



SHEYENNE NATIONAL GRASSLANDS

An Ecological Learning Center and Trail Enhancement in Ransom and Richland Counties of North Dakota

May 2017



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SHEYENNE NATIONAL GRASSLANDS


an ecological learning center and trail enhancement in Ransom
and Richland counties of North Dakota

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By

Hannah Roach

In Partial Fulfillment of the Requirements
for the Degree of
Bachelor of Landscape Architecture

A handwritten signature in black ink, appearing to read "Jim Hest", written over a solid black horizontal line.

Primary Thesis Advisor

A handwritten signature in black ink, appearing to read "Kathleen C. Pepple", written over a solid black horizontal line.

Secondary Thesis Advisor

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Fargo, North Dakota

THESIS ARCHIVAL NOTE

The following thesis project, entitled Sheyenne National Grasslands: An Ecological Learning Center and Trail Enhancement in Ransom and Richland Counties of North Dakota, was composed over the course of the 2016-2017 academic school year. The Thesis Program, as contained here, was initiated and completed in the fall semester as a part of the LA 563: Programming and Thesis Preparation course. Supplemental material, including the Thesis Boards and the Thesis Presentation documents, were generated in the spring semester as a part of the LA 572: Design Thesis studio. Any inconsistencies between the different documents, in terms of research and design, should be disregarded per the evolution of the project across the two semesters.



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ABSTRACT



Abstract

“Nature does not hurry, yet everything is accomplished.” –Lao Tzu

“In every walk with nature, one receives far more than he seeks.” –John Muir

“Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts. There is something infinitely healing in the repeated refrains of nature -- the assurance that dawn comes after night, and spring after winter.” –Rachel Carson

All of these people loved nature, and all have wisdom to share about how being immersed in nature is beneficial to people. In the last few decades, more and more land has been converted to farmland and developed land, destroying natural habitats that can never be fully restored to their original diversity despite restoration efforts. This scarcity of preservation is due to a lack of appreciation and understanding of the importance of native habitats. Immersion and interaction with nature in a positive way can change this downfall. Studies have proven that interaction with nature increases mental awareness and stability, therefore, a higher degree of exposure to nature will increase the understanding of its unique diversity. With the introduction of an environmental education center and an improved trail system in the Sheyenne National Grasslands, people can interact with the tallgrass prairie of North Dakota. Interaction with the diversity of the tallgrass prairie is the main focus, so design will emphasize the environment and will urge visitors to be immersed in the tallgrass prairie through self-guided exploration and through ranger-guided learning programs. Trail refurbishment is yet another focus to help people easily find the diverse landscape of the tallgrass prairie in the Sheyenne National Grasslands. Currently, there are no signs leading visitors or bystanders to the Sheyenne National Grasslands, and the three trailheads are nearly impossible to find without help from GPS. Increased wayfinding to the site as well as more accessible trails within the site would open up visitation to a wider variety of people. The users would be people of all ages that already love the outdoors as well as people that may not understand the uniqueness of the tallgrass prairie ecosystem.

The tall grass prairie ecosystem has been degraded to the point that vital habitat and ecosystem have been erased. The tall grass prairie ecosystem aids in day to day functions as well as environmental functions. With more appreciation for and understanding of this vital ecosystem, degradation will discontinue. The implementation of trail refurbishment as well as installation of an environmental learning center in which people can become immersed in the diverse ecosystem, will showcase the work of a landscape architect that cares for the environment. The design of the landscape with interactions among different aspects of the ecosystem into cohesive activity areas for people will allow visitors to experience the tall grass prairie first hand and learn about its importance to the earth as well as human lives. Through analysis of the site as well as precedents, a thorough project will emerge. In the coming months, more research will be done into how to create cohesive areas within the site to allow visitors to interact with several parts of the tall grass prairie ecosystem while learning about its vital functions. After research, design development will begin. Several sketches will be included in this process and will be examined to see the strong points and weak points of each design sketch. A master plan will manifest from these sketches, and site plans within will be detailed.



NARRATIVE



Narrative

The Big Idea

The tallgrass prairie ecosystem has been depleted down to 1% of its original size due to human intervention with expansion of urban and agricultural areas. Despite restoration efforts, the tallgrass prairie ecosystem can never return to its original state of being, so preserving and celebrating the remaining 1% is important. Without the original tallgrass prairie ecosystem, normal day to day functions can be hindered and the legacy of an entire ecosystem could potentially be lost due to human mismanagement of resources. An environmental education center and trail refurbishment in the Sheyenne National Grasslands in south eastern North Dakota, part of the remaining 1% of the tallgrass prairie ecosystem in the United States, can help to celebrate the legacy of the tallgrass prairie ecosystem through user immersion into nature. While other methods of teaching about the different ecosystems, their diversity, and their functions may be useful in some cases, it has been proven through research that immersion and direct interaction with nature are the most effective ways of improving mental health and increasing appreciation for nature, including the tallgrass prairie ecosystem. Currently, the Sheyenne National Grasslands has no signs leading to the site, and the three trailheads are difficult at best to find without knowing the exact coordinates and having them typed into a GPS. More signs need to be installed to help people find the Grasslands if they are to understand and appreciate them. The trail within the Grasslands is also in need of help. It is more developed in some areas with a one foot wide sand path, while the west side is simply a grass trodden path in a field. If the trail was changed to be more accessible to more people, then more visitors could explore the interesting and vastly diverse tallgrass prairie.



A large, stylized leaf in a golden-brown color, pointing to the right, serving as a background for the 'Narrative' header.

Narrative

A large, stylized leaf in a dark green color, pointing to the right, serving as a background for the 'Goals' header.

Goals

The project's main goal is to create an interactive site so people of all ages can experience the tallgrass prairie.

This would be implemented through an environmental education center that has a unique landscape with programmed and unprogrammed areas to help people become immersed into the tallgrass prairie ecosystem.

Other goals include enhancing the North Country Trail portion that goes through the Sheyenne National Grasslands to increase accessibility for people of all physical abilities as well as increasing the usability for biking, hiking, and other forms of travel across the trail.

A large, stylized leaf in a dark green color, pointing to the right, serving as a background for the 'Audience' header.

Audience

People of all ages would be the focus of design. While younger generations such as school age kids would be beneficial to teach about the environment for proactive positive environmental attitude and behavioral shaping, older generations of all other ages would benefit from environmental learning as well.

People of all physical abilities would be another audience to cater to. Currently, the trail system has no ADA regulations or areas where people that have physical disabilities can park or experience the tallgrass prairie ecosystem in the Sheyenne National Grasslands. More accessible areas would allow everyone to interact with nature and would create a safer environment.

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Documentation

Research Methodologies will include design research, interpretive research, and evaluative research. Documentation would include photographs if there are preliminary models, and scans of all other graphics. Scheduling a work plan will focus on each aspect of design and the number of weeks spent on each subject will depend on how long each section typically takes—one week for simple things and up to four weeks for longer processes.



Narrative

Justification

The tallgrass prairie offers many benefits to humans and wildlife. Plants that are associated with the tallgrass prairie help to provide clean water and aid in water recharge. The plants and land itself provides habitat for a multitude of animals that many people enjoy hunting and viewing, as well as providing nesting areas for migratory and nesting birds. Native grasses can provide biomass that can be used for alternative energy sources as well as creating stable soils that are less susceptible to erosion and slumping.

Among other things, the tallgrass prairie showcases the local land use history and heritage of North Dakota and other Midwestern states.

Research has shown that interacting with nature is the most effective way to have people learn about nature as well as providing restorative and healing benefits. Interacting with nature while learning about it engages more than one class of learning in the brain, making it more effective than traditional learning methods, which are only based on one class of learning in the brain.

Despite legislation such as the National Environmental Education Act of 1990 ¹ and education in schools, there are still many people that are not environmentally literate². One such example is Donna the Deer Lady³ who thought that deer crossing signs were put in place to show deer where they could safely cross the road. This does not happen to people in large cities in big states--it was local to a rural North Dakota town.

Creating an environment that takes into account the psychology of environmental learning, the environmental education center can cater to more than a single class of learning, making people exponentially more likely to have positive attitudes and behaviors towards the environment, especially the critical habitat of the tallgrass prairie.



GOALS AND CONCEPTS

Goals and Concepts

ACCESSIBLE

INTEGRATE

Space List and Land Use Requirements

Department	Area Name	Room Name	#	NSF/Unit
Central Services	Assembly	Large Assembly	2	
		Medium Assembly	2	
	Research Room	Research Room	2	
	Storage	Storage	1	
	Restrooms	Restrooms	1	

Central Services Total 18,000 NSF

Department	Area Name	Room Name	#	NSF/Unit
Administration	Office	Director		
		Public Affairs		
	Information Room	Grasslands Guide		
	Supply Room	Supply Room		

Administration Total 700 NSF

Assigned Areas Total 18,700 NSF

Unassigned Areas Total 1300 NSF

Total Building Area 20,000 GSF

Parking Allotment 7680 NSF

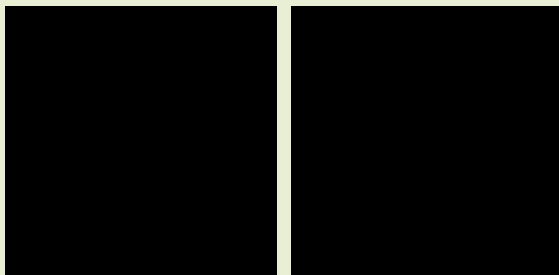
Total Land Use Requirement 27,680 GSF

CELEBRATE

LOW IMPACT

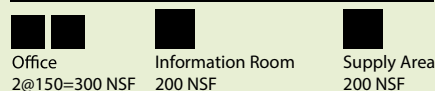
Environmental Learning Center

Central Services 18,000 NSF



Large Assembly
2@6400=12,800 NSF

Administration 700 NSF



Office 2@150=300 NSF
Information Room 200 NSF
Supply Area 200 NSF

Grand Total Net 18,700 NSF

Phasing

Phase 1:
Trail Development

Phase 2:
Environmental Learning Center



Medium Assembly
2@1600=3200 NSF2



Research Room
2@800=1600 NSF



Storage
200 NSF

Restrooms
00 NSF

Trail Restoration Materials

gravel
deciduous vegetation
evergreen vegetation
wood
steel

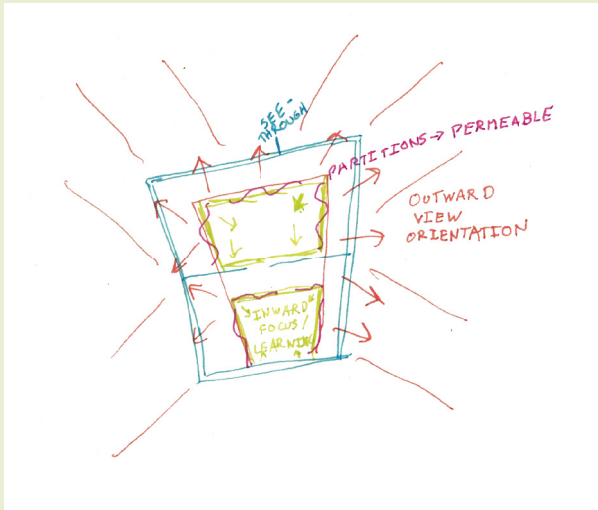
Learning Center Materials

glass
wood
steel
-beam
-joists
earth

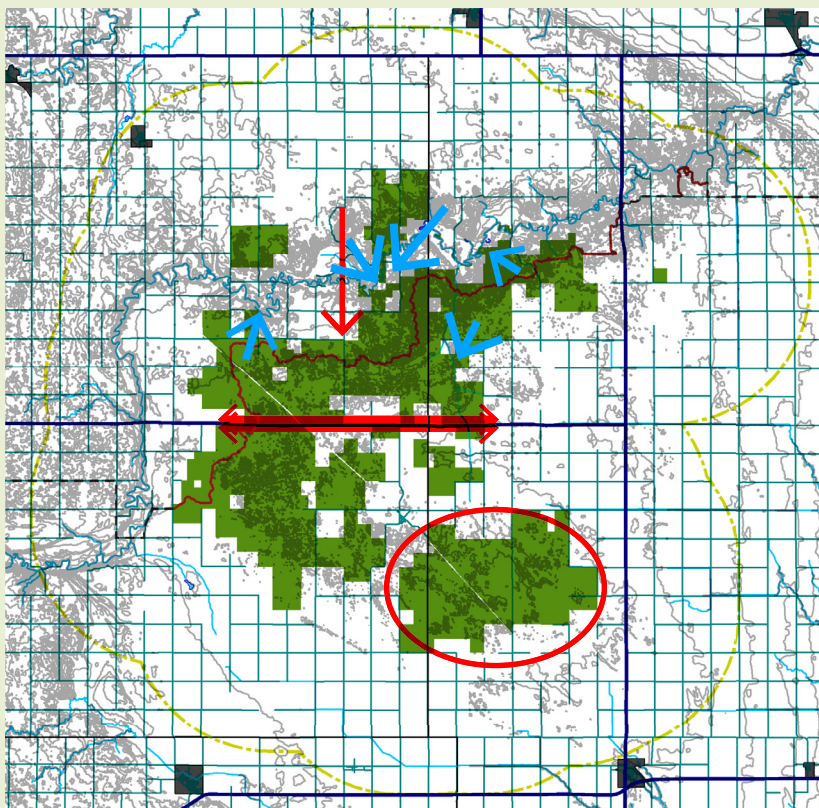
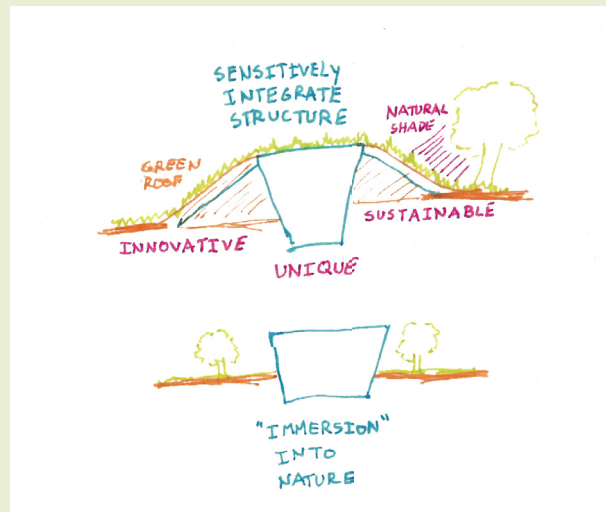
IMMERSION INTO NATURE




PERMEABLE

INNOVATIVE



SUSTAINABLE



-  More Interaction and Integration of the Rivers and Streams
-  Increase Accessibility
-  Increased signage and wayfinding within 5 miles of the grasslands

TOPIC RESEARCH





Environmental Education and Outreach

The Psychology of Methods' Effectiveness

Environmental Education and Outreach: The Psychology of Methods' Effectiveness

Priceless habitats and endangered lands have been declining due to inadequate environmental education, which leads to misunderstandings of the environment as well as negative attitudes and behaviors toward these environments. One such example is the tallgrass prairie ecosystem, which has been depleted slowly to less than 1 percent of its original size. Anthropogenic activities in North Dakota such as farmland conversion and increased development due to population influx have led to inadequate planning, thus leading to the depletion of the tallgrass prairie ecosystem in the state. Without education of the tallgrass prairie region and the negative effects of such related anthropogenic activities that deplete the region, the tallgrass prairie may become extinct.

Time and time again, anthropogenic activities have led to environmental catastrophes. Nearly all of these catastrophes were corrected with environmental education and realization of the human impact that was being had on the landscape and environment. While these issues are still happening, flaws in the environmental education system have led it to be less effective than it could be. A heightened understanding of environmental education, its goals, and the psychology and science behind its effectiveness in creating positive environmental attitudes and behaviors would increase the ability of planners and designers, as well as environmental educators to more accurately plan, design, or teach for effective environmental preservation and/or conservation. From this, one can conclude that constructivist and immersive learning methods as well as catering programs to specific age groups through positive influential role models are the most effective means to environmental education for creating environmentally literate citizens who have positive attitudes and behaviors toward the environment.

In order to gain knowledge on how to effectively foster environmental knowledge, Louise Chawla in his article "Life Paths into Effective Environmental Action" says "what matters most is not the actual past but how we understand and use the past in meeting the present and the future" (Chawla, 1999). Learning from the past is and has always been a major part of advancing life, whether it be technology or how humans interact with the environment. Despite efforts to change human behaviors to be more "pro-environmental," doing things such as recycling or switching to florescent light bulbs, Nicholas McGuire in his article "Environmental Education and Behavioral Change: An Identity-Based Environmental Education Model" states that "the environmental problems we face today cannot be solved by slow-to-react, incremental changes or the shoehorning of additional behaviors into existing patterns of consumption (McGuire, 2015)." This means that humans need to be proactive in changing behaviors and attitudes toward the natural environment in order to make a difference. Predicting the future is not feasible, but based on psychological research as well as other scientific research, educators can make the future generations realize the effects that humans have on the environment and the possible negative outcomes that can arise from environmental neglect.

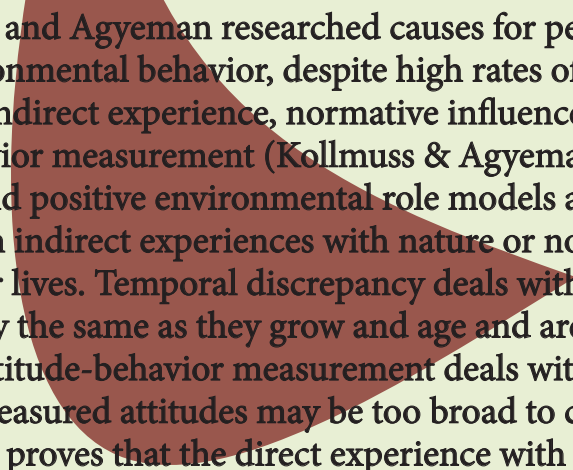
Baba Dioum said, “In the end, we conserve only what we love. We will love only what we understand. We will understand only what we are taught.” Expanding environmental knowledge has been the main focus of environmental education and outreach for several years, but recently, studies and articles have proven that environmental knowledge alone is not the only aspect of making environmentally literate citizens. Lessons one learns about the natural environment have many facets, involving not only school lessons, but also childhood experiences, influential people, religion, and several other sources of information and values (Chawla, 1999). Education alone is not the driving force of behavioral change or interests in the natural environment.

Taking into account that childhood experiences, influential people, organizations, negative experiences, education, and more can influence environmental attitudes and behaviors, more can be done in terms of creating programs that aid in encouraging changes in attitudes and positive environmental behavior. Educational programs can be changed to take into account these “sources of commitment to environmental protection (Chawla, 1999).” Chawla also discovered that education was fifth on the list of influences that affected environmental behavior and attitudes, after experiences in natural areas, family and other influential people, organizations, and negative experiences such as habitat destruction, pollution, or radiation (Chawla, 1999). Not only is education fifth on the list of influences on environmental behaviors and attitudes, but it is not correlative to positive attitudes or behaviors involving the natural environment. The article “High School Students’ Knowledge, Attitudes, and Levels of Enjoyment of an Environmental Education Unit of Nonnative Plants,” discusses an experiment in which high school students in a constructivist class learned more than students in a traditional class on the same unit, but the level of enjoyment and engagement was about the same for both classes (DiEnno & Hilton, 2005). This means that even though environmental knowledge may increase, engagement and enthusiasm for the natural environment will not necessarily increase as well. Understanding the psychology and science of these influences and their effects can, thus, have a beneficial effect on positive environmental behaviors and attitudes.

In further discussing the psychology of attitudes and behavioral change in regards to environmental education, several terms and concepts must be discussed. Anja Kollmuss and Julian Agyeman in their article “Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?” mention several “theoretical frameworks” that try to explain “the gap between the possession of environmental knowledge and environmental awareness, and displaying pro-environmental behavior (Kollmuss & Agyeman, 2002).” This gap needs to be addressed in environmental education in order to correct the disconnection between environmental knowledge and positive environmental behavior. When only one is addressed, education will not be doing all that it could and should to help the environment and the overall well-being of the biotic factors that live in the environment. To better educational efforts, one must study the psychology and science of the mind and how it relates to the environment.

The mind creates a self-concept and self-identity, which play pivotal roles in creating positive environmental behaviors and attitudes (McGuire, 2015). If the self-identity is taught to people in educational programs or school lessons, people will not only become more self-aware, but they will also be taking steps to become more environmentally literate. As stated earlier, people can be influential to younger generations. The Deviance Regulation Theory expresses that if a positive role model who partakes in positive environmental behavior, younger people are more likely to do the same, even if it is against the social norm (McGuire, 2015). This means that if communities can provide role models for younger generations through environmental education programs or lessons, whether it be teachers, guest speakers, park rangers, or someone else, they will be more likely to become environmentally involved, acting proactively rather than reactively to issues. McGuire states that in reality, “every behavior an individual exhibits that involves alteration of any physical material has a direct impact on our natural resource...so what is needed is behavior that reduces total consumption in a broad sense (McGuire, 2015).”

Even though humans cannot predict the future, all efforts to prevent disasters and negative impacts to the environment will in theory help. Through the research in McGuire’s article, he came up with an environmental education model that is based on the self-identity—the IBEE—which culminates his psychological and scientific research into a model that gears different educational programs to different age groups, with students under the age of 7 being the most susceptible to environmental influence through immersion in nature and positive environmental role models (McGuire, 2015).



Kollmuss and Agyeman researched causes for people to be disconnected from positive environmental behavior, despite high rates of environmental knowledge, listing direct versus indirect experience, normative influence, temporal discrepancy, and attitude-behavior measurement (Kollmuss & Agyeman, 2002). Having direct contact with nature and positive environmental role models are more influential on people's behaviors than indirect experiences with nature or not having influential environmental people in their lives. Temporal discrepancy deals with the fact that people's attitudes do not always stay the same as they grow and age and are influenced by new events and people, and attitude-behavior measurement deals with inconsistencies of information because the measured attitudes may be too broad to correlate with measured actions. Their research proves that the direct experience with nature, immersive learning, has more of an impact than the traditional classroom learning methods, which both impact the other elements discussed. These, then, provide a framework for environmental education programs that really work and gear programs towards different age groups, so as to target specific methods that can be the most impactful for the specific age group. This is different from the traditional one-size-fits-all environmental education method.

Going back to the goals of environmental education, the main priority is to change learner behavior. The North American Association for Environmental Education says that "environmental education is learner centered; providing students with opportunities to construct their own understanding through hands on, minds on investigations involves engaging learners in direct experiences and challenges them to use higher order thinking skills is supportive of the development of an active learning community where learners share ideas and expertise (Erhabor & Don, 2016)." Despite the best efforts of environmental education programs, these goals are not currently being met. In traditional classroom teaching methods in school, students do not get a chance to collaborate or think critically about environmental issues or processes, but rather learn by rote, and never get to have hands-on field experience. Julie Ann Pooley and Moira O'Connor mention in their article "Environmental Education and Attitudes: Emotions and Beliefs Are What Is Needed" that attitudes emerge from three classes of information—cognition, affect, and behavior (Pooley & O'Connor, 2000). Even though attitudes do not need to be based on all three classes, the current traditional teaching is based solely on cognition, which does not provide a lasting impression for positive environmental behaviors.

In addition to the lack of information class variety in traditional teaching, very few variables that have been linked to citizenship behavior, as discussed by Harold Hungerford and Trudi Volk in their article “Changing Learner Behavior through Environmental Education” are included in traditional teaching methods (Hungerford & Volk, 1990). These variables include the broad categories of entry-level variables, ownership variables, and empowerment variables, with sub-categories including topics such as knowledge of ecology, environmental sensitivity, a personal commitment to issue resolution, in-depth knowledge about issues, and locus of control, among others.

Jane Shaw in her article “Environmental Education” brings to light some other major issues in the current environmental education programs, stating that environmental education in schools has been geared more toward advocacy than actual education (Shaw, 2003). Exaggerations and misinformation about the environment have been floating around the media for years, and the misinformation has leaked into textbooks. Shaw says that this misinformation has caused undue unrest for students as well as parents, but that can change through her example of successful environmental learning case studies as well as her observation that “experiencing the outdoors motivates many children to explore and develop their scientific curiosity,” and environmental education centers and camps provide a great opportunity for people to combine learning and enjoying the outdoors (Shaw, 2003). This, again, shows that immersive learning is more effective than traditional learning at bringing forth environmentally literate citizens. Nature itself can also alleviate some of the undue unrest of students and parents.

Nature is more than just a commodity, and offers healing and restorative benefits to all who visit or even look at pictures of it. Carolyn Tennessen and Bernadine Cimprich in their article “Views to Nature: Effects on Attention,” as well as Stephen Kaplan in his article “The Restorative Benefits of Nature: Toward an Integrative Framework,” and Marc Berman, John Jonides, and Stephen Kaplan in the article “The Cognitive Benefits of Interacting with Nature,” all conclude that nature can have a restorative quality to a fatigued directed attention (Tennessen & Bernadine, 1995; Kaplan, 1995; Berman, Jonides, & Kaplan, 2008). The discussion of directed attention is important in that if it is fatigued due to prolonged focus or other factors like lack of change in stimulation over a prolonged period of time, devastating consequences can occur through human error—one such example would be a pilot on a long flight having directed attention fatigue, and causing a human error problem that affects the whole plane. In order for restorative benefits to occur, the environment must meet 3 criteria—being away, the environment must have extent, and there should be compatibility between the environment and one’s purposes and inclinations (Kaplan, 1995). The natural environment meets all of these criteria, especially if one is going from a very urban environment to a rural environment. Kaplan states that fascination is the root cause of restorative benefits, and nature, being a soft fascination, is more effective than hard fascinations (Kaplan, 1995). This leads one to believe that nature in and of itself is beneficial to preserve or conserve. Without it, people would lose a very easily accessible and easily preserved entity.



Overall, the current environmental education system is not as effective as it could potentially be, and needs to incorporate more psychological and scientific research to become the best that it can be. Some of the issues and topics discussed in the paper such as collaboration, hands-on, immersive learning, and age-specific programs call all help to create environmentally literate citizens that change their attitudes and behaviors to reflect positive environmental outcomes. Without advancing research and adapting teaching and learning methods to accommodate the overarching goals of environmental education, the environment, including endangered lands such as the tallgrass prairie region will continue to be exploited. If these endangered areas are to be saved, one must find ways to incorporate immersive and constructivist learning as well as catering programs to fit specific age groups into educational programs to better fit the broad goals of environmental education for sustainability of these priceless treasures. Louise Chawla surmises that “this broad definition of EE [environmental education] will require broad-based alliances of educators, local officials and organizations, landscape designers and planners, developers, recreation and park directors, and public interest media,” providing a challenging call to action to all of those group so of people (Chawla, 1999).



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Annotated Bibliography

Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological science*, 19(12), 1207-1212.

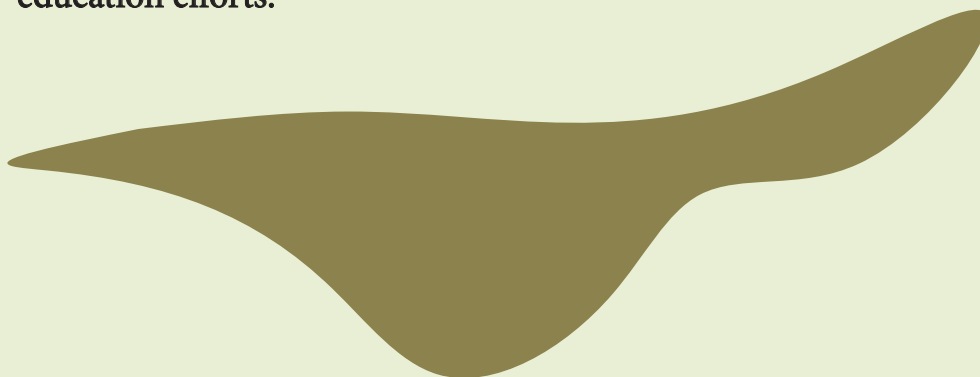
This article discusses two different experiments that both showcase how viewing or being in nature can positively impact the directed-attention, allowing it to be restored when fatigued. They use their experiments to further the discussion about improving cognitive performance. They end their article by saying that nature is too easily discredited as only an amenity, when it can be beneficial to cognitive functioning.

In the context of environmental education and outreach, understanding that the natural environment can help with cognitive function is beneficial. Not only can one plan lessons in nature, but one can also use the natural environment to his or her advantage to reduce cognitive fatigue. Immersive learning in the natural environment provides an alternative learning style that may benefit students and other people that are cognitively fatigued from traditional schooling, life, or urban environment overload.

Chawla, Louise. (1999). Life paths into effective environmental action. *The Journal of Environmental Education*, 31(1), 15-26.

Louise Chawla, in his article, researched the things to which environmentalists attributed their interests. He included in his sample of people, environmentalists from two countries—Norway and the United States. He found that people usually attributed their interests to three or four life aspects from childhood, college or university years, or after. Experience of natural areas as well as family, friends, and other people were the most common responses in both countries.

The article provides insight into how to make effective educational lessons/ programs and who to aim them at. When it is understood how people learn, and when they learn those things, one can propose effective methods for educating the future generations. The article also provides a framework for learning ways to use the media and other methods of outreach to rally support for the environmental education efforts.



DiEnno, C. M., & Hilton, S. C. (2005). High school students' knowledge, attitudes, and levels of enjoyment of an environmental education unit on nonnative plants. *The journal of environmental education*, 37(1), 13-25.

The authors presented an argument that a constructivist way of learning would increase knowledge retention compared to the traditional learning methods. They discuss that many educators stick with the traditional methods of teaching because of increasing state requirements for students to do well on standardized exams. Their experiment did prove that the constructivist group appeared to gain more knowledge than the traditional group, but the levels of engagement had no significant difference between groups.

The article provides evidence that teaching methods can have an effect on how much people learn. The method in which the students had hands on experience and went into the natural environment to learn, gained more knowledge than the group that only had traditional learning in the classroom. The level of engagement may have a link to attitude change, proving that knowledge may not have a link to attitude change, though.

Erhabor, Norris I. and Juliet U. Don. (2016). Impact of Environmental Education on the Knowledge and Attitude of Students Towards the Environment. *International Journal of Environmental & Science Education*, 12, 5367-5375.

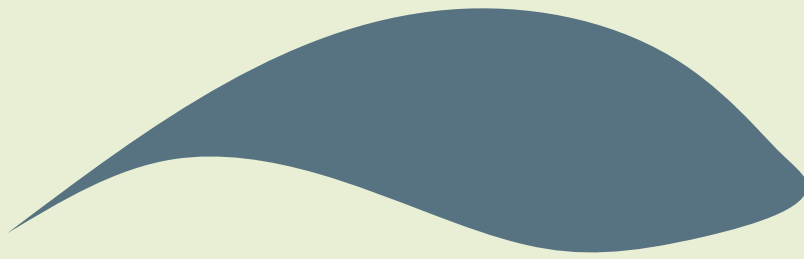
The article begins by discusses the goals of environmental education and poses a question about the relationship between students' knowledge of the environment and their attitude toward it. It was discovered that there is little to no correlation between environmental knowledge and environmental attitude.

This is useful to environmental educators in knowing that education alone cannot change attitudes of people to be more positive toward the environment. Something else must be added to education to make people more environmentally friendly.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The journal of environmental education*, 21(3), 8-21.

The article discusses the goals of environmental education and outlines multiple models of environmental education and changing learner behaviors. Several variables are discussed factoring into the behavior flow chart, and then they put the two together to form a new model for integrating the behavioral factors into an educational plan.

The article is interesting to researchers of environmental education, as it discusses the many different factors that go into changing learner behaviors, and how those factors can change methods of teaching to create more effective lessons and programs involving the environment, especially since the main goal of environmental education is to change human behavior.



Kaplan, Stephen. (1995). The Restorative Benefits of Nature: Toward an Integrative Framework. *Journal of Environmental Psychology*, 15, 169-182.

The article is about directed attention, how it can become fatigued, and effective ways to recover from directed attention fatigue. Directed attention's importance was discussed as well as the different components that make up directed attention. The restoration of directed attention has several important aspects. Nature meets the listed aspects, providing a preferred destination for a restorative environment. The article concludes by discussing stress and the role that it plays in relation to directed attention and the restorative process.

The article is pertinent to environmental education as it proves that nature has many benefits to restoring directed attention, and thus, cognitive functioning, as well as repairing fatigue that is linked to increased stress. Overall, the article is very perceptive of the reasoning behind nature being restorative to directed attention.

Kollmuss, Anja, and Julian Agyeman. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260.

The authors examine different models of pro-environmental behavior and the influences that change the factors that go into the different models, including the variables associated with pro-environmental behavior. The variables were then examined further and put into a new synthesized model of pro-environmental behavior, in which they included barriers to pro-environmental behavior.

The article can be useful in the realm of environmental education, as it takes into account the different variables that contribute to pro-environmental behavior, as well as other outside factors that play a part in determining behavior. With behavior change being the main goal of environmental education, the article is very suitable to aid in research about what can be done to change environmental education to make it more effective.

McGuire, Nicholas M. (2015). Environmental Education and Behavior Change: An Identity-Based Environmental Education Model. *International Journal of Environmental & Science Education*, 10(5), 695-715.

Psychology is the main focus of this article—the psychology of pro-environmental behavior and the psychology behind why people act and think the way they do in regards to the natural environment. They also discuss an educational model that is claimed to redefine pro-environmental behavior.

Environmental education research can benefit greatly from this article, as it explains the psychology behind how people behave in regards to the environment, as well as ways to make people more environmentally educated and engaged in the natural environment. Different age groups were discussed and methods of reaching them, education wise, were also mentioned, which is invaluable to the field of environmental education. While the article states that one of the shortcomings of the model it discusses is that it has not been empirically tested, through environmental education research program, the model can be tested.

Pooley, Julie Ann and Moira O'Connor. (2000). Environmental Education and Attitudes: Emotions and Beliefs Are What Is Needed. *Environment and Behavior*, 32(5), 711-723.

This article mentions that the main goal of environmental education is to change learner behaviors and what people think and believe about the environment. It explores the three domains upon which people's responses are based. It was discovered that an attitude is not based on all three domains, necessarily, and attitudes change based on the method of learning.

The article is helpful in the realm of environmental education in that the information presented about attitudes and how they can be used in education should be incorporated in schools as well as community programs to help reach all ages of people. Understanding the basics of an attitude and what goes into forming one is important if one is to reach the main goal of environmental education.

Shaw, Jane S. (2003). *Environmental Education. Society*, 41(1), 60-66.

The author provides a perspective that is counter to the one prominently in the media and news, as she tries to bring light to the fact that many media and even textbooks skew the facts about the natural environment, and that environmental education needs to take more of a path that is discussed in the case studies she provides at the beginning of the article. She states that education is not advocacy, and that despite schools and the media giving distorted facts, there are more accurate sources that are emerging in the field of environmental education.

The article helps the field of environmental education by raising awareness to the fact that education is not advocacy and that it should be unbiased and accurate. Her case studies provide examples of ways that education can be more effective in changing learner behaviors, shying away from traditional learning environments and classroom methods. Overall, it is observant of some of the flaws of the environmental education system as it is now, giving goals to work toward to make the system better for the future.

Tennessen, Carolyn M. and Bernadine Cimprich. (1995). Views to Nature: Effects on Attention. *Journal of Environmental Psychology*, 15, 77-85.

The authors surmise that nature can increase cognitive functioning through their experiment involving varying levels of nature being viewable from a dorm room. They found that the more nature present in the view, the higher test scores were on privately given exams.

The article can be helpful to one studying environmental education and outreach, as it mentions that exposure to nature can help restore and maintain cognitive functioning through directed attention. Directed attention is important to everyday life and without a focused directed attention, human error can occur, which is sometimes devastating to the environment or other people.

Wongpaibool, Duangporn, Wee Rawang, Ratchanont Supapongpichate, and Pataraboon Pichayapibool. (2016). A Process of Environmental Education Communication through Community Cultural Activity Area. *International Journal of Environmental & Science Education*, 11(12), 5687-5697.

This article is more of a case study providing an interesting way of incorporating community involvement in the non-traditional way of learning about the environment. It provides the failures and the successes that it found, as well as recommendations on how to create community programs for people of all ages to learn about the natural environment and effectively change their attitudes and behaviors toward it in a positive way.

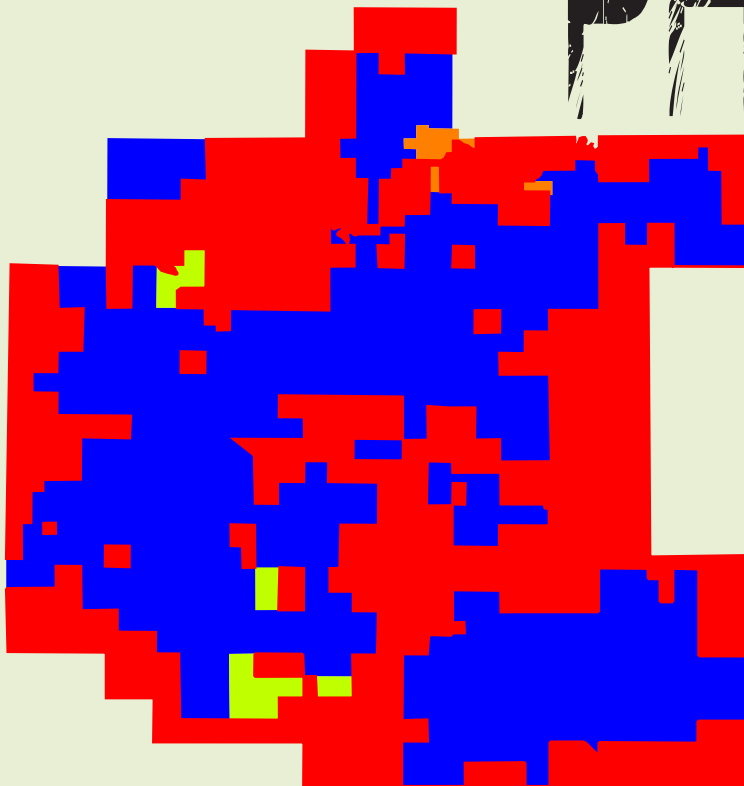
The article can aid the realm of environmental education in that it gives a framework and recommendations on one community involvement idea. The recommendations can be used in future community environmental education endeavors as well as for other environmental education programs, whether for schools or outreach centers.



SITE

CHARACTER

PHYSICAL



Land Ownership

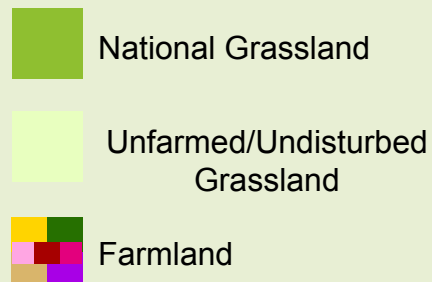
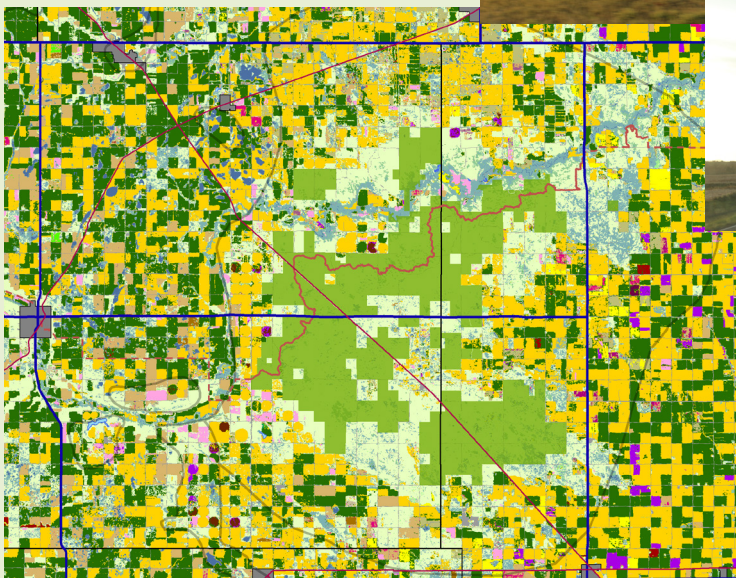


Private lands cannot be built on or changed without permission, but all of the federal land would be available, as per the US Forest Service.

The roads to get to the National Grassland are mainly paved state highways and gravel county roads. Farmland and some ranching are the main sights on either side of the road. Increased signage for finding the trailheads would be extremely beneficial.



Wetlands that dot this "Prairie Pothole Region" provide habitat for nesting and migratory birds. These wetlands play an integral role in cleaning water and providing habitat and should be protected and celebrated.



ATTRIBUTES

The Sheyenne National Grassland consists of 70,180 acres of public land and 64,769 acres of privately owned land.

It has sandy soils, originally deposited as the delta of glacial Lake Agassiz. The landscape of the grassland varies from one end to the next changing from flat plains to rolling hills and sand dunes.

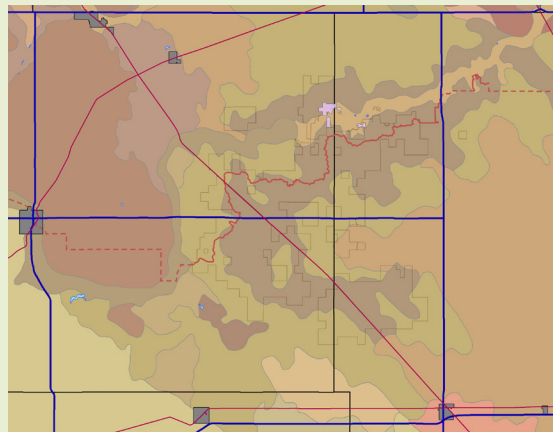
The Sheyenne National Grassland is the only national grassland in the tallgrass prairie region of the United States.

Prescribed fires and grazing are the main ways of maintaining the grassland ecosystem. These programs are both managed in cooperation with the local grazing association. Noxious weeds have become a problem, so the use of herbicides, biocontrol and sheep grazing have been implemented to mitigate the effects.

The grassland is located in both eastern Ransom and western Richland counties. The grassland is administered by the Forest Service as part of the Dakota Prairie Grasslands, but the local Sheyenne Ranger District office is located in Lisbon.

Soil Type

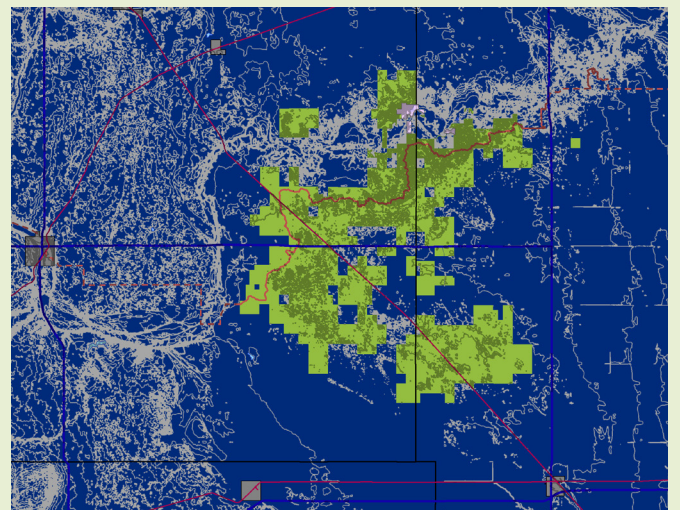
	Loamy
	Choppy Sands
	Limy Subirrigated
	Sandy
	Subirrigated Sands
	Loamy Overflow
	Loamy Subirrigated
	Wet Meadow



Soils vary from well drained, to partially well drained.

These soils bring forth challenges for building, but do not make it impossible.

The contours of the land provide opportunities for both flat places for building and rolling hills for scenic trails through the tallgrass prairie.



BIOLOGICAL

National Grassland Ecosystems provide services that:

- Disperse seeds
- Mitigate drought and floods
- Cycle and move nutrients
- Detoxify and decompose waste
- Control agricultural pests

Protect watersheds, and stream and river channels

- Pollinate crops and natural vegetation
- Provide aesthetic beauty
- Provide wildlife habitat
- Provide wetlands, playas
- Provide recreation
- Provide research opportunities

Common Prairie Flowers and other Plants



Prairie Smoke



Spiderwort



Penstemon



Western Wallflower



Western Prairie Fringed Orchid
Endangered



Hoary Puccoon

Common Trees



AshB



irchC



ottonwood



Linden



Oak



Elm



ATTRIBUTES

The grassland provides a diverse habitat for several plants and animals. The Sheyenne National Grassland is the only national grassland in the tallgrass prairie region in the United States and it has the largest population of the Greater Prairie Chicken in North Dakota. The grassland is home to a couple of sensitive species such as the endangered Dakota skipper and Western Prairie Fringed Orchid and the nearly threatened Regal Fritillary.

The Sheyenne National Grassland has one of the last patches of "virgin" (meaning it has never been mowed) prairie in North Dakota. In an attempt to return some of the land in North Dakota back to the prairie that it once was, The US Forest Service collects seed from the grassland's native plants.

The tallgrass prairie has recently (in the past couple of decades) become endangered with only 1 percent remaining. Increases in farmland and urban expansion are just two reasons this ecosystem is diminishing, and if it continues to shrink, species that are native to the ecosystem may become extinct as well.

Common Prairie Grasses



Big Bluestem



Prairie Brome



Canada Wildrye



Prairie Cordgrass



Indian Grass



Little Bluestem



Prairie Dropseed



Sideoats Grama



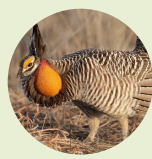
Switchgrass



Dakota Skipper
Endangered



Regal Fritillary



Greater Prairie Chicken



Wild Turkey



Bluebird

Common Animals

Other animals and insects like bats, bees, flies, moths, beetles, other birds, and other butterflies are pollinators that help the regrowth of native plants.



Cooper Hawk



Warbler



Western Meadowlark



Deer



Raccoon



CULTURAL

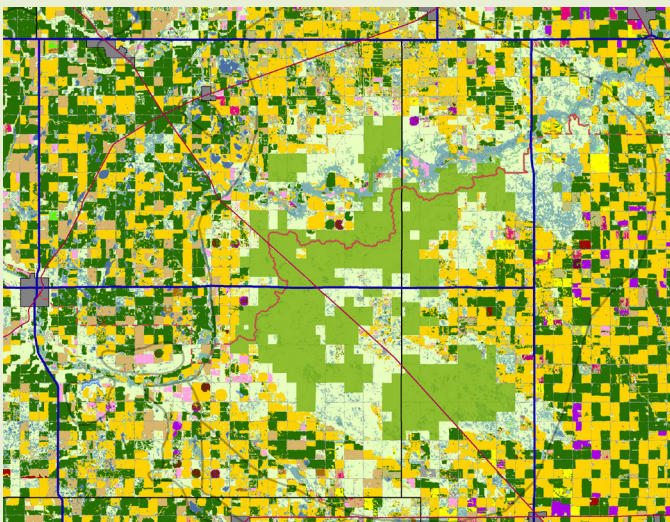
Twenty-Five miles of the Sheyenne National Grassland trails are part of the larger North Country National Scenic Trail system.

Recreation opportunities are abundant in and around the National Grassland. Some of the activities include hiking, hunting, camping, horseback riding, photography, and backpacking. Some of the interesting places within the grassland are: Iron Springs creek, the Horseshoe Hills, Old Bridges, Owego Pioneer Cemetery, and an Old Fire Lookout Tower.

South of the Grassland is the town of McLeod, where visitors can learn about the area's history, at the McLeod Museum Complex. Other interesting things near McLeod and the Grasslands include a Presbyterian Church built in 1909, the Soo Line Depot, a homestead house built in the late 1800s, and a one-room school house which operated from 1904-2002.

Activities

Bicycling
Camping
Fishing
Hiking
Horse Riding & Camping
Hunting
Nature Viewing



Farming is a major part of the culture of the area comprising most of the land use around the grassland. While farming is good for industry, conversion of farmland from CRP land infringes upon native plant and animal habitats, sometimes endangering species. This prompts a need to do more to protect endangered and threatened species of the area, including the endangered ecosystem of the Tallgrass Prairie.

Not only does it affect the ecosystems and animals, but it also affects the aquifer, with a major portion of farmland being over one. This can cause issues with groundwater, so something should be done to prevent harmful runoff from leeching into the aquifer.

ATTRIBUTES

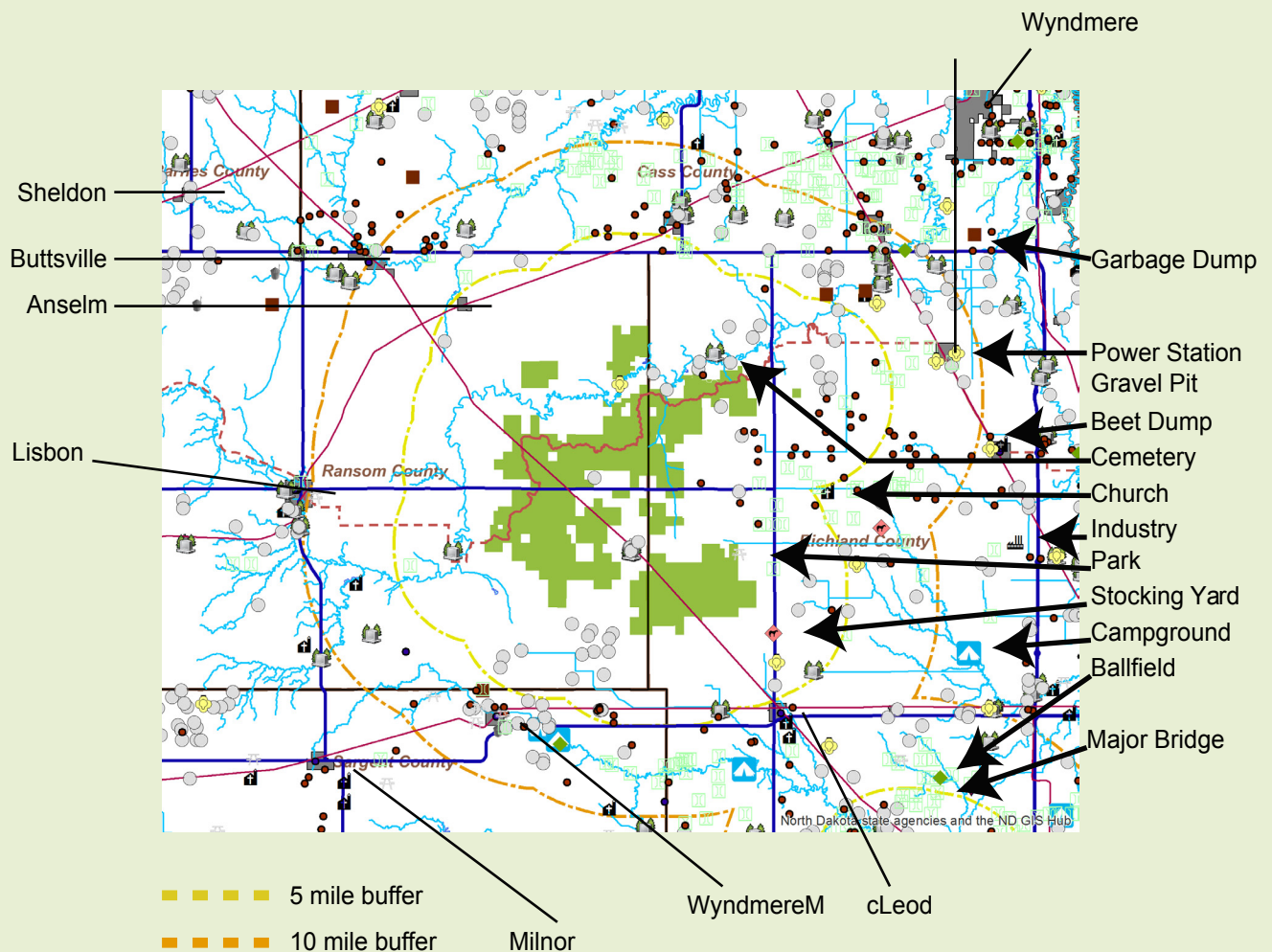
The National Grassland is a unique ecosystem that provides several recreational opportunities, but there is not much around for people to realize the potential that the grassland has. There are very minimal signs in the area highlighting the National Grassland, and it is not promoted in any town signs or websites.

Within 5 miles of the grassland, there is not much for amenities or other recreational opportunities.

Several gravel pits reside within the five miles, as well as beet dumps and some cemeteries.

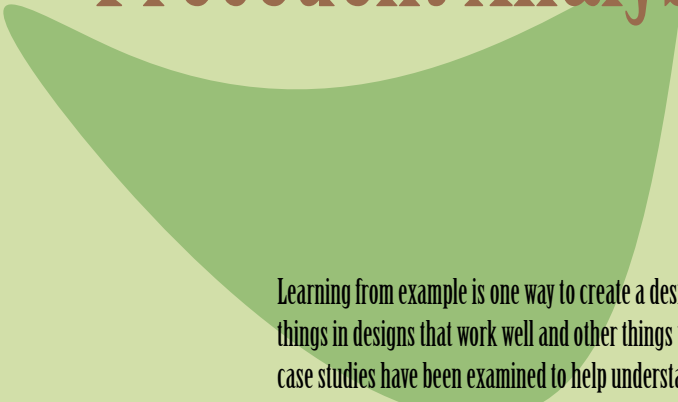
Within 10 miles, there are a few more things with some campgrounds and some towns.

This leads to the proposition of a nature/environmental learning center that can provide amenities for people that are visiting the area, as well as a draw for people to visit the area in the first place. This center would provide learning opportunities for all ages as well as possibly rent out equipment or horses to explore the area and the trail system within the National Grassland.



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Precedent Analysis

Two abstract, organic green shapes in various shades of green are positioned in the middle of the page, behind the text.

Learning from example is one way to create a design. Studying precedents is a good way to find things in designs that work well and other things that should maybe be avoided. The following case studies have been examined to help understand some of the environmental aspects that would be successful in design of an environmental education center as well as trail restoration or refurbishment.



Chimney Tops Trail Restoration

Great Smokey Mountains National Park, Tennessee | Trails Forever and National Park Service

The \$450,000 project provided needed restoration to the trail, increasing access and rebuilding two bridges that were washed away by heavy rains.

Chimney Tops Trail-Great Smoky Mountains

Roundtrip Length:	3.8 Miles
Total Elevation Gain:	1487 Feet
Avg. Elev Gain / Mile:	783 Feet
Highest Elevation:	4753 Feet

North Country Trail-Sheyenne National Grasslands

Length through the Grasslands:	34.3 Miles
Total Elevation Gain:	1206 Feet
Total Elevation Loss:	1220 Feet
Minimum Elevation:	965 Feet
Average Elevation:	1040 Feet
Max Elevation:	1082 Feet

Despite the difference in length and elevation change, both trails have unique features both geologically and biologically.

The North Country Trail can follow the example of the Chimney Tops Trail by celebrating the elevation changes (this happens from one end of the trail to the next) and highlighting the fact that the tallgrass prairie ecosystem is in danger.

The main goal of the trail restoration on Chimney Tops was to make it safer and more accessible for families. The same can be done to the North Country Trail. All of the restoration efforts were done using natural materials, which is another feature that would be included in the North Country Trail restoration.



Chimney Tops Trail is one of the most popular hikes in Great Smoky Mountains National Park. On average, 80,000 hikers visit it each year. It also has one of the park's most recognizable geological structures since it's a rare rock summit in the Smoky Mountains.



The Sheyenne National Grasslands are the lesser known grasslands in the state, but with trail restoration, they can become more popular and a destination. Like the Chimney Tops Trail with its unique geologic feature, the Sheyenne National Grasslands include the ever diminishing natural tallgrass prairie.

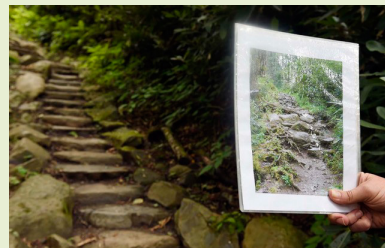


Increase in ease of access on trails as well as way-finding signs



Improvements to the trail

- Refurbished bridges over Road Prong Creek
- Moved giant gneiss rocks to form a trail boundary
- Over 50 hazardous trees removed
- Constructed a raised turnpike to prevent future erosion
- More than 360 rock step added to the trail
- Improved drainage with new ditches and waterbars
- Added 6 million pounds of crushed rock to harden trail tread and fill in structures.

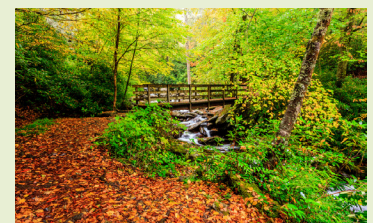


Improvements to the North Country Trail could include:

- Bridge restoration
- Forming a trail boundary and enhancing the trail identity (more than the remnants of foot traffic or a narrow 1 foot path of sand/gravel)
- Trail grooming (no mowing, though, to keep the prairie as natural as possible)
- A sky walk to allow visitors to experience both the ground plane of the prairie as well as the canopy areas
- Addition of interpretive signs along the trail



Bridge restoration



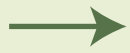
Prairie Wetlands Learning Center

Fergus Falls, MN

Area: 325 acres
Houses: native prairie and wetlands
Trails: 3.5 Miles

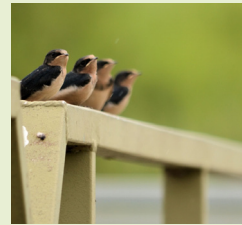


The Prairie Wetlands Learning Center (PWLC) has a variety of environmental education programs for people of all ages to interact with nature and learn about its complexities. The center highlights the cultural and natural history of the region with its many wetlands that house migratory and nesting birds along with an abundance of other wildlife and plants.



Currently the Sheyenne National Grasslands does not have any environmental education programs, but the landscape is just as diverse with interesting history and culture for the area. While there are far fewer wetlands in the Grasslands, the tallgrass prairie houses a multitude of unique plants and animals.

This prompts the need for an environmental education center to provide protection for the future as well as celebration at the current time.



The Center protects one of Minnesota's most biodiverse landscapes in the transitional zone between prairie and forest. Before people began to farm and develop the area, the land was dotted with 'prairie potholes,' or small wetlands within the prairie created when the glaciers carved the land. With the development of the land, a lot of the natural prairie was lost and wetlands were drained, and with it habitat was lost.

To help protect the land, the Fergus Falls Management District was established to protect the land, consulting with land owners to restore the natural prairie and wetlands. To date, more than 44,000 acres have been protected for waterfowl nesting.



The tallgrass prairie ecosystem provides a unique diversity of plants and animals and has, similarly, been affected by development and conversion of prairie to farmland. The Sheyenne National Grasslands themselves protect some of the tallgrass prairie, but other portions of it in the northern part of the US are still at risk, so education and more efforts to protect it would be beneficial to maintaining the biodiversity that the tallgrass prairie offers.

The Center provides workshops and training sessions for wildlife professionals as well as a visitor center that offers nature related books and gifts for people to continue their education outside of the Learning Center.

Classes include lessons about steps taken to protect the region's unique biodiversity for future generations.



Prairie Wetlands Learning Center

Activities include:

- hunting
- fishing
- wildlife viewing
- interpretation
- environmental education
- photography
- hiking

Despite the difference in size, the Sheyenne National Grassland can follow the example of the Prairie Wetlands Learning Center in that it could provide educational opportunities for people of all ages in order to maintain the unique biodiversity of the region and ecosystem.

North Country Trail-Sheyenne National Grasslands

Activities include:

- hunting
- fishing
- wildlife viewing
- horseback riding
- photography
- hiking

Area: 70,180 acres
(public/federal land)
Houses: native prairie and rolling hills
Trails: 34.3 Miles

Biesbosch Museum

Werkendam, Netherlands | Studio Marco Vermeulen



A path through the green roof allows visitors to experience the landscape at different levels



A willow filter takes wastewater and converts it to clean water, and the willows use the excess nutrients to grow. The wood is then sawn and used for fuel or other purposes. Such a filter can be an example for the Sheyenne National Grasslands.



The use of a green roof with paths and outlooks is an interesting concept that can be mimicked in the Sheyenne National Grasslands. The educational building would be more sustainable with a green roof and would allow visitors a view of the surrounding prairie. Visitors could then interact with the environment and building at the same time, creating a unique user experience with immersion in nature while still on/in the educational building. Not only could visitors learn about the tallgrass prairie environment, but they could also learn about sustainability through buildings, and how sustainability can leave a heritage of the past while still providing for the needs of future generations.



Open to the surrounding, the building allows visitors to learn about the environment and then explore it with a flawless transition of spaces.

The large glass windows allow people to see out to the surrounding parkland.

The building breaks up the ground horizon by allowing the building to seem like it is coming out of the earth or is one with the earth.

The appearance of the island and the building are always changing, as the tides inundate parts of the land.

The building has a history of harvesting and processing natural materials. The willow filters that the museum provides has allowed for the potential increase in sturgeon and salmon in the river nearby that had previously disappeared.

The Biesbosch provides a great example of taking a natural process and showcasing it while thinking of the environment and all of the animals and plants that are part of the complex ecosystem. The Sheyenne National Grasslands could do the same, but with the prairie ecosystem.



The structure blends into the landscape with the use of the green roof and natural materials, while also standing out due to its large glass windows and jagged structure. The use of glass is interesting in that it reflects the area around giving visitors a unique experience of the landscape both looking ahead and seeing reflections of the surrounding environment. A similar concept could be used in the Sheyenne National Grasslands to allow visitors to experience the site with a structure that both blends in, but also stands out to understand that it is there for education, not just internal reflection.

The proposed building in the Sheyenne National Grasslands could blend right into the rolling hills and show the character of the grasslands and the forested areas.

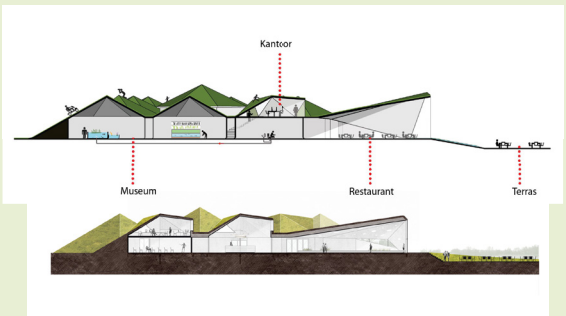


Interactive features inside the museum allow visitors to learn about the landscape and environment.



The museum is situated on an island and provides spaces for parking, education, and exploration. Trails weave through several geologic features and highlight the diversity of flora and fauna of the area.

While the focus is on tidal fluctuations and the transition of space in relation to tides, the building in the Sheyenne National Grassland can follow suit by studying the transition of prairie to forest lands.



Code Analysis

Occupancy type: educational, small assembly space with an occupant load of less than 50 persons

Occupancy load: classroom area-300 people $\times 20 \text{ net} = 6000 \text{ sq ft}$

Accessory storage areas, mechanical equipment room $2 \text{ people} \times 300 \text{ gross} = 600 \text{ sq ft}$

Exhibit gallery and museum $300 \text{ people} \times 30 \text{ net} = 9000 \text{ sq ft}$

Assembly unconcentrated $300 \text{ people} \times 15 \text{ net} = 4500 \text{ sq ft}$

Max exit width: 36 in

Construction type: Type IV

Max height: (A and E with sprinklers) 85' above grade plane

Square footage per ground floor: (A-1, S1) 60,000 square feet

Exit access travel distance: 250'

ADA requirements:

Parking

Total number of parking spaces: 101-150; accessible parking spaces: 5 and 1 van accessible (located on shortest accessible route from parking to an entrance); the universal symbol of accessibility shall be included

Ramps and Slopes

Slopes must be no steeper than 1:48

Accessible routes and ramps must be no steeper than 1:20; widths must be a minimum of 36 inches

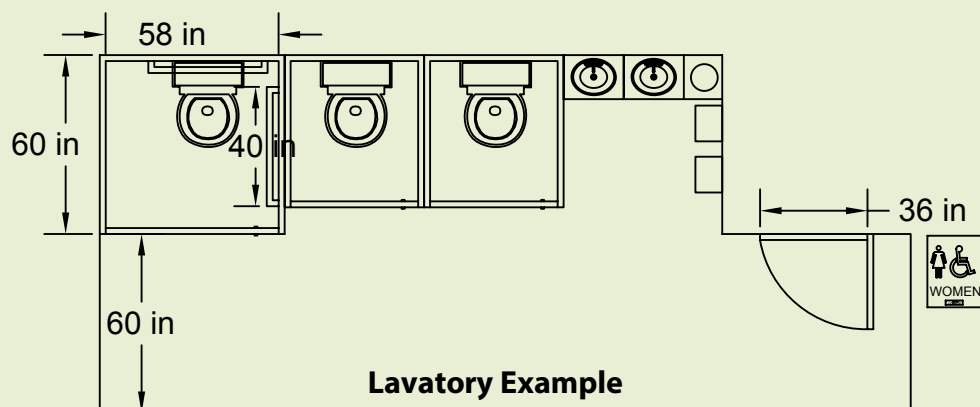
Cross slope of a ramp shall not exceed 1:48

Floor and ground surfaces of ramp runs shall be stable, firm, and slip resistant; ramp landings must be a minimum of 60 in long; edge protection shall be provided on each side of ramp runs and at each side of ramp landings

Handrails

Handrails shall be provided on slope runs more than 1:20; handrail heights are between 34 inches and 38 inches; handrail surfaces and any surfaces adjacent shall be free of sharp or abrasive elements and shall have rounded edges; handrails shall not rotate within their fittings

No revolving doors are allowed; door openings shall provide a clear width of 32 inches minimum; thresholds shall be 1/2 inch maximum; door and gate hardware shall be operable with one hand





DESIGN

Design Plan: Documentation & Methodologies

Moving forward in research, more information may need to be found on case studies about environmental education centers to see what design aspects people like in order to interact with nature, as well as more scientific and psychological research about what types of learning can change learner attitudes and behaviors.

The process of documentation would begin with the base material and end with the final entire thesis documentation document that is submitted to the University. The major things to document include:

- Base Material
- Analysis & Vision
- Master Plan
- Site Plan & Details
- Final Graphics

Other documented items may include process sketches as well as concept ideas and process.

All documented items will be digitally documented by photograph or scanned and kept in two locations: laptop and cloud for backup. Documentation will happen every Friday to log each weeks progress.

Methodologies

Of the several types of design methodologies and research, only a few will be implemented in my thesis.

Design Research:

This will be focused on the research paper aspect of the thesis preparatory work in which the effectiveness of learning methodologies in nature was looked into. The goal of the research was to find ways to incorporate the most effective learning methods into programmed landscape areas in order for people to change their (mainly) destructive behaviors and attitudes toward the environment, in particular, the tallgrass prairie region of North Dakota in the Sheyenne National Grasslands. The research into the most effective ways of changing learner behaviors and attitudes toward the environment through programmed and unprogrammed areas in the landscape can be used in the future as a case study in what is effective and ineffective design to reach these goals.

Interpretive Research:

Through interpretive research, programmed features of a landscape would be linked with psychological effects to change learner behaviors and attitudes toward the environment. Through research, these two particular things have not yet been linked and documented for further research. Interviews of people's perceptions of the landscape and their feelings of what may change their behaviors can be done and then correlated to a programmatic element or area's programmed activity/meaning.

Evaluative Research:

This will mainly be done through comparing several case studies-assumed to be normative values of design competence-to see what has worked in the past to try to form a more solid program of what should be designed at the specific site in the Sheyenne National Grasslands.

Through psychological and scientific research, design aspects and elements will also be compared for effectiveness in changing people toward more positive environmental behaviors and attitudes as well as overall environmental literacy.

Design Plan: Project Schedule

January 2017

W 1	Base Material
W 2	January 18 Base Material Review
W 3	Analysis & Vision January 25-27 Analysis & Vision Review
W 4	Master Plan

February 2017

W 5	Master Plan
W 6	Master Plan February 15-17 Master Plan Review
W 7	Site Plan & Details
W 8	Site Plan & Details

March 2017

W 9	Site Plan & Details March 8-10 Site Plan & Details Review
W 10	March 20-22 Presentation 1: Proposal Final Presentation Graphics
W 11	Final Presentation Graphics

April 2017

W 12	Final Presentation Graphics
W 13	Final Presentation Graphics
W 14	Final Presentation Graphics April 21 Digital Material Due
W 15	April 24 Final Printed Boards Due

May 2017

W 16	May 1-3 Final Presentations
W 17	Thesis Documentation Due May 10

APPENDIX

¹National Environmental Education Act of 1990:

<https://www.epa.gov/education/national-environmental-education-act>

²Environmentally Literate: the capacity of an individual to act successfully in daily life on a broad understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainably

³Donna the Deer Lady video link:

<https://www.youtube.com/watch?v=n5edIVgiTU4>