communities, as well as between living systems and the physical environment as chemical elements are recombined in different ways. Each recombination results in both storage and dissipation of energy.</td>
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<tr>
<td>GRADE IV. LIFE SCIENCE</td>
<td>G. Human Organism</td>
<td>The student will understand how all organ systems, including the nervous system, interact to maintain homeostasis.</td>
<td>1. The student will understand and describe the basic anatomy and physiology of the nervous system and sense organs. 2. The student will describe how the functions of individual organ systems are integrated to maintain a homeostatic balance in the body.</td>
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Appendix B

Newspaper Articles of Students and Teachers Using East Bethel/Cedar Creek Community Schools' Nature Area Sites
Snails, dragonfly nymphs, water boatman, and chorus frogs were just a few of the macro-invertebrates and vertebrates these Cedar Creek Community School third graders captured while investigating White Pine Pond. Parent helpers, rubber boots, nets, and materials provided by the Minnesota DNR MinnAqua Program enabled these students to begin their study of aquatic animals and plants. White Pine Pond, located on school property, is often used by CCCS teachers during the school year to help teach the Minnesota Standards for life science.
Enthusiastic students at Cedar Creek Community School and East Bethel Community School use their nature trail throughout the season. Science, art, social studies, math and language arts activities can be practiced and expanded through the use of the nature trail. Students share memorable experiences, gain an awareness and appreciation of nature, and learn first hand to enjoy the outdoors in Minnesota. The entrance to the nature trail is directly behind East Bethel Community School. Green Team teachers from both schools encourage non-motorized community use of the trail. Nature guides are available at the EBCS office.

Submitted photo
Late summer brings this adult fritillary to feed on native plants in the East Bethel Community School butterfly garden. Students from Cedar Creek and East Bethel Community Schools make good use of this pollinator friendly habitat to release adult monarchs raised from caterpillars in their classroom each fall.

Submitted photo
East Bethel Community School students were out in the school nature area gathering Monarch butterfly caterpillars as part of their science unit on insects. After watching the marvel of metamorphosis, the students released the adult butterflies in the school butterfly garden. The butterfly garden has native plants such as Blazing Star and Asters. The newly emerged butterflies sipped nectar from the flowers before they began their long journey south. Pictured with a caterpillar are Jeremy McLaughlin and Matt Thompson.
Second graders (pictured at right) in Ms. Dawson's class at East Bethel Community School volunteer to bring bird seed for the feeder outside their classroom window. The students enjoy watching the birds and trying to identify what they see. Shrubs planted by the Green Team are large enough to provide good cover for the birds on cold winter days. Submitted photo
The deep, new snow in February found East Bethel Community School students outside on the nature trail enjoying winter, nature, and their classmates. Thanks to funds provided by the PTO for purchase of a classroom set of snowshoes, this exhilarating experience tromps on.

Submitted photo
Shown above in these three photos, third grade students at East Bethel Community School were out collecting prairie seeds on a fine fall day. The school prairie is located directly east of the ball fields. Native grass seed is being gathered to continue the prairie restoration tradition started at EBCS in 1997. Prairie restoration gives students direct science experience with plant growth and development as well as experience in learning to work together to benefit the environment.
A lesson in fishing equipment

Submitted by Kevin Filippi 3rd Grade Teacher at CCCS

Former Cedar Creek Community School Principal Ray Churack spent a day with students from the classes of Mrs. Beechum, Mr. Spies and Mr. Filippi, teaching the students about different types of fishing and showing them the fishing equipment he has collected over his many years of enjoying the sport. The demonstration was part of the "Minnaqua" program which is Minnesota's angling and aquatic education program for students. The program was started by the DNR in 1990 to teach angling recreation and stewardship as well as the ecology and conservation of aquatic habitats. It was hard to tell whether Mr. Churack or the nearly 90 third graders had more fun on this special day! Mrs. Beecham has been using the "Minnaqua" program with her science classes at CCCS.

Ray Churack demonstrates various fishing gear. Submitted photo.
Appendix C

Green Team Survey (2002)
Green Team Survey

The Green Team would really appreciate your assistance in filling out this quick survey. We have one of the best school nature areas and we would like to know how to help you use it. Our focus previously has been establishing and maintaining our outdoor sites. Now, we would like to focus on meeting teacher’s needs for environmental education. Please answer these questions and return to Mary Folkman by Friday, January 10th. Thank you for your time.

1. In the last year have you taken your students to the:
   - butterfly garden? Yes No
   - prairie? Yes No
   - nature trails? Yes No
   - the bench sites? Yes No

2. Do you know where all those sites are? Yes No

3. Do you have a nature trail guide? Yes No

4. If yes, do you use it? Yes No

5. Have you used books or other materials on the shelves in the teachers’ workroom that are provided by the green team? Yes No

6. If not, do you know where those materials are? Yes No

7. Would you be interested in a list of activities (designated by seasons) that you could use with your students? Example - a list of activities by grade level for the winter months. Yes No

8. If conditions permit, would you use snowshoes with your class? Yes No

9. Would you be willing to participate in an in-service given by green team members on the use of the nature trail and outdoor areas? Yes No

If you have any comments please write them here or on the back side. Thank you so much for your time.
Comments on the survey for the following questions:

1. No Time
2. Not the butterfly garden
3. None
4. Have used it for a reference, not for a long time
5. None
6. Resource shelf? But I could locate if needed
7. Spring and fall seasons only
8. We did when help was available and curriculum was different. Short time does not help. Difficult for kindergartners. Time? It has been hard in the last few years to time it right. Maybe.
9. I took part in the classes years back and enjoyed them. Time now gets in the way. I would if counted as part of our 32 hours. Depends on when it is offered or what else is offered. Maybe. Refresher course is always good.

Comment area:
We are already pushed to the limit getting in required curriculum. Thanks for your time! Keep up the good work! I want to go out more! I think the Green Team is doing a great job and service for E.B.C.S. the flower you have planted are so beautiful! Thank you.

Survey analysis

1. Students are using nature trails and bench sites most
2. Need to make sure teachers know where sites are - 7 no's
3. Make available trail guides for anyone who does not have one
4. Definite interest in list of activities for seasons for grade levels, especially 1st, 2nd, and 3rd
5. Snowshoes are used more at 2nd and 3rd grade level
6. Inservice - counted as part of 32 hours??
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12.
## Green Team Survey Results - 24 returned surveys

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24 out of 28 surveys were returned - 85%

Comments and analysis on the following sheet
Appendix D

Prairie or Butterfly Garden Interest Response
Prairie or Butterfly Garden Interest Response

___ I am interested in a large scale prairie planting and would help plan and secure funds for the future.

___ I am interested in a seed gathering mini workshop.

___ I am interested in walking the trails and finding the prairie.

___ I am interested in gathering seeds with my class and scattering them on the fields.

___ I am interested in planting a small prairie of butterfly garden patch with my class.

___ I am interested in materials that infuse prairie planting or a butterfly garden into my current curriculum.

___ I would be interested in prairie of butterfly garden planting in the future, but not at this time.

Name ____________________________

Comments:
Appendix E

District # 15 Teacher Academy Study Group Application
Request for Teacher Academy Study Group

The Master Agreement between the District and Education Minnesota St. Francis provides 32 hours of individual professional development. All teachers have the option of selecting Teacher Academy activities as a way of fulfilling their 32 hours. Using the math study group model from 2003-2004, the District Professional Development Committee is seeking individuals or groups who wish to develop and offer study groups during the 2004-2005 school year. Staff who participate would have the option of fulfilling individual professional development hours or receiving Teacher Academy credit (one credit for each ten hours of study group time attended). All requests for Teacher Academy study group credit must be completed and returned to Mary Wherry or Randy Keillor on or before April 15. Late requests will not be considered.

In order to keep different activities from conflicting, study groups will be scheduled on Mondays and Tuesdays during the school year with the exception of the first Monday of each month that will be reserved for Site Management Council meetings.

Requesting Individual or Group  Pamela Beecham

Facilitator(s)  Pamela Beecham

(Facilitators would be compensated under Academy policy with credit or extended contract payment and would be expected to participate in any necessary training or planning activities.)

Study group would be open to:

This early fall study group is open to K-6 teachers of science who wish to learn techniques of management and inquiry along with specific lessons taught outside in the C.C.C.S./E.B.C.S. nature area. Teachers will also enhance their teaching of the Minnesota Science Standards and gain knowledge of the Environmental Literacy Benchmarks for Minnesota.

Study Group Description: (include a brief description of topics, activities, and so on, for registration booklet)

Topic/Pond Study
Activity
Teachers will collect aquatic invertebrates by using a dip net. They will sort, identify, and draw their findings in nature journals. Teachers will identify aquatic plants and construct a food web. The DNR's MinnAqua program and various other pond resources will be reviewed.

Topic/ Trees on Site
Activity
Teachers will compare and contrast coniferous and deciduous trees on the nature trail. Teachers will make drawings, practice inquiry, and learn questioning techniques. Photosynthesis, decomposition, and an interdependence of organisms will be stressed. Tree resources and the E.B.C.S. Nature Guide will be reviewed.

Topic/ Salamanders and Toads
Activity
Teachers will learn safe handling and classroom care of these local amphibians through the inquiry method. Minnesota amphibian resources will be reviewed, literature highlighted, and we will participate in art and writing inside, this session. We could also use this as a rain day activity if needed.
**Topic/Butterfly Garden and Minnesota Butterflies**

**Activity**
Teachers will discover the teaching possibilities of butterfly garden. Participants will identify plants and match the larvae or adult that feeds on them. We will gather seeds and store for them for teachers who want to plant their own butterfly garden in the spring. This will also be a fine time to share the many butterfly related activities that teachers currently use. Butterfly resources will be reviewed.

**Topic/Prairie**

**Activity**
Teachers will walk out to enjoy the prairie, participate in identification, practice seed gathering techniques, seed storage, and preparation, and take home seeds for use in the spring. *Project Blue Stem* will be reviewed along with SNAP resources and other prairie curriculum materials.

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**How would teaching & learning improve as a result of this study group?** (answer should address both what the need is and what the intended outcome will be)

A naturalist from Wargo Nature Center told me today that she thought we had the best school nature site she had ever seen, perhaps the best in the nation! Our teachers feel unprepared to use the nature site and crunched by curriculum. This study group will help teachers feel more comfortable teaching in an outdoor setting, connect science concepts across the curriculum, align nature study with the Minnesota Science Content Standards, and increase their use of our valuable resource. Hopefully this outdoor study group experience will awaken participant’s sense of wonder and set them on a new direction as a life long learner.

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<td>September 20, 2004</td>
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<td>September 27, 2004</td>
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<td>Meet in Beecham’s classroom and walk out to the B.F. garden.</td>
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<tr>
<td>October 5, 2004</td>
<td>4:00-6:00</td>
<td>Meet in Beecham’s classroom.</td>
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October 26, 2004 4:00-6:00 Meet in Beecham’s classroom and hike out to the prairie.

Costs:
Facilitator(s) would receive cash payment X credit X (first choice)

Supplies/materials:
Trail snacks and beverages for each person would be needed. Nature journals at a cost of $2.80 each per person would be needed. Copying outdoor lessons would need to be covered.
Other: (specify items and amount)

Study groups that are approved by the District Professional Development Committee will be included in registration information provided for the staff in May of 2004. A minimum registration of 10 will be required to offer and fund any study group.

Professional Development Committee Action:

Chair Signature _________________________ Date ________ _
Connections to the Classroom

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Where locations are not specified, registrants will be contacted prior to the first meeting to advise of the location.

During the 2004-2005 school year, a series of five different study groups will be offered to the teaching staff. Study Groups are open to all teachers. Each teacher needs to consider the relevance of the content before registering. All study groups will be held between 4:30 and 6:30 p.m. At the time of registering, teachers have a choice of using the ten hours to fulfill part of their 32-hour professional development requirement or receive one lane change credit. In either case, participating teachers are expected to satisfactorily complete the study group. For more details about the any of study groups, please contact the specific facilitators listed on page five.
Study Group Facilitator Guidelines

Facilitator expectations:
Facilitators will be allowed one hour of preparation for every three hours of facilitation.
Facilitators will have clearly stated topic and or activity for each session.
Facilitators will provide documentation of outcome(s) being met by a product, minutes or other appropriate method. Documentation should be included with the summary report.
Study Group accomplishments will be part of a written summary report prepared by the facilitator and given to the governing board. The summary report should be given to Randy Keillor no later than one week prior to a scheduled governing board meeting. The governing board meeting dates are:
- October 5
- February 1
- April 26
- May 2.

Recommendations for further study or changes to building, district programs or specific areas will be included in the summary report.
Provide an evaluation form for all participants at the end of each session if there are different presenters for each session or the final session if all sessions are led by the same facilitator(s). Submit all evaluation forms to Randy Keillor at St. Francis High School. A sample evaluation form is included in the materials. You may make adaptations as needed. Contact Randy Keillor for assistance with form.

Arrange for room and materials. Complete a request to use school facilities form for using any school space, including your own classroom.

Some supplies, markers, pencils, notecards, etc, are available through the Teacher Academy. Contact Mary or Randy to request them.

Up to $100.00 for supplies is available through the Academy budget. You may purchase materials and then complete a Misc. Itemized Expense Form, following instructions on the checklist and send it to Mary Wherry at East Bethel Community. You may also order materials using a the district Requisition Data Entry Form. Send the completed form to Mary Wherry at East Bethel Community School. District money cannot be used to purchase food for participants.

Education Minnesota St. Francis will provide up to $50.00 in reimbursement for treats for the participants. Use the Education Minnesota St. Francis Teacher Academy Request for Payment form. Send it to Mary Wherry at East Bethel Community School.

At the first session of your study group all participants should receive the Policy on Study Group Attendance and the Study Group Attendance Record. Participants will choose Teacher Academy lane change credit or ten PDP hours when they have attended five (5) sessions for a total of ten (10) hours. Discuss the policy at your first session to make sure all participants understand the expectations and do not ask you to make exceptions. Direct questions to Academy coordinators.

At the final session you will collect the attendance records, sign and date them, and send them to Randy Keillor at St. Francis High School. Participants are wise to keep a copy for themselves. Participants who successfully complete 10 hours will receive a certificate.
Participant expectations:
Attendance and participation:
Documented attendance forms signed by facilitator.
Teacher Academy credits granted in 10 hours increments.
Professional development hours will be counted per hour.
Completion of evaluation form.

At the conclusion of all sessions the facilitator(s) should do one of the following to be compensated for facilitator time:
- complete a payroll claim form for 15 hours of pay, pro-rated, or
- complete an attendance sheet for Academy credits (2) or IPDP hours up to 20 hours.
Appendix F

Study Group Plan of Topics
Study Group Plan of Topics

This 2004 fall study group is open to teachers who wish to learn techniques of management and inquiry along with specific lessons taught outside in the C.C.C.S./E.B.C.S. nature areas. Teachers may enhance their teaching of the Minnesota Science Standards and gain knowledge of the Environmental Literacy Benchmarks for Minnesota. Increased use of the nature areas by teachers is the main goal of this study group.

Trees on Site (Monday, September 20\textsuperscript{th})
Teachers will participate in a Trail Use Survey to document goals met and increase use of the nature areas. Attendance information will be discussed. Tips for handling students on the trail will be demonstrated. Teachers will make drawings, practice inquiry, and learn questioning techniques. Photosynthesis, decomposition, and the interdependence of organisms will be stressed. Tree resources and the E.B.C.S. Nature Guide will be reviewed.

Pond Study (Monday, September 27\textsuperscript{th})
Teachers will collect aquatic invertebrates by using a dip net. They will sort, identify, and draw their findings. Teachers will identify aquatic plants and construct a food web. The DNR’s MinnAqua program and various other pond resources will be reviewed.

Butterfly Garden and Minnesota Butterflies (Tuesday, October 5\textsuperscript{th})
Teachers will discover the teaching possibilities of the butterfly garden. Participants will identify plants and match the larvae or adult that feeds on them. We will gather seeds and store them for teachers who want to plant their own butterfly garden in the spring. This will be a fine time to share the many butterfly related activities that teachers currently use. Pollinator activities and butterfly resources will be reviewed.

Prairie (Monday, October 11\textsuperscript{th})
Teachers will walk out to enjoy the prairie, participate in identification, practice seed gathering techniques, seed storage, and preparation, and take home seeds for use in the spring. Project Blue Stem will be reviewed along with SNAP resources and other prairie curriculum materials.

Salamanders and Toads or Unfinished Tree Study (Monday, October 18\textsuperscript{th})
Teachers will learn safe handling and classroom care of these local amphibians through the inquiry method. Minnesota amphibian resources will be reviewed. Literature highlighted, and we will generate art and writing activities. Trail use survey will be given out for completion. This session will be substituted for previous session topics in case of rain.

Topics may change slightly to incorporate teacher participants input and needs. Each session will begin with a walk on the trail for our well being and phenological exploration. Please dress for at least an hour outside each session. My school phone number is 753-7150 (2859). I can be reached at home this year at 763-689-2682.
Appendix G

Site Specific Resources for Nature Study Group
Trail Introduction and Comparing Two Pine Trees

The first visit to the nature site is when outdoor learning rules and procedures are set. The children need to feel comfortable and learn to observe, discover, and enjoy being in an outdoor setting.

Before Each Visit

1. Let the children know several days in advance that they will be going outdoors so they dress appropriately.
2. Children need pencils and notebooks or sketch books.
3. Use the restroom before going outside. Inform the office of your whereabouts.
4. Line the children up by twos. Some classes have to be told to keep the same spots in line so they won’t argue.

Enter the woods near the low branches of red pine, and show the children how to pick off a cluster or green needles. They need to hold on to the needles for later use. They will learn the name of the tree shortly.

Walk to the benches and review rules. Follow the usual “leave no trace” practices. Caution against picking up sticks. If you collect items from the woods return them at some time. No climbing, kicking, and going ahead of the teacher. Stay on the path unless directed to explore.

Red Pine Discovery

Direct the children to pick up from the ground, under where they are sitting, another cluster of needles grouped in twos that are brown. Ask, “How are these two sets of needles alike? How are they different?” When they state that one set is green, tell them the green set is working. They were reaching for the sun when we picked them and were making food for the plant. That is their job. It is called photosynthesis. Any green plant is making food. The brown needles have finished their food-making job and now have another one. Direct the students to dig lightly into the duff under the benches. What do they see and feel? There are broken bits of needles turning into soil. They are decomposing. Have the children poke the sharp needles into their arms. When they say “ouch” give them the memory tip of poking, red blood, or red pine. Now is the time to carefully draw the needles in their notebooks. Walk around and admire careful work.

Next have the children stand and feel, smell, and draw the bark of the red pine. It may be a time for bark rubbing. Label the drawings.

Walk down the trail and see if they can find a red pine cone. They usually can, if not show them one first. Coniferous means cone bearing. Next, students sit on a stump and draw the red pine cone being carefully to draw the cells. Students will find immature cones too. In early September look for reddish cones with the seeds still inside.

White Pine Discovery

Walk toward the E.B.C.S. playground to examine the low branches and needles of the white pine. Immediately the students feel how soft the needles are. Show them how to gather a cluster of five needles. Spell out w-h-i-t-e on each needle. This is the memory trick. Have them feel and smell the bark. Usually the sticky pine sap is noticed. I tell the students to add a pinch of pitch to their journals. They are lucky to have a bit of it stuck to them to remember the woods for a few days. Gather a long white pine cone and head back to the benches to draw the needles and cones.
Look for some gnawed pinecones. Hold one up and ask the students if they know what animal has been nibbling on the pinecones like they do a cob of corn. The red squirrel makes its home in coniferous forests and survives on the seeds of pinecones. It stores a cache for the winter unlike the grey squirrel that buries acorns.

On the way out look for small pine trees. How did they get there? What type are they? How do they know?

Before leaving the woods or after returning to the classroom ask the children how they felt being in the woods. These positive reflections will help students value nature and later care for it as adults.
East Bethel/Cedar Creek Nature Site Use-April
Wake Up! It's Spring!

Peeps, trills and soft little quacks from wetlands on our site mean tiny frogs have awakened from a frozen winter state and are raucously calling the females to join in reproduction and declaring their territory near the water's edge. Student's good ears and keen interest in these amphibians can result in addressing Life Science Standards using all the senses to key into the sub strands of Diversity of Organisms and Interdependence of Life.

Frogs

Before taking the students outside, tell them today’s lesson is going to involve looking and listening for the first frogs, butterflies, and plants of April. Run you thumb over the teeth of a comb to introduce the sound of the tiny (2 to 3 cm) pear shaped, striped backed, western chorus frog. This call has been described as a raspy, ascending “creeeek”.

Another male calling from the ponds is the wood frog (5 to 6.5 cm). Its “glucks” sound like little ducks or chuckling, rolling clucks. The larger size makes them easier to see and catch so caution students about wetting their hands before handling any amphibian. Their tan color and dark robber’s mask behind their eyes makes them easy to identify.

Spring peepers (2 to 3 cm) are seldom seen but heard late into the night. Their call is a clear, high-pitched peep with a slight rise at the end. The peepers change color from tan to dark depending on temperature, mood, and surroundings. An “X” marks their back for easy identification.

The edges of White Pine Pond are a good place to sneak up on the frogs. They stop calling when they hear noise. Students can raise hands or point to where they hear the calls.

Butterflies

The first butterflies stand out well in our deciduous, leafless woods. The Mourning Cloak is large, colored dark velvety-brown with a cream-yellow border. It has hibernated under loose bark or logs and is out sipping sap from oak and maples on site. They are often found near yellow-bellied sapsucker holes. The woodpecker made these parallel rows of small holes that ooze sap. The adult will lay her eggs on the willows, cottonwood, birches, and aspens on our site. Another first butterfly out is the Compton Tortoiseshell, which again, hibernated in hollow logs or outbuildings. Maple tree sap is the only food available for its long tongue to suck up. Both butterflies feed on and can be attracted by rotting apples at this time.

The interdependence of birch, willow, and aspen leaves for caterpillar food is a good reason to stop and examine and draw the catkins hanging down from the aspen trees on site.

A large aspen has fallen across the trail near site 24 south of White Pine Pond. It is easy for the students to gather a catkin to examine. Pollen producing catkins are male. Seed producing are female. They grow on separate trees and depend on the wind for pollination. They will remain grey and caterpillar like for a time and are well worth checking for change during the next few weeks. Cottonwoods catkins outside the west fire doors at EBCS would also be easy to observe and draw over the next few weeks. The
pollen catkins cover the tree and give it a furry looking crown. Male catkins are 3 to 5 inches long. Female catkins mature into green bead shaped seeds. When ripe they pop and fly off on the fluff from which “cottonwood” gets its name.

The first small tree to green up throughout our site each year is the elderberry. This shrub or small tree is common in our woods and just at eye level for young students to draw, feel, and find hollow twigs. Large compound leaves unfurl from the huge buds. White flowers and later red berries develop in summer. Why are they so numerous on site?

Back In the Classroom

Reading about the frogs and the butterflies the next day can remind students of their visit to the woods and pond edge. See attached summaries. Folding paper for symmetrical Mourning Cloaks and using paint or Craypas for coloration would work well with your spring art projects. Drawing 2 to 3cm spring peepers in nature journals and larger masked wood frogs would tie in well with measurement. I can see K-1 students doing creative movement to match spring butterflies. Cycles, valuing down trees, and preserving habitat are other ideas to tie in with awakening of spring in our EBCS/Cedar Creek Nature Areas.

Tulips

The tulips are peeking out of the ground. Daily observations and measurements with Unifix cubes are fun for all.

Caution

April means that mother wood tick needs our mammal blood to reproduce. Have children tuck their pants into tall socks and avoid tall grass. Remind children to stay on the trail. It takes several hours for a tick to imbed itself into the skin so a post trail tick check is helpful. I like to carry scotch tape to fold ticks in. I took three classes out last week. We had only one tick sighting.

References

nearby pond can be a never-ending source of interest and pleasure. An underwater leaf may bear life—an egg of a spring peeper.

April

A simple hand lens will magnify wood frog eggs and the tadpoles that will soon hatch from them.

April

When chorus frogs are singing together, it can be hard to locate single frog. But listen carefully, look closely. Perhaps you’ll find tiny frog hidden in the grass.

The spring peeper is a small brown tree frog about one inch long with only an X-shape on the back breaking the color pattern. The Latin name of *Pseudacris (Hyla) crucifer* refers to the cross it carries, and the common name, peeper, denotes the call these small amphibians emit. With the use of his powerful vocal cords and an inflated singing sac, the male pierces spring evenings with a deafening sound that can be heard a mile away.

After sleeping through the winter under pondside leaves, the males have awakened to forces of propagation. Peeping calls serve two purposes: they interest females and also proclaim a section of pond as claimed territory. After the mating process is completed, eggs are deposited singly on plants under the pond water. April nights will still freeze and eggs need to be deep to survive the ice.

Wood frogs breed quickly and gregariously. Males float in a supine position on the surface and sing amorous "gluck-glucks" that have been compared to ducks' quacking or horses on cobblestone. The male declares a territory and when the female joins him, they produce masses containing hundreds of eggs. Indeed, the eggs appear to be too many to come from bodies this size. These eggs will be tadpoles by early May, and the new batch of wood frogs will hop onto the forest floor during July. The pond, now so filled with their activity, will have no wood frogs by the month's end.

Chorus frogs get their name from their practice of singing in groups, as they do through much of April. The males' song is often compared to running a thumb over teeth of a comb. Not as loud or rambunctious as some frog calls, it is still very persistent. While most frogs call in the evening or night, chorus frogs often sing much earlier in the day with only the advent of the cool early morning stopping them.
Unrolling its long tongue, the Compton tortoise shell feeds on dripping sap, about the only food available in early spring. Later it will also feed on rotten fruit and animal droppings. Eggs will be placed on aspen, birch, and willow trees where the caterpillars will feed.

Most butterflies survive winter as eggs, caterpillars, or chrysalises, but the mourning cloak is one of the few adult hibernators. Its winter home, a space behind bark or a crack in a tree, is not warm, but though large parts of the mourning cloak's body do freeze, they thaw in early spring sunlight, and the butterfly may be roused by early March. The large dark wings act as solar panels for excellent basking.

Early rising does have some disadvantages besides the cold. With no flowers in bloom, no nectar is available, and this hungry critter visits maple trees for a taste of spring sugar just as we do.

A small tree makes this first plunge. Despite the danger of late frosts, elders pioneer the greening of the woods. Like many plants of the forest floor, the elder needs time in sunlight before shade dims the landscape.

Large compound leaves pour from the huge buds that have held them all winter, and long green leafy fingers emerge holding the broccoli-like buds of the flowers in their grasp. Later these flower buds will give the tree white flowers and red berries that contribute to the common name of elderberry.

The dark wings of the mourning cloak absorb heat as well as the dark jackets we wear that are comfortable now but too warm in midsummer sun.
MINNESOTA'S FROGS

By: Larry Lindsay

When it comes to size, Minnesota's bullfrog tops the frog charts, sometimes reaching eight inches in length from tip of snout to rear end. Older bullfrog tadpoles also are very large, reaching lengths of 4-3/4 inches. Because it takes a long time for such a large frog to mature in our cool weather, it often takes them three years as tadpoles before they become frogs. They are common in the backwaters of the Mississippi River in extreme southeastern Minnesota. They have been introduced into counties as far north as Stearns and Chisago counties in south-central Minnesota, and are found as far west as Jackson County on the Iowa border. A bullfrog can be identified by its size and its solid green color. The bullfrog, not kept in check by other predators, can become a nuisance.

Minnesota's five tree frog species are very small, with adults ranging from 5/8 inch to two inches in length from snout to rump. The northern cricket frog, spring peeper, and western chorus frog have all evolved into ground dwellers.

Cricket frogs, once thought gone from Minnesota, have been reported in extreme southeastern and southwestern Minnesota. The spring peeper, ranging in size from ¾ inch to 1-1/4 inch, is tan to dark brown in color with a darker “x” on its back. The peeper makes its home in the eastern and northwestern counties of Minnesota in woodlands around water.

The western chorus frog is found statewide. Measuring 1-1/4 inches, it is easily recognized by its pear shaped body. Its color ranges from tan or green, to gray and has three darker stripes on its back.

The tree frogs that prefer trees and bushes are the gray tree frog and the Cope's gray tree frog. Both reach a maximum length of two inches, are green as often as they are gray, and have short, broad snouts and look more like toads than frogs. For this reason, they are often referred to as...
“tree toads”. Their toes have small, round bumps used for climbing. Gray tree frogs are found in wooded areas everywhere but southwestern Minnesota. Cope’s tree frogs occur in central Minnesota along forest edges.

Green frogs are found in eastern Minnesota from Canada to Iowa. They are 2-1/2 to 3-1/2 inches long, can be green or brown with almost no spotting.

Green Frog

Wood Frog

Minnesota’s wood frog lives in woodland marches and small pond. It can be easily identified by brown color and “robbers mask” around its eyes.

In addition to these solid color frogs, we have three spotted frogs. The northern leopard frog is found statewide in meadows and open areas near bodies of water. The mink frog lives in northeastern Minnesota in waters surrounded by woodlands. The pickerel frog is found only in extreme southwestern Minnesota. Each of these is just a little unique.

The mink frog is green with brown mottling. If you lightly scratch their backs, they give off an odor resembling rotten onions, or some say the smell of a mink.

The pickerel frog is tan with brownish spots. They produce toxic secretions through their skin that make most predators avoid them. If placed in a bucket with other frogs the toxin can kill other frogs as well. The northern leopard frogs are unique because they are so common. The leopard frog is green or brown with dark spots and are found in every county in Minnesota.

JUST THE NATURAL FACTS

- Frogs and toads are different. In general, Minnesota frogs need to live near water. Toads do not.
- Frogs have smooth moist skin. Toads have bumpy dry skin.
- Like trees, frog bones grow a new ring every year as the frog is hibernating. In this way scientists can determine the age of frogs.
- If we think the bullfrog is big, consider the goliath frog (good name) of Africa, whose body measures over one foot long with legs that are even longer!
Red Oak

The red oak you are planting today will be mature in a century and will grow for one or two centuries afterward. The thin stem of the red oak the seedlings will thicken over those centuries to two or three feet in diameter. Acorns will start to form on this tree in twenty-five years.

Red oak acorns provide valuable food for wildlife such as deer, squirrels, raccoons, chipmunks, mice, and black bear. Ruffed grouse, red headed woodpeckers, and mallards gobble up red oak acorns. The wood duck is sometimes called the "acorn" duck because acorns often comprise up to 62% of its diet. The wood duck has special claws on its webbed feet for grabbing onto oak tree limbs. Yes, you will see wood ducks up in oak trees.

Acorns were a major food crop for Native Americans. Some tribes gathered four or five hundred pounds of acorns each fall. Acorns were shelled, soaked in running water, dried, and pounded into acorn flour. In 1620 baskets of acorns were given to the Pilgrims by the local tribes to help them survive their first winter in Massachusetts.
Big Blue Stem Observation Sheet

Use a magnifying lens to observe the big blue stem seed heads and seed. Then draw what you see.

drawing of seed heads  drawing of seed

Observations and Questions

How do you think the seed gets into the ground?

Does the seed have anything special to help it get into the ground?
SHORELINE PLANTS (Plants growing at water's edge)
- Horsetail
- Reed Canary Grass

WATER HABITAT ID SHEET

EMERGENT PLANTS (Plants rooted in water with stems and leaves above water)
- Sweet Flag
- Cattail
- Wild Rice
- Hardstem Bulrush

FLOATING PLANTS (Plants have many floating leaves)
- Yellow Water Lily
- Duckweed
- Water Shield

SUBMERGED PLANTS (Plants completely under the water or nearly so)
- Northern Water Milfoil
- Coontail
- Wild Celery
- Curly Leaf Pondweed

EXOTIC PLANTS (Plants whose spread should be controlled)
- Purple Loosestrife
- Eurasian Water Milfoil
  - 9-21 leaflet pairs
  - whorls of 4

- 7-11 leaflet pairs
- whorls of 3-5
WATER HABITAT ID SHEET

AQUATIC INSECTS

Mayfly
- nymph
- adult

Dragonfly
- nymph
- adult

Predaceous Diving Beetle (1/8-1/2")

Whirligig Beetle (1/4-1/8")

Giant Water Bug (1-2")

Water Strider
- adult

Mosquito
- adult
- larva

Stonefly
- nymph
- adult

Caddisfly
- nymph
- adult
Waste Management Resources for Schools


- School Waste Reduction and Recycling Case Studies. Documents several schools' success at increasing recycling, reducing waste, and saving money.

- State of Minnesota Requirements for Public Entities. Comprehensive list of Minnesota mandates on waste issues that apply to public institutions and school districts; translated from state statutes into more understandable language.

- Laboratory Waste Minimization and Pollution Prevention. This guide for science teachers was developed to help minimize classroom lab waste and chemical pollution. (Battelle Corporation.)

IPM: Reducing Pesticides in Minnesota Schools. Online: www.moea.state.mn.us/ee/ipm.cfm
This study showed that it is feasible to implement integrated pest management (IPM) without incurring additional costs and that any school can have a successful IPM program, with a little bit of technical assistance and the commitment to make changes.

Other resources available from the Clearinghouse

- Staff assistance is available Monday through Friday, 8:00 a.m. - 4:30 p.m., to answer questions, help with requests, etc.

- Grants for educational programs are part of the OEA's Environmental Assistance Grants program. Watch www.moea.state.mn.us/grants/ for the current RFP, or call OEA to get on the interested parties list.

- Reference materials are also available for research or browsing at the OEA. Appointments are encouraged. E-mail the Clearinghouse at clearinghouse@moea.state.mn.us, call 651-215-0232 or 800-877-6300 toll free, or stop in and visit us in Saint Paul at 520 Lafayette Road North, Floor 2.

- Curricula that represent some of the best available in the environmental field.

- Posters for your classroom.

- Magazines and journals, including Green Teacher, green@work, E! The Environmental Magazine, In Business, and Resource Recycling.

- OEA fact sheets and reports. Topics include recycling, source reduction, buying recycled, problem materials, and pollution prevention.

- The OEA web site is always available. Visit us online: www.moea.state.mn.us.

Order materials mail or fax to 651-215-0246

Name

School/Organization

Address

Phone

E-mail
Curricula and Educational Materials


Circle one: K-6 7-12 K-12

Waste Reduction Materials. Fact sheets, posters, and clip art with ideas and examples for reducing waste in your daily routine. (Limited quantities available; download copies from www.reduce.org.)

- Home
- School
- Shopping
- Composting
- Home toxics

Lawn & garden
Traveling
Workplace
Posters & clip art
Phosphorus
Pesticides

English as a Second Language (ESL) Resources. EE materials for teaching English. Each workbook contains vocabulary in six languages: Bosnian, Hmong, Russian, Somali, Spanish, and Vietnamese. (Indicate total number of workbooks needed, or download: www.moea.state.mn.us/ee/esl.cfm.)

Teacher's guide workbook
Reduce Reuse Recycle
Newcomers and the Environment (Intermediate)
Newcomers and the Environment (Advanced)

Activity: Luscious Layered Landfill.
In this hands-on activity, students learn the composition of a landfill by making an edible version. Instructions, background information, related web sites, and other resources.

Video and Brochure: Toxic Air in Minnesota and Your Health (18 min.). This video documents various pollutants in the air we breathe, how they might affect our health, and what individuals can do to reduce exposure. (High school)

Video: Lean, Green, Drivin' Machine: Automobile Care for the Environment. A 15-minute program that covers safe handling of common vehicle fluids, and provides practical environmental tips for becoming an informed, responsible driver.

Resource and Reference Materials

- How Earth Friendly Are You? A Lifestyle Self-Assessment Questionnaire. Divided into 11 categories, this 32-page booklet is a lifestyle questionnaire. It raises questions and provides new options for thinking and acting on topics like energy and living space, education, money/work, and more.

- Glossary of Environmental Terms. A list of solid waste terms and their definitions.

- All-Consuming Passion: Waking up from the American Dream. Discover how consumption affects our personal lives, the lives of others, and the environment. Learn how to live a "low-consumption, high-fulfillment" life.

- "The E Connection." Based on a five-part public television series, the video and Educator's Guide include lesson plans, activities, and resource lists related to Minnesota's environment.

- Packet of Pre-K Education Materials. A collection of hands-on activity guides for preschool children. Several age-appropriate videos are also available for checkout.

- Earth 'n Jeopardy. An environmental trivia game by the Minnesota Earth Day Network.

- Tour 'n Jeopardy. An environmental trivia game by the Minnesota Earth Day Network.

- Environmental Video Catalog. Also online: www.moea.state.mn.us/ee/videos.cfm. OEA has over 400 titles available for loan from the Clearinghouse's free video lending library. There are videos appropriate for all ages on a wide variety of environmental topics.

- Learning Trunks. Available for loan, these three distinct learning trunks are filled with great hands-on lessons, props, and fun learning activities. Please call Clearinghouse staff regarding availability and contents.

- Recycled Products Trunk
- Non-Toxic Cleaning Kit


- Software. Saturday Chores is a free set of three educational computer games on everyday waste issues: Shop Smart, Yard Chores, and Trash Sort.

- A GreenPrint for Minnesota: Second Edition. Also online: www.seek.state.mn.us/eemn_d.cfm. Minnesota's state plan for environmental education offers guidance to increase environmental literacy.

- Environmental Literacy Scope and Sequence. Also online: www.seek.state.mn.us/eemn_c.cfm. A tool for educators that provides a systems approach to environmental education in Minnesota.

The report card describes the environmental literacy of Minnesotans, including environmental knowledge, attitudes, and behaviors.

- Natural Wonders, A Guide to Early Childhood. www.seek.state.mn.us/classroom_e.cfm. This guide offers background and practical EE strategies for young children, including developmentally appropriate programs and activities.
MINNESOTA FORESTRY EDUCATION
Programs and materials coordinated by the
Minneapolis Department of Natural Resources' Division of Forestry

PROGRAMS

School Forest Program – This program allows schools to designate an outdoor classroom as a school forest—places where young people learn about their environment by experiencing it. The program connects schools with local DNR foresters, sponsors in-service learning opportunities with Project Learning Tree and other natural resource materials and curriculum. See also www.dnr.state.mn.us/schoolforests. Audience: School educators and administrators.


Arbor Month Program – Arbor Day in Minnesota is the last Friday in April. May is Arbor Month. The Arbor Month Program coordinates partners to allow educators to get tree seedlings and teachers' guides. There is no new poster or education packet for 2003. Audience: All.

Big Tree Registry – This program allows individuals, classrooms, and community groups to nominate a tree in their community as one of Minnesota's biggest trees. Audience: All.

Firewise – This program helps communities assess for susceptibility to fire. Visit www.dnr.state.mn.us/education/wildfire. Audience: All.
Firewise also produces a series of grade-level activity guides which focus on fire prevention. Schools can collaborate with the program to become a “Firewise School” and participate in field activities to monitor forests and prevent fires. Visit www.dnr.state.mn.us/education/wildfire/firewise_communityproject.html. Audience: High school educators and administrators.

POSTERS

Forest Ecosystems – This poster focuses on forest succession and biodiversity. Four activities and additional information are on the back.

100 Years and Growing – This poster celebrates more than 100 years of Minnesota's State Forest System. The back contains information on forests, succession, animals, and Minnesota’s State Forests.

Minnesota’s Forest Treasures – This poster features 35 of Minnesota’s 52 native tree species. The front illustrates the leaf and seed as well as the tree form. Educators can photocopy the eight forestry panels on the back of the poster for classroom handouts and background information.
Minnesota’s State Symbols – This poster features the state symbols on the front and the historical significance on the back. This is an excellent resource for social studies and civics projects.

Minnesota Biomes Poster – This poster focuses on the ecological classification of Minnesota’s ecosystems. The back of the poster is divided into panels containing information on each of Minnesota’s three biomes as well as other educational material.

**Brochures**

Natural Resources Education – This brochure outlines most of the major education programs offered by the Minnesota DNR (e.g. volunteer programs, firearms safety, student internships, Adopt-a-River, state parks, etc.)

Project Learning Tree and School Forest Program brochures are also available.

**Student Materials**

Tree Talk 4 and 5 – These tabloids focus on larger forestry topics such as urban sprawl, fire, ecology, global forestry, etc. Available in classroom sets. Audience: Grade 6 reading level and higher.

Logging In – This student guide challenges learners to take a closer look at their schoolyard. Exploring your schoolyard can teach many things about ecology and forestry! Through drawing, touching, writing, watching, and listening, students will learn many new things about nature. There is an accompanying teacher’s guide. Audience: K-6 students and educators.

**Teacher’s Guides**

Where Are All the Trees? A Minnesota Primer and Discovery Guide for K-9 – This packet is a primer for educators on Minnesota trees and forestry. The Discovery Guide contains activities for students based on Minnesota’s trees and forests. This guide was developed as a Minnesota supplement to the national PLT PreK-8 Activity Guide. Audience: K-9 educators.

A Teachers’ Guide to Arbor Month – This guide contains activities and lessons by grade level. The activities focus on Arbor Month (May) and encourage students and teachers to explore Minnesota’s forests. Lessons are in math, science, language arts, physical education, etc. Download free at www.dnr.state.mn.us/arbormonth/index.html. Audience: K-8 educators.

Dr. Splinter’s World – This video and teacher’s guide addresses biodiversity and forest products. The zany video is aimed at grades 4-6 and contains lab experiments. Audience: Grades 4-6 educators.

For more information or copies of these materials, please contact:
DNR Information Center
500 Lafayette Road
St. Paul, MN 55155
651-296-6157
888-646-6367
info@dnr.state.mn.us

October 2003
“The Buggy Sounds of Summer” Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article “Buggy Sounds of Summer,” by Larry Weber. Illustrations by Taina Litwak. Published in the July–August 2004 Volunteer, or visit www.dnr.state.mn.us/young_naturalists/buggysounds

Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This guide contains a brief summary of the article, suggested independent reading levels, word count, materials list, estimates of preparation and instructional time, academic standards applications, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources (including related Volunteer articles), copy-ready study questions in Minnesota Comprehensive Assessments (MCA) format, an answer key, and a copy-ready vocabulary sheet. Users are encouraged to provide feedback through an online survey at www.dnr.state.mn.us/education/teachers/activities/ynstudyguides/survey.html.

Summary
“Buggy Sounds of Summer” introduces readers to crickets, katydids, and cicadas, three insects that make sounds with specialized body parts. Through photos, illustrations, and text, students learn about four kinds of crickets and katydids, and five kinds of cicadas. Topics include physical appearance; habitat and diet; and how, when, and why these interesting insects produce their songs.

Suggested reading levels: Fifth through eighth grades

Total words: 1,569
"The Buggy Sounds of Summer"—Teachers Guide

Materials: Print resources from your media center on insects, poster board, colored pencils and markers, aquarium with screen top, magnifying lenses, materials for musical instruments, e.g., combs, wooden chopsticks, wood, plastic, razor knives and small saws (provide safety instruction and supervision), glue, tape, rubber bands

Preparation time: One hour (not including extensions)

Estimated instructional time: Two to three 50-minute class periods (not including extensions)

Minnesota Academic Standards applications: “Buggy Sounds of Summer” activities and extensions may be applied at the third through eighth grades to the following strands (I, II, III) and substrands (A–E):

I. Reading and Literature
   A. Word Recognition, Analysis and Fluency
   B. Vocabulary Expansion
   C. Comprehension
   D. Literature

II. Writing
   A. Types of Writing
   B. Elements of Composition
   C. Spelling
   D. Research
   E. Handwriting and Word Processing

III. Speaking, Listening and Viewing
   A. Speaking and Listening
   B. Media Literacy

Arts: Artistic Expression: Music and Visual Arts

Science
   Grade 5: Life Science E
   Grade 7: Life Science B, C and E

Complete Minnesota Academic Standards are available on the Minnesota Department of Education Web site: www.education.state.mn.us.

Preview Late spring or early fall, when students may observe crickets, katydids, and cicadas in the wild, is a good time to read this article. Pet shops sell crickets, which are easy to care for and make interesting classroom pets. You may have access to audio recordings of calls (see www.ent.iastate.edu/list/insect_sounds.html or type “cricket sounds” into a Google search and you will be amazed at the options) that will help students become familiar with similarities and differences between species.

Ask students to preview the photos and illustrations. Then use the KWL strategy to find out what students know (K) about these insects, what they
Vocabulary preview

Use the transparency-ready vocabulary review sheet to preview key terms, invite students to list terms they feel are important to understanding the article, or ask students to discover word meanings through context. Following your preview of the article, and based on your knowledge of your students’ needs, you may wish to add words to the vocabulary list.

Study questions overview

Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). This is an important organizational tool for students and should be emphasized before you begin working on the study questions. Preview the entire guide with your class before you read the article. You may wish to read the story aloud and complete the study questions in class or in small groups. The questions may be assigned as homework, depending on the reading ability of your students. Inclusion teachers may provide more direct support to special needs students (see Adaptations section). The study questions may also serve as a quiz.

Adaptations

Read aloud to special needs students. You may choose to abbreviate the study questions and then, if time allows, complete the remaining questions. For example, do items 1–5 and 9–12 first. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. With close teacher supervision, cooperative groups can also offer effective support to special needs students, especially for extension activities.

Assessment

You may use all or some of the study questions, combined with vocabulary, as a quiz. Items on the study questions have been written in the same format as MCA Base Reading Items. Other assessment ideas: (1) Students may create a two- or three-column chart comparing and contrasting species in the orders Orthoptera and Hemiptera (formerly Homoptera) described in the article. While all have some features in common, each species has evolved unique characteristics, occupies a different habitat, and makes different sounds. (2) Students may draw, color, and label a species from each group. (3) Ask students to explain in a short essay how crickets, katydids, and cicadas produce their songs.

Extension activities

1. Ask students to listen for the songs of crickets, katydids, and cicadas at school and at home. Students may even make audio recordings of songs to replay in class. Observations may be noted in nature journals.
2. Keep in an aquarium crickets, katydids, and cicadas that students have captured or purchased. Students may make observations (magnifying lenses will be helpful) for a week and record their notes in a nature journal. Breakfast cereals such as Cheerios or Rice Krispies and a damp paper towel will provide adequate food and water. Wild insects may be released where they were captured after you complete your observations. Do not release purchased crickets into the environment.

3. Use this article to introduce your students to the fields of entomology and taxonomy.

4. Provide a variety of materials (wood, plastic, cardboard, combs, wooden chopsticks, etc.) and tools (with appropriate supervision) and invite students to create cricket-sound instruments. Have students experiment with making sounds. Compare student sounds to online sounds.

5. Students may wish to do more in-depth research on a particular species or group of insects. Use poster sessions to let students present visual and oral information.

**Web resources**

There is a wealth of information about insects online. Google searches will provide dozens of excellent sites. Here are a few examples:

- **Singing Insects of North America**
  - buzz.ifas.ufl.edu
- **Cricket graphics**
  - www.enchantedlearning.com
- **Insect classroom activities**
  - www.insectzoo.msstate.edu
- **Tree of Life Web Project**
  - tolweb.org/tree?group=Orthoptera&contgroup=Neoptera
- **Japanese Singing Insects**

Several related *Volunteer* articles are available online at www.dnr.state.mn.us/volunteer/articles, including:

- **July–August 2001**
  - “What’s Eating You?”
- **July–August 2000**
  - “Minnesota Profile: Katydids”
- **July–August 1996**
  - “Damsels and Dragons”
- **July–August 1994**
  - “Flying Flowers”
Study Questions

"The Buggy Sounds of Summer," by Larry Weber. Illustrations by Taina Litwak

Minnesota Conversation Volunteer, July–August 2004

www.dnr.state.mn.us/young_naturalists/buggysounds

Name ___________________ Period _____ Date _______ _

1. When you hear crickets, katydids, or cicadas singing, who is making the sounds? _____
   
   A. The females
   B. The males
   C. The babies
   D. All three

2. What is the purpose of the calls? _____
   
   A. They are a danger signal
   B. They help parents find their babies
   C. The male calls for a mate
   D. They predict the weather

3. Why don’t crickets, katydids, or cicadas sing on cool mornings? _____
   
   A. They are cold blooded, and need heat to become active.
   B. They don’t sing in the morning.
   C. The sun is their signal to begin singing.
   D. They must digest their food before they sing.

4. Why are insect sounds loudest in late afternoon or early evening? _____
   
   A. It is the warmest time of day.
   B. The insects are hungry by then.
   C. Their babies are most active then.
   D. No one knows for sure.

5. How do crickets and katydids make their songs? _____
   
   A. They whistle through their mouths.
   B. They fly swiftly through calm air.
   C. They rub their legs together.
   D. They rub the sharp ridge of one wing against the rough part of the other wing.
6. Why do you think people have kept crickets as pets for thousands of years?

7. How many kinds of crickets and katydids are described in this article?

8. List one interesting fact about each:

<table>
<thead>
<tr>
<th>Crickets</th>
<th>Fact</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Katydid</th>
<th>Fact</th>
</tr>
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<td></td>
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</tr>
</tbody>
</table>

9. The harp and mirror parts of a cricket’s wings serve what purpose?

A. They help the cricket locate food.
B. They protect the cricket’s babies.
C. They broadcast the cricket’s song.
D. They reflect sunlight.

10. Cricket and katydids belong to the insect order Orthoptera. To which order do cicadas belong?

A. Hemiptera (formerly Homoptera)
B. Orthoptera
C. Cicadas are not insects
D. Plethora
11. What happens to young cicadas after they hatch? 

A. They fly away.  
B. They burrow into the ground.  
C. They cling to tree bark.  
D. They spin a cocoon.

12. Why is the prairie cicada disappearing? 

A. It is the smallest cicada in Minnesota.  
B. It cannot find mates.  
C. The weather has been too dry.  
D. Its prairie habitat is disappearing.

13. What makes periodic cicadas so unusual? 

14. How do male cicadas make their sounds? 

15. The purpose of this article is to 

A. Entertain  
B. Persuade  
C. Inform
Study Questions Answer Key

1. When you hear crickets, katydids, or cicadas singing, who is making the sounds? B
2. What is the purpose of the calls? C
3. Why don't crickets, katydids, or cicadas sing on cool mornings? A
4. Why are insect sounds loudest in late afternoon or early evening? A
5. How do crickets and katydids make their songs? D
6. Why do you think people have kept crickets as pets for thousands of years? Answers will vary, but should mention the cricket's song and use as a fighting animal.
7. How many kinds of crickets and katydids are described in this article? Four of each
8. List one interesting fact about each: Answers will vary regarding interesting facts. The four kinds of crickets are spring field, fall field, ground, and tree. The katydids are shieldback, meadow, conehead, and bush.
9. The harp and mirror parts of a cricket's wings serve what purpose? C
10. Cricket and katydids belong to the insect order Orthoptera. To which order do cicadas belong? A
11. What happens to young cicadas after they hatch? B
12. Why is the prairie cicada disappearing? D
13. What makes periodic cicadas so unusual? Answers will vary, but should include how long they stay underground, their huge numbers, and the fact that they are confused with locusts.
14. How do male cicadas make their sounds? By popping the timbals on their abdomen very fast and amplifying the sound with their tympana.
15. The purpose of this article is to: C
amplify  to make louder

Hemiptera  insect order to which cicadas belong (formerly Homoptera)

Orthoptera  insect order to which crickets and katydids belong

predators  animals that eat other animals

pulsate  beat in a rhythm, as in a heartbeat

species  animals that can mate with one another

stridulation  singing style of crickets and katydids

synchronize  to make two things happen at the same time
Young Naturalists Teaching Materials
Now Available Online!

Free learning activities and teachers guides for selected Minnesota Conservation Volunteer articles are now available online.

These activities are designed for teachers and environmental educators working with elementary and middle-school students.

Follow the links at www.dnr.state.mn.us/young_naturalists to find these Young Naturalists stories and corresponding teachers guides:

- Mirrors of Minnesota (state symbols)
- Hey, How's the Weather?
- The Slinky, Stinky Weasel Family
- Let's Go Birding!
- Hopping With Hares and Rabbits
- Oh Deer!
- Six Slippery Salamanders
- Fish Sense
- Damsels and Dragons
- Tremendously Marvelous Trees

Young Naturalists is a kid-friendly feature found in every issue of Minnesota Conservation Volunteer, the Department of Natural Resources' bimonthly conservation magazine.

Each new Young Naturalists will have a corresponding teachers guide.

Coming up: Wired Life (telemetry).

For more information, contact Meredith McNab, meredith.mcnab@dnr.state.mn.us or 651-215-0615.

Sign up for your FREE subscription to Minnesota Conservation Volunteer. Just call 888-646-6367 or go to www.dnr.state.mn.us/volunteer/subscribe_online.

www.dnr.state.mn.us/young_naturalists
Resource List for Nature Study Group 2004

Trees

Activities from pages: 15, 44, 46, 50,
1. Sounds, Colors
2. Meet a Tree
3. Identification Game
4. Tree Silhouettes

• Quotes and tidbits of nature information.

• Each participant received a copy of this from the Minnesota Department of Forestry. This guide infused forestry into all areas of the curriculum and was a fine resource.

• Field Enhancement 2, Observing Forest Interactions, 2-3 Unit.
• Field Enhancement 3, Forest energy Scavenger Hunt, 2-3 Unit.
• Field enhancement 2, Sensing the Forest, K-1 Unit.
• Field Enhancement 1, All About My Tree, K-1 Unit.
• Field Enhancement 1, I Can Be a Forester, 2-3 Unit.
• Field Enhancement 3, Caring for The future of Forests, 4 Unit.
• Field Enhancement 1, Wood’s Worth, 5-6 Unit.
• Field Enhancement 1, Tree Identification, 7-8 Unit.

Nature Trail

• The Following articles fit well with our site. We all made sumac lemonade.
• White Pine-King of the Forest, Stinging Nettle-A Plant to Test Your Mettle, 
Poison Ivy-Leaves of Three, Let It Be, Bumblebees, Wood Tick-Tiny Terrors of 
the Woodlands, Staghorn Sumac-Quenching a thirst for Nature, Wooly Bear 
Caterpillar-Natures Weather Forecaster, Night shade-Witches Secret Ingredient, 
Red-Squirrels Sounding the Woods Alarm

Publishing/Cornell University Press.

• This source has invaluable information. I used it for the mushroom tally sheet 
source, and inquiry questions.

Books.

• One art teacher was a participant. These are the activities copied for the 
participants.

• Nature collage, mobiles from nature, mushroom spore prints, What are mosses? 
• Moss forest drawings, drawing leaf litter, drawing a tree hotel

Cronin-Jones, L. (1992). *The schoolyard wildlife activity guide*. Florida Game and 
Fresh Water Fish Commission.

• I copied the following activities for the participants.

• Weevils and Acorns (Lesson 11), Mosses are Picky Devils! (Lesson 13), Ant 
Views (Lesson 7), Mushroom Rally (Lesson 30)


• Sensory Explorations, A Quick Quadrant, Magic of the Sun

Passineau, J. & Hoffman, K. “Nature Journaling: Follow your pencil to a deeper 

• I recopied this handout for participants.

novice& naturalist*. Cambridge, Minnesota:/Adventure Publications.

• This source provided clear pictures of common plants and provided recipes and 
historical uses of the plants.

• This is a daily resource of phenology.


**Pond Study**

Minnesota Department of Natural Resources, (2004). MinnAqua
[http://www.dnr.state.mn.us/minnaqua/curriculum.html]
[http://www.dnr.state.mn.us/young_naturalists/fishsense/index.html]


• This is a monthly classroom publication for grades 4-6 for $3.00/student. The articles are all about animals and plants in Minnesota. Interest subscribers can write to: Minnesota Conservation Federation, 551 Snelling Ave. South, Suite B, St. Paul, MN 5516-1525


**Prairie**

Shirley, Shirley (1994). *Restoring the Tall grass Prairie*, University of Iowa Press Iowa City, IA 52242. A fine guide to prairie restoration: history, planning, preparing, & maintaining a site, starting seeds, and identifying prairie species.
Appendix H

Survey #1 and Survey #2 Site Use
Your participation in this study group demonstrates your interest in the value of educating students about the environment. Just outside our doors, East Bethel/ Cedar Creek Community Schools (EB/CCCS) have a 160-acre, diverse resource. Sharing our experiences, activities, and methods will generate enthusiasm and increase usage by our staff. Providing meaningful and repeated exposure to the natural world on our school grounds will connect our students with their local environment. They will gain environmental knowledge. Students will gain awareness and sensitivity to the natural world. We are helping produce environmentally responsible adults. Thank you for completing this survey to determine on-site nature use.

1. During the 2003-04 school year, how many times did you use the following outdoor resources to enhance curricula?

<table>
<thead>
<tr>
<th>Resource</th>
<th>0-1</th>
<th>2-3</th>
<th>4-5</th>
<th>6+</th>
</tr>
</thead>
<tbody>
<tr>
<td>nature trail</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ponds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>butterfly garden</td>
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<tr>
<td>prairie</td>
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<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
<td></td>
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</tbody>
</table>

2. During the 2003-04 school year, your primary use(s) of the EB/CCCS nature sites were to infuse environmental education into:

- Science
- Social Studies
- Math
- Language Arts
- Art
- Nature Study/Enjoyment
- Recreation

3. What inhibits you from using the EB/CCCS nature resources as often as you would like to or feel you should? Please rate the following from 1-5, where 1 is not a barrier and 5 is a strong barrier.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of time</td>
<td></td>
</tr>
<tr>
<td>Environmental knowledge</td>
<td></td>
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<tr>
<td>Student behavior</td>
<td></td>
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<tr>
<td>State standards</td>
<td></td>
</tr>
<tr>
<td>Administrative support</td>
<td></td>
</tr>
<tr>
<td>Environmental teaching resources</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

4. What Minnesota State Science Standards have you addressed while using the EB/CCCS nature areas?

- State Standard 1
- State Standard 2
- State Standard 3
- State Standard 4
- State Standard 5

5. What Minnesota Environmental Literacy Benchmarks have you addressed while using the EB/CCCS nature trail?

- Benchmark 1
- Benchmark 2
- Benchmark 3
- Benchmark 4
- Benchmark 5
The ten hours you spent participating and sharing ideas during the fall 2004 Nature Study Group demonstrates you value educating students about the environment. Please complete this survey to determine if participation in the Nature Study Group during the fall of 2004 increased the use of the East Bethel/Cedar Creek Community Schools’ Nature Sites.

1. During the 2004-05 school year, how many times did you use the following East Bethel/Cedar Creek Community Schools’ Nature Sites to enhance curricula?

- nature trail
- ponds
- butterfly garden
- prairie
- other

<table>
<thead>
<tr>
<th></th>
<th>0-1</th>
<th>2-3</th>
<th>4-5</th>
<th>6+</th>
</tr>
</thead>
<tbody>
<tr>
<td>nature</td>
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</tr>
<tr>
<td>ponds</td>
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<tr>
<td>butterfly</td>
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<tr>
<td>prairie</td>
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<tr>
<td>other</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2. During the 2004-05 school year, your primary use(s) of the East Bethel/Cedar Creek Community Schools’ Nature Sites were to infuse environmental education into:

- Science
- Social Studies
- Math
- Language Arts
- Nature Study/ Enjoyment
- Art
- Recreation

3. What inhibits you from using the East Bethel/Cedar Creek Nature Area Sites as often as you would like to or feel you should? Please rate the following from 1-5, where one is not a barrier and 5 is a strong barrier.

- Lack of time
- Environmental knowledge
- Student behavior
- State standards
- Environmental teaching resources
- Administrative support
- Other

4. What Minnesota State Science Standards have you addressed while using the East Bethel/Cedar Creeks Community Schools’ Nature Sites during the 2004-05 school year?

5. What Minnesota Environmental Literacy Benchmarks have you addressed while using the East Bethel/Cedar Creek Community Schools’ Nature Area Sites during the 2004-05 School year?
East Bethel/ Cedar Creek Community Schools

Trail Use Survey # 1

Grade Level_School

Your participation in this study group demonstrates your interest in the value of educating students about the environment. Just outside our doors, East Bethel/ Cedar Creek Community Schools (EB/CCCS) have a 160-acre, diverse resource. Sharing our experiences, activities, and methods will generate enthusiasm and increase usage by our staff. Providing meaningful and repeated exposure to the natural world on our school grounds will connect our students with their local environment. They will gain environmental knowledge. Students will gain awareness and sensitivity to the natural world. We are helping produce environmentally responsible adults. Thank you for completing this survey to determine on-site nature use.

1. During the 2003-04 school year, how many times did you use the following outdoor resources to enhance curricula?

- nature trail
- ponds
- butterfly garden
- prairie
- other walks/trails

2. During the 2003-04 school year, your primary use(s) of the EB/CCCS nature sites were to infuse environmental education into:

- Science
- Social Studies
- Math
- Language Arts
- Art
- Nature Study/Enjoyment
- Recreation

3. What Minnesota State Science Standards have you addressed while using the EB/CCCS nature areas?

4. What Minnesota Environmental Literacy Benchmarks have you addressed while using the EB/CCCS nature trail?

5. What Minnesota Environmental Literacy Benchmarks have you addressed while using the EB/CCCS nature trail?
East Bethel/ Cedar Creek Community Schools' Nature Area Site Use Survey #2

The ten hours you spent participating and sharing ideas during the fall 2004 Nature Study Group demonstrates you value educating students about the environment. Please complete this survey to determine if participation in the Nature Study Group during the fall of 2004 increased the use of the East Bethel/Cedar Creek Community Schools' Nature Sites.

1. During the 2004-05 school year, how many times did you use the following East Bethel/Cedar Creek Community Schools' Nature Sites to enhance curricula?

<table>
<thead>
<tr>
<th>Nature Site</th>
<th>0-1</th>
<th>2-3</th>
<th>4-5</th>
<th>6+</th>
</tr>
</thead>
<tbody>
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<td>nature trail</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>4</td>
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<tr>
<td>ponds</td>
<td>11</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>butterfly garden</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>prairie</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>other</td>
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</tbody>
</table>

2. During the 2004-05 school year, your primary use(s) of the East Bethel/Cedar Creek Community Schools' Nature Sites were to infuse environmental education into:

- Science
- Social Studies
- Math
- Language Arts
- Art
- Nature Study/Enjoyment
- Recreation

3. What inhibits you from using the East Bethel/Cedar Creek Nature Area Sites as often as you would like to or feel you should? Please rate the following from 1-5, where one is not a barrier and 5 is a strong barrier.

<table>
<thead>
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<tr>
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<td>Environmental knowledge</td>
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<tr>
<td>Student behavior</td>
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<tr>
<td>Environmental teaching resources</td>
<td>1</td>
</tr>
<tr>
<td>State standards</td>
<td>2</td>
</tr>
<tr>
<td>Administrative support</td>
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</tr>
<tr>
<td>Other</td>
<td>3</td>
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<tr>
<td>Weather</td>
<td>3</td>
</tr>
<tr>
<td>Travel</td>
<td>3</td>
</tr>
</tbody>
</table>

4. What Minnesota State Science Standards have you addressed while using the East Bethel/Cedar Creeks Community Schools' Nature Sites during the 2004-05 school year?

5. What Minnesota Environmental Literacy Benchmarks have you addressed while using the East Bethel/Cedar Creek Community Schools' Nature Area Sites during the 2004-05 School year?

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Email charts to drackers@uwsp.edu just in case my account isn't up yet. Thank you!
Appendix I

Nature Study Group Evaluation
1. Lack of time, student behavior, environmental teaching resources, and environmental knowledge were rated by the study group as being the strongest barriers to using the East Bethel/Cedar Creek Community Schools’ Nature Sites at the start of the five study group sessions. Have any of these barriers become less formidable to you as a result of participation in this group? Please comment.

2. The most common reason listed by the study group for using the East Bethel/Cedar Creek Community Schools’ Nature Sites was science and nature study/enjoyment. Has participation in this group enhanced science and nature study? Please comment.

3. Has exposure to the Minnesota Academic Standards K-12 Science Standards and the Minnesota Environmental Literacy Scope and Sequence while participating in this study group been connected to your use of the EBCS/CCCS Nature Sites? Please comment.

4. It has been suggested that we gather in winter for snowshoeing and spring for sharing activities related to the season. Would you be interested in two 2-hour sessions for this purpose? yes no

5. It has been suggested that we gather together to read through the resource material as part of our individual professional development time. Would you interested in this reading time? yes no
6. Please make any comments or suggestions for improving this study group if it were offered in the future. Also suggest other means to increase EBCS/CCCS Nature Sites use by other teachers.

Thank you for completing this evaluation. It has been a pleasure studying and sharing with all of you. I am hopeful about creating environmentally responsible students as a result of your dedication.