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Developing an environmental education program at Teller Wildlife Refuge

Steven Cohen
The University of Montana

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DEVELOPING AN ENVIRONMENTAL EDUCATION PROGRAM AT
TELLER WILDLIFE REFUGE

by

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Presented in partial fulfillment of the requirements
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Developing an environmental education program at Teller Wildlife Refuge was a collaborative effort and requires many thanks. Chris Miller, Manager of TWR provided honest and patient responses to my many inquiries. Sue Wall-Maclane, Jill Maus, Karen Bleibtry, Kerry Wall-Maclane, and Beth Underwood worked to ensure that the EE program at TWR would be of the highest quality.

The academic committee of Tom Roy, Fletcher Brown, and Ralph Allen formed a diverse and productive team. Lee Metzgar offered guidance during the evolution of the project. Words of praise and respect go to Mary O'Brien, the initial committee Chair, for sharing her relentless passion to change the world.

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The process of writing this paper and learning what shapes an environmental consciousness caused considerable reflection. So, to my family, for nurturing this child's sense of wonder and providing opportunities for significant life experiences to occur. It has made all the difference.

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Introduction

Teller Wildlife Refuge (TWR) is a 1,300 acre protected natural area in the Bitterroot Valley of Montana. In the spring of 1993, TWR approached the Environmental Studies Department at the University of Montana (UM) for assistance in developing one of their charter goals of environmental education (EE). TWR offered little specification concerning the appropriate approach for this task.

Mike Schlafman, a fellow Environmental Studies graduate student and I tackled the project as part of Lee Metzgar's EE workshop class. We collaborated with Jack Sturgis, a third grade teacher at Corvallis, to design and implement EE materials for use at TWR. In the fall of 1993, I decided that my graduate project would be to help TWR develop an EE program.

I was a newcomer to the field of EE and eager to apply my recently learned abstract notions of effective EE to practical experience. Additionally, the lack of a set direction for the project from TWR provided the attractive opportunity of participating in the development of an EE program from relative "scratch." So, this paper describes the process undertaken during the past two years to develop EE at TWR. Fundamentally, this project applies theoretical notions of EE in a real-life setting.
TWR, the initial academic committee at UM consisting of Mary O’Brien, Lee Metzgar, and Ralph Allen, and I identified two primary goals for the project:

1. To create an environmental education infrastructure at TWR that will ensure use by Bitterroot Valley schools.
2. To ensure that the environmental education use offered supports the goals of producing positive values and behaviors towards the land.

Chapter One of this paper establishes a theoretical and historical base for EE and outlines attributes of effective EE. In Chapter Two, I explore the unique setting for this project: TWR in the Bitterroot Valley of Montana. The third chapter offers an innovative EE approach: integrating ecological restoration as the core component of the educational experience. Chapter Four bridges the gap from the theoretical to the applied by disclosing the EE measures that were implemented at TWR during the past two years. In the final chapter, I offer recommendations to TWR for continuing the effort.
Chapter 1

A Theoretical Foundation for the Project

A perception exists that the beauty, stability, and integrity of the natural world is suffering. The question that arises, therefore, is: what is the appropriate response? Numerous, complementary approaches to fighting for the environment are available. Some try to change governmental policy, expose scientific realities, directly confront immediate destruction, employ the powers of the pen and paper or gain victories in courts of law. Environmental education (EE) is another broad, inclusive method for fighting for the natural world.

The essence of EE is to change personal and societal values and behaviors towards the land. One can argue that present environmental damage stems from an anthropocentric view; that society as a whole values the health and prosperity of humans above all. This view accepts the degradation of the natural environment. EE attempts to instill an ecocentric view where society values the health and prosperity of the environment, of which humans are included. In this view, humans behave responsibly towards the land.
Aldo Leopold, in *A Sand County Almanac*, effectively expressed the dichotomy between anthropocentrism and ecocentrism; "a land ethic changes the role of *Homo Sapiens* from conqueror of the land-community to plain member and citizen of it." Leopold observed a progression of human ethics. First we developed ethics that dealt with humans to other humans, then humans to society, and now emerging is an ethic of humans to the land. "The extension of ethics to the third element of the human environment is, if I read the evidence correctly, an evolutionary possibility and an ecological necessity (Leopold 1966)."

I believe TWR has the potential to take one step towards achieving Leopold's lofty land ethic. Specifically, TWR offers the land as an outdoor classroom for students to engage in quality learning experiences that nurture positive environmental values and behaviors.

**History and Status of Environmental Education**

EE emerged over a generation ago, coinciding with liberal surges in the 1960's. Benchmarks such as the National Environmental Policy Act (NEPA), Environmental Protection Agency (EPA), Environmental Education Act, National Conference on Environmental Education, and yes, Earth Day, occurred within two years' time. High hopes were born for EE and subsequently
produced the World’s First Intergovernmental Conference on Environmental Education in Tbilisi, USSR in 1977. The conference produced five main objectives for EE that are still relevant. They are:

**Awareness**- to help social groups and individuals acquire an understanding and sensitivity to the total environment and its allied problems.

**Knowledge**- to gain a variety of experiences in, and acquire a basic understanding of, the environment and its allied problems.

**Attitudes**- to acquire a set of values and feelings of concern for the environment, and the motivation for actively participating in environmental improvements and protection.

**Skills**- to acquire the skills for identifying and solving environmental problems.

**Participation**- to provide an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

For the purposes of this paper, these broad, multi-tiered objectives identified at Tbilisi suffice as a working definition for effective EE.

EE evolved from such established institutions as outdoor education and interpretation. These fields are closely related to EE but fundamentally different in a significant aspect. Outdoor education’s and interpretation’s goals are
limited, primarily, to the awareness and knowledge levels identified at Tbilisi.

EE strives to reach the skills and participation levels.

National Park Service (NPS) interpretive programs are classic examples of this limited awareness and knowledge educational approach. As a seasonal NPS "interpreter" or "naturalist," I have observed countless fascinating naturalist-led walks and talks that effectively promote an awareness and appreciation for natural wonders. The national park is often treated as a protected island, devoid of human impact. National Parks, however, like most natural areas, are highly susceptible to degradation from human activities. Unfortunately, NPS naturalists rarely take advantage of compelling opportunities to relate human behaviors to the land.

Again, EE includes awareness and knowledge as basic goals but strives higher, by declaring its ultimate goal as producing values and behaviors that are beneficial, or at least less harmful, to the natural world. This extension forms the defining criteria for successful EE and is the crucial difference with related fields.

Some express the view that EE has not yet succeeded in achieving its goals. There are two primary criticisms of EE. First, on a quantitative level, EE has not attained widespread and extensive use in the public schools, nationally and in Montana (Gunderson 1989, Disinger 1986). Anne Swisher Palen's UM thesis assessed the status of EE in Montana and revealed that only
three public school systems (Billings, Great Falls, and Lolo) had formal EE programs (Palen 1991). EE has not become an accepted, integral, structured component of public education.

The second criticism, which argues a more qualitative case, states that the EE commonly implemented has not been effective because it has rarely addressed personal behaviors and values towards the land. (Childress 1978, Van Matre 1990, Schmidt 1993). Generally, the research concludes, that past EE efforts have been limited to awareness and knowledge levels.

Why has EE not been effectively used? Although Tbilisi identified five significant objectives, they are admittedly broad. The Conference’s conclusions lacked specific means to implement their new ideas. This deficiency has led to "infusion confusion" concerning the appropriate methods to introduce EE into the schools (Simmons 1989). Some advocated that EE activities should be sprinkled throughout a curriculum at the teacher's discretion. Unfortunately, this method has usually resulted in haphazard, diluted notions of EE in the classroom.

This "infusion" approach is typified by the well-known Project Wild materials. These materials are environmentally oriented educational activities designed for easy teacher use. Not surprisingly, Project Wild has become the dominant EE material that teachers employ (Siegenthaler 1986). In a 1986 essay, Siegenthaler reported that 37 states have adopted Project Wild materials.
as "officially sanctioned, distributed, and funded" educational activities. Project Wild, however, fails to provide guidance to the teacher concerning the development of a comprehensive EE program into their class.

Other EE advocates have espoused a "supplemental" approach in which EE is established as a separate subject. Due to an already overcrowded curriculum, and general lack of dedication among teachers for EE's goals, this approach has also not succeeded.

EE has not received significant support from sanctioned educational authorities. In general, local school boards and state education boards have not mandated EE (Durgin 1993). Richard Durgin, in his UM thesis revealed that only thirteen states possess an officially mandated EE program. Furthermore, EE has not become a significant component of most states pre-service teacher training (Palen 1991). Without official support, implementation of EE into a class is left to the motivation of individual teachers.

Steve Harris, a middle school teacher at Hellgate in Missoula, has developed one of the few structured EE programs in the area: the Eagle Project. He uses an adjacent natural area three times during each year for EE purposes. Harris described initial, intense opposition to his ideas by school boards, administrators and even other teachers. Harris believes nothing short of "years of martyr-like dedication to the cause" allowed the Eagle Project to succeed (Harris, personal communication, May 1994).
Kari Lind, in her UM thesis, researched teacher-reported barriers to EE and discovered four main types:

**Conceptual barriers** - stem from a lack of consensus about the definition of EE and its place in the curriculum.

**Logistical barriers** - stem from perceived lack of time, funding resources, instructional materials, suitable class size etc.

**Educational barriers** - stem from teacher misgivings about their own competence to conduct EE programs.

**Attitudinal barriers** - stem from teacher attitudes about EE and science instruction (Lind 93).

Lind devised an EE experience aimed to alleviate these barriers: the Rattlesnake Valley Ecology Project (RVEP). She created educational materials for teachers at Prescott School in Missoula to use at nearby Greenough Park and Rattlesnake National Recreation Area. Lind conducted a workshop to train and instill confidence in the teachers regarding use of the materials. Unfortunately, the RVEP has not produced significant increased educational use at the nearby natural areas (Lind, personal communication, November 1995). Teachers have used aspects of her curriculum in-class, but have mostly avoided implementing RVEP's significant outdoor component.

EE efforts developed for teachers, such as Lind's, necessitate detailed, scrupulously prepared materials. Consequently, notebook binders of curriculum
guides are a common sight on any EE practitioners' shelf. Similarly, the EE world is inundated with educational "trunks" or "boxes." These units allow for significant prop use and easy transportation. The Montana Environmental Education Association offers over thirty educational trunks to entice teachers to incorporate EE into their classes.

Attributes of Effective Environmental Education

As identified, the distinguishing characteristic of EE is to foster positive values and behaviors towards the land. Initially, EE practitioners advanced a simplistic model for behavior change. As shown below in Figure 1, this concept portrays a cause-effect relationship that assumes if we increase knowledge of the environment, we create positive attitudes, which result in responsible action. This model appears wonderful to the untrained eye and, consequently, has become one of the most pervasive approaches in the EE movement (Van Matre 1990).

Figure 1. Initial Behavior Change Model

![Figure 1. Initial Behavior Change Model](image)

Adapted from Hungerford & Volk (1990).
The attraction of this model is clear: it is simple to implement. I believe the knowledge/awareness approach to EE is dominant in the field. For example, at a recent teacher workshop administered by Joseph Cornell, one of the most renowned EE practitioners, the activities and concepts presented never ventured past awareness and appreciation levels (personal observation, November 1993). The activities Cornell offered were limited to effective techniques that nurture good feelings and heightened senses towards nature.

But what are we then teaching? Limiting the EE experience to knowledge and awareness concepts, will not, I believe, succeed in fostering positive values and behaviors towards the land. The root cause of environmental degradation, humans' anthropocentrism, is not addressed. The research clearly shows that the hypothesized cause-effect relationship of awareness/knowledge to behaviors is not solid (Hungerford and Volk 1990). To fully achieve the goals of EE we need an enhanced approach.

Two comprehensive studies of behavior change in EE provide useful models. These models (Figures 2 and 3) reveal that environmentally responsible behavior is influenced by variables other than just awareness, attitudes, and knowledge of nature. The studies concluded that for EE to achieve its goals, we must also introduce concepts such as ownership, empowerment, action skills and knowledge of issues. EE researchers and practitioners have, subsequently,
identified further components that contribute to responsible environmental behaviors.

**Figure 2. The Hines, Hungerford and Tomera Model of Responsible Environmental Behavior**

Adapted from Hines et.al.(1987).
Figure 3: The Hungerford and Volk Model of Environmental Citizenship Behavior.

Adapted from Hungerford & Volk (1990).
Tanner analyzed factors that contribute to shaping environmental advocates (persons who demonstrate positive environmental values and behaviors). The study indicated that "significant life experiences" was the most commonly cited variable that shaped future environmental advocates (Tanner 1980). Unfortunately, some of the powerfully shaping experiences mentioned, such as loss of nearby natural areas were negative and can't, and shouldn't, be re-created. EE practitioners, however, should create atmospheres where significant life experiences can occur. Bringing learners outside to natural areas such as TWR and allowing semi-structured "free-time" is a step in this direction.

Similarly, we should attempt to make EE enjoyable to our students. For example, Steve Harris' Eagle Project in Missoula contains a variety of educational activities for each visit. Harris noted that "it took us a while to realize our students will want to learn more about nature if they're having a fun time in it." Subsequently, the Eagle Project incorporates exciting scout-like stations such as outdoor cooking, shelter-making, and first-aid along with the more conventional awareness and knowledge oriented activities.

Lozzi (1989) and Bardwell (year unknown) stress the importance of positive, success stories of the environment. Media and society seem to thrive on negative images, including those of environmental degradation. EE should also illuminate uplifting stories like protecting a piece of land or saving a certain species.
Steve Van Matre designed Earth Education, an approach which creates "magical learning experiences" filled with mystery and adventure. He advocates "focused, sequential, cumulative learning programs with specific outcomes" (Van Matre 1990) that typically involve extended outdoor stays. Additionally, Van Matre argues that EE should avoid involvement in overwhelming issues and focus instead on individual, personal lifestyles.

Earthkeepers is a detailed 2 1/2 day flagship Earth Education program available for $500. In Earthkeepers, students spend 2 1/2 days outdoors engaged in educational activities. They must then dutifully perform an ecologically friendly behavior for a month, and then persuade another to do the same, before they become an official Earthkeeper. To implement Van Matre's approach demands significant teacher dedication, as well as funding.

Values discussion is an extremely controversial educational technique when related to classrooms. Parents often object to the teaching of certain "sets" of values. These detractors, however, neglect to realize that there never was, and never will be, a value-free learning environment. The mere act of choosing or designing a curriculum is itself an expression of values.

Values education advocates emphasize values exploration or values clarification, rather than the imposition of certain sets of values. Learning to examine our own or others' values, searching for consistency among values, and articulating these values fosters critical thought on issues. Values discussion is
a key component of fostering responsible environmental behaviors and is embodied by the notion of "teaching how to think as opposed to what to think."

Role models are also a powerful educational tool. For example, picking up trash as we walk at TWR educates without requiring a word spoken. Conversely, a poor role model might impede an educational message. If a teacher created effective lessons for conveying the importance and methods of recycling but then unknowingly exhibited behaviors that contradicted this message, for example, the learners might not recycle.

Conclusions

The multi-tiered definition advanced from the Tbilisi Conference close to 20 years ago, highlighted the need for EE to be successful on a variety of levels. The ultimate, defining goals for EE are to produce positive values and behaviors towards the land.

The means of achieving EE’s goals, however, have not been clearly identified. Unfortunately, research has shown that EE has not been extensively incorporated into the schools. Moreover, considerable barriers face teachers hoping to instill EE into their classes. Subsequently, the EE infrastructure at TWR will attempt to alleviate potential teacher obstacles.
Research has suggested that the EE that has been implemented has not been effective in fostering positive values and behaviors towards the land. Studies have proven that the hypothesized causal relationship between knowledge and behaviors is not sound. We now know that EE efforts must contain expanded variables. Specific attributes of an effective EE program are: empowerment in abilities, ownership in decisions, values discussion, significant life experiences, issues investigation, lifestyle analysis, and positive role models. The EE offered at TWR, therefore, will strive to contain these components.
Chapter 2

The Setting for the Project

Land History

Teller Wildlife Refuge (TWR), a 1/2 mile north-west of Corvallis in the Bitterroot Valley of Montana, (see Maps 1, 2, & 3), is a diverse and dynamic landscape. The meandering Bitterroot River, with its related processes of deposition and erosion, produces river bottom habitats of different successional stages. Lowland forests of cottonwood, ponderosa pine, and quaking aspen with understories of rose, snowberry, chokecherry, and hawthorne are present. Riparian areas of Bitterroot River tributaries allow for willow and sedge communities. Further from the river are open, rolling grasslands dominated by blue-bunch wheatgrass and western wheatgrass, accompanied by such forbs as bitterroot, arrowleaf balsamroot, and yarrow.

The wildlife of this landscape is also diverse. TWR contains abundant bird habitat for waterfowl, upland game birds, passerines, and raptors. Many fish species, including bull trout, still inhabit the tributary streams of the
Bitterroot River. Mammals such as white-tail deer, muskrat, red fox, coyote, mink, river otter, and beaver are common. Moose and mountain lion sightings were reported in 1994.

The first humans to successfully settle into the river bottom of the Bitterroot Valley were the Salish, commonly called the Flathead. Similar to most Native American Indian tribes of their day, they lived close to the abundant land and adapted their culture to its unique requirements. Accounts portray a people who respected the land and were conscious of their relationship to it (Thomason 1991). Unlike other tribes of Montana, however, such as the Blackfoot, Sioux, and Crow, the Salish gained a reputation as peace-loving and friendly to outsiders. This quality also left them vulnerable to exploitation.

After Lewis and Clark traveled throughout the area at the turn of the nineteenth century, waves of whites ventured into the Bitterroot Valley. The first were Christian missionaries who found the Salish agreeable to their presence. Some historians propose the Salish's congenial attitude was generated by the need for protection from their often volatile neighboring tribes (Thomason 1991). The word was spread that the Bitterroot Valley was a desirous place.

The next wave of newcomers to the Bitterroot Valley were homesteaders. They found the inspiring peaks of the Bitterroots, the lush river bottom, and
friendly neighbors attractive to settle by. The Slack and Chaffin families, among the very first homesteaders in the Valley, settled at the present site of Teller Wildlife Refuge in the 1860's. They began the process of extensively modifying the landscape to suit their purposes.

These first settlers in the Bitterroot Valley logged ponderosa pines to build the structures of their homesteads and supply warmth through the bitter Montana winters. They plowed over grasslands and re-planted them to hay to feed their dairy cattle. They built networks of drainage ditches to divert water from the river and creeks to the homestead. They imported and propagated exotic plant species such as orchard trees. They dismantled and drained beaver dam induced wetlands. They killed predators such as the wolf, grizzly, mountain lion, and coyote to avoid livestock losses. They suppressed fire to protect life, property, and timber. They dammed mountain streams to control runoff. Unfortunately, Montana and Bitterroot Valley residents continue most of these damaging practices today.

**TWR Establishment**

Otto Teller acquired 1,300 acres of Bitterroot River bottom land in the mid to late 1980's. Teller, a dedicated conservationist involved in sustainable agriculture and wildlife management issues and a founding member of the
national group Trout Unlimited, brought new ideas to the management of the land. Teller sought to protect and restore the integrity of the unique piece of land by placing it under conservation easements.

Conservation easements are a relatively recent approach to private land protection. Their primary purpose is to permanently safeguard open space and wildlife habitat against development. A conservation easement is an interest in a property deeded to an environmental organization or government agency. In TWR's case, the Montana Land Reliance, of which Otto Teller is a past director, holds the easement. The easement carries forth to subsequent landholders who are bound by its specific guidelines. The easement on TWR, for example, does not allow construction of new buildings, dumping of waste, and, uniquely, bans all chemical use. Teller is an adamant advocate of biological methods for agriculture and land management.

In 1988 Teller established a trust fund and created a non-profit, tax-exempt organization to oversee its appropriation on TWR. Teller resides in California and is only involved in decision-making as part of a 15 member Board of Directors. TWR offers three original renovated homestead houses on the property as accommodations to the public. Furthermore, a limited amount of bow-hunting of white-tail deer is allowed on TWR to the general public on a permit basis. Pheasant and duck hunting and fishing are also permitted.
TWR Goals

The Board of Directors has identified three goals for TWR to fulfill its non-profit, tax-exempt status obligations:

1. **Sustainable Agriculture.** As stated earlier, sustainable agriculture is of particular interest to Otto Teller. TWR grows hay on property pastures that are maintained organically; some are farmed using horse-drawn farm equipment. Garden City Seeds, located a few miles away, leases plots of TWR land to test and cultivate varieties of native "heirloom" seeds. Montana State University also uses TWR land for agrichemical-free experiments.

2. **Habitat Restoration.** Although technically called a "wildlife refuge," the wildlife and plant habitats of TWR have suffered severe degradation since white settlement. The varied human activities described earlier have dramatically reduced biological diversity and stability. No habitat is devoid of impact.

The Bitterroot River has been channelized, and without its natural meandering, fewer successional stages of plant communities occur. Predator eradication has contributed to an explosion of white-tailed deer populations which browse heavily on ponderosa pine and cottonwood seedlings. Tree regrowth has thus been extremely minimal. Riparian areas have suffered from diversion ditches, beaver dam dismantling, livestock grazing, and erosion from
the plow. Grazing and plowing have also degraded the grassland habitats. Fire suppression has minimized normal nutrient recycling to produce grasslands which are a mere semblance of their original condition.

The spread of non-native plant species is another impact experienced throughout TWR. Primarily spotted knapweed but also leafy spurge, tansy, and Canada thistle are out-competing native plant species in virtually every habitat type.

Given these realities, TWR has initiated a habitat restoration effort with the goal of restoring native plant and animal communities to their "pre-white settlement conditions" (Wall-MacLane 1991). The restoration project is a long-term commitment headed by the Refuge Manager, a quarter-time Restoration Coordinator, a Restoration Advisory Committee and volunteers. Michael Cembalskie, who recently replaced Sue-Wall MacLane as the Restoration Coordinator, is in the process of developing a long-range restoration plan for TWR. The initial step of identifying and mapping historic and current plant communities is complete and specific projects are being implemented.

A primary goal of the restoration project is to eliminate, or at least control, the non-native plant species. The lands on TWR are the most significant bio-control experimental areas for spotted-knapweed in the United States. Six insect predators have been established in heavy knapweed areas in an attempt to control seed distribution. A small band of domestic sheep are
allowed to graze on thistle and spurge in tightly controlled areas. Mulching, covering, hand-picking, and burning are also employed.

Another major task of the restoration project is to propagate native plant species. Ponderosa pine and cottonwood trees, varieties of shrubs such as willows along stream banks, and native grasses are planted experimentally. Seedlings of trees and shrubs are often protected by cages, nets, or within exclosures to avoid browsing. Prescribed burns are conducted in the forest and grasslands to clear underbrush, aid nutrient recycling of the soil, and eliminate non-native species.

Considerable restoration work is also planned for the three main creeks of TWR: Spring, Willow, and Gird. TWR is attempting to establish legal water rights with the aim of diverting water to the original stream locations. Some stream channels will be dredged and re-constructed to resemble their original morphology. TWR also plans to construct fish habitat improvements, dams to mimic beaver activity, and sediment catches to decrease silt loading in the water.

Habitat restoration projects such as these are a relatively new and unproven approach to land management. Nobody can predict with certainty what the success of each of these restoration methods will be, or if the original condition is even attainable. However, the project at TWR is a bold step to return the land to a prior, less impacted, healthier condition.
3. **Environmental Education.** The primary manifestation of this goal has been the Environmental Writing Institute (EWI), now entering its sixth year and gaining nation-wide recognition. The EWI is a five-day workshop offered each year to talented nature writers under the guidance of a prominent writer. Peter Matthiessen, Annick Smith, Wendell Berry, Gretel Ehrlich and Terry Tempest Williams are past tutors; Barry Lopez will be a future instructor.

In 1991, TWR established a fund of approximately three to four thousand dollars called Small Grants for Education (See Appendix A). The fund was created to alleviate financial barriers to educational use at TWR. Teachers were invited to use the fund to cover travel expenses, specialist costs, educational supplies, and other reasonable expenses.

Other than the EWI and the Small Grants for Education Fund, EE at TWR has been reactive. A few motivated teachers, mostly from the nearby town of Corvallis, have brought their class to TWR for field trips. In 1991, six school field trips with a total of 300 students were conducted at TWR. In 1992 these figures increased to 18 trips and 850 students and in 1993; 17 trips and 775 students. Many of these trips were repeat visits, led by a few teachers.

TWR has not created a staff position for EE purposes. There has only been an Education Committee comprised of volunteers to offer general advice. Nor has TWR provided guidance to teachers on possible effective EE approaches. If we critically analyze the scope of EE that has occurred at TWR
we must conclude that it has not fulfilled its potential. The purposes of this project are, again, to create an infrastructure that ensures use of TWR for EE purposes, and to ensure that the EE offered is effective.

Conceptually, the land of TWR offers tremendous EE opportunities. TWR is a convenient place to study humans' role and relationship to the natural world. TWR, unlike the adjacent, relatively pristine Selway-Bitterroot Wilderness Area, exhibits heavy human impact. Although environmentally this is disturbing, educationally I find it exciting.

Studying impacted natural areas offers a wide avenue to take the EE step from awareness and knowledge to behaviors and values. At TWR we can explore relevant questions such as: what human activities led to the impacts?, which activities are still occurring?, which impacts remain from earlier activities?, and how can we attempt to alter our behaviors to lessen or reverse the impact? If one of EE's goals is to promote responsible environmental behaviors, then it is useful to observe areas that have suffered from our ignorance, neglect, or mistreatment.

Wilderness areas, by definition, are places where humans do not belong on a permanent basis. While there is significant value in this notion, there must also be natural areas where people belong, places where we learn to respectfully love and use the land. There must be a transition from towns to wilderness,
places that illustrate how we can use nature without destroying nature. Where else can we learn to truly act responsibly to the Earth?

When I walk the grounds of TWR, I feel this place offers much in that respect. Instead of the dramatic inspiration of vast wildness and giant old-growth trees, I see where humans have been and will be for the foreseeable future. Importantly, I also see where nature's processes continue to function. The line between human and natural is blurred and I realize how much there is to learn here. Unfortunately, areas such as these are rare.

**Bitterroot Valley Background**

The natural environment of the Bitterroot Valley, similar to TWR, has suffered significant human impacts. The causes are similar: livestock grazing, agriculture, logging, and development have, on a larger scale, degraded the natural beauty, stability, and integrity of the Bitterroot Valley. Unlike TWR, however, there is not a current force to restore the land to pre-disturbed conditions.

The Bitterroot Valley is a distinct area 25 miles wide, 96 miles long (2,383 square miles), with definite natural boundaries in all directions. The communities that grew within were built from dollars extracted from the land. A unique social and political context which nurtures a strong anthropocentric
attitude towards the land resulted. Like the waves of newcomers a century or so before, the Bitterroot Valley is again experiencing an influx of new people. This time, however, the numbers of newcomers are substantially greater. Between 1980 and 1994, Ravalli County population increased 36% from 22,493 to 30,700. The past four years alone witnessed an astonishing 23% increase to produce, by far, the largest population growth of any county in Montana (Census 1995). Finally, the Ravalli County Chamber of Commerce estimates a high potential population of 52,000 by the year 2005.

Some of these newcomers are introducing new forms of land use. Old farms and ranches are sold to developers and transformed into subdivisions or "ranchettes." The Bitterroot Valley is an apparently attractive place to fulfill the dream of building a log cabin with a view of the mountains. Ironically, the log home industry in the Bitterroot Valley is now booming as the timber industry declines (Ravalli County Chamber of Commerce 1993).

Other people are moving to the Bitterroot Valley to live the dream of a simple, sustainable life in the mountains. Many have migrated from crowded urban areas to try to re-establish their ties to the land. Although the dreams of these newcomers vary, a common draw for their move to the Bitterroot Valley is its natural wonder. The benefits these people derive are not those extracted from the land, but conversely, what is left intact.
These newly established values and attitudes towards the land are, at times, inconsistent with the traditional, dominant views. The resource extractive practices of the past are often questioned as detrimental to the land. This voice is growing stronger and leads to conflicts of interest. Change does not come easy to the Bitterroot.

The battles over proper land use are polarizing the Bitterroot Valley like never before. Issues such as gray wolf and grizzly bear re-introduction, wilderness designation, and water rights are extremely sensitive topics. Furthermore, the media thrives upon depicting environmentalists versus industry as opposing sides of an issue. Not surprisingly, this reality can make EE difficult to implement.

**Environmental Education in the Bitterroot Valley**

The Bitterroot Valley's history in regard to EE is similar to that of the rest of the country. EE gained recognition in the liberal, late 1960's and EE funding was available from the federal government. A small nature center was established which offered "curriculum out of a bus" and took school-kids on field trips (Kerry Wall-MacLane, personal communication, March 1994). The early educational themes in the Bitterroot Valley were geared to agriculture and ranching. By the early 1970's, however, interest waned, the dollars disappeared,
arson struck the nature center, and EE's short career subsided. The EE scene in
the Bitterroot Valley has been quiet the past twenty years.

The Bitterroot Valley is comprised of six school districts totalling 5,600
students. From North to South they are: Florence, Stevensville, Victor,
Corvallis, Hamilton, and Darby. (Lolo lies geographically within the Bitterroot
Valley, but politically within Missoula County.) None of these six school
districts contain an established EE program.

The general reasons for lack of extensive and effective EE outlined in
Chapter 1 apply to the Bitterroot Valley. This setting, however, offers a unique
barrier: the perceived controversial nature of EE. Attitudes towards EE are
indicative of attitudes toward environmental issues. EE is often viewed as an
attack on the livelihoods of those in extractive industries. The mere word
"environmental" sends up the proverbial red flags. In fact, it is common to use
the phrase "the E word" when discussing environmental education in the
Bitterroot Valley.

Jack Sturgis, a former third-grade teacher at Corvallis shared a telling
episode. He recalled that the sheer act of inquiring about bringing a Wolf Box
(an educational trunk designed to discuss wolves and humans) into a classroom,
caused members of the Bitterroot Stockgrowers Association to storm into the
principal's office and object.
Citizens recently formed a group in the Bitterroot Valley as a result of the lack of EE and the intense polarization of views regarding environmental issues. Bitterroot Ecological Awareness for the Resource (BEAR) is designed to "provide area children with the information and tools necessary to better understand the complex inter-relationship of the environment in which they live" (Bear Tracks, 1994). BEAR is a cooperative of volunteer presenters that teachers can select for in-class or outdoor lessons. BEAR presenters are listed according to their individual themes or skills, and the list varies widely, from timber industry to nutrient cycling to alternative energy topics. BEAR states the "co-op consists of diverse members of the community with very different perspectives on what constitutes appropriate use of the resources. They all agree that education is the key to resolving resource issues facing students today."

Kerry Wall-MacLane, director of BEAR and winner of the 1994 Montana Environmental Education Association's "Sense of Wonder" Award, described the "stigma" associated with EE. He has observed that perceptions are extremely powerful in this conservative community and, for better or worse, need to be accepted as reality. Hence the word Ecological instead of Environmental for the "E" in BEAR.

Wall-MacLane also pointed to school boards as major roadblocks to EE implementation in the schools. School boards determine the policy and budget
of each school district. They are comprised of elected officials who, to allow the time needed for these political positions, are generally older and retired. Not surprisingly, the boards tend to be conservative and resistant to new ideas for the classroom, especially if they cost money.

There are significant obstacles to address when developing a structured EE program in the Bitterroot Valley. There is hope, however, that business-as-usual is changing. Wall-MacLane has observed the trend in schools towards "integrated curriculum" in which environmental themes are almost "unknowingly" developed. In the short six month history of BEAR, requests have more than doubled each month (Wall-MacLane, personal communication, December 1994).

Beth Underwood, EE coordinator at the US National Park Service administered Lee Metcalf National Wildlife Refuge, (about fifteen miles north of TWR), shared this optimism. Underwood has recognized a growing interest for the teacher workshops and training that she offers. Similarly, Underwood noted that educational use at the Lee Metcalf NWR has significantly increased each of the past five or six years (Underwood, personal communication, November 1993).

In the winter of 1994, two new Corvallis High School Science teachers, T.A. Hennard and Jim Striebel, developed the Corvallis High School Riparian Monitoring Project, a collaborative effort with the US Forest Service and Trout
Unlimited. Hennard and Striebel’s students measure the health of key streams in the Bitterroot Valley according to physical, biological, and chemical parameters. The classes initiated the project on streams that flow through TWR, and have provided valuable baseline data that will be used to guide restoration activities. These types of proactive efforts from teachers are extremely encouraging.

It is uncertain where this increased awareness of and desire for EE is originating. Perhaps it is a result of the new blood and new views towards the land arriving in the Bitterroot Valley seemingly daily. It does illustrate that the Bitterroot Valley is ripe for EE opportunities to emerge.
Chapter 3

Restoration and Education:
An Approach for Teller Wildlife Refuge

A carefully crafted approach is required to implement environmental education (EE) that aims to build positive values and behaviors towards the land in the particular setting of Teller Wildlife Refuge (TWR) in the Bitterroot Valley of Montana. I believe promoting the habitat restoration project underway at TWR provides enormous potential as the EE theme. Giving learners an active, hands-on participation in the restoration project, then, will be the guiding philosophy for developing an EE program at TWR.

A primary benefit of this approach is to bypass the stigma associated with EE in the Bitterroot Valley. As discussed, environmentalism, which unfortunately has encompassed EE, is an extremely controversial topic in the conservative Bitterroot Valley. TWR's EE program would likely meet strong opposition if we explicitly stated that the goals were to foster positive values and behaviors towards the land. Restoration education does aim to produce positive values and behaviors towards the land, but these controversial goals are
implicit. In the Bitterroot Valley community, which places great significance on perceptions and terms, this subtlety makes a world of difference.

Although habitat restoration at TWR carries preservationist tones, it is moderately accepted in the Bitterroot Valley. Furthermore, similar practices to TWR’s restoration activities are conducted on area ranches, farms, and timberlands. For example, non-native species removal is one of the few land management activities that has a virtual consensus of approval. Just about everyone in the Bitterroot Valley hates spotted knapweed and many are experimenting with control methods. Native plant propagation is another restoration activity that is practiced elsewhere and does not receive adamant opposition.

So, stressing the habitat restoration project as our EE theme is a possible avenue to gain community acceptance for our EE program. The crux is that values and behaviors towards the land are implicit in this explicit "safe" notion of restoration.

**Educational Benefits of Restoration**

The benefits of utilizing the habitat restoration project exceed mere acceptance by the conservative Bitterroot Valley community. Restoration offers exciting opportunities for achieving the varied objectives of EE. Importantly
though, the benefits, if they are to be attained, are predicated on effective
implementation by the teacher. As Kerry Wall-MacLane expressed: "what the
teacher does at the end of the activity is critical for the success of the
educational message (Wall-MacLane, personal communication, November
1994)." Restoration holds potential as a powerful EE tool; however, if a teacher
neglects to apply the activities to relevant in-class discussion, a fun field-trip
day might be all that’s remembered.

Restoration, educationally, offers opportunities to study humans’
behaviors towards the land. The process of restoration allows us to analyze past
actions, discuss present activities, and form direct relationships to their
associated impacts on the land. At TWR, we are able to directly observe
consequences of our actions on the land, as opposed to just discussing them in
the classroom. Our behaviors’ connection to the environment, consequently,
become less abstract.

Integral to this notion of studying human behaviors is local land history.
Land contains our history of actions and attitudes towards it. By discovering
this history, we enhance our understanding of the community we live in.
Restoration affords convenient discussion of the changes that have occurred in
the Bitterroot Valley. From the rising of the mountains to the emergence of the
plow, change has occurred in the Bitterroot and always will. Studying human
history from Native Americans, to European homesteaders, to the present influx
allows the learner to ponder the respective legacies and place them in an appropriate context. We may decide which of the associated impacts are good or bad for the health of the land. This poses the question: "why do we want to restore the land?"

Of course, this a value question. TWR values the land in a prior, less humanly impacted state. However, not everyone in the Bitterroot Valley agrees, and probably all students will not agree, that we need to restore. Some might view the impacts and changes that have occurred to the land and not object. Perhaps they reside on an adjacent ranch or farm, as the land of TWR used to be, and believe it is not necessary to change the present condition. Others might view recent impacts as detrimental to the land and share TWR's value for native plant/animal habitat and natural processes. Certainly TWR is not "right" in their goals for the land and this should be discussed. Before the learners ever get their hands dirty they must understand why they will restore this land.

Furthermore, we must answer: "what do we want to restore the land to?" TWR identified "pre-white ecological conditions" as the goal of the restoration project. However, conceivably, we could attempt to restore the land to other conditions, such as pre-Native American. Exploring this question with students delves at the heart of values towards the land. Certainly a discussion will ensue reflecting ecocentric and anthropocentric values. Without this value foundation, a significant component of our educational message is lost.
Participation in restoration activities introduces key educational variables identified in Chapter 1. Restoration assists in instilling empowerment. Learners make small, yet significant, differences on an actual piece of land. They recognize that they possess capabilities to produce positive change. This empowerment, ideally, is then applied to other "real life" situations. For example, students might channel their empowerment to improve other degraded natural areas or initiate recycling in their school.

Too often, our educational system neglects to empower students. Consequently, individuals in our society often perceive themselves to be powerless in the face of "overwhelming" environmental degradation. Wendell Berry offers insight into the notion of empowerment in today's society:

> Nobody can do anything to heal a planet. The suggestion that anybody can do so is preposterous... That will-o’-wisp of the large scale solution to the large scale problem, so dear to the governments and universities and corporations, serves mostly to distract people from the small private problems that they may in fact have the power to solve... The question that must be addressed therefore, is not how to care for the planet, but how to care for each of the planet’s millions of human and natural neighborhoods, each of its millions of small parcels of land (Berry 1990).

When a person cares for a small parcel of land on TWR we begin the step of empowering, of illustrating that we possess the abilities to affect change when needed.

Other EE variables which are manifested by participation in restoration projects are stewardship and responsibility. The educational process of the
restoration project includes follow-up visits to the site to monitor and maintain the work. Learners then appreciate that, before we place a flag with our name next to a newly planted willow, we must take great care to ensure its survival. By working and maintaining actual pieces of land, they assume responsibility for the land and learn from the success or failure of their endeavors.

Richard Nielson, editor of *Helping Nature Heal*, relates this sense of ownership to our lives:

> If you are helping to restore fish to a local stream, the whole effort can hang on the acidity of the water. Once you realize this, the pollutants that come from your car's exhaust pipe or the nearest power plant cease to be abstract, and the benefits of using mass transit or buying energy efficient appliances becomes easier to see. The synergism of the biological world spills into our own lives (Nielsen 1990).

Restoration highlights our impacts upon the natural world and aids in building a sense of responsibility for lessening those impacts. This ownership and sense of stewardship instilled can be extrapolated to other natural areas or communities, such as the entire Bitterroot Valley.

Restoration offers unique avenues to study ecology. In essence, restoration is ecology "in action." The educational effectiveness of restoration does not depend on its ecological success. Substantial educational opportunities exist even if the willows that we planted do not survive. We might find, for example, that the summer was exceptionally dry or deer browse was significant.
enough to prevent our willows from taking root. By finding out why our willows are not alive, we expose ecological relationships.

The University of Wisconsin Arboretum in Madison is credited with the first planned restoration project. Beginning in 1934, Aldo Leopold directed the effort to restore the native tallgrass prairie community. After a few years, the results were considered a failure (Jordan, et al. 1987). Leopold and others then experimented with fire, an important natural process on the prairie, and the results proved much more satisfactory. The reasons why a restoration project are not succeeding educate us about the natural system perhaps more significantly than our successes.

Restoration ecology has recently emerged as a new scientific field. William Jordan III, the founder and director of the Society for Ecological Restoration, believes ecological restoration serves a useful role as a basic tool of scientific research. Certainly, we are limited in the degree of manipulation allowed in un-degraded areas. By tinkering with the natural system in degraded areas and analyzing its parts, we are provided unique opportunities for understanding nature's processes. Learners relate better to ecological concepts they observe and participate in, as opposed to reading them from a textbook.

Finally restoration can harness the enormous amount of energy a class of youngsters generates. Most of this energy is wasted "sitting and staring," as Steve Van Matre expressed, in the classroom to explode at three o'clock (Van
Anyone who has witnessed the energy level of a third grade class can attest to the desire to channel it towards a positive goal. Much physical work is needed for restoration projects; let's get kids to help!

Integrating ecological restoration with EE has only recently been attempted. Among the initial efforts to combine restoration and education was the UW-Madison Arboretum project. They developed the Earth Partnership Program that trains teachers to direct prairie restoration projects at their school site.

In the Pacific Northwest, many stream and fish restoration projects are beginning to include an educational component. The Nature Conservancy's Silver Creek Preserve in south-central Idaho, for example, devised a restoration activity guide for elementary, middle, and high schools: the Big Wood River and Silver Creek Education Project in 1992. Similarly the Missoula County Conservation District in 1991, developed the Clark Fork Watershed Education Project as an educational complement to the restoration of the Clark Fork River.

Andrea Stephens, in her UM thesis, Environmental Education and Ecological Rehabilitation: A Synthesis, effectively described the rich and varied educational opportunities of this synthesis. She preferred to use the term rehabilitation "because true restoration is such an improbable task" and she wanted to "maintain enough flexibility to pursue a number of agendas outside the traditional discipline of restoration (Stephens 1992)." Ultimately, Stephens
viewed restoration as a "process for empowering students, by integrating knowledge, compassion, and action."

Restoration/education is an exciting and evolving approach for achieving the goals of EE. Potential exists for restoration projects at nearby degraded natural areas, on school grounds, and even in urban areas. The concept of helping students heal the Earth is applicable to many educational settings.

Considerations of Ecological Restoration

Although Leopold's tallgrass prairie restoration project began in the 1930's, the field of ecological restoration is just beginning to receive widespread attention. Some are cautious of their praise for ecological restoration projects and present cogent concerns.

There is a view expressed that by gaining the ability to restore lands to prior, less impacted conditions we will inadvertently allow more degradation. This claim states that extractive industry will now have restorationists on call to mitigate damage done to the land. Although we may generalize that restorationists are working for the better of the land, and not for license of further destruction, educators need to respect this claim.

John Cairns, editor of *Rehabilitating Damaged Ecosystems* presents this dilemma as one of "balanced risks and benefits." He believes that if the "true
costs of restoration are made abundantly clear and responsibility for them correctly assigned, these costs will probably be a major deterrent to disturbing ecosystems of any kind (Cairns 1988)." Restorationists must openly refute the notion of allowance for further destruction. Moreover, these fears are neglecting the reality of the present damage to the Earth. There is much destroyed and in need of repair.

The restorationist’s goal is often stated as an "original" or "pre-existing condition." For example, Leopold wanted to re-create the tallgrass prairie, and TWR seeks to return the land to "pre-white ecological conditions." There is trouble in this notion. It emphasizes a static role of nature and neglects change. The perception exists that restorationists believe that if we return the land to a prior, less impacted condition, they have done their job.

Restorationists have begun to sing a new tune in light of these concerns. The product is no longer the important thing, the processes are. Fifty years later, Leopold’s tallgrass prairie did not resemble the community that was originally sought. The Arboretum focused then on the successful return of certain prairie ecological processes such as fire, nutrient cycling, and succession in an attempt to justify the significance of the work (Jordan 1987).

In many areas being restored such as TWR, the original condition can never be fully attained. This is especially true of relatively small, isolated areas such as TWR where activities on adjacent lands are beyond direct influence.
With many integral components of the original ecosystem missing (e.g. predators, fire, the meandering of the river, top-soil) the goal must be to allow natural processes to return. Falk summarizes this well:

Restoration uses the past not as a goal but as a reference point for the future. If we seek to recreate the temperate forests, tallgrass savannas, or desert communities of centuries past, it is not to turn back the evolutionary clock but to set it ticking again (Falk 1990).

Finally, some argue that restoration is another form of anthropocentrism. Restoration, they say, is manipulation of the land to suit human purposes. Barry Commoner's Third Law of Ecology, widely known as "Nature knows best." states that "any major man-made change in a natural system is likely to be detrimental to that system (Commoner 1971)." This anti-management philosophy believes that nothing people do is as good as nature operating without our influence. Furthermore, others have proposed that restoration serves as a "forgery" of nature and restored areas are of less value than a natural area (Cowell 1993).

The wolf reintroduction issue in the Northern Rockies embodies these varying philosophies. The typical wolf debate centers around those for and against wolves' return. Another controversy, however, surrounds the supporters of wolf recovery who adamantly disagree on how to best accomplish the goal.

Humans now possess the knowledge and abilities to manipulate wildlife populations. Therefore, advocates of the intensive effort to return wolves say
that we can, and should, speed up and closely manage the species' recovery.

Other wolf advocates, on the other hand, adopt a more "nature knows best" philosophy. They point to the fact that wolves are currently expanding their range without intensive human management. If given time, nature's time, wolves will return on their own. Additionally, the wolves that will return will have undergone an arduous journey, and are likely to be genetically strong. The wolves that are reintroduced, having allowed themselves to be caught are therefore likely to be genetically inferior.

How do humans solve this ethical dilemma? Should we use our new knowledge and abilities to return a basic, missing component of the ecosystem? Or should we restrain from this effort in hopes of nature, eventually, performing the task? These are difficult questions that restorationists must address.

A notion implicit in Commoner's Third Law of Ecology is that humans and their associated impacts are not, necessarily, natural. Humans and nature are dichotomous in this philosophy. Wilderness becomes a place to set aside as a preserve for us to visit, but not remain. Therefore, we should avoid major modification of natural systems because that impact is inherently harmful. Jordan calls this view "anti-ecological" because "it emphasizes relationships and interactions, the influence of species on each other, while setting up non-involvement by our species as a kind of ideal (Jordan 1986)."
Although there are merits to the "Nature knows best" philosophy, ultimately I find it troubling. In Chapter 2, I described a movement that accepts and values humans' roles in nature. Restoration embodies this participatory, mutualistic ideal. Through restoration, we re-enter nature with a new respect. Jordan states "it keeps human beings in the picture, in intimate contact with nature, changing the landscape unapologetically, as all creatures do, but with a humility and an abiding respect for ourselves as well as the rest of nature (Jordan 1985)."

This view presents humans and their impacts as natural, hence, caution is needed to avoid all impacts labeled as such. Humans need to recognize the paramount reality that we possess more power to alter the Earth than any other species. Therefore, Cowell states "an ethical restraint must be added involving at least some level of respect for the intrinsic characteristics of ecosystem constituents and functions" (Cowell 1993). The fact, paradoxically, that humans, historically, have not utilized ethical restraint in relation to our power creates the present need to set aside areas that further distance ourselves from nature.

When Falk described restoration as setting the clock ticking again, it was predicated on humans practicing this ethical restraint. Restoration aids in fostering this land ethic by demanding of us to analyze our role in the natural world. Some claim restoration of the land ultimately becomes restoration of our
souls and society. Barry Lopez writes: "restoration is "a humble and often joyful mending of biological ties, with a hope, clearly recognized, that working from this foundation we might, too, begin to mend human society (Lopez 1991)."

Finally, Jordan writes:

> it is clear that the business of ecological restoration is much more than a technical or scientific challenge. It is also a model for a healthy relationship between ourselves and nature and, beyond that, a way of exploring, defining and ultimately celebrating the terms of that relationship. It is here I now see the greatest value of restoration- not in its ability to transform the landscape directly (or at least not only that), but in its ability to transform it indirectly through the education and transformation of the human beings who inhabit it (Jordan 1991).

Whether society will practice this new ethical restraint as we re-enter nature is uncertain, but it is crucial to the success of the field of restoration. As the discipline evolves, then, the importance of integrating the educational aspect becomes significant. Restorationists, as well as educators, must address the value questions outlined in the educational process.

Jordan’s notion is, perhaps, too idealistic to believe restoration in and of itself can educate and transform human beings. For restoration to be successful in this endeavor, a diligent educational effort that works within the social, political, and economic realities is required.
Chapter 4

From the Theoretical to the Applied

I will now apply these theoretical notions of effective EE and a restoration/education approach towards the actual development of an EE program at TWR. TWR had no magic path or patented technique for this effort. The goals for this project, again, were:

1. To create an EE infrastructure that ensured use of TWR by Bitterroot Valley schools.

2. To ensure that the environmental education provided supports the goals of producing positive values and behaviors towards the land.

The first step in this process was the formation of an EE Committee of volunteers in the fall of 1993. The initial members were Karen Bleibtry, a fifth grade teacher at Corvallis and TWR Board member; Beth Underwood, then a fifth grade teacher from Corvallis; Jill Maus, with diverse experience in education; Kerry Wall-MacLane, director of Bitterroot Ecological Awareness for the Resource (BEAR); and myself. Bleibtry assumed committee Chair responsibilities. Sue Wall-MacLane, then TWR’s Restoration Coordinator and Chris Miller, TWR’s Manager, also contributed. All decisions and actions
regarding EE at TWR were screened through these individuals. (I will use the term "we" to describe decisions and actions that were performed through this committee.)

TWR set aside a room on the property solely for EE purposes during this initial stage. The primary use that we envisioned for this EE room was a resource library and educational equipment storehouse. This facility could also serve as an indoor classroom if inclement weather forced field trips inside. The EE Committee collected educational materials and equipment to offer teachers on a check-out basis.

**Outreach Efforts**

The EE Committee recognized two fundamental needs for the development of an EE program. First, we needed a grasp of Bitterroot Valley teachers' attitudes and knowledge concerning EE and TWR. We sought to discern how aware teachers were of the EE opportunities at TWR, and how inclined they were to bring their classes for educational purposes. Due to TWR’s recent establishment, and the present sparse use, we hypothesized that awareness was low. Our second identified need, then, was to outreach assertively to teachers and promote the rich educational opportunities of TWR.
At this time, the EE Committee began to address questions concerning the educational "carrying capacity" of TWR. We desired increased educational use but were also concerned about possible over-use. We noted that an extremely effective outreach program might produce a level of use that the land of TWR, and its varying uses (described in Chapter 1) could not adequately support. Therefore, we focused our initial outreach effort on the closest proximity school districts of Corvallis, Hamilton and Victor. (They are one-half, five, and seven miles from TWR, respectively.)

I offered to design and conduct the outreach effort as part of the requirements for my professional paper. I decided that the most efficient method to fulfill our two identified needs was to directly address and survey Bitterroot Valley teachers and administrators. Subsequently, I contacted each school's principal by phone and requested time at their regularly scheduled faculty meetings to conduct a ten to fifteen minute presentation concerning the educational opportunities at TWR. This "personal touch" was used because teachers are often overwhelmed by educational solicitations through the mail.

My requests were readily accepted by all schools except Hamilton Middle School and Hamilton High School. The Hamilton Middle School principal simply stated that there is "insufficient need to make the presentation." The Hamilton High School principal was agreeable to the idea, but was never able to allocate time from a faculty meeting. He said there were many entities, such as
the Wood Products Industry and Stockman's Association, with similar requests and he couldn't figure out how to accommodate them all.

I made presentations to the following schools, with the respective number of faculty present:

<table>
<thead>
<tr>
<th>Name of School</th>
<th>Number of teachers in attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corvallis Primary-</td>
<td>22</td>
</tr>
<tr>
<td>Corvallis Middle-</td>
<td>38</td>
</tr>
<tr>
<td>Corvallis High-</td>
<td>27</td>
</tr>
<tr>
<td>Victor K-12-</td>
<td>25</td>
</tr>
<tr>
<td>Grantsdale Primary-</td>
<td>7</td>
</tr>
<tr>
<td>Daly Primary (Hamilton)-</td>
<td>36</td>
</tr>
<tr>
<td>Total #:</td>
<td>155</td>
</tr>
</tbody>
</table>

The goals of these presentations were to increase teacher awareness of the educational potential at TWR and address possible barriers to its educational use. I introduced general information regarding TWR: its history, ecology, demographics, and goals. I then discussed TWR's educational opportunities that could alleviate obstacles to its use: the Small Grants for Education Fund to offset administrative costs of a field trip to TWR, the new EE Room with available educational resources and equipment, and the possibility of educational specialists to assist with the planning and implementation of a visit.

I emphasized the opportunity of integrating TWR's ongoing habitat restoration project as an educational theme. I described the heavily impacted condition of the land and the various restoration activities planned such as exotic
species removal, native species propagation, stream and riparian improvements, and prescribed burns. I offered that students are welcome to participate in these activities as part of the educational process. We discussed how multi-disciplinary components such as empowerment and ownership are easily introduced into this restoration oriented learning experience.

Next, I distributed relevant information regarding EE at TWR: a TWR newsletter, a resource materials and equipment list available at the EE Room (See Appendix B), and a Small Grants for Education Application. Finally, I gave each teacher a survey (See Appendix C). I stressed that participating in the survey will aid TWR's understanding of teachers' attitudes and needs in relation to EE at TWR, which will ultimately return to benefit them. They were asked to give the completed survey to their respective principals who would forward them in a self addressed stamped envelope to TWR.

The Survey

The teacher-survey investigated three general areas: teachers' experience with outdoor and environmental education, their specific knowledge and attitudes towards educational use of TWR, and suggestions for making TWR more teacher-friendly. I limited the length of the survey to one page in an attempt to produce a quick and easy-to-complete survey.
Fifty-two completed surveys (out of 155 distributed) were returned to TWR for a response rate of 33%. Some of the teachers that attended the presentations who received the survey might not have felt that their subject matter was relevant for a field trip to TWR. For others, perhaps the survey was simply lost in the maze of paperwork that teachers receive. Finally, some teachers might not have recognized the value of an educational visit to TWR. Consequently, the survey is biased towards teachers who wanted to respond to the survey,

The responses to each survey question were as follows:
[For a tabled, numeric display of the survey responses, see appendix D.]

1. How often do you take your class out-of-doors for educational purposes? Which locations? Subjects/Activities taught?

There was an even division between teachers who rarely take their class out-of-doors (less than five times per year), and teachers who frequently do (more than ten times per year). The majority of teachers who responded positively, utilize their school grounds and teach science related topics when out-of-doors.
2. Do you incorporate environmental education in your class? If yes, in what form? If no, why not?

Of those answering, 80% reported that they incorporate some form of EE in their class. Certainly though, without defining EE in the survey, the teachers were liberal in their answers. Only about 20% of those answering "yes" specifically mentioned education that relates to behaviors and values towards the land.

3. Have you considered taking, or have you taken, your class to the TWR? If yes, for what purposes?

Forty-seven percent of the teachers stated that they have taken, or have considered taking, their classes to TWR. With low numbers of actual recorded use, this indicated teachers often consider, but rarely take, their classes to TWR. An important response was the 20% who replied that they hadn’t previously considered a visit, but with the new information provided at the presentation, they were more inclined. One teacher remarked, "I’m going to now; with your urging, I’m more excited about TWR."
4. Which educational topics/activities might you incorporate with a visit to the TWR?

- Local History
- Plant/Animal Surveys
- Reading Assignments
- Water Quality Tests
- Math Problems
- Current Resource Issues
- Musical/Artistic Expression
- Biology
- Chemistry
- Writing
- TWR Improvements
- Habitat Monitoring

This question was designed to offer educational topics that the teachers might not have thought of incorporating at TWR. It seemed to work. The first two survey questions had indicated that teachers usually incorporate science oriented activities for EE. Yet the most cited response of this multi-choice question was writing (cited by 55%), and second was local history (cited by 48%). This showed an apparent recognition of the potential multi-disciplinary educational opportunities at TWR.

5. Would you be interested in taking your class to participate in hands-on habitat restoration activities at the TWR?

This was a broad question that allowed teachers to be liberal in their responses. Likewise, 73% stated that they would be interested and only 9% stated they would not. It should be noted that "interested" did not imply any commitment to participate. Teachers were apparently open to new ideas.
6. **Please describe the major obstacles you face concerning taking your class to the TWR.**

The majority of respondents (52%) described lack of time as a major obstacle. One teacher provided a remark that seemed indicative of the general responses: "Time constraints, trying to meet all of my curriculum needs. I think EE ought to be written into the curriculum. However, I do take my students twice a year and would take them more if I had help with the planning and logistics." Another teacher stated: "I don’t know where to start, who to call, and what I should be teaching there. I’m not certain if I’m expected to organize the day or if someone else does. I’d like the help."

7. **What suggestions do you have for encouraging teacher use of the TWR?**

This question elicited numerous productive suggestions. Most of the teachers who responded expressed a general desire for more information about TWR. One teacher remarked, "Attending a meeting and talking with us is the best way to reach teachers. We are overwhelmed with fliers in our boxes. Thank you for taking the time to inform us!" Many also mentioned that an informal, on-site visit to TWR for teachers would be helpful.

The teacher survey provided valuable information for embarking on the creation of an EE infrastructure at TWR. Responses suggest three types of
teachers: first, there were a few teachers who did not value EE and were not ready to make an effort to implement its goals. Second, there were a few (not many) highly motivated teachers who will incorporate EE into their curriculum on their own. Finally, the majority of teachers were characterized as possessing limited exposure to EE, willing to incorporate new ideas into their curriculum, but in need of outside assistance to actually plan and conduct EE at TWR. "If you put it together, and help out when we’re there, then we’ll use it," was a pervasive attitude expressed.

Teacher Open-House

In May of 1994, the EE Committee offered a teacher "open-house" in response to the expressed desire for more information and on-site training at TWR. We gave notice about the upcoming event to all schools in the Bitterroot Valley and advertised via newspaper press-release and radio public service announcements. We scheduled the open-house for an afternoon after a school-day.

Fourteen teachers attended, with representatives from all Bitterroot Valley school districts except Stevensville. The number of participants was small but it was beneficial to have various districts represented. This enabled the EE
Committee to identify key teachers within each school who could then, hopefully, motivate their colleagues.

At the open-house we showcased the EE room and offered educational activities, such as insect sampling, for teachers to participate in. TWR's Restoration Coordinator presented slides of the various habitat restoration projects undertaken and suggested educational tie-ins. Finally, we toured the property in an open, pick-up drawn surrey. We observed where restoration/education work had been undertaken and other areas with educational interest. The atmosphere was informal and the teachers who attended expressed interest in using TWR in the future.

The outreach effort identified Corvallis as the Bitterroot Valley school district with the highest potential to incorporate EE at TWR. Corvallis is only a half-mile away and classes could walk to the educational site from the school. Corvallis was also recognized as one of the more progressive school districts in the conservative Bitterroot Valley.

For example, in 1994 Corvallis revamped their Science curriculum to reflect a philosophy that promotes "a safe environment where students are able to take risks and experience science through a hands-on, learner-centered approach that integrates all curricular disciplines (Corvallis School District Science Curriculum)." Alyson Hoiland, the Principal at Corvallis Elementary, led this effort. She identified a "progressive and motivated" Science Curriculum
Review Committee of faculty and an "incredibly supportive school board" as key steps in this process. Corvallis' revised curriculum, additionally, suggested two visits to TWR per year for each class. Subsequently, the EE Committee decided to utilize Corvallis as the pilot school for the EE materials that were to be developed.

**EE Coordinator**

In May of 1994, TWR was awarded $5,000 from Phillips Petroleum Environmental Partnerships Award and then matched these funds with another $5,000 in contributions. TWR allocated this money to various EE infrastructure needs: educational resources and equipment, an interpretive trail, and a part-time EE coordinator. Jill Maus was hired as the coordinator.

Maus established the priority of developing educational materials for teachers to use on field trips. She felt that prepared materials would encourage involvement and ownership in EE at TWR from the teachers. During the summer of 1994, Maus and a summer intern collaborated with the lead Science teacher from Corvallis' grades 1-4. They teamed together to develop educational "units" for field trips to TWR, and consulted with the teachers concerning their use.
The themes of each unit reflect specific topics within each grade's curriculum and focus around a hands-on field component related to the restoration project. The field aspect contains five or six educational field "stations" which the students rotate through during the day. The stations are comprised of various EE activities that are personalized to TWR and are staffed by volunteers. The units also contain pre- and post-visit lessons to complement the field activities.

The combination of our outreach effort and the prepared units increased educational use of TWR. In the spring of 1994, 24 school groups visited TWR with a respective total of 980 students. In the fall, 21 school groups visited with a respective total of 750 students. The 1,730 students that visited in 1994 was more than double any previous year. Moreover, the fall 1994 grade 1-4 visits used, almost exclusively, the newly developed units.

"Year at Gird Creek" Educational Unit

The heavy amount of use that Maus' units received highlighted the utility of prepared materials for teachers to use on field trips. Therefore, in October 1994, I began developing a year-long educational unit with Michael Allen, the sixth grade Science teacher at Corvallis. Aquatic biomes were among the topics covered in Corvallis' new 6th grade Science curriculum and Allen expressed a
personal love of streams and fish. Consequently, Maus and I identified TWR's restoration of Gird Creek as the educational theme for this unit.

Gird Creek is a major tributary of the Bitterroot River that flows from the Sapphire Mountains to the east and through TWR for approximately one mile. Numerous human-related activities such as diverting water for agricultural purposes, grazing livestock that denudes native riparian vegetation, dismantling of beaver dams, invasion of exotic plant species, and logging, road building, and trampling that increased the stream’s sediment load have severely degraded the overall health of Gird Creek. There are still a few spawning fish in Gird Creek but its carrying capacity for these fish is far below its potential (Gary Decker, Watershed Restorationist for the Bitterroot National Forest, personal communication, November 1994).

All the streams on TWR, such as Gird Creek, are slated for restoration. TWR's Restoration Advisory Committee emphasized enhancing native spawning fish habitat for the stream restoration projects. Specific stream restoration activities planned are: channel narrowing and deepening, bank stabilizing, riparian re-vegetating, exotic species removal, and in-stream fish habitat improvements.

I consulted with TWR's Restoration Advisory Committee, TWR's EE Committee, and the fifth grade teacher at Corvallis to complement their curriculum material, and began the meticulous process of selecting, creating, and
organizing various educational activities in an attempt to produce a thematic, focused, and empowering learning experience. *Year at Gird Creek* (YGC) is a manifestation of the effective EE components outlined in Chapter 1, and the unique opportunities of integrating restoration and education outlined in Chapter 3.

I developed a progression of educational concepts for the four visits of YGC. The first visit in the fall nourishes an enhanced awareness and appreciation of the natural world. The winter visit introduces the concepts of natural and unnatural change to the landscape of TWR. The early spring visit strives to increase students' knowledge of general ecological components, including humans' relationships to the environment. Students also begin to make assessments of healthy habitat. With this background, YGC culminates in late spring with actual habitat restoration activities aimed to empower students with their capabilities.

The field visits contain a natural flow to the day and diverse activities to keep interest high. The day starts with a fun group game to generate enthusiasm and channel the kids' energies. An introductory discussion session is structured to establish key questions that guide the students during the day. Then, similar to Maus' units, the class divides into smaller learning groups and rotates through educational stations. Stations are varied in atmosphere; some are quiet and reflective, others are fun and active, or exploratory in character. An
environment where "significant life experiences" can occur is nurtured. The students re-group at the end of the day for final activities and to discuss and share thoughts of their experiences.

Field journals are an educational technique employed during their visits. Students create the journals in class and are provided opportunities to use them for drawing, writing, poetry, and quantitative problems throughout the day. Photographs are taken, both by the students and teachers, to document the day and be displayed in class. Additionally, there are opportunities to invite specialists, such as a fish expert from a state or federal land management agency, to offer their expertise and enhance the day.

In-class lessons are a significant component of YGC. Preliminary activities are designed to build a foundation for their visit to TWR. They introduce the main concepts that are addressed in the field and create excitement for their special day.

The teacher is provided a primer of proper logistical preparation for such miscellaneous, yet important, field trip items as dress, lunches, garbage, and the bathroom situation. Instructions for station facilitators are also included. Proper preparation by teachers and volunteers is important to convey sound role model behavior. While educating at TWR, it is critical that everyone acts in an environmentally responsible manner.
The in-class follow-up to the field experience is critical to reinforce the concepts students learned and relate them to their values and behaviors towards the land. This juncture is where the extension from a limited nature awareness and knowledge experience can be extended to one that addresses behaviors and values. The teacher must assume responsibility to effectively make this application. The discussions, writing assignments, issues analysis, debates, and research projects of YGC are designed to facilitate this paramount goal.

Hopefully, YGC will be used by other Corvallis 6th grade teachers. Unlike K-5 grades where one teacher teaches all subjects to the same class, 6th grade and higher is departmentalized; there are separate teachers for Science, Math, English, Social Studies, etc. At its core, YGC embodies a multi-curricular learning approach. Although science is, perhaps, the most appropriate subject to begin this project, students will learn local, cultural and geographic history, sharpen their math skills, and express ideas orally and in reading and writing. As such, there are numerous avenues for participation from subject teachers other than science.

YGC highlights the need for a structured program in Corvallis’ seventh grade to complement 6th grade’s experience. Student’s must return to the site year after year and monitor their results in order to instill a true sense of ownership and responsibility towards the land. Obviously, this clarifies the need for a comprehensive EE unit similar to YGC in all grades.
YGC is designed for use by Corvallis’ 6th grade for many years. However, it is not certain how long the education/restoration of Gird Creek can continue. Eventually, students will have completed most of the direct restoration activities. Hopefully though, Gird Creek will have improved in health, and students will continually monitor and assess its condition.

Coordination with TWR’s Restoration Coordinator is also required to ensure that the restoration tasks that the students perform are ecologically, as well as educationally, effective. Students are working with the dynamic entity of land restoration; as the project progresses, certain aspects, such as the effectiveness of the willow plantings, may change.

Ideally, YGC could become a model stream restoration/education project for other classes on other Bitterroot Valley streams. There are two other degraded streams on TWR that another motivated Corvallis teacher could adopt. Moreover, if a proactive teacher from a school district other than Corvallis desired to use YGC, it might be prudent to adopt a stream closer to their school. Gary Decker, the Watershed Restorationist for the Bitterroot National Forest, stated that all valley stretches of Bitterroot River tributaries are unhealthy.

YGC will be organized in four binders, one for each visit. These binders will include the procedures for each of the summarized lessons, locations for
needed equipment, and relevant background information. An overview of material in each binder follows:
Year at Gird Creek

Overall Goals:
-To build an appreciation and value of the natural environment of Teller Wildlife Refuge.
-To gain an understanding of stream ecology.
-To discover how humans are related to the health of Gird Creek.
-To engage students in hands-on, empowering restoration activities that improve the health of Gird Creek.

Fall Visit

Unit Objectives:
-To build an awareness and familiarity for the stream environment.
-To learn about the varied fish and insects that inhabit Gird Creek.
-To generate enthusiasm for future visits to TWR.

*****Key Pre-visit Discussion Questions:
-What do we expect the land of TWR to look like?
-What do we think Gird Creek will look like?
-What types of fish and insects do we think live in Gird Creek?
-What other people might use TWR?
-How should we treat the land and the animals when we’re at TWR?

PRE-VISIT, IN CLASS ACTIVITIES:

Written and oral report on one aspect of TWR
To create general interest, students research a topic from a prepared list of natural and historical themes relevant to TWR. They prepare a short paper and, over a few class periods, present five minute oral reports of their findings to the class.
Create TWR journals

A class period is devoted to artistic expression by creating individual field journals for use during their visits to TWR.

FIELD ACTIVITIES: (full day, 5 1/2- 6 hours)

Who am I? game (group introductory game)

This is a good game to initiate a friendly, fun atmosphere to the day. Students pin a picture of a plant or animal on the back of another and then all circle about for 10 minutes, asking questions about their unrevealed animal in an attempt to find out what they are. Answers are limited to yes, no, or maybe.

-Introduce procedure of the day, discuss key questions and divide into groups for station activities.
  (Four stations, each approximately 1 hour.)

1. Gird Creek Nature Walk

This walk is intended to promote familiarity with Gird Creek and the stream environment. A quick introduction to the walk is provided and then students are given a Gird Creek Nature Walk Checklist for things to look for on their hike. Binoculars, hand lenses, camera and trash bags are also brought along. Remaining quiet and staying together are stressed. The walk will identify various restoration activities from prior classes.

2. Sensory Awareness Games

These three activities are designed to heighten students’ senses and awareness for the uniqueness in the natural world:

Magic spots- students find an individual spot to sit and work in their journals. Possible journal projects: sketches, poems, nature interview, bird calls.

Blind trail- students are blindfolded and guided by a roped path through varying sensory experiences (Cornell pg. 29).

Un-nature trail- students walk along a trail and try to identify various staged unnatural objects (Cornell pg. 40).
3. Fishing Around
Students explore the stream environment and discover the various fish that live in Gird Creek, and qualities of good fish habitat. They don waders and use nets to try to collect, analyze with a dichotomous key, and record specimens (Big Wood pg. 69). It is important to discuss respectful treatment of wildlife.
*A Fish, Wildlife, and Parks or Forest Service person might be able to participate.

4. Bug Fun
At this station students discover the insects that live in and around Gird Creek, and their unique life cycles. They’ll scrape rocks and use other sampling devices in an attempt to discover, and record, interesting findings (Clark Fork pg. 54, Hands On pg. 122). As in the fish station, it is important to discuss ethical handling of the insects.

-After the stations, students regroup for final activities.

Act out a Creek
Students pick a natural component (e.g. water, rock, fish, willow) of Gird Creek and role-play their component together to form a functioning stream. Manipulation of the varying components provides interesting changes to the stream.

Sharing session
To culminate the day, students and facilitators sit in a circle and each describes one thing of interest from their day. Field journal entries are encouraged to be shared. Discussion questions should be re-visited.

****Kev post-visit discussion questions:
-What did TWR look like?
-What did Gird Creek look like?
-What types of fish and insects did we find?
-How did we treat the land and the animals?
-What do we remember most from our day?
IN CLASS, FOLLOW-UP ACTIVITY:

Letter to TWR
To reinforce their experiences, students write a letter to TWR describing what they learned. They are also encouraged to make suggestions for their future visits.

Winter Visit

Unit Objectives:
- To gain an appreciation for natural and unnatural change that occurs in nature.
- To understand what animals do to survive the winter.
- To learn various outdoor skills.
- To learn how to be comfortable in the winter environment.

**** Key Pre-visit Discussion Questions:
- What changes do we expect to notice from our last visit?
- What will the animals and plants be doing?
- What changes can we observe from Lewis and Clark's time?
- How will we stay comfortable for our half-day at TWR in the winter?

IN CLASS, PRE-VISIT ACTIVITIES:

Then and Now
To initiate thoughts of change, students read excerpts from The Journals of Lewis and Clark. A discussion begins of the changes that have occurred in the Bitterroot Valley since Lewis and Clark. Aerial photos from 1937 and 1988 of TWR are provided for visual reinforcement. The changes the students come up with are listed on the board and connected to human activities.

Mapping
To gain a new perspective of the area of TWR, students work with topographic maps. They trace Gird Creek from the headwaters, through TWR to the Bitterroot River. To reinforce change concepts.
they try to observe what changes exist on the map since Lewis and
Clark’s time.

FIELD ACTIVITIES: (1/2 day, about 3 1/2- 4 hours)

How many fish can live in Gird Creek? (Group introductory game)
This game, adapted from Project Wild’s "How many bears can live in the
forest" has students role play fish and try to obtain food from a fixed,
limited amount. Changes are made in fish food supply with accompanied
results in the habitat’s carrying capacity identified (Project Wild
Elementary pg. 115).

-Introduce procedure of the day, discuss key questions and divide into groups
for station activities.
(Three stations, each approximately 45 minutes.)

1. Migration/Hibernation Station
To appreciate what animals do to survive a Montana winter, students play
a migration game with various barriers to observe the difficulties for
migrating birds. They use hands-on demonstration activities to learn
adaptations that local animals use to survive winter (Hands-on pg.88 &
131).

2. Winter Walk
Students walk along a different stretch of Gird Creek and focus on
natural, seasonal changes of the land. The walk culminates at a fence-
line boundary of adjacent private property. This dramatic contrast of
Willow Creek highlights impacts of grazing to a stream.

3. Survival Skills
To participate in a fun, warming and different activity, students learn
various outdoor skills: fire making, cooking, shelter making. Various
sources, such as Boy Scout books are used. Local residents with
particular skills should be invited.

After stations, students re-group for final activities.
Owls and Crows
In this highly physical, warming game, students play a variation of tag in response to relevant questions from the concepts learned during the day (Cornell pg. 73).

Artistic Then and Now
If time and temperature permit, students use their TWR field journals and quiet time to draw a picture that Lewis and Clark might have seen, and then one of today. After, a discussion ensues of the differences in the two drawings. Questions concerning the related human activities that have caused these changes are introduced.

****Key Follow-up Questions:
- What changes did we notice from our Fall visit?
- What do the animals do during the winter?
- What differences did we imagine from Lewis and Clark's time?
- What do we think caused these changes?
- Are these changes unnatural? Good or bad?
- Did we stay comfortable during the day?

IN CLASS, FOLLOW-UP ACTIVITY:

Change, Change, Change
In this issues analysis activity, students read recent newspaper articles concerning fish populations in the Bitterroot Valley and discuss what changes have occurred, and what future changes they foresee. They then construct a time-line to place these changes in an historic context (Clark Fork pg. 18). Other articles that discuss environmental changes are available.

Early Spring Visit

Unit Objectives:
- To introduce the ecological concepts of habitat and watershed.
- To establish the parameters of a healthy stream habitat.
- To teach students how to measure the health of Gird Creek.
- To understand ways humans have changed the health of Gird Creek.
*****Kev Pre-Visit Discussion Questions:
- What things would we expect to see in a healthy stream?
- What things would we expect to see in an unhealthy stream?
- Do we think Gird Creek is healthy or unhealthy?
- How might a stream change in health?
- What things make up a habitat?
- What does a watershed look like?

IN CLASS, PRE-VISIT ACTIVITIES:

What makes a healthy stream?
After reading background materials on stream ecology, students brainstorm what they feel makes for a healthy stream and riparian area. They then produce a field data sheet they’ll use to assess the health of Gird Creek. A sample data sheet will be used to make sure important parameters are not forgotten (Green pg. 14).

It all flows together
To visualize how water flows, students create a physical model of a watershed (Big Wood pg. 12). They then role play a river to see what happens when human things, such as pollutants, enter the watershed and flow downstream (Big Wood pg. 23). Healthy water quality parameters will be introduced (Big Wood pg. 67).

FIELD ACTIVITIES (full day, 5 1/2 to 6 hours)

Habitat Lap Sit (introductory group game)
To start the day with a fun game, students role-play the stream habitat components of food, water, shelter, and space to form an interrelated, physical unit. When we alter the habitat, by removing food for example, we notice dramatic changes in the stability of the habitat unit (Project Wild Secondary pg. 33).

- Introduce procedure of the day, discuss key questions and divide into groups for station activities.
  (Four station, each approximately 1 hour.)
1. Stream Detectives
   Students use their pre-determined parameters of stream health to assess the relative health of Gird Creek. Two transects will be established and observations made concerning riparian vegetation, stream habitat, and wildlife sign. Data from previous insect, fish, and water quality observations will also be used.

2. Water Quality Testing
   Students use TWR’s water quality testing equipment to measure various parameters of Gird Creek’s water quality: dissolved oxygen, temperature, sediment, phosphates, and velocity. Data are recorded and used in conjunction with overall stream health assessment (Clark Fork, Big Wood, Stapp).

3. Watershed of Life
   A pre-determined "mini-watershed" site is located where students map and measure the area. They then participate in a fun game to realize the extent of an average household’s water use. Pretending they live before plumbing, they carry a short distance the actual amount of water a household uses in day (MT Wet pg. 52).

4. Willow Cuttings
   Before obtaining cuttings, students spend time examining various twigs still in winter form and learn how to identify them. With TWR’s Restoration Coordinator they gather willow cuttings to be used for the Late Spring visit’s plantings. They are prepared for planting by being placed in a sack, partially submerged in the creek. Some cuttings are brought back to class for experimentation (Big Wood pg. 130).

Students regroup after stations for final activities.

Thirsty Deer
   To reinforce habitat components and build a thirst, students play a physically tiring game of "Oh Deer" (Project Wild Elementary pg. 131). They then play, "Pass the Jug" (MT Wet) where students pour drinking cups of a limited supply of water. They discover how it feels when there is not enough water to satisfy the last, downstream students.
*****Key Follow-up Questions:
- Have we noticed any changes from past visits?
- What did we discover makes up a good stream habitat?
- What did we learn of the water quality and vegetation of Gird Creek?
- Do we think Gird Creek is healthy or unhealthy? Why or Why not?
- What human activities have effected Gird Creek?
- Should we try to make Gird Creek healthier?
- What could we do?

IN CLASS, FOLLOW-UP ACTIVITIES:

Town Meeting Role Play
In this values clarification exercise, a hypothetical scenario is developed around a controversial water issue: damming a tributary, building a mine or logging near a stream. Students are assigned varying community roles and asked to present the varying perspectives. Attempts are made to find solutions for balancing the varying ideas.

Willow cuttings experiments
The willow cuttings from TWR are experimented with in-class. Students manipulate possible environmental factors such as light, sediment, fertilizer, water, browsing, etc.

Late Spring Visit

Unit Objectives:
- To learn how to perform various stream habitat restoration activities.
- To be empowered in our abilities to make positive changes.
- To discover ways that humans affect streams.
- To instill ownership and responsibility towards Gird Creek.

*****Key Pre-Visit Discussion Questions:
- What did we decide about the health of Gird Creek from our last visit?
- Should we try to improve the health of Gird Creek? Why or Why not?
- What would happen if we didn’t do anything?
- Why do we need to restore Gird Creek?
-What do we want Gird Creek to look like when we’re done? How about in 10 years? 100 years?
-How are we going to restore Gird Creek?

IN CLASS, PRE-VISIT ACTIVITIES:

Water-use survey
A water-use chart is used that describes the amounts of water that various everyday activities consume. Students then determine their average household use and attempt to lessen it (MT Wet pg. 61, Clark Fork pg. 22).

Restoration Plan
This empowering activity lays the important value foundation for restoration activities. After reviewing their stream health assessment students decide upon a restoration plan. Different strategies for improving the overall health of Gird Creek are proposed. Important value questions concerning restoration will be discussed.

FIELD ACTIVITIES (Full day, 5 1/2 to 6 hours)

Pyramid of Life (introductory group activity)
In this fun game, students become an actual physical food pyramid of producers, herbivores, and carnivores. They discover the appropriate proportions of each that produces a self-sustaining unit (Cornell pg. 52). Alterations on proportions produces interesting results.

-Introduce procedure of the day, discuss key questions and divide into groups for station activities.
(Four stations, each approximately 1 hour).

*Note- These activities require coordination with TWR’s Restoration Coordinator to ensure appropriate methods.
-Photographs will be used to document the effort.
1. Willow planting and deer protection
   Their restoration plan is put into action as students perform the restoration tasks of planting and protecting willows. The procedure is outlined and demonstrated. Each planting is flagged with students’ names and protected from deer browse with cages or nets.

2. Fish Habitat Improvements
   Physical stream improvements such as shoveling sediment from the stream bottom, securing downed logs to create pools, and adding riffles are performed.

3. Grubbing Exotics
   The students set up and mark three knapweed (or other non-natives) control test plots. They will mulch, pull, and cover small areas of knapweed. (Removal of exotic species should have been identified in their restoration plan.)

4. Natural Fun
   These awareness activities are meant to build upon earlier visits. Students return to their previously selected magic spots for more journal entries. A micro-hike is conducted where students carefully examine small sections of ground (Cornell pg. 47). A web of life game is played that illustrates the inter-connectedness of all living things (Cornell pg. 57). Finally, students take another student to their magic spot to share something of interest.

Students regroup after stations for final activities

Sharing Session
   Students and facilitators form a circle and share memories from their Year at Gird Creek. The discussion should highlight the positive actions taken to improve Gird Creek and what they can do to take good care of Gird Creek. They are given a follow-up assignment of changing one lifestyle behavior that will help Gird Creek. If they successfully undertake this behavior for a month they will receive a badge as official TWR Junior Rangers.
Key Follow-up Discussion Questions:
- How do we feel about our Year at Gird Creek?
- Have we made Gird Creek healthier?
- How have we learned people affect stream health?
- What can we do to continually help Gird Creek?
- How could we help other creeks or areas in the Bitterroot Valley?

IN CLASS, FOLLOW UP:

Working to change others
To follow-up on YGC, students research and learn how to become involved in an issue. Different methods such as talking to neighbors, writing letters, attending community meetings, and starting an advocacy group are discussed (Green). Positive, success stories of change for the environment should be mentioned.

Busting at the Seams
To place their experiences in an appropriate context, students read and discuss a recent newspaper article describing the population boom of Ravalli County. Questions concerning the Bitterroot Valley's carrying capacity and what students can do are introduced.
Curriculum Resources

Acclimatizing, A Personal and Reflective Approach to a Natural Relationship, Steve Van Matre, 1974, American Camping Association, Bradford IN.


Earthkeepers, Four Keys For Helping Young People Live in Harmony with the Earth. 1987, Steve van Matre, Institute for Earth Education, Greenville WV.


Montana Wet, Water Education for Teachers. 1991, Project Wet Montana, MT Water Resources Research Center, Bozeman MT.


Stream Team Handbook. 1992, City of Olympia, Public Works Department, Olympia WA.
Chapter 5

Where do we go from here?

Over the past two years, many groups and individuals collaborated to develop an EE program at TWR. TWR formed an EE Committee and established a room on the property devoted to EE purposes. I conducted presentations and surveys to six nearby schools to increase awareness of educational opportunities at TWR and generate constructive feedback from teachers. The EE committee held an open-house to further familiarize Bitterroot Valley teachers with TWR. TWR hired a temporary, part-time EE coordinator, Jill Maus, who designed and piloted educational units for Corvallis' grades 1-4 fall visits. Finally, I developed a year-long educational unit for Corvallis 6th grade.

These measures were apparently effective in increasing educational use of TWR as 1994 school group use doubled over any previous year. I believe, TWR possesses a sound EE infrastructure. The combination of the preserved land, the restoration project, the growing community recognition, the EE Coordinator and Room, the prepared materials, the Small Grants for Education
fund, and the outreach effort will ensure future use of TWR by Bitterroot Valley schools.

These were positive steps towards a structured EE program at TWR, but they illuminated pressing needs for future actions. Ensuring that the EE offered at TWR is effective, I have learned, takes longer than two years. Therefore, I now present my recommendations to TWR for continuing and improving upon the effort.

1. Expand TWR's Environmental Education Committee.

I believe a major weakness of the EE program at TWR is the lack of a coordinated, substantial committee effort. TWR's EE Committee failed to hold regular meetings, and meeting attendance was limited to an average of 2-4 individuals. Proposed actions were rarely the product of diverse input. The steps taken from committee were sound, however, we could significantly expand our support base by expanding the EE committee to include more and diverse members.

Case studies and research on incorporating EE or other change efforts into schools point to active, substantial, and diverse advisory committees as critical to success (Clark, 1989, Euler 1981). Dahlem Environmental Education Center in Michigan, for example, established productive educational relationships with local schools. They cited "an active advisory committee
comprised of teachers, administrators, parents, and community members" as the key to winning support for their program (Monroe 1984). Sandy Union High School in Oregon effectively incorporated innovative Science skills into their curriculum. An advisory committee "spread interest to community members and parents. With broad-based public support a new, innovative educational approach has a better chance of succeeding (Crow 1986)". On a larger scale, the Tacoma Washington initiative at curriculum reform utilized a 28 member main committee and "action planning teams" of over 400 individuals (Tacoma 1983).

I recommend building a TWR EE Advisory Committee comprised of at least 12 members of diverse Bitterroot Valley interests. Teachers of varying districts and subjects, parents, university representatives, and community members should be included and involved in the decision process. Furthermore, this expanded EE Advisory Committee must meet regularly for discussion. Any educational initiative needs widespread community support to succeed. TWR's goal to expand the controversial notion of EE in the conservative Bitterroot Valley will not be fully achieved until there is broad-based support.

A united front of interested Bitterroot Valley parties, instead of just TWR, would be more effective in fostering school boards to initiate change in the schools. For example, Bitterroot Ecological Awareness for the Resource (BEAR) collaborated with key teachers from the Hamilton school district. The
Teaming of these teachers and the BEAR representatives enabled them to convince Hamilton's School Board to allocate funds towards BEAR's efforts (Wall-MacLane, personal communication, March 1995). Promoting schools as advocates for EE at TWR would help the program tremendously, especially given TWR's limited financial support.

In a paper on school reform, James Shymansky stated that "the process of reform is as important as the product. Participants in the reform process must become, and see themselves becoming, actively involved in the planning, acting, observing, and reflecting stage" of reform efforts (Shymansky 1990). This holistic approach to reform has often been referred to as "systemic change" (Hall 1992). Additionally, in Curriculum Change from the Grassroots, David Martin compared school change to "social change" (Martin 1990). In essence, when we create an active and diverse EE Advisory Committee, we enhance EE opportunities to the entire Bitterroot Valley community, not just the young students.

This expanded EE Advisory Committee will help fulfill the vital role of outreach. Previously, a representative from TWR, such as myself, went to the schools to promote EE opportunities. Ideally, with the new committee, schools and community will already have ownership in TWR's decision-making and planning. Moreover, this diverse EE Advisory Committee could assist in building partnerships with different entities in the Bitterroot Valley. TWR could
then more effectively network with land management agencies, conservation associations, educational groups, the universities and the like to produce a strong coalition for EE in the Bitterroot Valley. Finally, all of the following recommendations and proposed actions would greatly benefit from a diverse EE Advisory Committee offering input.

2. Create an Environmental Education Plan for TWR.

TWR should establish an overall theme for the EE program. I have proposed utilizing the ongoing habitat restoration project to produce empowering, hands-on learning as the educational theme. However, this theme is only one of many available for TWR. For example, the Yosemite National Institute in California has identified "inter-connectedness, a sense of place, and stewardship" as the three core educational themes that all activities must somehow touch upon (Yosemite 1991). An EE plan would identify the overarching theme that varying EE topics and measures at TWR should relate to.

Three primary EE measures exist in the preliminary stages at TWR: the educational units, the EE Room, and an interpretive trail. An overall EE Plan would coordinate these components for a school group's field trip. For example, a school group might start a visit at the EE Room, conduct field activities and walk the trail, and then return to the EE Room for extension
activities. The utility of these EE entities would be increased if they were used to complement each other.

Another critical aspect of the overall plan would be to assess the quantity and ecological impact of educational use at TWR. In 1994, 1,730 students visited at TWR. The EE Advisory Committee should collaborate with TWR’s Restoration Advisory Committee to determine the educational carrying capacity of the land. At some point, TWR might have to start limiting the amount of use. Otherwise, TWR might fall into a Catch-22 scenario of bringing students to participate in restoration work, only to impact the land further. We do not want to add EE to the long list of detrimental activities to the land at TWR.

An EE Plan could identify areas other than TWR that school groups could use for EE purposes. The Selway-Bitterroot Wilderness to the west and the Sapphire Mountains to the East are huge natural areas that receive sparse EE use. Promoting the use of these areas would disperse educational use impacts and fulfill different educational niches.

3. Develop methods to evaluate the EE provided at TWR.

The second initial, identified goal for this project was to ensure that the EE offered at TWR supports the ultimate objective of producing positive values and behaviors towards the land. TWR has not yet established formal techniques to determine if the EE program is advancing these goals. TWR should develop
long-term, continual evaluation methods to assess the program's effectiveness. For example, research projects could track students as they progress through years of educational visits at TWR in an attempt to discern if environmentally responsible values and behaviors are being shaped.

Educational representatives from TWR rarely observed or participated in activities before or after the field trips. We only recommended appropriate activities to the teacher and hoped (s)he would implement them. The success of EE at TWR in achieving the goal of instilling positive values and behaviors towards the land is dependent upon proper in class preparation and follow-up. The field experience should be viewed as just one part of the EE process.

Consequently, we must understand the extent and type of in-class tie-ins teachers make. Surveys of the teachers, phone-calls, and direct observation of classes before and after visits would be helpful to assess our overall effectiveness. We should also explore the idea of requiring in-class preparation before a field trip.

Similarly, we should ask the teachers about their experience at TWR. A field trip follow-up survey asking teachers their opinion of the procedures at TWR and suggestions for improvement would help improve our offerings.
4. Offer more teacher training opportunities at TWR.

The educational priority at TWR has been to create units of prepared materials for use on field trips. However, developing a detailed workable unit is incredibly time consuming and TWR's EE resources are extremely limited. Although these units are useful and effective in encouraging teacher-use at TWR, I do not believe they are the most efficient method.

For EE to be successful at TWR, I believe we should create opportunities to teach teachers how to create their own effective EE experience. Our expanded EE Advisory Committee could share their expertise with less experienced teachers. In essence, we should strive to empower teachers in their abilities.

Training teachers to assist in the design of the field trip, I feel, would ultimately produce more effective EE at TWR. The educational experience would better complement each teacher's unique style and curriculum content if the teacher was directing the effort. Moreover, the nature of the field experience at TWR is to divide into station activities that are staffed by volunteers. Teachers need to be able to train these volunteers to staff effectively these stations.

Teacher training at TWR obviously requires increased participation and responsibility from the teacher. Consequently, we must be aware of the logistical limitations placed upon teachers and aid their efforts with our support.
base of education specialists, materials, and equipment. When we create the broad-based community support for EE, I'm optimistic teachers will take on the extra effort to instill EE into their curriculum.

5. Explore alternative education models.

EE at TWR has assumed the particular niche of field trips for school groups. This model has its merits but also limitations. I am not sure that a few-hour visit, a few times a year is an extensive enough field component to foster positive values and behaviors towards the land.

Other models of EE programs exist. Some, such as Glacier Institute in Montana and Yosemite Institute (YI), offer a 2-5 day residential, fee-for-service approach in addition to day trips. Brian Empie, Executive Director of YI said that an overnight stay "transcends what goes on academically to help build a true sense of place (Empie, personal communication, March 1995)." He is convinced that parents will pay the modest fee for this valuable educational service. YI supports a staff of instructors who work closely with the school teacher to plan an appropriate experience. The instructors then supervise the educational activities. The cost of YI is about $35-$40 per day for instruction, meals, and lodging.

Expedition Yellowstone is a 3-5 day educational residency program in Yellowstone National Park. Students are led by park naturalists through
educational activities and stay in renovated bunkhouses. Teachers and students prepare their own meals in furnished kitchens. The program has become extremely popular and receives about three times as many requests as it can fill. Richard Jehle, Yellowstone National Park ranger and director of Expedition Yellowstone, stated that the program recently instituted a fee of $12 per night per student to cover operating costs. So far, the fee system has not received objection nor decreased use (Jehle, personal communication, March 1995).

TWR possesses three renovated homesteads that are used as accommodations. Conceivably, these facilities could be used in their down-times during the week and school-year for residential educational purposes. A small fee could be charged to the parents to cover the overhead costs for this project. Additionally, EE use of adjacent natural areas such as the Selway-Bitterroot Wilderness would complement this residential approach. This model requires considerable re-working of the present EE direction at TWR but is worth exploring.

Similarly, TWR possesses opportunities for students to perform extensive "service learning" projects at TWR. The Montana Conservation Corps and the Student Conservation Association are two organizations that place youth crews in outdoor areas to participate in conservation projects. TWR's habitat restoration project would make an ideal summer internship for a crew of motivated youths.
The Environmental Writing Institute at TWR has gained nation-wide recognition and is another effective educational model. TWR could offer other similar residential workshops to older, experienced learners. Potential workshop topics relevant to TWR are: restoration/education, sustainable agriculture, and private land conservation practices. This workshop model could also be combined with teacher-training to produce a residency workshop for local teachers.

These are a few alternative models of EE for TWR to explore. The present educational model of field trips for school groups is good, but TWR should do more. TWR could more fully realize its EE potential by offering varying levels of educational experience and involvement.

6. Create a permanent, full-time EE coordinator at TWR.

Maus’ position as EE Coordinator was funded by external grant funds which will expire in May, 1995. TWR has just recently created a permanent, one-quarter time EE Coordinator position. However, I do not believe ten hours per week is adequate to fulfill the necessary EE responsibilities at TWR. The recommended, expanded EE Advisory Committee should assist in the identification and formulation of tasks, but I feel TWR needs a full-time position to perform the necessary, multi-faceted EE responsibilities. It is
unlikely that the above recommendations can be implemented without a full-time EE Coordinator.

I believe the priorities for the EE Coordinator at TWR should be to:

1. Organize and direct the EE Advisory Committee and their meetings.
2. Develop an overall, long-range EE Plan.
3. Coordinate the logistics and educational content of school field trips.
5. Design methods to evaluate the EE provided.
6. Offer teacher training opportunities.
7. Explore alternative EE models.
8. Seek external funding sources.

7. Solicit support for EE purposes from TWR’s Board of Directors.

The TWR Board of Directors is the entity that will ultimately decide to create a full-time EE Coordinator. Unfortunately, financial realities indicate that TWR will not be able to internally allocate additional funds for an EE Coordinator. I see promise, though, in obtaining external funding from grants and contributions. TWR possesses attractive attributes for funding sources: an operating endowment, land protected by conservation easements, and active community projects. I do not believe the EE Coordinator should be burdened
with the extra responsibilities of grant-writing. Instead, TWR’s Board of Directors should become proactive in obtaining funding, or hiring professional grant-writers to support their stated goals, such as EE. In short, we must explore EE measures aimed at TWR’s own Board of Directors.

There is a belief in the EE world that our best hope for fighting environmental destruction lies with educating the young. I still believe EE for children is critically important. However, I also see now that this approach is limited in its effectiveness. This project has highlighted for me the need to consider EE measures for teachers, administrators, school boards, Boards of Directors, and the community. If we do not remember to educate adults on the need for positive values and behaviors towards the land, then we may never get the opportunity to teach to our children.
Chapter 1 References


Chapter 2 References


Ravalli County Chamber of Commerce. 1993. Ravalli County Community Profile.


Chapter 3 References


Chapter 5 References


Monroe, Martha C. 1984. "Building the Gap Between the Natural and the Built Environment with Nature Center Programs." Dahlem Environmental Education Center, Jackson MI.


Appendix A

TWR’s Small Grants for Education Information
REQUEST FOR PROPOSALS

Small Grants for Education

The Teller Wildlife Refuge, Inc. is again pleased to request proposals for small grants from schools in the Bitter Root Valley to encourage educational use of the Teller Wildlife Refuge, a private wildlife refuge near Corvallis. The intention is to provide assistance with travel expenses, modest teaching supplies, and other reasonable expenses. We hope to encourage teachers and students in our community to become familiar with the Teller Wildlife Refuge and the possibilities for educational experiences here.

The Teller Wildlife Refuge contains reclaimed rangeland, creeks, ponds, and riparian areas along the Bitter Root River. There are areas suitable for nature study, wildlife viewing, and similar activities.

New in 1994 is the Environmental Education Room (the EE Room), just north of the Refuge office on Chaffin Road. It is quite bare at this time, and we look forward to working with local educators in setting it up as a permanent classroom with interpretive displays and educational information that will add to visitors experience here. We also have a list of local resource people available for tours and educational programs.

TWR's Education Committee will review Proposals for Small Grants and will notify applicants of their decision within two weeks of submission of the grant request. Proposed activities can be planned up to one year in advance. We look forward to hearing from you!

Send Proposals To: Teller Wildlife Refuge
1292 Chaffin Road
Corvallis, MT 59828

If You Have Any Questions Call:

Chris Miller, manager at 961-3507 (office) or 961-3669 (home)
Proposal for Small Grant for Education in 1994

Teacher's Name: _____________________ Telephone: ___________________
School: ______________________________ Telephone: ___________________
Grade: __________________
Number of students: __________

Proposed Date and Time of activity: (date) __________ (time) __________
Description of Activity: _____________________________________________

Accounting of Requested Funds:
Travel Expense: ______________________________________________________
Teaching Supplies: ____________________________________________________
Tour with tour guide: $15/1 hour, $10/ea. additional hour: _______________
Day Use of Tent Camp: (max.: 25 people) $25: _______________
Overnight Use of Tent Camp: (max.: 8 people) $50: ___________
Wagon and driver: $50: ___________
Other: _______________________________________________________________________
Other: _______________________________________________________________________

Total Grant Request: ________________

Other comments: ___________________________________________________________________

Applicant's Signature: __________________________
Date: __________________________

Return completed application to: Teller Wildlife Refuge
1292 Chaffin Road
Corvallis, MT 59828

If you have questions, call: Refuge manager at 961-3507
Appendix B

TWR’s Environmental Education Resource List
Montana Department of Fish Wildlife and Parks has made the following items available for use. These items are located in the Environmental Education Room or can be borrowed directly from PWP.

- 5 Rain Ponchos
- 6pr. Wading/Hip Boots
- 1 Pond Raft (PWP)
- 1 Slide Series on aquatic insects, fish (PWP)
- 1 Color laminated fish etc. pictures (PWP)
- Small Library of reference books and videos

**Montana Evergreen ID Book**
- Golden Guide-Fond Life
- Birds of W. America
- Oceanography
- Observing Insect Lives-Stokes
- How to Do Successful Science Projects
- Carolina Marine Aquaria
- Carolina Freshwater Aquarium Handbook
- Environmental Science:
- Science Fair Projects
- Frogs and Toads
- Carolina Arthropod Manual
- Projects in Wildlife Watching
- Representative Aquatic Insects Sets (slide program)
- Birder's Handbook
- Field Guide to Habitat
- Now the Wonder of Wetlands
- Project Wild Elementary
- Project Wild Secondary
- Project Aquatic
- Environmental Ed. in Schools
- Sharing the Joy of Nature
- Sharing Nature with Children
- Aquatic Entomology
- Nymphs
- Aquatic Insects of W. America
- Bigwood River & Silver Creek Ed. Project

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**Reference Materials**

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<td>Cloud Chart</td>
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<td>1</td>
<td>Land Form Model</td>
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<td>Land Forms Photo Set</td>
</tr>
<tr>
<td>1</td>
<td>Needs Chart</td>
</tr>
<tr>
<td>1</td>
<td>Pine Forest Chart</td>
</tr>
<tr>
<td>1</td>
<td>Meadows Chart</td>
</tr>
<tr>
<td>2</td>
<td>Plant Presses</td>
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<tr>
<td>1</td>
<td>Soil Sampling Tube</td>
</tr>
<tr>
<td>1</td>
<td>Ph-700 soil meter</td>
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<tr>
<td>1</td>
<td>Soil Thermometers</td>
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<tr>
<td>1</td>
<td>Big Screen Microscope</td>
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<tr>
<td>1</td>
<td>Plant Slide Kit</td>
</tr>
<tr>
<td>1</td>
<td>Insect Slide Kit</td>
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<tr>
<td>20</td>
<td>Copies of the Montana Evergreen ID Books</td>
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<tr>
<td>1</td>
<td>Lemott Water Sampl. Kit</td>
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<tr>
<td>1</td>
<td>Wildco Sutber Stream</td>
</tr>
<tr>
<td>1</td>
<td>Stream Bottom Sampler</td>
</tr>
<tr>
<td>1</td>
<td>Stereomicroscope #1</td>
</tr>
<tr>
<td>1</td>
<td>Stereomicroscope #2</td>
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<td>9</td>
<td>Magnifying jars</td>
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<tr>
<td>3</td>
<td>Insect Nuts</td>
</tr>
<tr>
<td>1</td>
<td>Leaf I.D. Kit</td>
</tr>
<tr>
<td>1</td>
<td>Acid Rain Test Kit</td>
</tr>
<tr>
<td>1</td>
<td>Poster Set; Pond, Forest, Ocean, Grassland</td>
</tr>
<tr>
<td>1</td>
<td>Binoculars 7x35</td>
</tr>
<tr>
<td>12</td>
<td>Droppers</td>
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<td>8</td>
<td>Petri Dishes</td>
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<tr>
<td>10</td>
<td>Dissecting needles</td>
</tr>
<tr>
<td>10</td>
<td>Forceps</td>
</tr>
<tr>
<td>2</td>
<td>Scissors</td>
</tr>
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<td>2</td>
<td>Large Bulb pipettes</td>
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<td>100</td>
<td>Packet Folders</td>
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<tr>
<td>4</td>
<td>Kites</td>
</tr>
<tr>
<td>7</td>
<td>Magnifiers</td>
</tr>
</tbody>
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**Montana Wildlife Refuge 1200 Chaffin Road, Corvallis, MT**

Call the Refuge Manager at 961-3507 to schedule field trips.

The Environmental Education Room will be opened from 4:00 p.m. to 5:30 p.m. Tuesdays and Fridays for checking out and returning materials.
<table>
<thead>
<tr>
<th>POSTERS - PLANTS/HYDROCARBON</th>
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<tbody>
<tr>
<td>PM-1 Wood Products</td>
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<tr>
<td>PM-2 Wildflowers</td>
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</tr>
<tr>
<td>PM-3 Trees</td>
<td></td>
</tr>
<tr>
<td>PM-4 Mushrooms</td>
<td></td>
</tr>
<tr>
<td>PM-5 Noxious Weeds</td>
<td></td>
</tr>
<tr>
<td>PM-6 Minerals</td>
<td></td>
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</tbody>
</table>

| POSTERS - WILDLIFE            |     |
| PW-1 Swan/Goose              |     |
| PW-2 Wild Geese              |     |
| PW-3 Endan.Sp. (US)          |     |
| PW-4 Endan.Sp. (World)       |     |
| PW-5 Endan.Sp. (Sea Turtle)  |     |
| PW-6 Endan.Sp. (Arctic)      |     |
| PW-7 Endan.Sp. (A-Z)         |     |
| PW-8 National Wildlife       |     |
| PW-9 National Wildlife       |     |

| Week Activities              |     |
| PW-10 Predators (Barn Owl)   |     |
| PW-11 Predators (Leopard)    |     |
| PW-12 Various Species       |     |
| PW-13 Nat. Wildlife Week    |     |
| PW-14 Migratory Bird Routes |     |
| PW-15 Blk (Hunting)          |     |
| PW-16 Heron                  |     |
| PW-17 Insects                |     |
| PW-18 Bird Nests             |     |
| PW-19 Birds                  |     |
| PW-20 Snakes                 |     |
| PW-21 Lizards                |     |
| PW-22 Butterflies            |     |
| PW-23 Fish                   |     |
| PW-24 Tracks                 |     |
| PW-25 Mammals                |     |
| PW-26 Song Birds             |     |
| PW-27 Wolf                   |     |

<table>
<thead>
<tr>
<th>POSTERS - ECOCLOGY</th>
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<tr>
<td>PE-1 Nat. Wildlife Week</td>
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<td>PE-2 Rainforests</td>
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<tr>
<td>PE-3 Wolves</td>
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<tr>
<td>PE-4 US Wetlands</td>
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<tr>
<td>PE-5 Fire's Role-Nature</td>
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</tr>
<tr>
<td>PE-6 Habitat-Species List</td>
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<tr>
<td>PE-7 Wetlands</td>
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<tr>
<td>PE-8 Hazardous Waste</td>
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<tr>
<td>PE-9 Cloud Chart</td>
<td></td>
</tr>
<tr>
<td>PE-10 Pond Poster</td>
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</tr>
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<td>PE-11 Forest Poster</td>
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</tr>
<tr>
<td>PE-12 Ocean Poster</td>
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<td>PE-13 Grassland Poster</td>
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<td>PE-14 Landform Posters</td>
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<td>PE-15 Wetland Habitat</td>
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</table>
Appendix C

TWR Teacher Survey
**Teacher Survey for the Teller Wildlife Refuge (TWR)**

Name____________________   School_____________________
Grade____________________   Class_____________________

1. How often do you take your class out-of-doors for educational purposes?  
   Which locations?

2. Subjects/Activities taught?

3. Do you incorporate environmental education in your class?  
   Yes, in what form?  If no, why not?

4. Have you considered taking, or have you taken, your class to the TWR?  
   Yes, for what purposes?

5. Which educational topics/activities might you incorporate with a visit to the TWR?  
   - Local History
   - Plant/Animal Surveys
   - Reading Assignments
   - Water Quality Tests
   - Math Problems
   - Current Resource Issues
   - Musical/Artistic Expression
   - Biology
   - Chemistry
   - Writing
   - Refuge Improvements
   - Habitat Monitoring

6. If others, Please describe:

7. Would you be interested in taking your class to participate in hands-on habitat restoration activities at the TWR?

8. Please describe the major obstacles you face concerning taking your class to the TWR.

9. What suggestions do you have for encouraging teacher use of the TWR?, and any additional comments or suggestions, please use back.   ____________

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Appendix D

TWR Teacher Survey Response Sheet
Teacher Survey Response Sheet
(52 total responses)

How often do you take your class out-of-doors for educational purposes?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Total Responses</th>
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</thead>
<tbody>
<tr>
<td>1-2 times per year:</td>
<td>7</td>
</tr>
<tr>
<td>3-4 times per year:</td>
<td>8</td>
</tr>
<tr>
<td>5-6 times per year:</td>
<td>1</td>
</tr>
<tr>
<td>1-2 times per month:</td>
<td>7</td>
</tr>
<tr>
<td>More than 2 times per month:</td>
<td>7</td>
</tr>
</tbody>
</table>

*25 non-responses

Which locations?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. School Grounds</td>
<td>22</td>
</tr>
<tr>
<td>2. Teller Wildlife Refuge</td>
<td>15</td>
</tr>
<tr>
<td>3. Lee Metcalf Nat. Wildlife Refuge</td>
<td>5</td>
</tr>
<tr>
<td>5. Lake Como</td>
<td>4</td>
</tr>
</tbody>
</table>

Subjects/Activities taught?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Science:</td>
<td>15</td>
</tr>
<tr>
<td>2. Math:</td>
<td>6</td>
</tr>
<tr>
<td>3. Art:</td>
<td>6</td>
</tr>
<tr>
<td>4. Social Studies:</td>
<td>5</td>
</tr>
<tr>
<td>5. Ecology:</td>
<td>4</td>
</tr>
</tbody>
</table>
Do you incorporate environmental education in your class? If yes, in what form? If no, why not?

Yes: 37

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Issues, (pollution, conservation, recycling, etc.): 15</td>
</tr>
<tr>
<td>2.</td>
<td>Science: 10</td>
</tr>
<tr>
<td>4.</td>
<td>Integrated Disciplines: 5</td>
</tr>
</tbody>
</table>

No: 9 (No responses)

Have you considered taking, or have you taken, your class to the TWR? If yes, for what purposes?

Yes: 26

(Ecology/Science/Nature Awareness)

No: 16

No, but with new information, yes: 11

Which educational topics/activities might you incorporate with a visit to the TWR?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total Responses</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Writing 29</td>
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<tr>
<td>2.</td>
<td>Local History 25</td>
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<tr>
<td>3.</td>
<td>Plant/Animal Surveys 23</td>
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<td>4.</td>
<td>Habitat Monitoring 21</td>
</tr>
<tr>
<td>5.</td>
<td>Biology 18</td>
</tr>
<tr>
<td>6.</td>
<td>Math Problems 17</td>
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<tr>
<td>7.</td>
<td>Refuge Improvement 14</td>
</tr>
<tr>
<td>9.</td>
<td>Musical/Artistic Expression 13</td>
</tr>
<tr>
<td>10.</td>
<td>Water Quality Tests 13</td>
</tr>
<tr>
<td>11.</td>
<td>Reading Assignments 9</td>
</tr>
<tr>
<td>12.</td>
<td>Chemistry 6</td>
</tr>
</tbody>
</table>
Would you be interested in taking your class to participate in hands-on habitat restoration activities at the TWR?

**Total Responses**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td><strong>Yes</strong></td>
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<tr>
<td><strong>No</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Not Sure</strong></td>
<td>6</td>
</tr>
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</table>

Please describe the major obstacles you face concerning taking your class to the TWR.

**Rank**

<table>
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<th>Obstacle</th>
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<td>2. Putting it together:</td>
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<tr>
<td>3. Subject Appropriateness:</td>
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<tr>
<td>4. Departmentalized, Enough parents:</td>
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<tr>
<td>5. Age level, Transportation, Schedules:</td>
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<tr>
<td>6. Money, Handicapped:</td>
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What suggestions do you have for encouraging teacher use of the TWR?, and any additional comments or suggestions, please use back.

**Rank**

<table>
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<tr>
<th>Suggestion</th>
<th>Total Responses</th>
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<td>1. More Information:</td>
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<td>2. On-site Training:</td>
<td>8</td>
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<tr>
<td>3. Guides:</td>
<td>2</td>
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