

Improving prairie relationships: utilizing the arts in elementary science education

by

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A REPORT

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Abstract

Due to budget and liability issues, teachers often find connecting students to hands-on learning opportunities and nature-specific lessons challenging to implement. This also means that children do not have as many opportunities to interact with nature in school and other settings as compared to the past. Children have also become less interested in pursuing science topics and careers past their K-12 schooling. Improving access to lesson plan resources for teachers can create an easier way to incorporate nature education in the classroom. This study aims to address this issue by creating a science-based lesson plan centered around prairies that incorporates arts-based activities. It includes a matrix of educational sites in Manhattan, Kansas that support prairie education and other education topics for future research and build-out. This lesson plan will include an accessible field trip to the Marianna Kistler Beach Museum of Art which uses art to support science education. An immersive field trip is encouraged but not required for the lesson as well to increase students' hands-on, experiential learning opportunities. These outcomes look at incorporating science-based prairie education with artistic activities to fill an educational gap in prairie programming in Manhattan, Kansas. Furthermore, these resources have been incorporated into a website to be accessible to anyone who wishes to view or utilize them.

IMPROVING PRAIRIE RELATIONSHIPS

Utilizing the Arts in Elementary Science Education

Gabrielle Smith | Spring 2025





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ABSTRACT

Due to budget and liability issues, teachers often find connecting students to hands-on learning opportunities and nature-specific lessons challenging to implement. This also means that children do not have as many opportunities to interact with nature in school and other settings as compared to the past. Children have also become less interested in pursuing science topics and careers past their K-12 schooling. Improving teacher access to lesson plan resources can create an easier way to incorporate nature education in the classroom.

This study addresses this issue by creating a science-based lesson plan centered around prairies that incorporates arts-based activities. It includes a matrix of educational sites in Manhattan, Kansas, that support prairie education and other education topics for future research and build-out. This lesson plan includes an accessible field trip to the Marianna Kistler Beach Museum of Art and K-State Meadow, which use art to support science education. An immersive field trip is encouraged but not required for the lesson to increase students' hands-on, experiential learning opportunities.

These outcomes incorporate science-based prairie education with artistic activities to fill an educational gap in prairie programming in Manhattan, Kansas. Furthermore, these resources have been incorporated into a website to be accessible to anyone who wishes to view or utilize them.



Figure 1.3 *A moth on heath aster (Smith 2025).*

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INTRODUCTION

Abstract

Due to budget and liability issues, teachers often find connecting students to hands-on learning opportunities and nature-specific lessons challenging to implement. This also means that children do not have as many opportunities to interact with nature in school and other settings as compared to the past. Children have also become less interested in pursuing science topics and careers past their K-12 schooling. Improving teacher access to lesson plan resources can create an easier way to incorporate nature education in the classroom. This study addresses this issue by creating a science-based lesson plan centered around prairies that incorporates arts-based activities. It includes a matrix of educational sites in Manhattan, Kansas, that support prairie education and other education topics for future research and build-out. This lesson plan includes an accessible field trip to the Marianna Kistler Beach Museum of Art, which uses art to support science education. An immersive field trip is encouraged but not required for the lesson to increase students' hands-on, experiential learning opportunities. These outcomes incorporate science-based prairie education with artistic activities to fill an educational gap in prairie programming in Manhattan, Kansas. Furthermore, these resources have been incorporated into a website to be accessible to anyone who wishes to view or utilize them.

◀◀ **Figure 2.1** *Rough blazing star in the Konza Prairie (Smith 2025).*

◀ **Figure 2.2** *Narrow-leaf four o'clock at the Konza Prairie (Smith 2025).*

Purpose

This research aims to promote the use of the arts in science education, make a prairie, nature-focused lesson plan that is more accessible to educators, and further promote a third prairie education center in Manhattan, Kansas, through the Marianna Kistler Beach Museum of Art. In Kansas, the Association for Conservation and Environmental Education has created programs promoting green schools, school gardens, and WILD Outdoors. These programs incorporate environmental education in schools and utilize the existing school grounds as an opportunity for educational experiences. In Manhattan, Kansas, groups like the Flint Hills Discovery Center and the Konza Prairie Biological Station have created programs to promote education in nature. The Flint Hills Discovery Center focuses on the history of Flint Hills, its formation, settlement, and development, as well as the natural aspect of the prairie, the plants, animals, and natural processes that survive in it and help it to thrive. The Konza Prairie Biological Station focuses on the science of the Flint Hills, the plants, bison, and burning of the prairie while immersing visitors in a native prairie environment. The Beach Museum of Art can serve as Manhattan's third prairie education center. It focuses on Kansas and regional art in the gallery spaces and facilitates interactions with the adjacent K-State Meadow, a plot of native prairie plantings. A unique science learning opportunity with art can occur with the addition of a prairie-centered lesson plan before a field trip. It is also the most accessible location, with free admission and tours and bus funding available.

Research Question

How can adding a third prairie education center in Manhattan, Kansas, fill a gap in current prairie education programming? More specifically, how can the Beach Museum of Art and the K-State Meadow, with the addition of a grades 3-5 prairie-centered lesson plan, add to the prairie education experience in Manhattan, Kansas?

Outcomes

The primary outcome of this project includes a lesson plan and activities centered around the K-State Meadow and Beach Museum. A seasonal prairie image gallery and website were also created to serve as an educational resource. Specific products included in this project are an inventory matrix of nature learning centers in Manhattan, Kansas, informational photo galleries, and a prairie-focused lesson plan for grades 3-5 that includes a field trip to the Beach Museum of Art and the K-State Meadow. These were accomplished through a site inventory that compared existing educational sites and reviewed existing amenities at the Beach Museum of Art and K-State Meadow, observation and photography of four selected prairie environments, and precedent studies of an existing educational hub and prairie-centered lesson plans. Educators and the Beach Museum now have access to a prairie-focused lesson plan and an informational photo gallery for displays. They can also access the educational materials provided on the website.

Glossary

Informal learning: Spontaneous learning situations with no mediator, often taking place in the home, neighborhood, etc. (Eshach 2007).

Hands-on learning: Doing or performing a task (Wells et al. 2019; Eshach 2007); Manipulating items or events in a natural setting in order to understand the natural world around them through observations, inferences, and conclusions (Flick 1993).

Experiential learning: Learning by doing; Outdoor education that follows scientific principles and can be conducted through activities like community service, field work, and internships (Gilbertson et al. 2006a; Millenbah and Millspaugh 2003).

Active learning: Learning through activities like simulations and case studies while reading, writing, and reflecting on their experiences and findings (Millenbah and Millspaugh 2003).

Outdoor education: Any learning that takes places outside of the classroom, i.e. field trips (museums, zoos, science centers, camps, etc.), playgrounds, grocery stores, and more with the goal of increasing appreciation and awareness of the natural world (Gilbertson et al. 2006a).

PEB: Pro-environmental behavior (Whitburn et al. 2023).

STEM: Science, Technology, Engineering, and Math.

STEAM: Science, Technology, Engineering, Art, and Math.

“Wilderness is not a luxury but a necessity of the human spirit.”

–Edward Abbey



03



BACKGROUND

Context

Manhattan, Kansas, sits in the heart of the Flint Hills Tallgrass Prairie ecoregion and is directly adjacent to the Konza Prairie Biological Station. The Konza Prairie is part of North America's largest remaining area of tallgrass prairie. Additionally, in Manhattan, Kansas, there are places like Washington Marlatt Memorial Park, the Kansas State University Meadow, and the Kansas State Memorial Stadium green roofs, which strive to observe, preserve, and better understand these prairie ecosystems. However, many residents and educators may not be aware of these local prairies, understand them, or take full advantage of them.

Many people do not see beauty in these landscapes and overlook their importance in the natural world. Educators also have limited time in their schedules to develop new lessons, which can lead to unique science learning opportunities being overlooked. This project aims to feature the beauty of these landscapes throughout the year, link resources together about prairie education, and improve access to nature education for residents and visitors in Manhattan.

◀◀ **Figure 3.1** *Goldenrod in the K-State Meadow (Smith 2025).*

◀ **Figure 3.2** *Yellow moth on heath aster (Smith 2025).*

DILEMMA BACKGROUND

Relationship with the Outdoors

The world is changing, and it is becoming increasingly important that people are educated and informed on environmental topics. Starting this education when people are children is the most effective way to increase their interest, care, and social action to preserve and protect nature (Eick 2012). However, children today spend less time outdoors than in the past (Rosenow and Bailie 2014; Powers 2019). Ayotte-Beaudet et al. (2023) stated that “Ecology education is particularly important in an era of global change and biodiversity loss worldwide,” (277). Environmental education involves getting children involved and passionate about the outdoors. Powers (2019) shared the statistic that children today experience only “4-7 minutes of unstructured outdoor play per day and [spend] 7.5 hours a day in front of some type of technology” (5). Some reasons for this diminished access to the outdoors include increased use of technology, fewer wild spaces for children to explore, modern lifestyles, a fear of danger, and overprotective parenting (Rosenow and Bailie 2014; Eick 2012). This has led to a misunderstanding of the outdoors, with many people viewing it as mysterious and fearing weather, wild animals, and insects (James and Williams 2017). A simple way to make people more informed is to encourage experiences in nature. This can be utilized at all ages, but the most impactful is youth environmental education. Using the environment in education has many benefits, including awakening curiosity, providing field investigations, utilizing sociological relationships, gaining an aesthetic appreciation for nature, and helping people better understand the world around them (Stark 1970). This being said, it is not enough to talk about the environment; students need to experience the environment in a hands-on way to grasp ecological concepts fully.

HANDS-ON LEARNING

Definition

An active form of environmental education is hands-on learning. Hands-on learning involves doing or performing a task, like an interactive museum exhibit (Wells et al. 2019; Eshach 2007). It can be considered a general approach to teaching or a specific strategy that provides an activity where students are actively engaged in handling materials (Flick 1993). For something to be considered hands-on learning, students should manipulate items or events in a natural setting and strive to understand an aspect of the natural environment by making observations, inferences, and conclusions (Flick 1993).

Benefits

Hands-on science activities are highly beneficial for students who have little to no experience in natural outdoor settings. It exposes them to movement and skills like hand-eye coordination and processes like data analysis, inferencing, and hypothesizing (Flick 1993). Pairing traditional classroom learning with hands-on science learning increases the amount of knowledge students gain because they are not only passive observers but active participants in the lesson (Wells et al. 2019). This also improves student’s perceptions and attitudes toward science and learning (Flick 1993; Wells et al. 2019). In order to ensure that students are gaining knowledge and reaching desired learning outcomes, the activities need to be evaluated in some way. This communicates what elements of the activity are important, provides feedback to students, and allows the instructor to observe how students interact and what they feel is important or exciting about the activity (Flick 1993).

EXPERIENTIAL LEARNING

Definition

Experiential education is not just about being outside but ensuring students have an educative experience while following scientific principles (Gilbertson et al. 2006a). Millenbah and Millspaugh (2003) defined experiential learning as being a spectrum of experiences that include things like “community service, field work (including field-oriented course work), internships, and undergraduate participation in faculty research” (127). Essentially, it is learning by doing. Experiential learning is often confused with active learning, where students participate in activities such as simulations, case studies, and problem-solving while talking, reading, writing, and discussing their experiences and findings with others (Millenbah and Millspaugh 2003). The most important part of the experiential learning process is reflecting. While experiential learning often involves hands-on learning, the act of reflecting is what sets it apart. The primary goals of experiential learning include “integrating theory and practice, to increase student motivation through the experience of applying knowledge, and to encourage students to develop their skills as independent scholars” to expand and deepen the instruction and learning processes (Millenbah and Millspaugh 2003, 128).

Benefits

The most impactful benefit of experiential learning is that it “facilitates learning for individuals with a diversity of learning styles (i.e., it targets more than auditory learners)” (Millenbah and Millspaugh 2003, 128). Additionally, it creates a learning environment where students are actively acquiring information and developing critical thinking skills (Millenbah and Millspaugh 2003). Experiential learning increases confidence, reduces stress, and

makes students more familiar with the learning material. However, it can be challenging to implement with the overall time commitment and unexpected weather conditions. Millenbah and Millspaugh (2003) also found that in their study, students appreciated the opportunity to conduct fieldwork and real-world applications and thrived in an environment that did not mimic a traditional classroom.



Figure 3.3 Students participating in experiential education (BC Gov Photos 2018).

OUTDOOR EDUCATION

Definition

At its broadest definition, outdoor education includes any learning that takes place outside of the school building, i.e., field trips (museums, science centers, zoos, camps, etc.), a playground, grocery store trips, and more. The primary goal is to “increase awareness and appreciation of the natural world” while focusing on problem-solving and nature education (Gilbertson et al. 2006a). Outdoor education is comprised of several types of learning, including hands-on and experiential learning. Gilbertson et al. (2006a) explained how it can be sorted into nonformal, formal, and informal forms of education. Formal education could also be referred to as traditional education and takes place within the organized school system. In this setting, learning is typically individual and based on abstract concepts (Ramey-Gassert 1997). Nonformal education is still structured learning but occurs outside the school building. Informal education is almost a direct contrast to formal education, where the student oversees the educational experience. This type of learning can lead to higher retention due to the trial-and-error aspect of the activities, and students are generally more motivated to gain personal meaning from the experience and their learning (Gilbertson et al. 2006a; Eshach 2007; Ramey-Gassert 1997). In general, outdoor education focuses on three subject areas: ecological relationships, developing physical skills, and interpersonal relationships (Gilbertson et al. 2006a).

Importance

In today’s world, schools tend to focus on book learning and test-based accountability. This has limited the number of opportunities in school to experience nature and participate in outdoor environmental education. When considering that outdoor learning environments are often referred to as “authentic” or “context-based” and spaces where science can “come alive,” this seems counterintuitive (Ayotte-Beaudet et al. 2023, 278). According to James and Williams (2017), experiential, hands-on, and in-context learning are the most effective ways to reach students and are essential in meaningful and comprehensive student learning. When learning is active and experiential, it connects classroom learning to the greater environmental context, commits information more easily to long-term memory, and gets students who are generally apathetic excited about their education (James and Williams 2017; Eick 2012; Ayotte-Beaudet et al. 2023). Traditional learning relies on technology, which can expose learners to new environments but also limits them to using two senses. Outdoor education employs the use of all five senses and immerses students in a new and unique environment (Powers 2019).

Limitations

All this being said, teachers often do not utilize out-of-school science learning experiences. This could be because they are unsure about how to incorporate them into the curriculum, are not confident in the content, or do not know the resources that exist (Ramey-Gassert 1997; James and Williams 2017). Parents can also cause an underutilization of outdoor education resources as they are often afraid of safety concerns involving their children and unsupervised activities outside of the school (James and Williams 2017).

Benefits

Outdoor education is highly beneficial for students who struggle in a traditional classroom setting; those who tend to be more invisible take on leadership roles and use critical thinking skills (James and Williams 2017). Children who experience behavioral issues find support and passion in these settings, and hands-on and active learners have a space where they thrive (Powers 2019). A sense of wonder, curiosity, and ability to learn through exploration is often lost by third grade with traditional classroom learning (Ramey-Gassert 1997). Furthermore, a loss of connection with nature throughout life leads to diminished use of the senses, attention difficulties, and higher rates of emotional and physical illnesses (Powers 2019). There are mental, physical, and social health benefits to outdoor education. Children develop cognitive, social, emotional, and physical skills while building confidence and a positive attitude toward the environment (Powers 2019). It has also been proven that spending time in nature and viewing from a window improves mental health, well-being, and the behavior of children and adults (Powers 2019).

Additionally, outdoor education has cognitive and academic benefits. It improves students' sense of autonomy, creates deeper engagement and interest levels, and enhances student cooperation (Ayotte-Beaudet et al. 2023). Students learn best when abstract science principles and contexts are tied to their existing knowledge and familiar contexts. This is especially true if local and familiar species are focused on which garners awareness and appreciation for their environment (Waite 2011). It has already been stated that environmental learning helps with retention and deeper learning. This results in better performance on standardized tests, reduced classroom management problems, and increased classroom engagement (James and

Williams 2017). Outdoor education also allows students to develop scientific questions, investigate the natural world, and use their own observations to explain the answers to questions (Eick 2012).



Figure 3.4 Teacher engaging students in outdoor education (Nilov 2021).

FIELD TRIPS

Importance

Field trips are one way of promoting hands-on learning, experiential learning, and outdoor education. They have many benefits, and teachers have expressed many reasons for conducting one. They connect to the curriculum in a way that reinforces and expands ideas more meaningfully, provide new and memorable learning experiences, foster interest and motivation in students, provide a change in setting or routine, and provide enjoyment (Eshach 2007; Kisiel 2005). Additionally, field trips promote lifelong learning and can fulfill school demands (Eshach 2007; Kisiel 2005). Because of this, teachers feel that field trips are helpful and benefit students in ways that classroom learning cannot. Students gain new knowledge and additional perspectives, form new connections, and discover interests in topics and concepts (Kisiel 2005).

Limitations

Time and transportation are regular barriers to participating in field trips and field studies (Ayotte-Beaudet et al. 2023). Budget, however, is the most common concern. Hands-on experiences can be expensive and take time to plan and conduct (Wells et al. 2019; Rohlf 2015). Administrators sometimes have concerns over liability, safety, and the quality of the experience (Rohlf 2015). In some cases, field trip sites must be preapproved by the district or principal, which limits options. There are also instances where rules about which trips each grade can take exist to avoid repeat trips (Kisiel 2005). There is merit to this idea, but the same site can have different impacts on a student depending on their age, and the trips can have differing educational focuses that are new or built upon prior experiences. Teachers can also be limited in

the timing of field trips or if they occur in the first place (Kisiel 2005). In these cases, things like “mobile museums” are an alternative way to bring the science centers to the classroom or even prep for a field trip (Eshach 2007).

Benefits

Whitburn et al. (2023) found that “children who took part in the environmental education field trip had higher levels of pro-environmental behavior (PEB) relative to children in the control group” (6-7). Having more PEB means the students supported conservation more and gained a higher connection to nature. When comparing field trips to other teaching methods, it is easy to see how they enhance students’ attitudes toward science and how deeper contextual connections are formed (Ramey-Gassert 1997). On field trips, students gain skills related to collecting and synthesizing information, reasoning, collaboration, and leadership. Field trips, being a way to facilitate outdoor education, allow students to learn in a democratic way where they can explore their interests and gain confidence (Rohlf 2015). Because of this, they often exhibit feelings like interest, enthusiasm, motivation, alertness, awareness, and an eagerness to learn (Ramey-Gassert 1997). Field trips immerse students in their surroundings through sights, sounds, smells, and textures. Another benefit is increased retention, especially for visual or tactile learners (Lankford 1992a). This is true for a trip the duration of a single day, with Rohlf (2015) finding that 96% of children and adults who participated in a survey, the total being 138, could recall at least one thing they learned on a field trip.

CHILDREN, SCIENCE, AND ART

Children + Science

Learning about science topics can often be intimidating for young students. This is often because they feel they do not belong in science practices (Caiman and Jakobson 2019) due to a lack of subject material they can relate to (Mirkin et al. 2020). This is especially interesting when considering that scientists and children have a lot in common. Both groups are curious, observant, and ask questions. They also use “similar cognitive processes to generate knowledge and make discoveries about the world” and use sense-making to process what they see and experience (Beisly and Moffitt 2024, 1). There is one significant difference between the two, however. Scientists work in a lab, while children’s workspaces can be more informal, including the classroom, backyard, kitchen, and other places where they interact with the world around them (Beisly and Moffitt 2024). Children are always exploring and using play, exploration, and creativity to solve problems, develop ideas about the world around them, and adapt to new experiences and information (Beisly and Moffitt 2024). Utilizing hands-on learning and activities enhances the learning and meaning making of science for young children (Caiman and Jakobson 2019).

Children + Art

Art can have a similar impact on children and their understanding of the world. Beisly and Moffitt (2024) define art as “a form of knowing that emerges from the engagement with the artistic process” (3). When art is used in the daily classroom experiences of children, it allows them to “wonder, explore, interact, and connect through drawing, painting, sculpting, dancing, and singing” (Beisly and Moffitt 2024, 4). The more art experiences children are exposed to and participate in, the better they are at using art to show and explain theories of how the world works to others (Beisly and Moffitt 2024). This is because they can use line, shape, and color to make their thoughts visible, which expands their “understanding of the world, imagination, emotional expression, interpersonal communication, and problem-solving skills” (Beisly and Moffitt 2024, 4). Art also provides media outside of spoken word for children to express their thoughts, ideas, and understanding of the world. This can be especially true for scientific concepts where they may not be familiar with specific terms but are familiar with processes or visuals.



Figure 3.5 Students in art class (Kevo 2009).

Science vs. Art

Art and science have always had a complicated and ever-changing relationship. Both artists and scientists observe and create, but they tend to exist in different cultural spheres (Zhu and Goyal 2019). Both science and art have had varying definitions over the years. Nowadays, science can be described as “a body of empirical, theoretical, and practical knowledge about the natural world” (Braund and Reiss 2019, 221). In the eyes of students, this can make science seem restrictive and that it is a fact-driven pursuit that exists separate from the culture it exists within and serves (Braund and Reiss 2019). Art has existed for as long as cognate human existence through figurines, beads, and decorative features on handles, implements, and vessels (Braund and Reiss 2019). In more modern times, art has come to include “visual arts (including drawing, painting, sculpture, filmmaking, architecture, photography, and ceramics), literature (poetry, drama, prose, and fiction), and the performing arts (theatre, dance, and music)” (Braund and Reiss 2019, 220). Throughout time art and science have existed indistinguishable from each other until the 19th Century in the West when the term “scientist” was coined, and they shifted into separate cultures (Zhu and Goyal 2019). Both art and science have origins in the representation and interpretation of nature. Through observation and interpretation, science and art mix in physical objects based on engineering and artistic design, for example, La Sagrada Familia and the sketches of insects by Maria Sibylla Merian (Zhu and Goyal 2019). Art and science provide ways to show ideas about the world in a form where the viewer can connect to the idea (Zhu and Goyal 2019).

Science + Art

People tend to see science as using critical thinking rather than creative thinking, as science relies on logic and testing evidence-supported claims (Braund and Reiss 2019). This being said, there are several instances where scientific discoveries would not have happened without changes in literature and the arts, as art provides new ways of looking at the world (Braund and Reiss 2019). Earlier views of brain functions believed that the left and right hemispheres of the brain control different physical and cognitive functions; therefore, art and science thinking were believed to exist in different realms, the left dealing with analytical and sequential reasoning used in math and science, and the right dealing with interpersonal, imaginative, and emotional thinking (Braund and Reiss 2019). Recently, however, it has been found and believed that artistic activities stimulate the brain in ways that traditional science activities do not (Braund and Reiss 2019). Science and art are closely related in that both practices deal with “sensation, imagination, emotions, and analysis” (Caiman and Jakobson 2019, 157), and they both have origins in representing art and nature through differing methods (Beisly and Moffitt 2024; Zhu and Goyal 2019). The idea of holistic learning emerged from these ideas. Holistic learning combines aesthetic and cognitive aspects of learning to promote health (Caiman and Jakobson 2019; Mirkin et al. 2020).

Using art in science education has many benefits. Art is an effective way to make science concepts visual, allowing students to see science concepts as they occur (Beisly and Moffitt 2024). This also makes science concepts more accessible to students, humanizing it and creating a starting point for future science learning and understanding (Caiman and Jakobson 2019). Art provides

a way to simplify societal and universal questions in a way that is accessible and understandable to the everyday person (Zhu and Goyal 2019). A study that looked at children using art in a leaf-focused science lesson found that the art activity enhanced the science learning about leaves and improved aesthetic appreciation of leaves (Caiman and Jakobson 2019). One reason that has been provided for artistic activities' impact on science learning is that art utilizes visual thinking and learning. Today's children exist in a world that is dominated by "television, video games, computers, tablets, films," and more, so an approach using art allows students to see the answers they find to scientific problems (Braund and Reiss 2019, 229). The arts have the ability to engage and inspire students. Because of this, students gain an "immediate and significant improvement in learner interest in the content covered, as well as an increase in their perceived interest" in science topics (Mirkin et al. 2020, 6).



Figure 3.6 *Students using art in a science lesson (Schneider 2022).*

STEM + STEAM

STEM has been around for nearly 25 years. It is an acronym for Science, Technology, Engineering, and Math and is often used in curriculum and professional settings. STEAM was created a handful of years after STEM and added Art to the acronym in an effort to accentuate the artistic and creative processes that take place in those fields (Caiman and Jakobson 2019). Adding Art also provides another way for children to understand and show their understanding of science (Beisly and Moffitt 2024). It has been adopted in curriculums to improve youth engagement in science (Braund and Reiss 2019). STEAM education incorporates holistic learning to work in transdisciplinary ways that avoid false separations of disciplines (Braund and Reiss 2019). This means that hands-on learning and experiences are incorporated, which allows children to "explore, experiment, design, collaborate, and think creatively" (Beisly and Moffitt 2024, 4). In addition to this, STEAM "introduces students to life skills such as active learning; social, emotional, and interpersonal skills; divergent thinking; and cultural competency, the ability of an individual to understand and respect values, attitudes, beliefs, and customs that differ across cultures" (Beisly and Moffitt 2024, 4). Ultimately, science students must retain their creativity to be educated in modern times. The sciences and arts provide people with critical and creative minds that have aesthetic and emotional capacities to be well-rounded and cognate people (Braund and Reiss 2019).

SUMMARY

This review looked at the importance of connections to nature and how outdoor education and field trips can be used to enhance that connection in children. In the modern world, humans rely on technology for several things, including education. However, simulations and maps, while beneficial, cannot replace or fully replicate the experience of being outside at a physical location. Using outdoor education through hands-on and experiential learning allows for deeper connections to be made in the classroom and in children’s personal lives. Incorporating art into science lessons improves students’ perceptions of science and encourages them to think creatively and critically. Some structure is essential through these experiences, but free exploration and learning should be encouraged. Being outdoors has numerous mental, physical, and social health benefits, creating a greater appreciation and understanding of the natural world.

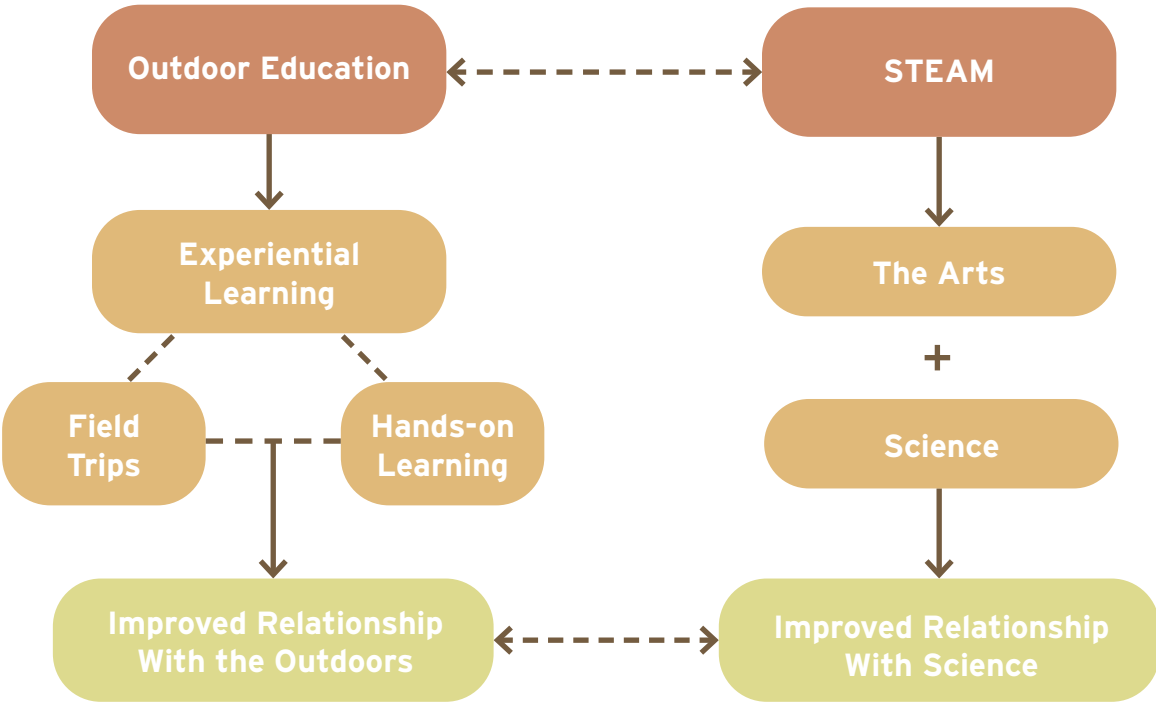


Figure 3.7 Literature review summary of relationships (Smith 2025).



Figure 3.8 Hands-on nature education (Forest Service Pacific Northwest Region 2017).



04



METHODOLOGY

Overview

The methods in this study include site inventory, observation and photography, and precedent studies. A literature review was completed first to ensure that an understanding of outdoor education concepts and the relationship of art in science education was reached. After this, an inventory and comparison of educational sites in Manhattan, Kansas, was completed. The sites focused on were the Konza Prairie, the Flint Hills Discovery Center, and the Marianna Kistler Beach Museum of Art. Their mission, history, and other information were reviewed to compare how they support education in Manhattan, KS. The site inventory also looked at the Marianna Kistler Beach Museum of Art and the K-State Meadow. This was the selected location for the field trip and allowed for arts-based activities to be incorporated into the science lesson plan. Reviewing the programs at the Beach Museum, the Meadow's information and history, and the elementary science standards for Manhattan guided which tours and topics were selected for utilization in the final lesson plan and activities. The observation and photography portion was completed for four sites in Manhattan: the K-State Meadow, the K-State Memorial Stadium Green Roofs, the Konza Prairie, and the Washington Marlatt Memorial Park. This provided seasonal imagery that was then used in the lesson plan and image galleries on the final website. Finally, a series of precedent studies were completed to further understand website construction and lesson plans related to prairies in Manhattan. This allowed for an understanding of the topics and plants covered in existing lessons. Additionally, they informed the structure of the lesson plan and its additional components.

◀◀ **Figure 4.1** *Trail at Washington Marlatt Memorial Park (Smith 2025).*

◀ **Figure 4.2** *Grasshopper on heath aster (Smith 2025).*

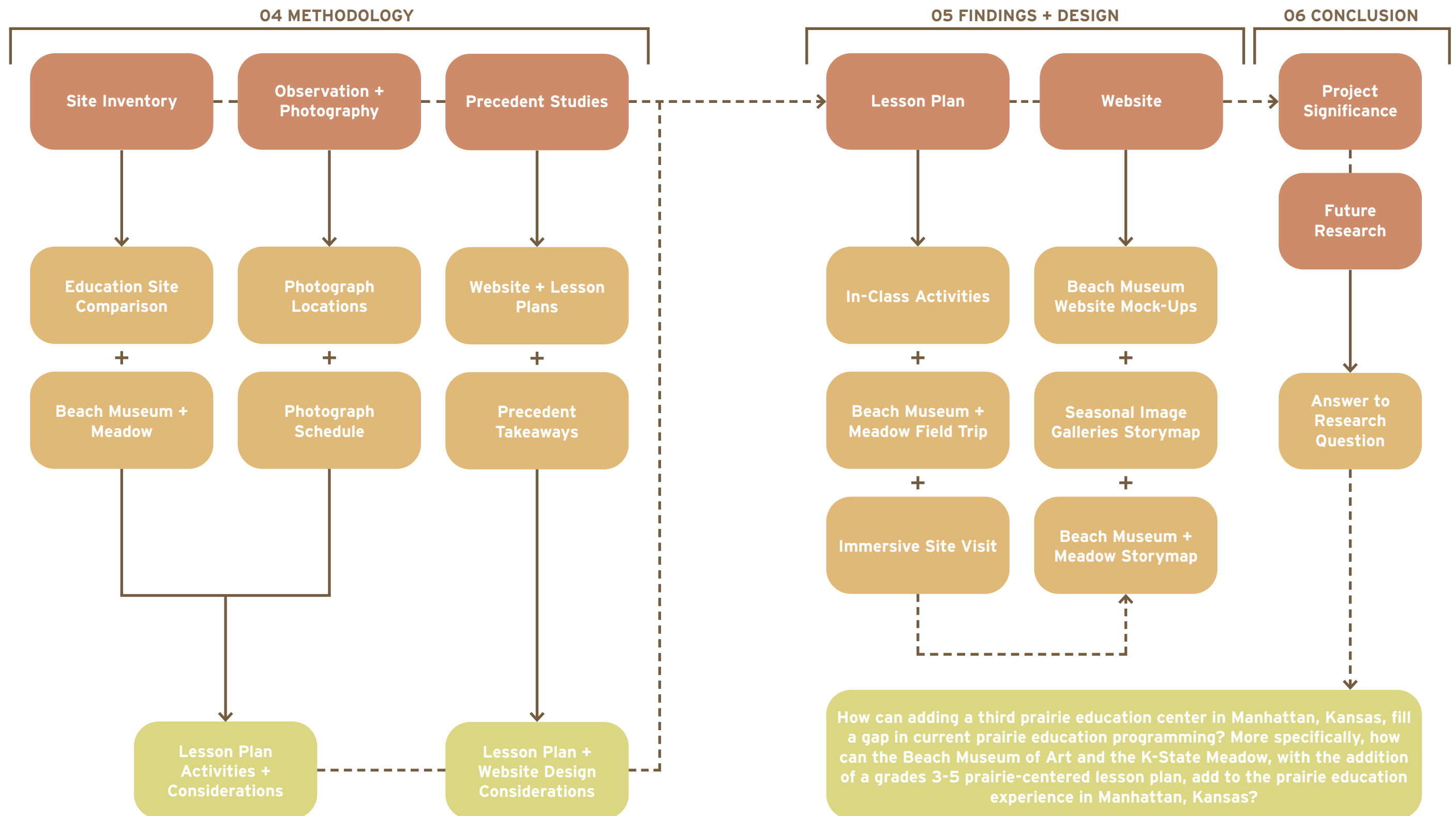


Figure 4.3 Methodology to conclusion process diagram (Smith 2025).

SITE INVENTORY

Comparison of Education Sites in Manhattan

There are three primary prairie-related educational sites in Manhattan, Kansas. These include the Konza Prairie Biological Station and Prairie, the Flint Hills Discovery Center, and the Marianna Kistler Beach Museum of Art. Each location has a distinct focus and provides a unique view to prairie and Kansas education. The Konza Prairie focuses on immersive experiences and learning in the Konza Prairie. The educational activities use the prairie as a laboratory and exhibit to learn about the processes, plants, animals, insects, and more on the prairie. The Flint Hills Discovery Center focuses on the history and formation of the prairie, specifically the Flint Hills ecosystem. It has a series of permanent educational exhibits covering a wide range of topics related to the prairie, a space for temporary exhibits, and a children's learning area. The Beach Museum of Art focuses on Kansas and regional art. It has a permanent collection, rotating temporary exhibitions, and a station for children to further their learning through play, reading, and activities. All the sites have educational programs whose lessons and content relate to prairies through their individual focus and specialty, immersion, history, and art.

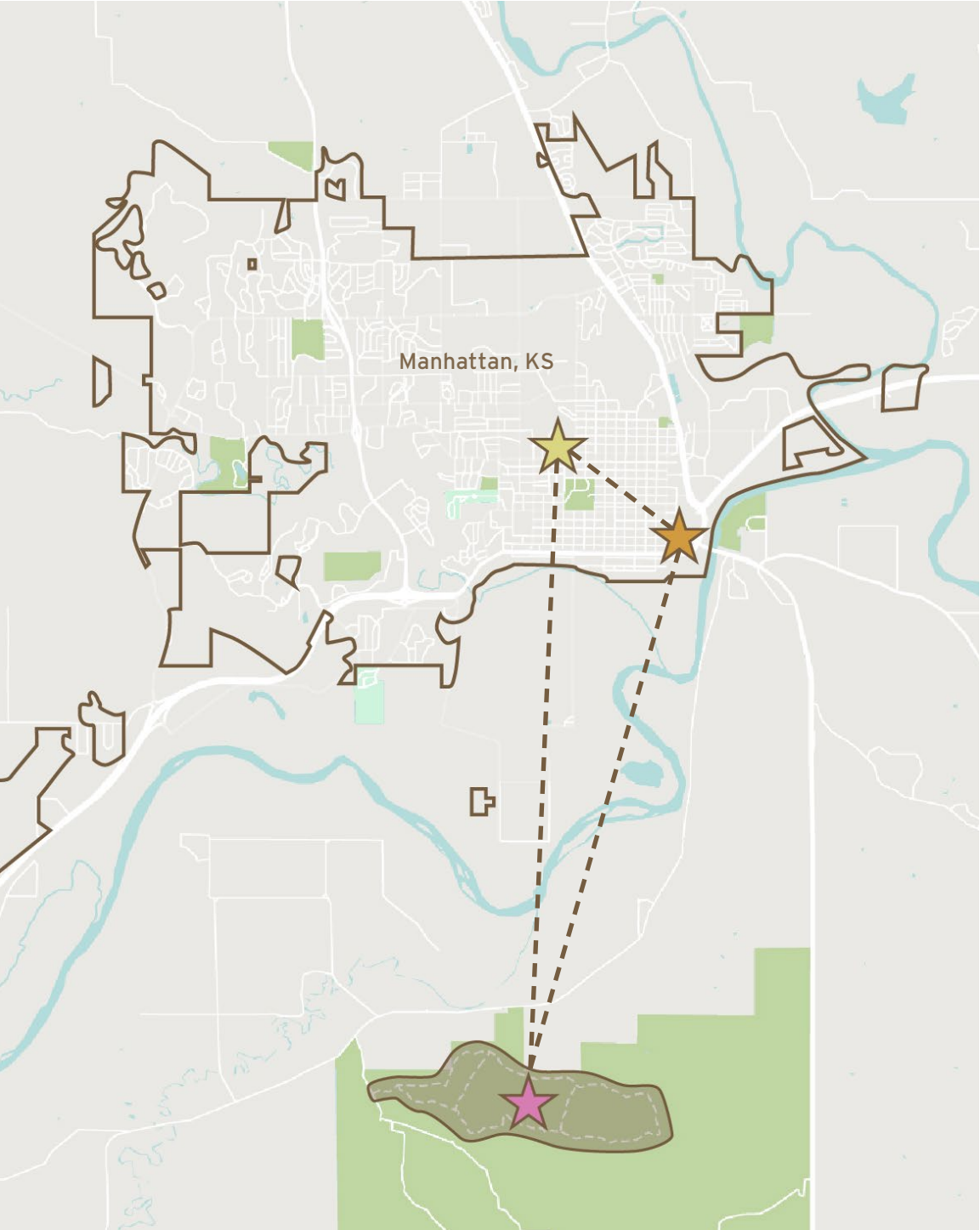


Figure 4.4 Manhattan, KS prairie education sites map (Smith 2025).
★ Beach Museum ★ Flint Hills Discovery Center
★ Konza Prairie

Konza Prairie Biological Station

LAND ACKNOWLEDGMENT

For thousands of years, the Konza Prairie Biological Station site was home to several named and unnamed indigenous peoples who lived and hunted on the land before European colonization. It is named after the Kaw, Kansa, people who inhabited the area until their forced removal between 1846 and 1872.

MISSION

The Konza Prairie Biological Station has a threefold mission centered around long-term ecological research, education, and prairie conservation. It is a unique outdoor laboratory that provides opportunities for studying tallgrass prairie ecosystems.

ABOUT

The Flint Hills ecoregion encompasses over 1.6 million hectares in eastern Kansas from around the Kansas-Nebraska border in the south into northeastern Oklahoma. It is one of North America's largest remaining areas of unplowed tallgrass prairie. The Konza Prairie Biological Station covers 3,487 hectares of native tallgrass prairie and is owned by the Nature Conservancy and Kansas State University. The K-State Division of Biology operates the preserve as a field research station.

HISTORY

The Konza Prairie Biological Station was founded in 1971 under the leadership of Professor Lloyd C. Hulbert of K-State. Tracts of adjoining land, such as the Dewey Ranch, were purchased between 1971 and 1979. The land was purchased for K-State by the Nature Conservancy with funds provided by a private donor, Katharine Ordway. It was initially named the Konza Prairie Research Natural Area to recognize the Kansa, Kaw, people. The site of the Dewey Ranch included a large limestone ranch house and barn built in the early 1900s. These buildings were renovated in 1996 and 2008, respectively, and now serve as the station headquarters. In 2000 it was renamed the Konza Prairie Biological Station.



Figure 4.5 *Konza Prairie (Smith 2025).*

Flint Hills Discovery Center

OVERVIEW

The Flint Hills Discovery Center tells the history and formation of the Flint Hills Prairie. On the entry atrium floor is a map of the Flint Hills overlayed on the states and counties it covers, showing the context of the Flint Hills in the United States. There is also a theater, permanent exhibit spaces, a rotating exhibit space, a children's learning floor, and an outdoor walkway with prairie plantings and informational signage. The majority of the exhibits have interactive aspects and teach visitors about prairies, their formation from seas, their rock types and fossils, prairie plant roots, soils, insects, plants, animals, seasons, grazers, the development history of oil, trains, cowboys, pioneers, and indigenous peoples, and the riparian corridors.

MISSION

The Flint Hills Discovery Center inspires people to celebrate, explore, and care for the Flint Hills. The center has a lifelong commitment to learning. It has developed an array of exhibits and programs that are exciting, educational, and authentic to engage visitors of all ages and all walks of life. It also has a commitment to living, growing, and evolving. To fulfill this, the center acts as a living, growing, and evolving institution capable of fulfilling long-term sustainability goals on a physical, philosophical, and financial level.

ABOUT

The Flint Hills Discovery Center is the result of a community dream and opened in April of 2012. The facility is 35,000 square feet total and immerses visitors in the beauty and wonder of the Flint Hills through its 10,000 square feet of interactive exhibits, temporary exhibits, theater experience, and prairie-inspired outdoor plazas.



Figure 4.6 *Flint Hills Discovery Center entrance (Smith 2025).*

HISTORY

The Flint Hills Discovery Center was a part of the South End Redevelopment Project and funded by Kansas STAR (Sales Tax And Revenue) bonds. Planning for the center began in 2007. In the center’s construction, over 85% of the labor and materials came from within 50 miles of the site. The groundbreaking ceremony was held in July of 2012, and construction took a little over 1.5 years to complete. It opened to the public on April 14, 2012, with almost 3,000 visitors on the first day and 10,000 guests within the first month. Annually, the center welcomes 70,000 guests.

FUNDING

The facility was built on STAR bonds as a part of a \$24.5 million project in Manhattan. The Flint Hills Discovery Center is a division within the city of Manhattan Parks and Recreation Department. It receives administrative support from several city departments, including human resources, finance, and legal. 3 sources of revenue fund the day-to-day operational expenses. The most significant component is earned revenue from admission fees, gift shop sales, education program registrations, membership sales, and facility rental fees. The second source of revenue comes from contributions from individuals, foundations, grant programs, and corporate sponsorships. The final revenue source is a portion of the Special Parks and Recreation fund, which comes from the 10% liquor tax collected from establishments in the city. Additionally, the Flint Hills Discovery Center Foundation, a private 501(c)3 charitable organization, supports large projects and programs that help advance the center’s mission. This includes technological upgrades, films for the immersive theater, and the renovation of the second-floor children’s area.

SUSTAINABLE DESIGN

The Flint Hills Discovery Center is committed to the preservation of our prairies. In January 2013, the center received LEED (Leadership in Energy and Environmental Design) Gold Certification. It was the first city of Manhattan to receive a LEED certification and the third in Manhattan.



Figure 4.7 Flint Hills Discovery Center display (Smith 2025).

Marianna Kistler Beach Museum of Art

OVERVIEW

The Beach Museum of Art sits on the southeast corner of the Kansas State University campus. It owns an extensive collection of works and hosts exhibits by nationally known artists, students and faculty of the college, and local Kansas artists. The primary emphasis is on Kansas or regional art, but the museum also hosts temporary exhibitions of other works.

MISSION

The Marianna Kistler Beach Museum of Art furthers the teaching, research, and service missions of K-State by collecting, studying, caring for, and presenting the visual art of Kansas and the region. The exhibitions and programs connect regional art, culture, and interests with the larger world.

ABOUT

The exhibitions in the museum often pay tribute to the land and those who care for it. The museum has over 10,000 works in its collection, with permanent displays of work by John Steuart Curry, the best-known Kansas-born artist who painted the murals in the Kansas State Capital building in Topeka. His widow also gifted 950 pieces of his work to the museum. Additionally, there are works by the best-known Kansas-born photographer, Gordon Parks. He is African American and was committed to social justice throughout his life. The museum now owns over 200 of his photographs. The museum has free gallery displays and special exhibitions in addition to presenting public programs and educational programs for audiences of all ages.



Figure 4.8 Beach Museum of Art (Smith 2025).

HISTORY

For decades the K-State art collection was housed in various campus public spaces and offices with art focused on Kansas and the region. As part of the University's 1990 Essential Edge campaign, the University's first lady, Ruth Ann Wefald, led efforts to raise private funds to construct a 26,000-square-foot museum on the southeast corner of campus. The museum opened in the fall of 1996 and had five galleries, two art storage spaces, an auditorium, a classroom, offices, and workspaces. Within the first five years the collection grew triple fold, there was a desire to showcase the permanent art collections as well as offer an active temporary exhibition program, and there was a desire to expand the educational programs which all led to the University prompting a private fundraising campaign for a building addition. This fundraising began in 2001, and in October of 2007, the new wing opened, which housed three additional exhibition galleries, three new storage areas, and renovated and new offices and workspaces. The museum has expanded its collection from 1,500 pieces to over 11,000 objects while maintaining its focus on regional art. The museum's annual attendance is close to 30,000 visitors.

COLLECTION HISTORY

The current museum collection contains over 11,000 objects. In January of 1928, K-State dedicated the Farrell Library, now the Hale Library. This building featured a lighted art gallery that held a temporary exhibition of over 100 paintings and prints by Birger Sandzén. In the following months, students, faculty, and the community raised funds to acquire two of his large oil paintings, which became the first pieces in the K-State art collection. In 1934, the K-State Friends of Art formed, which is now known as the Friends of the Beach Museum of Art, and was established to raise funds for the acquisition and care of work in the permanent collection.

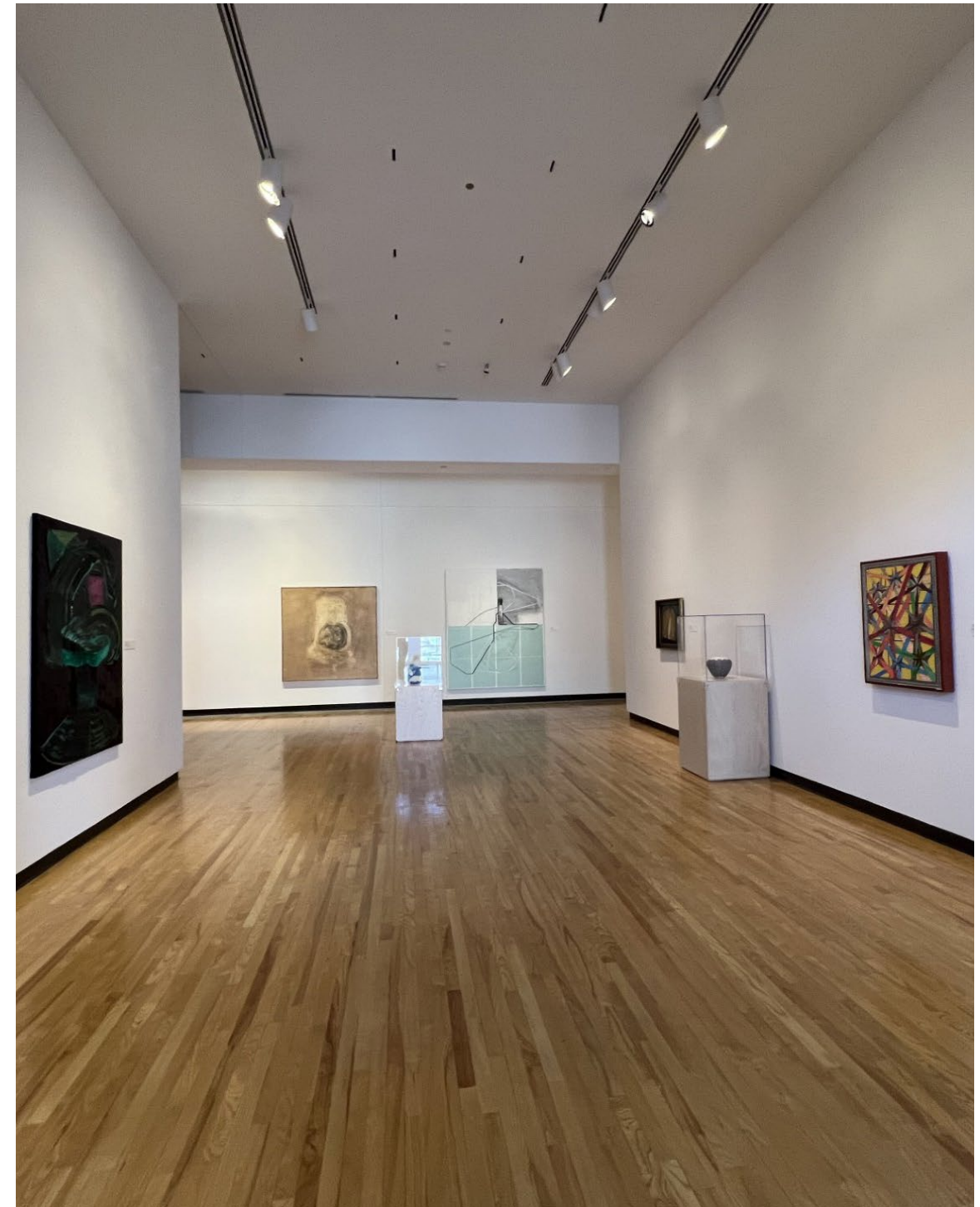


Figure 4.9 Beach Museum gallery space (Smith 2025).

Comparison Matrix

	Beach Museum of Art
Admission	Free
Time Needed	1.5 hours
Busy Seasons	September – October April – May
Annual Visitors	30,000
Visitor Breakdown	30% students, 30% university students, and 40% general visitors
Exhibit Types	Permanent and rotating art exhibits of paintings, photographs, sculptures, and prints.
Learning Locations	Gallery spaces, classroom space, and the Meadow
Activities	<i>Dependent on selected tour.</i> Ex-Grow like a plant and VTS (visual thinking strategies) activities.
Prairie Landscapes	K-State Meadow

Figure 4.10 Prairie education center comparison matrix (Smith 2025).

Flint Hills Discovery Center	Konza Prairie	
	Biological Station	Nature Trail
Adults – \$4 per adult Students – \$4 (<i>no education program</i>) or \$8 (<i>with education program</i>)	Controlled Access USD 383 – Free Other schools – \$25 per class	Open Public Access Free
1.5 hours	1.5 to 4 hours (<i>tour and schedule dependent</i>)	Any (1+ hours)
September – October April – May	September – October April – May	September – October April – May
70,000	3,500 – 4,000	<i>unknown</i>
<i>unknown</i>	All are students, 50% are from USD 383	Hikers, families, individuals, groups, photographers
Exhibits, immersive theater, prairie playscape, outdoor prairie terrace, trail, and classroom.	The Konza Prairie landscape and trails.	Hokanson Homestead, natural prairie, trails
Indoor exhibits and theater; outdoor prairie walkway and classroom	Hokanson Homestead, along the trail, grassy and wooded areas.	Hokanson Homestead, along the trail, grassy and wooded areas.
With education program – formal school program and lesson plans (1 of 9) Without – 15min film and scavenger hunt	Scavenger Hunt, identifying birds, insects, or plants, etc.	Hike, bird watch, etc.
Rooftop Prairie Walk	Konza Prairie	Konza Prairie

Comparison Matrix Continued

	Beach Museum of Art
Exhibits	Prairie Views (permanent), annual K-State Common Works of Art, and current rotating exhibits Printing Beyond Borders, Field Guide to a Hybrid Landscape, and In Bloom.
Lesson Plans	Salt Air Educational Units (with virtual exhibit), Two by Two: Animal Pairs Educational Units (with virtual exhibit), Language Learning Through Art, The Prairie Through New Eyes, Beyond OZ, All In A Day's Work, A Journal for Writing with Art, and An Eye on Our Town.
Field Activities	K-State Meadow Activities: Scientific drawing, looking at plants through magnifiers, found object sculptures (make and display)

Figure 4.11 Prairie education center activities matrix (Smith 2025).

Flint Hills Discovery Center	Konza Prairie
The Voices of the Flint Hills, Where the Air Is So Pure, Blowing Winds in the Tallgrass Prairie, Fanning the Flames, Winds of the Past, Underground Forest, Shaping Winds & Waters.	The Konza Prairie and its trails, insects, animals, and plants.
(K-12) Introduction to the Flint Hills, Big Bluestem, Little Bluestem's Story, Eight Great Kansas Based Non-Fiction Books, Flint Hills Wildflowers, Managing Prairie Communities, Tallgrass Printmaking, Eco-Services of the Tallgrass Prairie, Kansas Day Activities List (K-5) Flint Hills Map Exhibit Unit, Prairie Grass Texture Collage, Tallgrass Prairie: Your Place in Our World, Fossils, Grassroots, My Book of Flint Hills Grasses, Prairies and Grasslands, Prairie Plants, Seasonal Wheelscape, Tallgrass Tiles.	Prairie Week Curriculum: Elementary School – Introduction, bison, grasses, fire, and rocks on the tallgrass prairie. Middle School – Introduction, precipitation, a healthy prairie, maintaining a prairie, and restoring a prairie. High School – 6 lessons with a driving question under the overarching question: How do ecosystems maintain their health?
Prairie walk signage, outdoor classroom events, nature together program, viewing plants and insects.	Scavenger hunt, identification activities for birds, butterflies, grasshoppers, wildflowers, and other (dependent on teacher and/or volunteer docent goals and ideas).

Site Inventory Overview

The Marianna Kistler Beach Museum of Art and the K-State Meadow sit on the southeast corner of the Kansas State University campus in Manhattan, Kansas. The museum collections focus on art of Kansas and the surrounding region while showing artists from around the world. It has an ongoing exhibition and yearly rotating exhibitions, along with virtual exhibitions of current displays and collections available for viewing online. The Meadow is a half-acre learning landscape of native Flint Hills prairie plants that was planted in 2013 with over 40 species of plants. It offers students, faculty, residents, and visitors a chance to experience the native species of the Flint Hills Ecosystem while on campus. Additionally, it has been the base of several research and observation projects on its qualities for learning, restoring, and experiencing.

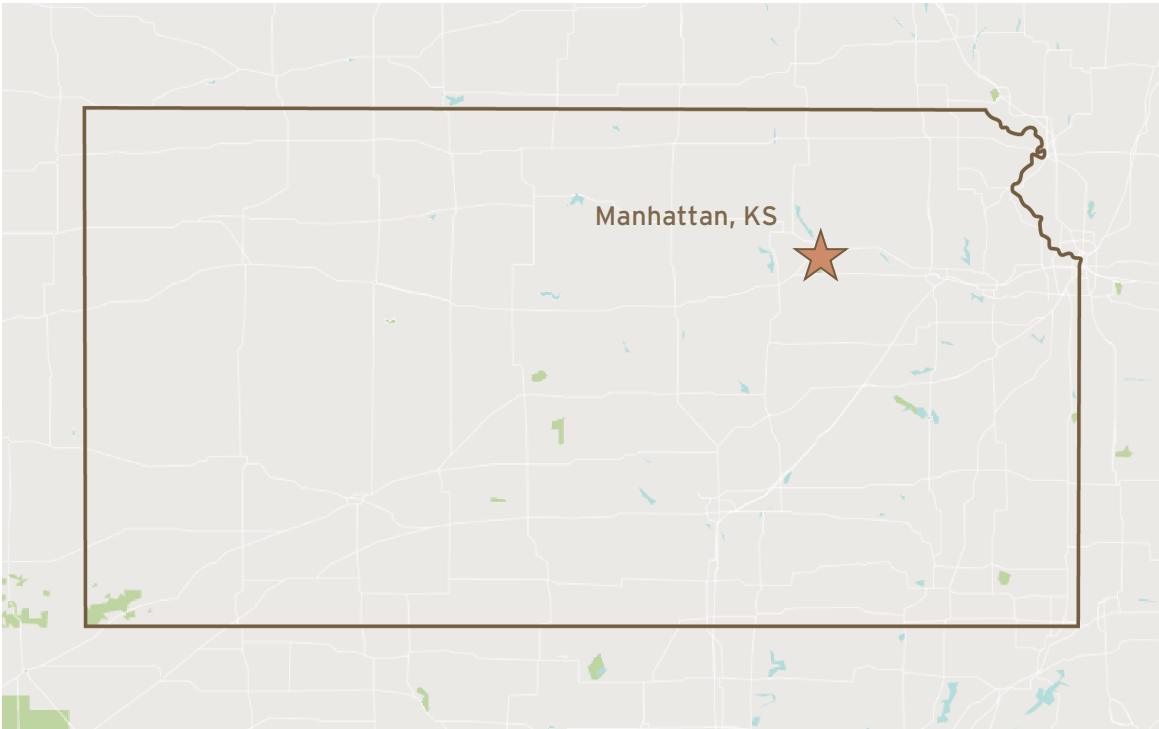


Figure 4.12 Manhattan, KS location map (Smith 2025).

Figure 4.13 Site location map (Smith 2025).

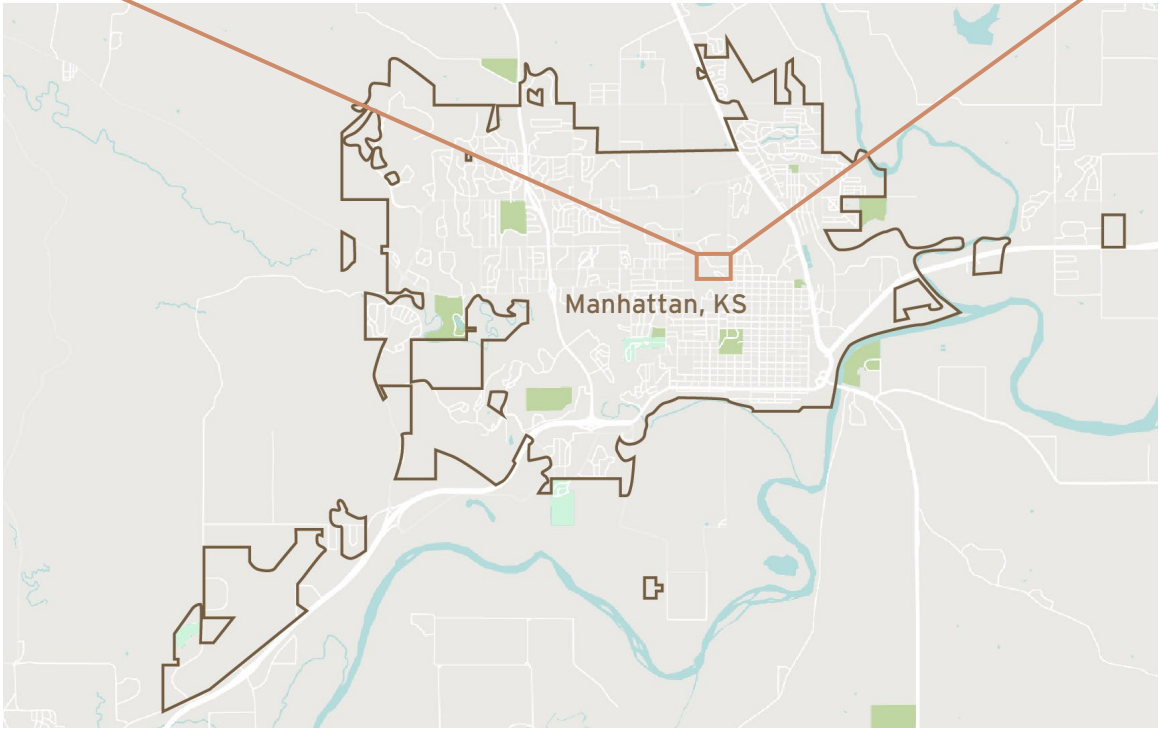


Figure 4.14 Beach Museum of Art and K-State Meadow location map (Smith 2025).

Beach Museum Tours

OVERVIEW

Tours must be scheduled 30 days in advance and are free, with bus funds available for school groups. Tours last 1.5 hours, and time is spent in the galleries, classroom space, and, weather permitting, at the K-State Meadow. The Museum can handle no more than three classes attending at a time. Tours are available for all ages in both the temporary and permanent exhibits. There are adult tours, early childhood preschool tours, K-State academic tours, and K-12 school tours. The K-12 school tours correspond to the USD 383 curriculum and Kansas National Education Standards and integrate social studies, language arts, math, and science in gallery activities, discussions, and art activities.



Figure 4.15 Beach Museum Prairie Views exhibit (Smith 2025).

THE FINE ART OF OBSERVATION

This tour takes place in the permanent collection and includes activities such as comparing and contrasting art, visual observation and evidence, and descriptive words and observations of art pieces. Weather permitting, the tour includes activities related to scientific drawing with measuring and descriptions in the Meadow. In the museum classroom, students also handle nature objects and magnifiers to practice visual thinking, observation, and expressive language.

PICTURING KANSAS: PRAIRIE VIEWS

This tour and lesson focus on the seasons of the prairie and plant life cycles. It also addresses the importance of water and controlled burns on the prairie. The activities include a poetry project, an art project, a food web activity, and, weather permitting, a visit to the Meadow.

SUMMER PROGRAMS

Summer art studio: Young artists spend time in the Meadow doing art projects and creating pieces like a found object sculpture that is then put on temporary display in the Meadow for viewing by family and friends.

ARTSmart: Weekly program with process-oriented art with sketching and photography activities. Students complete an observation activity centered around a piece in the exhibit, learn about the artist, explore an academic connection, receive a storybook suggestion, and complete an art project.

Beach Museum Tour Map

A typical school tour takes 1.5 hours. This time is split between the gallery spaces, the meadow, and the classroom space, with thirty minutes spent at each location. In each space students complete activities related to the tour theme, like the Fine Art of Observation or Picturing Kansas tours.

1

Gallery Spaces

There are permanent exhibitions that rotate pieces as well as rotating exhibitions. The museum shares themed tours related to the art on exhibit. Activities are completed that support the overall lesson's theme.



Figure 4.16 Temporary exhibit space (Smith 2025).

2

K-State Meadow

The Meadow is an area of native prairie plantings open to the public. When the weather allows, tour groups spend 30 minutes here, completing activities like scientific drawing of plants with magnifiers and creating art displays.



Figure 4.17 The Meadow on the K-State Campus (Kingery-Page, nd).

3

Classroom

In this space, students see and handle prairie objects such as dried plants and bison hide. Students can also participate in art activities with the supplies provided. They may also learn from display boards in the room.



Figure 4.18 Beach Museum classroom space (Richards 2025).



Figure 4.19 Beach Museum of Art tour route map (Smith 2025).

K-State Meadow Inventory

MISSION

The primary goal of the Meadow project is to heighten awareness of the need to protect grasslands worldwide. Over 49% of the world's grasslands have been destroyed, and only 4% are currently protected.

ABOUT

The Meadow is a half-acre learning landscape of prairie plants native to the Flint Hills. The site was transformed from mown turfgrass starting in 2013. After the 2014 growing season, the Meadow included over 40 species of plants. The project was made possible through a collaboration of staff, faculty, students, and community members. The Meadow is a setting for careful observation, discussion, and drawing activities, which encourages visitors to make meaningful connections between art, science, and enjoyment of the natural world. Additionally, it fosters lifelong learning about the Flint Hills Ecoregion and sustainable landscape management. Benefits of urban native meadows include habitat and forage for pollinators, increased stormwater infiltration of runoff, increased plant biodiversity, and potential for informal learning about ecosystems.



Figure 4.20 K-State Meadow (Smith 2025).

HISTORY

The project started in 2013, with plantings being added in 2014 from a mix of grown and bought native plugs funded by the K-State Green Action Fund. There were six trees on the site, with two being natives, a Chinquapin Oak, and an Eastern Red Cedar. The non-native trees were eventually removed. The plant palette is pulled from the Konza Prairie, and the plants were combined in five different mixes in response to the site's sun/shade and edge conditions. The mixes were part shade grasses and forbs, shade grasses and forbs, part shade grasses for edge, sun grasses for edge, and sun grasses and forbs. During the 2014 growing season, plants were transplanted from the K-State greenhouses, which increased the number of species on the site from 20 to 40. The Meadow decreases stormwater runoff and needs minimal maintenance. Funding for the creation and additions to the site came from generous private citizens such as the Hummel family, the Henley family, the K-State Green Action Fund, and volunteer hours from faculty, staff, and community members. In 2018, a batch of interpretive signage was added, providing information on things related to the Meadow, like water savings, chemical-free landscapes, and volunteers. Through a series of research and observation projects, the value of the Meadow is seen through its qualities for learning, restoring, and experiencing. The Meadow is home to several native insects and on the Rapid Ecological Assessment rubric written by Dr. Trisha Moore (KSU faculty and researcher), it scored a combined 3.56 out of 4 in the categories of plant health, soil erosion, soil health, and structure. The Meadow has provided a place on campus for reflection and appreciation of native grasses.

PURPOSE OF CREATION: **Taken from the Beach Museum Website*

- Demonstrate a sustainable landscape that uses less water and pesticides than traditional lawns.
- Provide a natural laboratory for graduate and undergraduate research projects.
- Provide a resource for teaching plant identification and native plant establishment.
- Add an experiential feature for Beach Museum tours.
- Allow visitors to examine, touch, and smell plants that are depicted in regionally significant art on display in the Museum's galleries.
- Create an extension of work done by Beach educators and faculty across campus to make meaningful connections between art, science, and the natural world.



Figure 4.21 K-State Meadow seating area (Smith 2025).

SIGNAGE:

In 2018 and 2019 interpretive signage was added around the Meadow. The signs are based on studies completed in the Meadow and provide information about the Meadow, its mission, volunteers at the Meadow, pollinator insects, biomass, the stormwater benefits of native plantings, chemical-free landscapes, and water savings.



Figure 4.22 K-State Meadow signs and locations map (Smith 2025).

PLANTS:

The Meadow was planted with 20 species of native plants in 2013. With additions and donations over 40 species of plants were present in the Meadow in 2014. This is a sampling of the plants still present in 2025.



A. Sideoats Grama



B. Little Bluestem



C. Northern Sea Oats



D. Switchgrass



E. Indian Grass



F. Canada Wild Rye



G. Golden Tickseed



H. Butterfly Milkweed



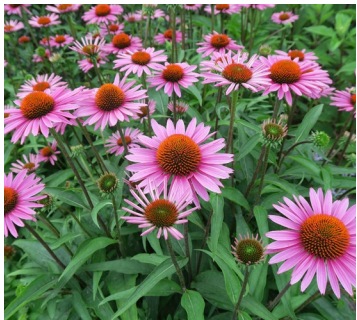
I. Black-eyed Susan



J. Compass Plant



K. Wild Blue Indigo



L. Purple Coneflower



M. Rose Verbena



N. Bee Balm



O. Goldenrod



P. Rough Blazing Star



Q. Heath Aster



R. Field Bindweed

Figure 4.23 K-State Meadow plants (Smith 2025).

OBSERVATION + PHOTOGRAPHY

Overview

This section relates to the photography portion of the project. Four prairie environments were selected for observation and photographic documentation throughout the academic year. These environments are the K-State Meadow, K-State Memorial Stadium Green Roofs, Konza Prairie, and Washington Marlatt Memorial Park. They were selected as they all represent prairie environments in differing ways: two are man-made, two are natural, and all are at different scales. These sites are located across Manhattan, where some are on the KSU campus; one is just south of the city, and the other is along the northwestern edge of the city.

The first set of photos were taken in September and provide a (late) summer visual of the prairie environments. The second set of photos were taken between November 6th and November 13th, representing these spaces in the fall. The winter photos, the third set, were taken in late January. The photos were taken with a Canon EOS 7 D Mark II camera and aim to show the beauty of the prairies. This was done through images of plants, insects, animals, and scenes encountered at each site.

The photos were sorted by location and season as they were captured. As the academic year progressed, the images were reviewed several times and narrowed down, removing any images of poor quality. In the spring, the images were added to their respective web page to be viewed and downloaded.

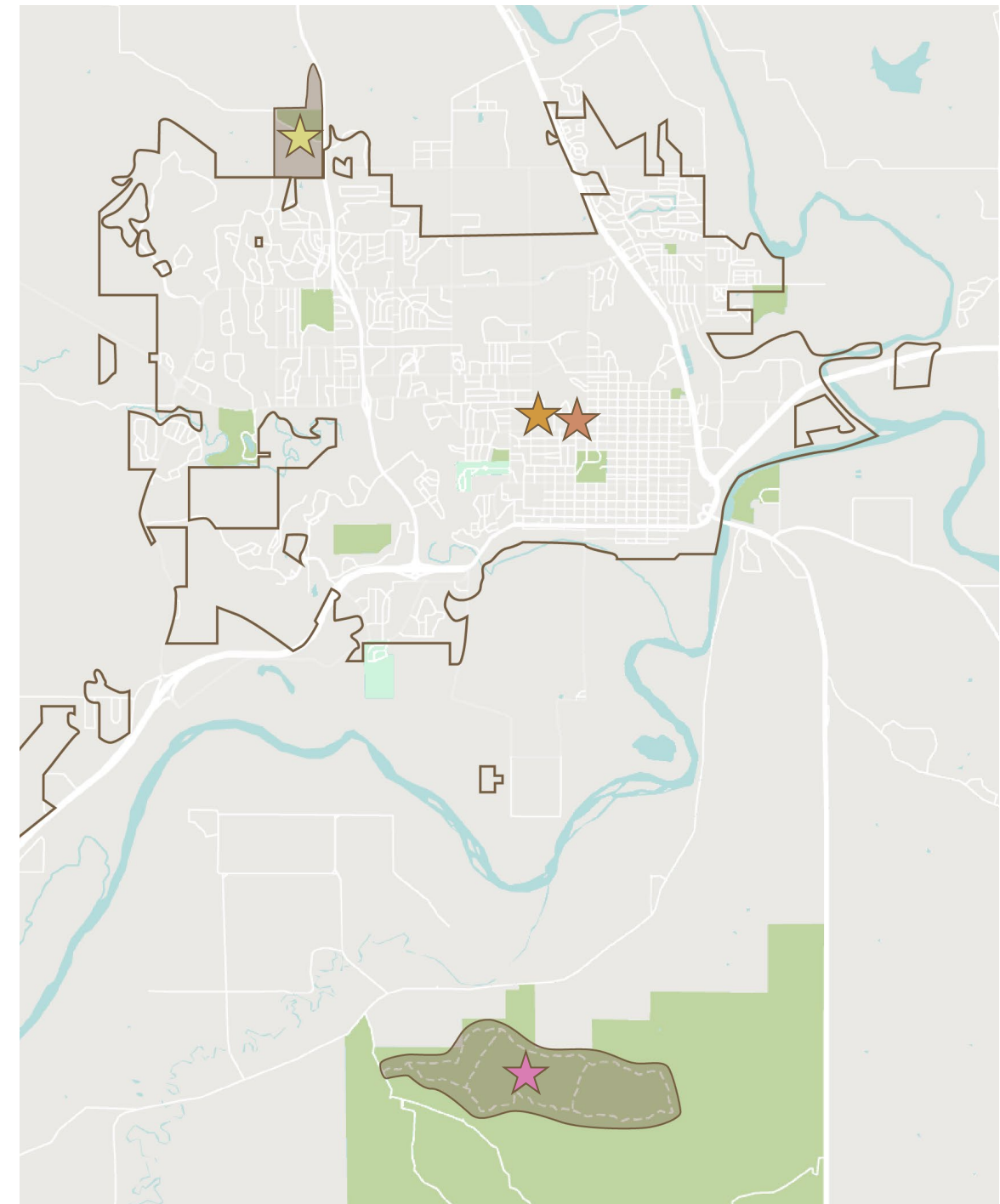


Figure 4.24 Observation and Photography site's locations map (Smith 2025).

★ Washington Marlatt Park
★ Konza Prairie

★ Memorial Stadium
★ K-State Meadow

PRECEDENT STUDIES

Overview

Precedent studies were conducted for an educational website and prairie lesson plans. The website reviewed was the Wildcat Creek Coalition. This website was created on ArcGIS Hub with “sub-hubs” linked within it. It was reviewed for its formatting, use of maps and comparison features, user experience, and inclusion of teacher resources.

A series of precedent studies were conducted over prairie lesson plans based in Manhattan, Kansas. This ensured that information and activities were repeated as little as possible and that a complete understanding of existing resources was reached. The lessons talk about prairie plants and forbs in different ways and discuss different plants. This helped to gain an understanding of the documents necessary for a complete lesson plan, presentations, guides, worksheets, activities, and printable files. Additionally, the plants covered in the lessons were compared to plants identified through research to ensure common plants were chosen and that plants and their information were repeated as little as possible to avoid redundancy.

PRECEDENTS

- Wildcat Creek Coalition
- Konza Environmental Education Program
- Flint Hills Discovery Center – Flint Hills Wildflowers
- Flint Hills Discovery Center – Prairie Plants

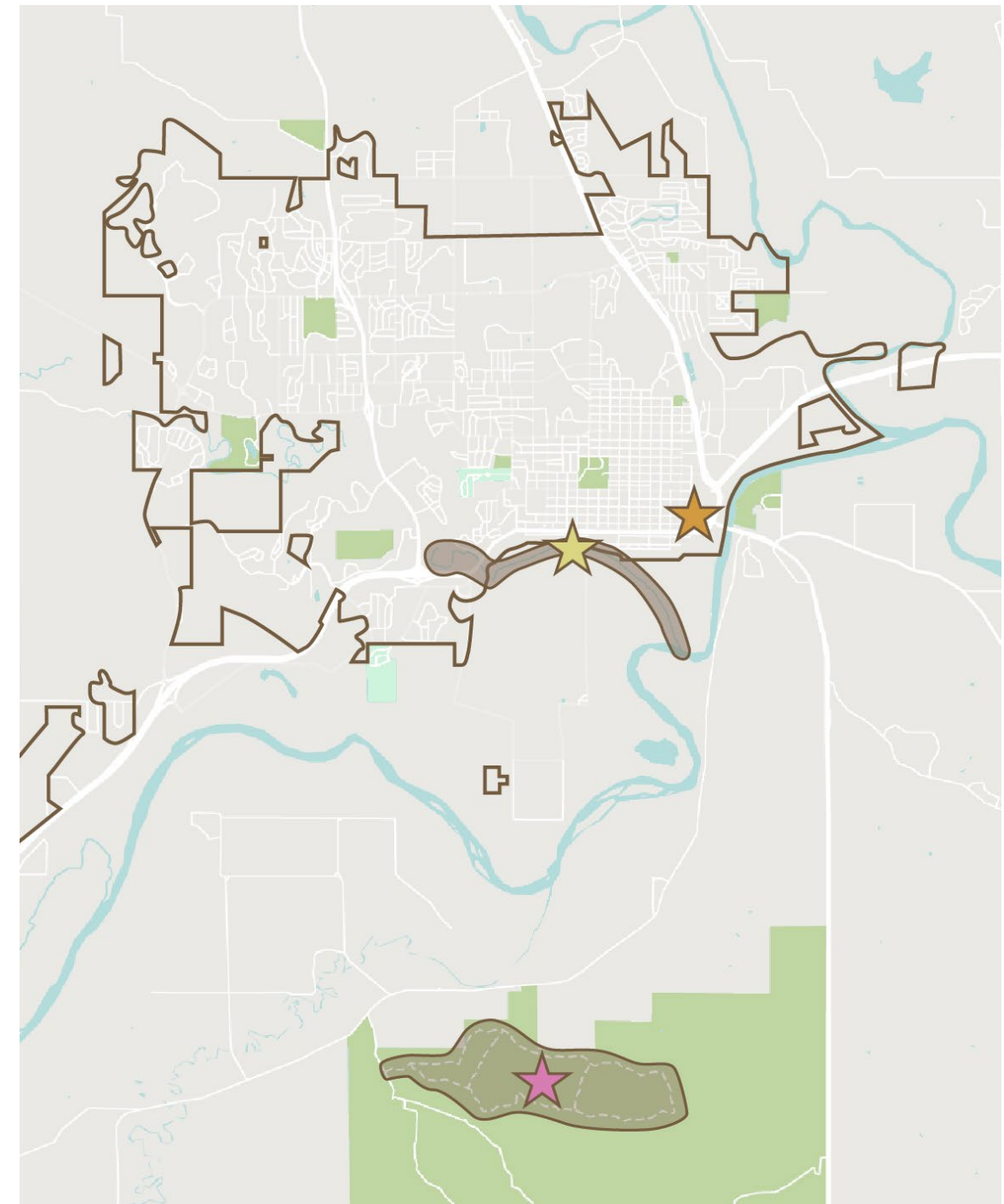


Figure 4.25 Precedent study site's location map (Smith 2025).

- ★ Wildcat Creek
- ★ Flint Hills Discovery Center
- ★ Konza Prairie

Precedent 1

Website

Wildcat Creek Coalition



EXPLORE WILDCAT CREEK

Promoting Greater Community Engagement

Wildcat Creek in Manhattan, Kansas is an underutilized community asset. Although it is largely hidden by thick vegetation, flood events in recent decades have reminded residents of its presence. City initiatives have sought to mitigate or lessen future flood impacts by better respecting natural processes within the creek corridor. The creek also offers much potential to support community events, nature education, recreation, and research activities. This site summarizes past efforts and documents associated with the creek, highlights potential creek opportunities, and serves as a hub to coordinate an informal coalition of residents, city officials, educators, recreationists, and researchers involved with the creek. Explore your creek, contribute your time and talents in expanding activities along the creek, and enjoy what this local resource offers!

Figure 4.26 Wildcat Creek Coalition Home Page Banner (Hahn 2023).

This website was created as a part of a project by K-State Landscape Architecture students. It provides general information on Wildcat Creek, such as the watershed, flood hazard, and assets near the creek on the home page. The “sub-hubs” are titled Community, Education, Recreation, and Research. All hubs were reviewed for their formatting and content, focusing on the education hub for its similarity to this project.

PURPOSE

The home page provides an overview of the purpose of the website, which summarizes past efforts and documents related to the creek, highlights potential opportunities on the creek, and acts as a hub to coordinate an informal coalition of residents, city officials, educators, recreationists, and researchers involved with the creek.

COMMUNITY

Covers city planning design initiatives, engaging with the creek, community outreach, and K-State design studios. It also includes a list of affiliated groups.

EDUCATION

This hub includes teacher resources, affiliates, educational sites, and Sunset Zoo information and links. “Teacher resources” has links for lessons and activities covering environmental education, nature arts and crafts, and field trip activities. “Affiliates” shows organizations aligned with the wildcat creek

coalition and includes links to their websites. “Educational sites” has an interactive map with locations in Manhattan where education opportunities could be held in nature. “Sunset Zoo” has general information about their education program, resources, and contact information for their educators.

RECREATION

Includes parks, trails, activities, potential projects, and resources.

RESEARCH

Includes KSU research/consultants, citizen science, pilot projects, green infrastructure, and resources.

Precedent 2

Curriculum

Konza Environmental Education Program



Figure 4.27 Konza Prairie entrance sign (Smith 2025).

These lessons intend to introduce prairie ecology and ecological concepts and how to use data to solve problems and answer questions. It consists of an elementary, middle, and high school curriculum focusing on various prairie topics throughout a school week. The elementary lesson contains information on prairies, bison, grasses, fire, and rocks, all relating to the Tallgrass Prairie. The middle school lesson contains information on prairies, precipitation, health, maintenance, and restoration of the Tallgrass Prairie. Finally, the high school lesson focuses on research and a project centered around a series of questions relating to prairie health, living organisms in a prairie, ecosystem comparisons, keystone species, fire, and water on the Tallgrass Prairie.

DAY 1 – INTRODUCTION

Students draw a picture of the plants, animals, and insects found in the prairie. It has facts about the animals and insects found in the prairie, where trees are in the prairie, and prairies through the seasons.

DAY 2 – BISON ON THE PRAIRIE

Bison eat grass which allows more forbs to grow which attracts more insects and animals. Bison create mini marshes and grasshoppers eat more grass than bison.

DAY 3 – GRASSES OF THE PRAIRIE

Why grasses are important, the roots absorb water, are fibrous, and can go dormant, there are cool and warm season grasses, rain determines the height of grasses, and how to identify some of the major grasses.

DAY 4 – FIRE ON THE PRAIRIE

Fire is good for the prairie because it removes dead plants and controls tree and shrubs. 75–80% of plants are underground (their roots) so they are able to grow back after it burns.

DAY 5 – HOW ROCKS SAVED THE TALLGRASS PRAIRIE

Settlers changed the landscape for farming corn and soybeans. Two types of rocks make the Flint Hills, limestone (made from shells) and shale (made from mud). Flint can be found in the limestone and is sharp.

LESSON MATERIALS

- Each day has a PowerPoint to download and present.
- Each day has a Teacher's Guide showing how much time the lesson will take, the materials needed, and a slide-by-slide script for the presentations with extra questions, teacher help, and answers.
- Days 2–5 have student worksheets that have the slide number with a corresponding question, space to answer, and any additional questions, recaps, or drawing spaces.

Precedent 3

Lesson Plan

Flint Hills Discovery Center – Flint Hills Wildflowers



Figure 4.28 Flint Hills Discovery Center Prairie Walk (Barrett 2022).

In this lesson, students learn about 24 wildflowers native to the Flint Hills. This is done through watching a video, listening to the song lyrics, and looking at plant photos with their name captions. Teachers then have a choice of follow-up activities. One consists of flashcard IDs with questions and lyrical analysis, where students learn how to identify plants, explore the importance of biodiversity, and find literary devices in the song lyrics. A second option is a wildflower illustration activity involving students observing and recreating a flower in a drawing. These can then be hung up together to create a class wildflower field. The final activity option is having students analyze how people can support what they value through a non-profit organization case study on the Kansas Native Plant Society.

LESSON PLAN

- Subject areas
- Grade levels
- Curriculum standards
- Step-by-step activity plans

PROVIDED MATERIALS

- Song and video
- Wildflower song lyrics
- Wildflower picture page
- Wildflower flash cards
- Plant ID and lyric analysis questions and key
- Wildflower illustration activity
- Analyze non-profit student questions and key

LESSON SETUP

Introduction

- Watch the music video and complete the Plant ID and Lyrics Analysis Questions worksheet.

Flash Cards

- Guess the plant from the picture.

Wildflower Illustration / Collage

- Follow the hand-out.

Analyze a Non-Profit Organization

- Examine the website for the goals of the organization. Answer the questions on the worksheet.

PLANTS COVERED

1. White-eyed Grass
2. Blue Wild Indigo
3. Wild Alfalfa
4. Leadplant
5. Wild Bergamot Bee Balm
6. Wavyleaf Thistle
7. Catclaw Sensitive Brair
8. Ground Plum Milk Vetch
9. New Jersey Tea
10. Butterfly Milkweed
11. Rose Verbena
12. Ohio Spiderwort
13. Prairie Wild Rose
14. Showy Evening Primrose
15. Cobaea Beard-tongue
16. Yellow Coneflower
17. Purple Coneflower
18. Purple Prairie Clover
19. Cardinal Flower
20. Snow-on-the-Mountain
21. Dotted gayfeather
22. Blue Pitcher Sage
23. Sunflower
24. Aromatic Aster

Precedent 4

Lesson Plan

Flint Hills Discovery Center – Prairie Plants



Figure 4.29 Flint Hills Discovery Center Plantings (Barrett 2022).

This lesson introduces students to the categories of prairie plants and has them investigate the natural and cultural history of wildflowers. To begin the lesson, teachers present a PowerPoint about wildflowers found in the Flint Hills. Each student then researches a flower and shares the information they find with the class. An activity to be conducted after this is a game of plant recognition. To conclude the lesson, each student draws their plant and writes five sentences about their plant.

LESSON PLAN

- Subject areas
- Grade levels
- Curriculum standards
- Time required
- Objectives
- Step-by-step activity plans

PROVIDED MATERIALS

- Lesson plan
- Background information
- Wildflower in the Flint Hills PowerPoint
- Exploring Kansas Wildflowers worksheet
- Prairie Plants Assessment Powerpoint
- Wildflower Cards

LESSON SETUP

- Use a bouquet of native plants to talk about where to find them and how Native Americans used them.
- Present the Wildflowers in the Flint Hills PowerPoint.
- Have each student pick a plant to research and present to the class.
- Class plant recognition game.
- Suggested field trip.

PLANTS COVERED

1. Broomweed
2. Sunflower
3. Lead Plant
4. Gayfeather
5. Echinacea
6. Butterfly Milkweed
7. Compass Plant
8. Blue False Indigo
9. Purple Ground Cherry
10. Yarrow
11. Spiderwort
12. Catclaw Sensitive Briar
13. Blue Sage
14. Astor
15. Joe-Pye Weed
16. White Clover
17. Old Plainsman
18. White Snakeroot
19. Beebalm
20. Illinois Bundleflower
21. Goldenrod
22. Snow on the Mountain
23. Prickly Pear Cactus
24. Leavenworth Eryngo

Website

The takeaways from the Wildcat Creek Coalition website are centered around formatting. Esri ArcGIS Hub and Storymaps would be the best format for the final product due to their ability to create geolocated, interactive maps. These maps include points of interest that link to an informational banner that runs along the side of the page. The user experience is straightforward, with webpages being listed in the top banner and the addition of an arrow to take the site visitor back to the top of the page. Adding image galleries is also simple, which will be a necessary part of this project. One thing to be aware of is that if any information is linked, there is the potential for the links to be broken in the future if the site is not monitored.

Lesson Plans

The primary files that should be included in the lesson materials include a lesson plan, a presentation, and student worksheets. The lesson plan should also act as a teacher's guide and include background information, necessary materials, extra questions, and teacher help, such as definitions. For ease of use, presentation page numbers should be included in the lesson plan to make it easy to follow along as the lesson progresses. Many files in the reviewed lessons were downloaded as Microsoft Word files, making it more difficult to open the files and adding extra steps for printing. Instead, the files provided for this lesson will be in PDF format. Finally, any activities or worksheets will be created and provided by the author for ease of use for teachers.

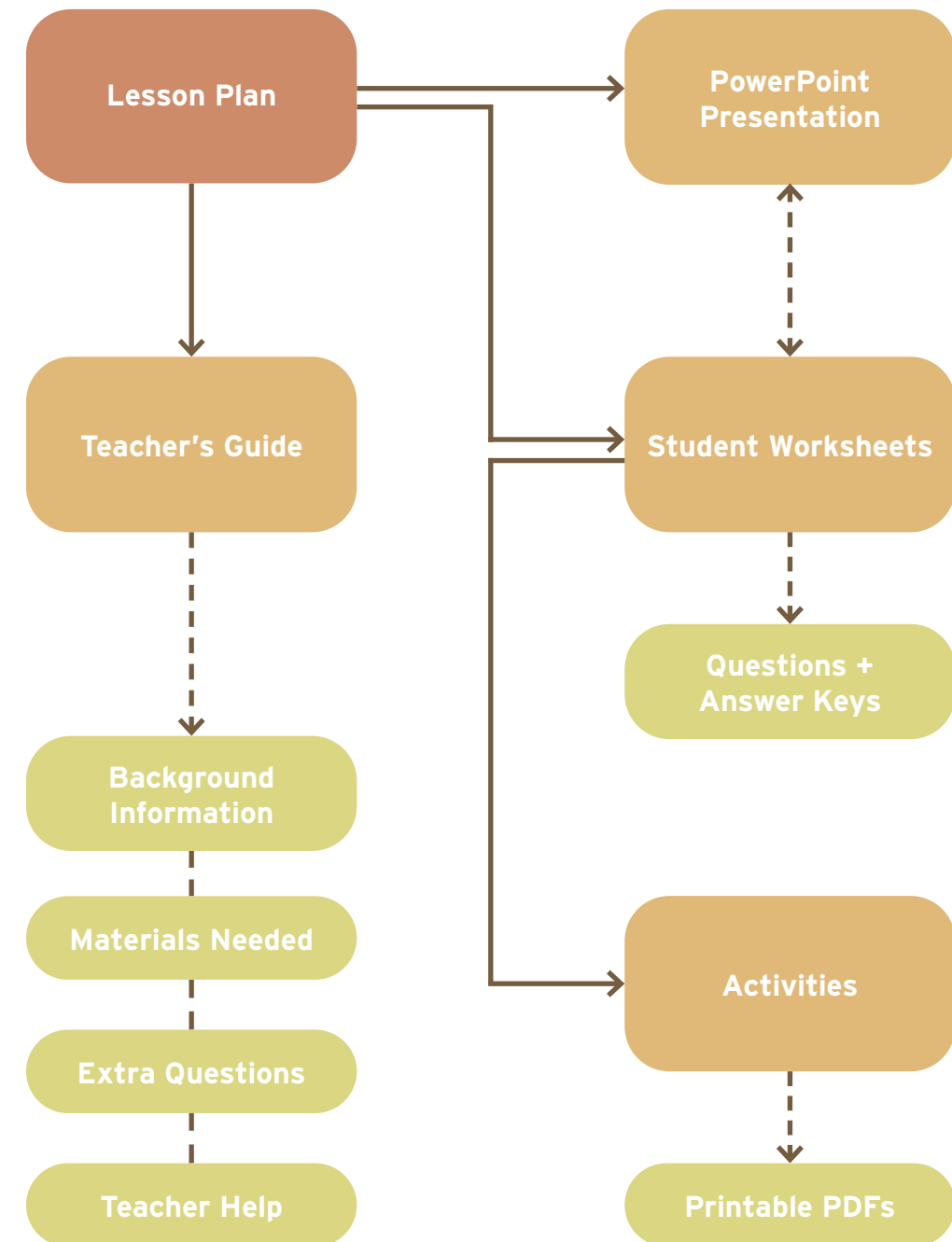


Figure 4.30 Precedent takeaways graphic (Smith 2025).

Methods Summary

The methods completed have produced support for the use of the Beach Museum of Art as a third prairie educational center in Manhattan, Kansas, a series of seasonal image galleries for the K-State Meadow, K-State Memorial Stadium Green Roofs, Konza Prairie, and Washington Marlatt Memorial Park, website design considerations, and lesson plan formatting, content, and materials. The site inventory shows that the Beach Museum can promote prairie education in a unique and accessible way. The primary supporting aspects include funding, free tours with available bus funds, their existing tour content and setup, and using art to expand science learning through activities in the galleries, classroom, and K-State Meadow. The Beach Museum of Art provides more opportunities for field trips and contact with prairie plants found in the K-State Meadow. Additionally, it is a smaller-scaled experience for students who may be less inclined for nature contact. The lesson plans provided a reference for formatting and contents such as objectives, curriculum standards, additional teacher notes, and supporting worksheets and background. The lesson plan will be formatted with these in mind and incorporate a field trip to the Beach Museum to utilize their existing art and science educational tours. The images from the photo galleries will be used to support activities in the lesson plan and provide a way to virtually view the prairies throughout the seasons at any time of the year.

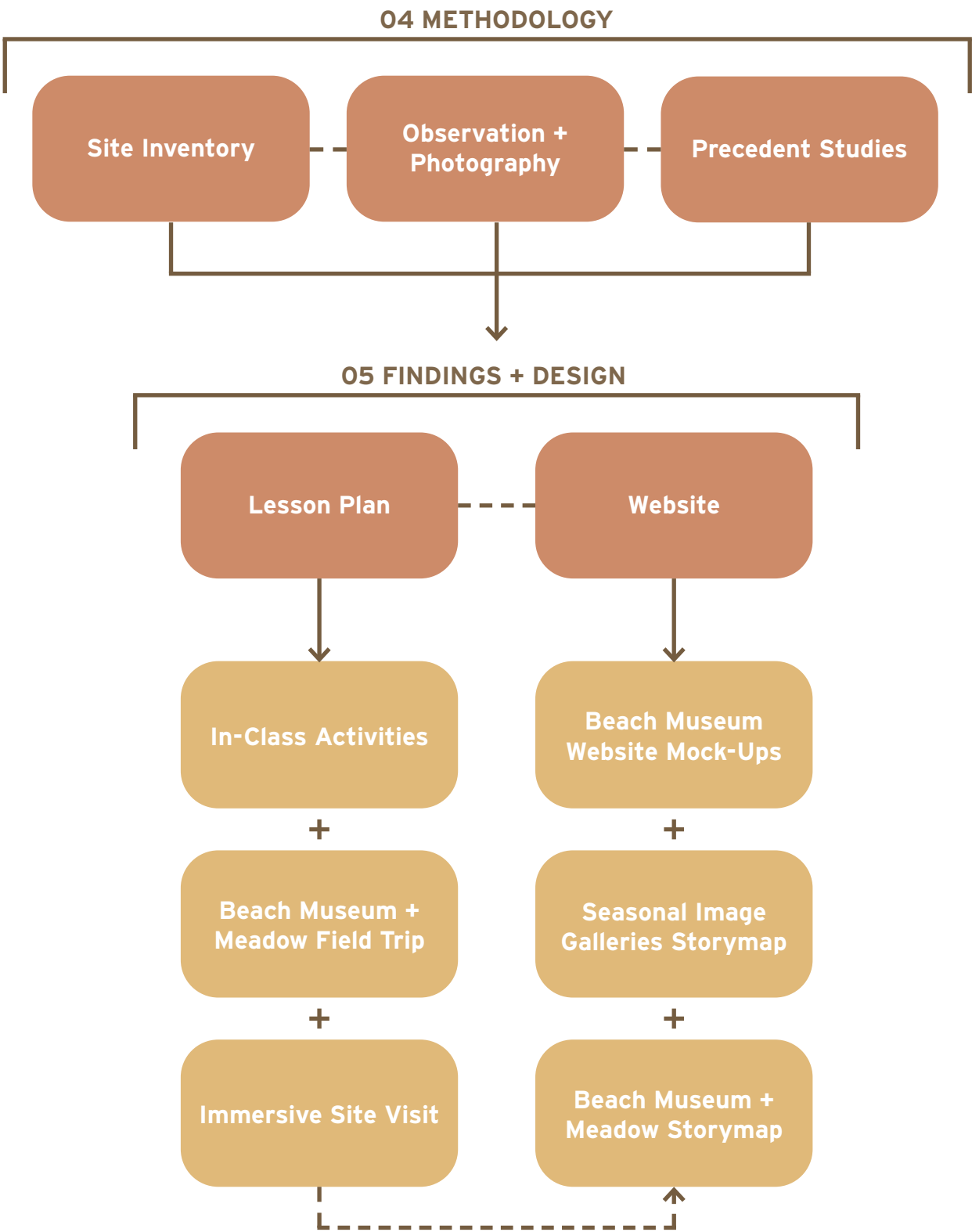


Figure 4.31 Methodology to findings summary (Smith 2025).



05



OUTCOMES

Overview

The primary outcome for this project is a prairie-focused lesson plan centered around the Marianna Kistler Beach Museum of Art and the K-State Meadow. This lesson plan was created for grades 3-5 and teaches students about prairies, their location, and what they look like throughout the seasons. Additionally, a webpage mock-up was created to demonstrate how the Beach Museum could implement a portion of this work onto its website. This would enhance the user experience and provide more information about the student tours, educational centers in Manhattan, Kansas, and the K-State Meadow. A link on this webpage would be provided to an existing ArcGIS Storymaps site, providing more detailed information about these topics. Similar links could be added to a Storymap about the Konza Prairie and the Flint Hills Discovery Center. A link would be provided to a website containing prairie image galleries of the K-State Meadow, Memorial Stadium Green Roofs, Konza Prairie, and Washington Marlatt Memorial Park as well.

◀◀ **Figure 5.1** *Washington Marlatt Memorial Park (Smith 2025).*

◀ **Figure 5.2** *Raindrops on prairie dropseed (Smith 2025).*

Part 1

Lesson Plan

Content

OVERVIEW

This lesson consists of an interactive presentation, two worksheet activities, an active in-class activity, and a field trip. The intention is to get students excited about science learning and for them to see how art and science relate. The Beach Museum of Art field trip should be completed the same or next day. It is also preferred that students participate in a field trip to the Konza Prairie after this lesson to have an immersive experience in a prairie environment, however, it is not necessary for the lesson.

TIME REQUIRED

1/2, 1, or 2 days depending on the scheduling of field trips.

OBJECTIVES

1. Students will be able to name the prairie ecosystems they are in, the Flint Hills and tallgrass prairie and locate them on a map.
2. Students will be able to describe what a prairie is and how the tallgrass prairie is different than a shortgrass or mixed-grass prairie.
3. Students will be able to analyze weather graphs and interpret their information.
4. Students will be able to describe the prairie throughout the seasons and recognize the seasons from images.
5. Students will understand that prairie plants survive the winter and burning due to their roots and be able to name three benefits of deep roots in the prairie, drought resistance, fighting erosion, and regrowth abilities.
6. Students will get hands-on experiences in prairie environments, using art to support science learning and be immersed in the prairie.

CURRICULUM STANDARDS

- 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Adapted for 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment, if the Picturing Kansas: Prairie Views tour is completed at the Beach Museum of Art.

PROVIDED MATERIALS

- Lesson Plan – *An Introduction to the Prairie*
- Presentation – *An Introduction to the Prairie*
- Mapping Worksheet
- I see, I think, I wonder Worksheet
- Optional K-State Meadow Scavenger Hunt

REQUIRED MATERIALS

- Access to a projector for the presentation – *An Introduction to the Prairie*
- Printer – Alternatively, if students have iPads the worksheets can be completed virtually
- Yarn and Scissors – Alternatively, tape, a whiteboard, or other method of representing plant root length

Lesson Plan Flow Chart

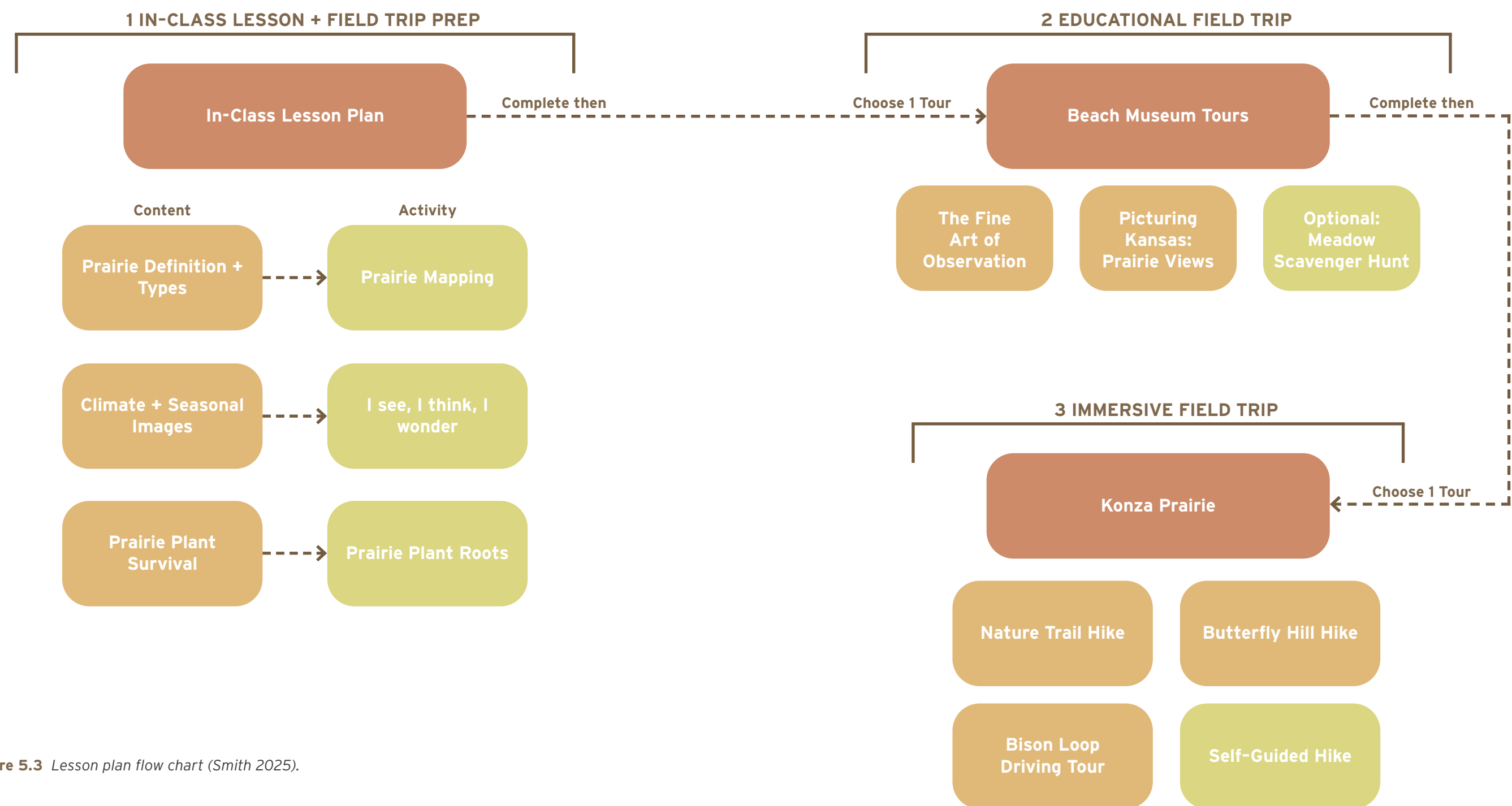


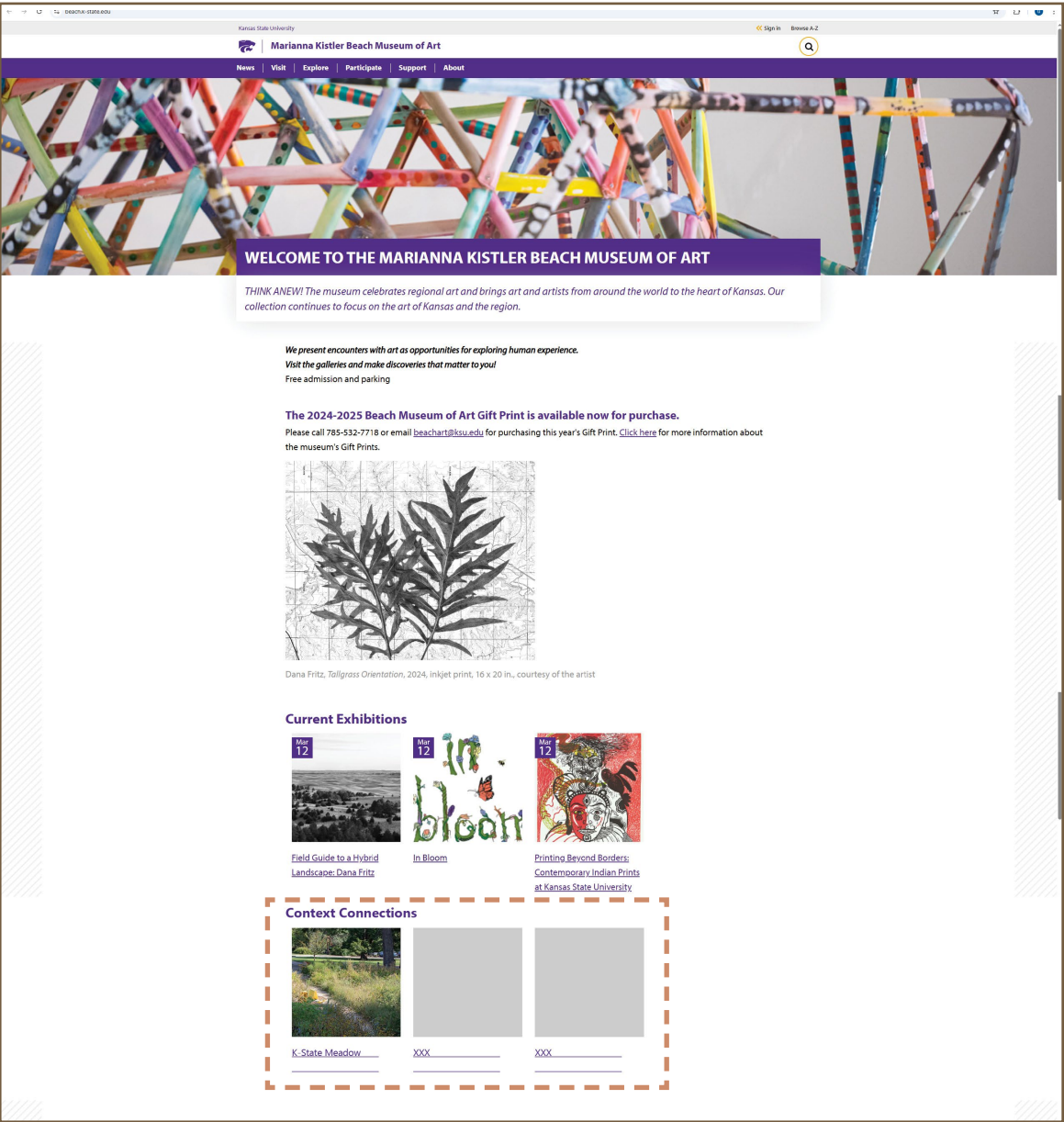
Figure 5.3 Lesson plan flow chart (Smith 2025).

Overview

A mock-up was created for the addition of a prairie context connections webpage on the Beach Museum of Art website. This included a new item on their homepage and a new webpage with information on the three prairie education centers (the Beach Museum of Art, the Konza Prairie Biological Station, and the Flint Hills Discovery Center), Beach Museum tours, and the K-State Meadow. At the bottom of this page are hyperlinks to ArcGIS Storymaps for the Beach Museum and Meadow and seasonal prairie image galleries. The research and materials included in this report have been incorporated into the ArcGIS Storymap focusing on the Beach Museum of Art and the K-State Meadow. The website covers the information, mission, history, and collection history of the Museum, the information, mission, history, purpose of creation, signage, and plants of the Meadow, and resources for educators, including the created lesson plan available for download. The prairie image gallery website includes the photos taken during the observation and photography method, showing seasonal prairie images. Once this project is completed, work will be done with the museum to implement the website mock-ups on their site.

Beach Museum Revised Home Page Mock-Up

A mock-up was created for the addition of a prairie context connections webpage on the Beach Museum of Art website.



Home Page Addition

Figure 5.4 Beach Museum of Art home page mock-up (Smith 2025).

Beach Museum New Webpage Mock-Up

On this page are hyperlinks to ArcGIS Storymaps for the Beach Museum of Art and K-State Meadow and seasonal prairie image galleries.

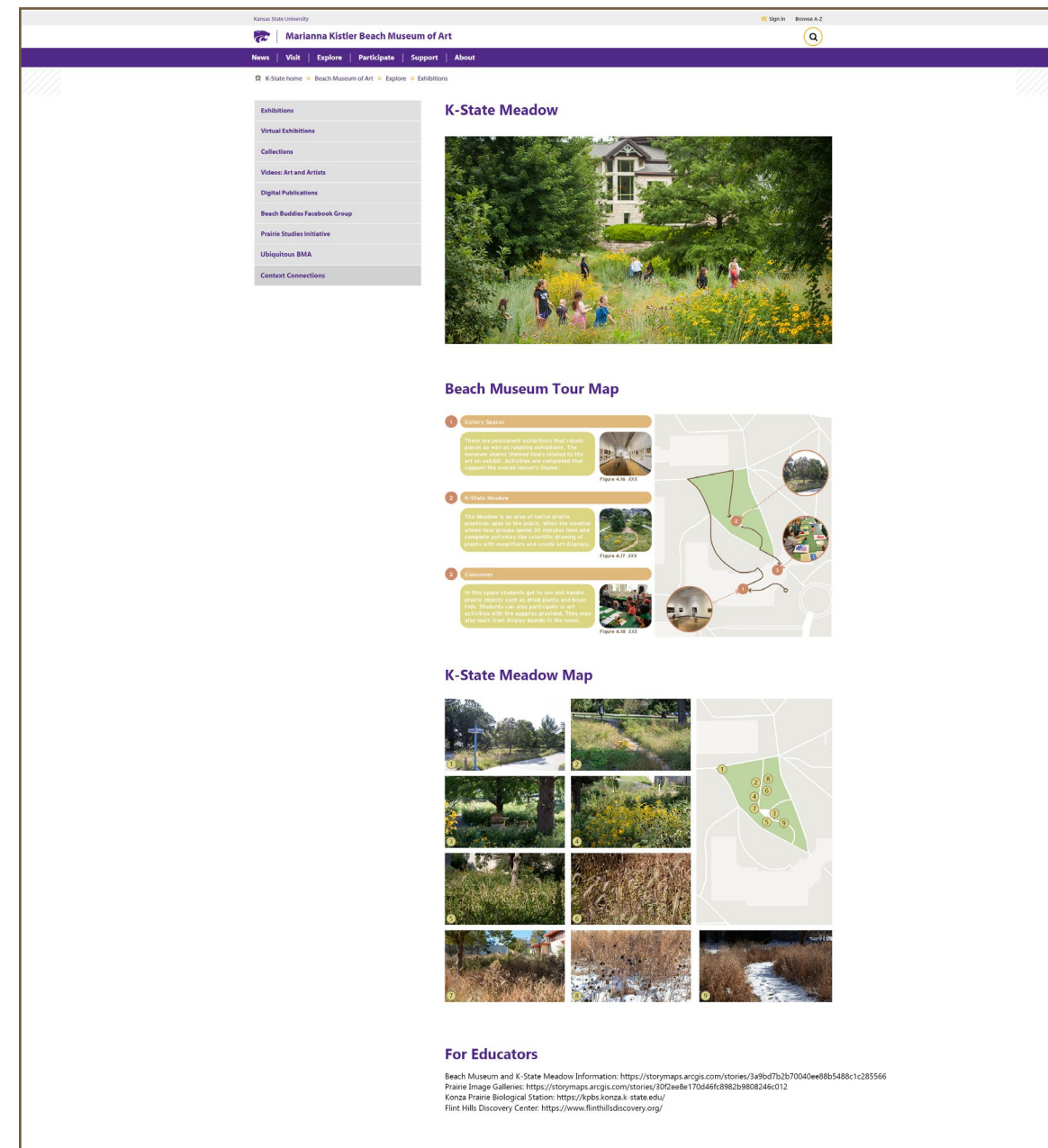
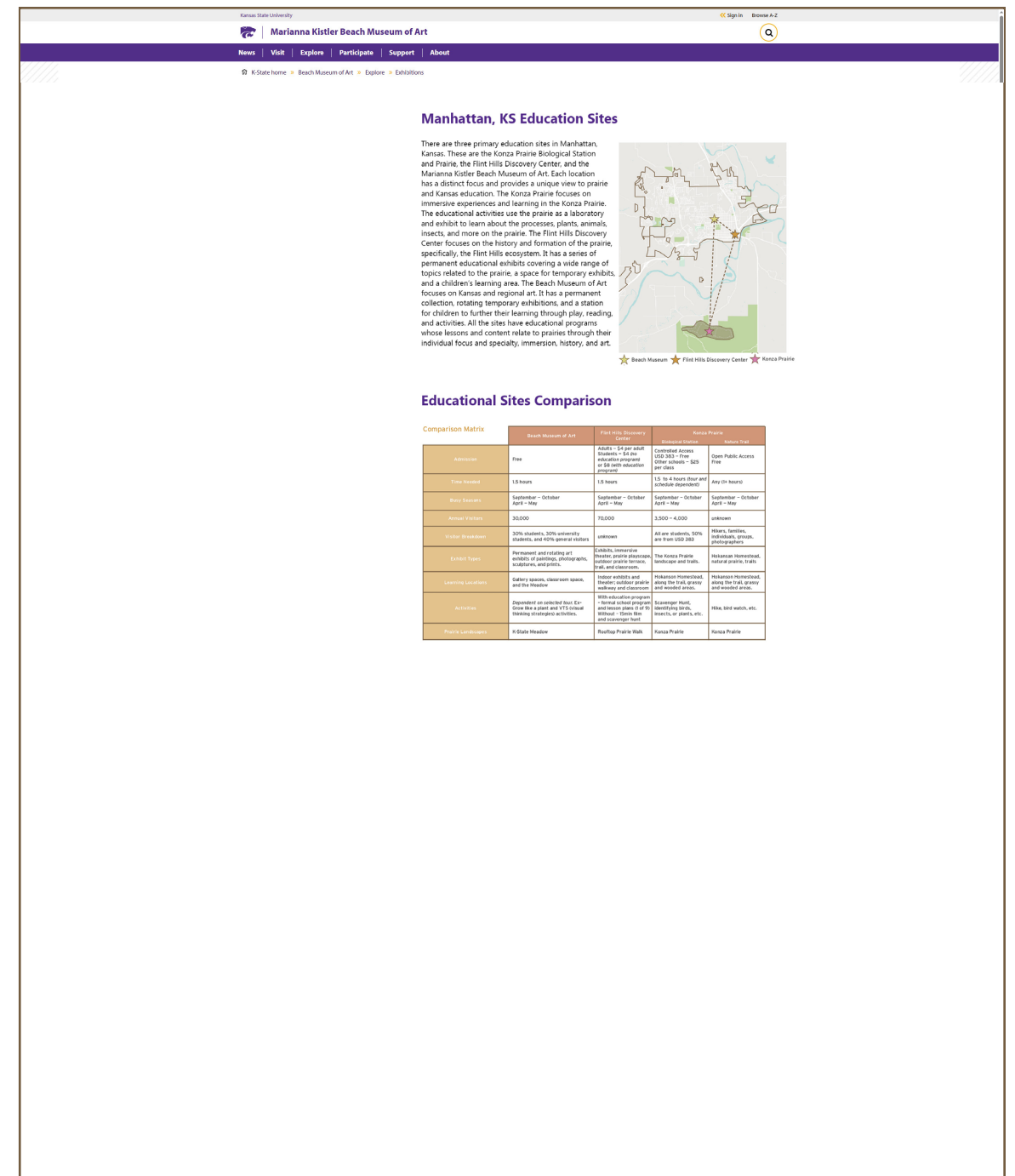


Figure 5.5 Beach Museum of Art webpage mock-up (Smith 2025).



Beach Museum Storymap

A sample of the content on the Beach Museum Storymap. Information from the site inventory method is included on the site under Marianna Kistler Beach Museum of Art and K-State Meadow headings. Link: <https://storymaps.arcgis.com/stories/3a9bd7b2b70040ee88b5488c1c285566>



Marianna Kistler Beach Museum of Art and K-State Meadow

Draft

[Overview](#) [Marianna Kistler Beach Museum ...](#) [K-State Meadow](#) [For Educators](#)

Figure 5.6 Landing page on the Beach Museum & Meadow ArcGIS Storymap (Smith 2025).

For Educators

Tours: <https://beach.k-state.edu/visit/tours/>

Lesson Plans: <https://beach.k-state.edu/participate/educational-resources/>

Beach Museum and Meadow Lesson Plan

An Introduction to the Prairie

Lesson plan and teacher guide.

www.arcgis.com



An Introduction to the Prairie

Presentation

www.arcgis.com



I see, I think, I wonder

Worksheet

www.arcgis.com



Figure 5.7 Educator resources on the Beach Museum & Meadow ArcGIS Storymap (Smith 2025).

Prairie Image Gallery Storymap

A sample of the images available on the prairie image gallery Storymap.

K-STATE MEADOW



Summer



Fall



Winter

Figure 5.8 Sample photo gallery of the K-State Meadow (Smith 2025).

Link: <https://storymaps.arcgis.com/stories/30f2ee8e170d46fc8982b9808246c012>

K-STATE MEMORIAL STADIUM GREEN ROOFS



Summer



Fall



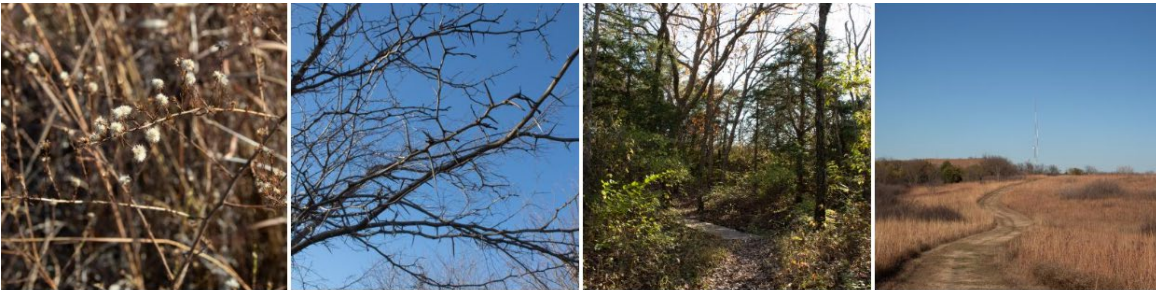
Winter

Figure 5.9 Sample photo gallery of the K-State Memorial Stadium Green Roofs (Smith 2025).

WASHINGTON MARLATT MEMORIAL PARK



Summer



Fall



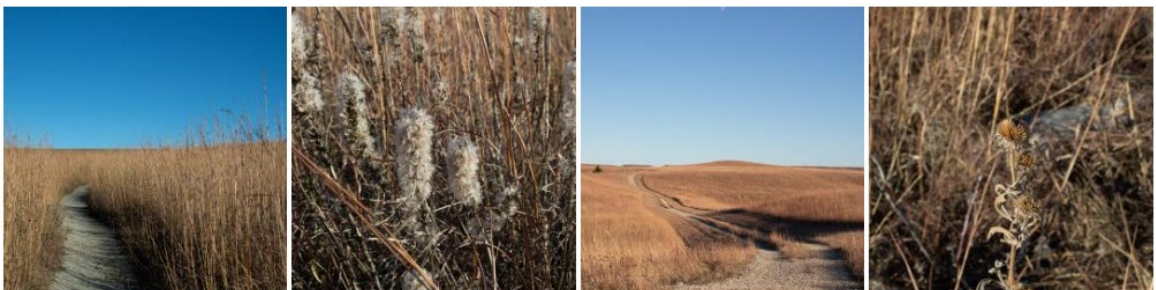
Winter

Figure 5.10 Sample photo gallery of Washington Marlatt Memorial Park (Smith 2025).

KONZA PRAIRIE



Summer



Fall



Winter

Figure 5.11 Sample photo gallery of Konza Prairie (Smith 2025).

Website Flow Chart

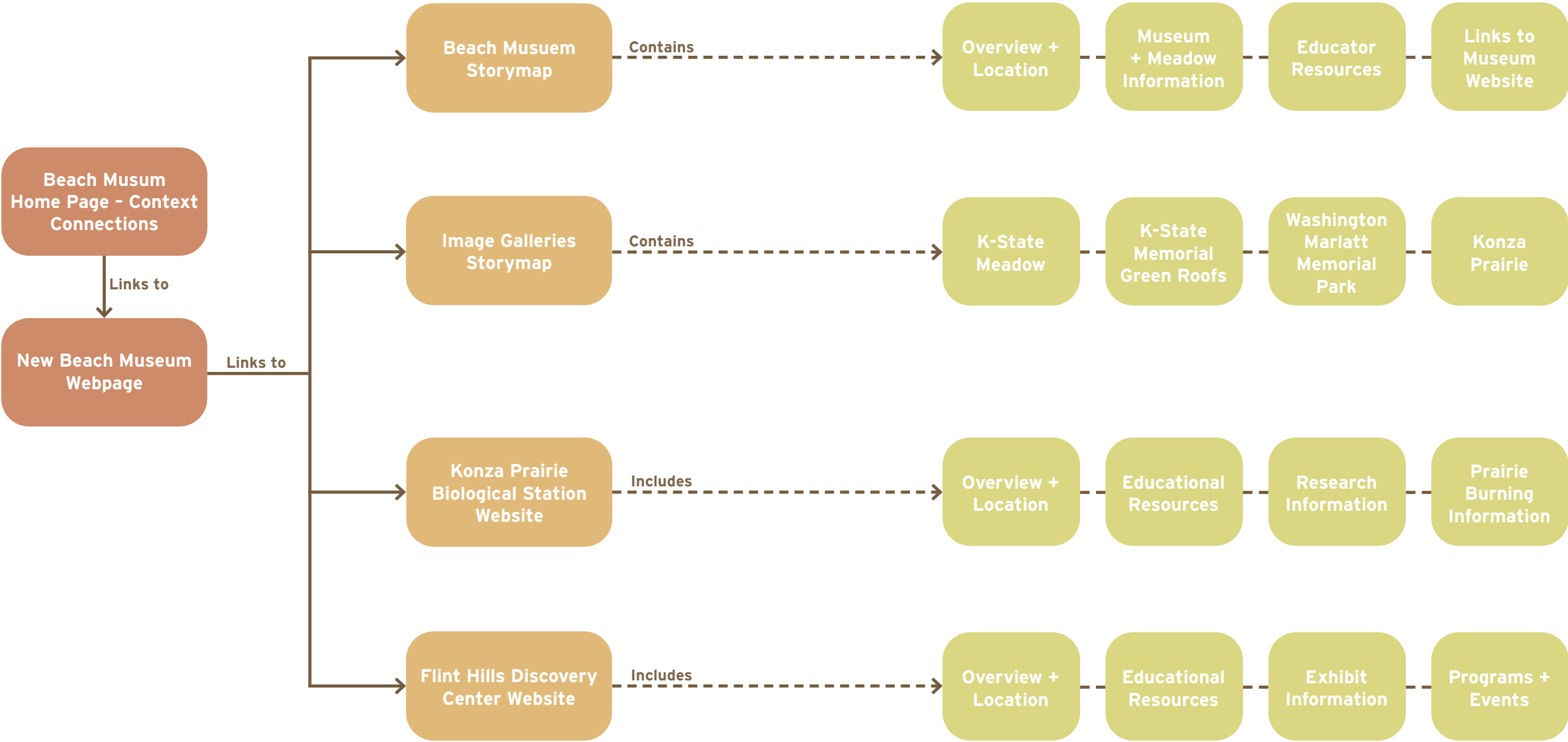


Figure 5.12 Flow chart from Beach Museum website to the Storymps (Smith 2025).



06



CONCLUSION

Overview

This project sought to demonstrate that the Marianna Kistler Beach Museum of Art could be implemented as a third prairie education center in Manhattan, Kansas, to improve prairie and science education. A prairie-focused lesson plan for grades three to five was created for the Beach Museum and K-State Meadow. These materials, as well as the images taken for observation and photography, were incorporated into ArcGIS Storymaps to be utilized by educators.

◀◀ **Figure 6.1** *Hay bale on the Konza Prairie (Smith 2025).*

◀ **Figure 6.2** *Butterfly on prairie blazing star (Smith 2025).*

Project Significance

Children spend less time outdoors than in the past, so their connection to nature is weakening. This is exacerbated by educators' limited time and resources to implement experiential science learning. Hands-on, experiential science lessons allow students to make real-world connections to the topics they are learning. Utilizing the arts in this education makes scientific topics more approachable. This strengthens students' connections to the outdoors and their local environments. Having a range of education center types provides experiences with different focuses and varying degrees of accessibility. These centers also make students more excited about learning, especially in science education.

Limitations

A few limitations were found throughout this project. The primary ones were centered around time. There was not enough time to build out the project as much as was initially planned. This led to creating one lesson plan for grades 3-5 instead of multiple lessons available for a broader range of students. The limitation with available time was the hosting of the website. As this book has been printed, the educational website is hosted on ArcGIS Storymaps. Ideally, the website can be incorporated into or linked to the Marianna Kistler Beach Museum of Art K-State website. Further work can be done to build out the educational website and better connect it to existing educational resources.

Future Research

This project can be developed and added onto in several ways. One example is creating and adding lesson plans that accommodate grades outside of 3-5. This would add depth to the site and allow teachers to find resources for several ages in one location. Additionally, more topics can be added to the website to expand the breadth of content the site contains. Virtual tours can be created to support the image galleries, allowing teachers and students to "visit" the prairie landscapes from their classroom at any time of the year. This would be beneficial for seasonal comparisons, poor weather conditions, and off-season site visits. The primary item that could be furthered is the hosting of the website. It can be built out onto the Beach Museum website and even form a prairie coalition between the Beach Museum, the Flint Hills Discovery Center, and the Konza Prairie. Research can also be conducted on the created lesson plan. It can be tested in classrooms to determine if it enhances the learning experience at the Beach Museum when conducted before a field trip. More research can also be conducted to determine more specific benefits of using art in science education, especially for elementary-aged students.

Final Thoughts

This project sought to create better access to educational resources for educators. Implementing the Marianna Kistler Beach Museum of Art as a third prairie learning center would accomplish this. Additionally, it would provide a new type of prairie education, one supported by art to be added to the science and history-based Flint Hills Discovery Center and immersion and science-based Konza Prairie educational programs. By adding the created materials to the Beach Museum website, educators would have improved access to information and resources.



07



APPENDICES

Overview

The appendices are divided into three parts. Appendix A contains the materials created for the final lesson plan. This includes the lesson plan, the presentation, the mapping exercise worksheet, and the I see, I think, I wonder worksheet, and the optional K-State Meadow scavenger hunt worksheet. Appendix B includes references used for content like background knowledge, writing, and research. Appendix C includes citations for all images and graphic references throughout the book.

◀◀ **Figure 7.1** *Konza Prairie in the fall (Smith 2025).*

◀ **Figure 7.2** *Round-head bush clover in fall (Smith 2025).*

APPENDIX A

Lesson Plan

Lesson Plan: An Introduction to the Prairie

Focus Subject Area: Science

Supporting Subject Areas: Art, Social Studies

Time Required: 1/2 day, 1 day, 2 days (dependent on field trip decisions)

Grade Levels: 3-5

Curriculum Standards:

- 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Adapted for 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment, if the Picturing Kansas: Prairie Views tour is completed at the Beach Museum of Art.

Materials Provided:

1. An Introduction to the Prairie lesson plan
2. An Introduction to the Prairie presentation
3. U.S. map worksheet
4. I see, I think, I wonder worksheet
5. *Optional* K-State Meadow scavenger hunt activity

Materials and Technology Needed:

1. Access to a projector for the presentation - An Introduction to the Prairie
2. Printer - Alternatively, if students have iPads the activities can be completed virtually
3. Yarn and scissors - Alternatively, tape, a whiteboard, or other method of demonstrating plant root length.

Author's Note: This lesson consists of an interactive presentation, two worksheet activities, an active in-class activity, and a field trip. The intention is to get students excited about science learning and for them to see how art and science relate. The Beach Museum of Art field trip should be completed the same or next day. It is also preferred that students participate in a field trip to the Konza Prairie after this lesson to have an immersive experience in a prairie environment, however, it is not necessary for the lesson.

Figure 7.3 A

Vocabulary:

- Prairie: A large open area of grassland
- Shortgrass Prairie: An ecosystem in the western part of the Great Plains of North America with plants that reach two feet in height.
- Mixed-Grass Prairie: An ecosystem between the short and tallgrass prairies that is rich in diversity and serves as a transition between the dry western prairie and the eastern prairie that experiences more rainfall.
- Tallgrass Prairie: A grassland ecosystem in the eastern part of the Great Plains of North America that has rich soils where grasses can grow to over five feet in height.
- The Flint Hills: A unique tallgrass prairie ecosystem with abundant forbs and grasses and shallow, rocky soil.
 - The Flint Hills used to be an inland sea that covered North America 290 million years ago and deposited alternating layers of hard limestone and softer shale rocks.
- Forb: An herbaceous (non woody) flowering plant that is not a grass.
- Grass: Herbaceous (non woody) vegetation consisting of plants with long, narrow leaves and hollow stems.
- Drought: The absence of precipitation; a drier than normal period.
- Erosion: The geological processes that remove soil, rock, or other materials and moves it to another.
- Regrowth: When a plant grows again after injury or interruption.

Objectives:

1. Students will be able to name the prairie ecosystems they are in, the Flint Hills and tallgrass prairie and locate them on a map.
2. Students will be able to describe what a prairie is and how the tallgrass prairie is different than a shortgrass or mixed-grass prairie.
3. Students will be able to analyze weather graphs and interpret their information.
4. Students will be able to describe the prairie throughout the seasons and recognize the seasons from images.
5. Students will understand that prairie plants survive the winter and burning due to their roots and be able to name three benefits of deep roots in the prairie, drought resistance, fighting erosion, and regrowth abilities.
6. Students will get hands-on experiences in prairie environments, using art to support science learning and be immersed in the prairie.

Figure 7.3 B

Teacher Notes:

Slides 2–8

Additional Note:
Give each student
a physical or digital
copy of the blank
map provided
before starting.

Slides 9–12

Additional Note:
The 3 types
of prairies are
shortgrass in the
west, mixed-grass
in the middle, and
tallgrass to the
east.

Slides 13–14

Additional Info:
Plants in the
tallgrass prairie can
grow up to 8 feet
tall.

Additional Info:
Students can
make a connection
between plant
height and its
access to water.

Lesson Procedure:

Part 1: Introductory Presentation

2. Locating + Definition

- Slide 3: Have students point on the map to where they think Manhattan, Kansas is.
- Slide 4: Reveal the location and have students mark it on their maps.
- Slide 5: Have students share what they think a prairie is.
- Slide 6: Share the definition of a prairie.
- Slide 7: Have students guess on the map where the prairie is.
- Slide 8: Reveal the outline and have students draw it on their maps.

3. The 3 prairie types

- Slide 9: See if students can guess what the 3 types of prairies are.
- Slide 10: Reveal the prairie types to the students.
- Slide 11: Have students guess where the 3 types are located within the prairie outline.
- Slide 12: Reveal where the prairies are located and have students color them in on their maps and make a key.

4. The Tallgrass Prairie

- Slide 14: Share the definition of a tallgrass prairie with students.
- Extra Questions:
 - Q – See if students can guess the plant heights for each prairie type.
 - A – Shortgrass less than 2 feet tall. Mixed-grass 3-5 feet tall. Tallgrass 5-6.5 feet.
 - Q – See if students can guess why the plants are shorter to the west.
 - A – The climate is drier meaning there is less rainfall.

Figure 7.3 C

Slides 15–16

Additional Info:
The Flint Hills is a
type of tallgrass
prairie unique for its
geology. It is made
up of alternating
layers of limestone
and shale.

Slides 17–19

Additional Info: That
means the average
precipitation per
month is only 2.79
inches!

Additional Info: The
hottest month is
July. The coldest
month is January.
Students should do
90-21 to get 69.

Figure 7.3 D

5. Where are we in the Tallgrass Prairie?

- Slide 15: We can get more specific than just the tallgrass prairie for our local ecosystem. Ask students if they know the name of this ecosystem.
- Slide 16: Reveal the map showing the Flint Hills and have students color in the Flint Hills and add it to their key.
- Extra Questions:
 - Q – Why is it called the Flint Hills?
 - A – Flint can be found in the limestone layers of the hills. The native peoples, Pawnee, Osage, Wichita, and Kansa, used flint to make tools and weapons.

6. Flint Hills Climate

- Slide 18: Have students analyze the precipitation graph and answer a series of questions.
 - Find the month you are currently in. How much precipitation should you get?
 - Find the month with the least precipitation. Have students guess what form it will be in.
 - Find the month with the most precipitation. Have students guess what form it will be in.
- Extra Questions:
 - Q – About how much precipitation does the Flint Hills get annually?
 - A – 33.45 inches
- Slide 19: Have students analyze the temperature graph and answer a series of questions.
 - Find the month you are currently in. What are the average high and low temperatures?
 - Find the hottest and coldest months. What is the difference between the highest and lowest temperatures on the graph?
 - A – 69 degrees. That means the Flint Hills experiences a 70 degree difference throughout the year!

Slides 20–23

I see, I think, I wonder chart:

I wonder...
I think...
I see...

Slides 24–30

Additional Note: Questions and discussion of their thoughts from the images can help lead into the next part of the presentation.

Slides 31–33

Further Reading on Prairie Burning: <https://keep.konza.k-state.edu/prairieecology/fire.html>

Figure 7.3 E

- 7. The prairie through the seasons
 - Slide 20: Pass out, have students pull up, or have students make the I see, I think, I wonder chart.
 - Slides 21-23: Summer, Fall, and Winter
 - Ask students what they notice in the image; color, plants, texture, etc.
 - Have students imagine what it would be like in the space; what they would feel, hear, smell, etc.
 - Have students add this to their I see, I think, I wonder chart.
 - Have students compare the images from the 3 seasons using their notes.
- 8. Prairie plants through the seasons
 - Slide 24: Pass out, have students pull up, or have students make the I see, I think, I wonder chart.
 - Slides 25-30: Summer, Fall, and Winter plants
 - Ask students what they notice in the first 2 images; color, plants, texture, etc.
 - Have students observe, describe, and compare the 4 flower and plant images.
 - Have students imagine what the plants would be like; how they would feel, sound, smell, look, etc.
 - Have students add this to their I see, I think, I wonder chart.
 - Have students compare the images from the 3 seasons using their notes and share or discuss their questions.
- 9. Prairie Burning
 - Slide 31: Ask students if they have ever seen when they burn the Konza Prairie.
 - Slide 32: Share the prairie burning images and information below with the class.
 - Prairies have always experienced burning naturally from lightning strikes during dry seasons and from human influence through Native Americans. They used fire to guide bison herds and clear land. Fire has always been an important part of prairie health.
 - Ask students why they think we burn the prairie now.
 - Slide 33: Reveal why we burn the prairie to the students.

Slides 34–36

Additional Info: Over 75% of the plant’s biomass is underground!

Slides 36–38

Additional Note: If you are unable to use yarn, you can use tape on the floor, draw on a large whiteboard, or use objects to show the lengths.

Additional Note: Attempt to give each student a task or allow them to work together to complete the root length models.

Figure 7.3 F

- 10. How do prairie plants survive the winter and burning?
 - Slide 34: Have students share their guesses.
 - Slide 35: Reveal the answer.
 - Ask students how deep they think the roots can grow.
 - Reveal the answer on the slide. (15 feet).
 - Slide 36: Show students the graphic comparing the root depths of lawn grass to native prairie plants.
 - Have students share what they see and compare the plant heights and roots.
 - i.e. Which plant has the deepest roots? Which plant has the shallowest roots? Is there a relationship between plant height and root depth (does plant height equal root depth)?
- 11. Root depth activity
 - Slide 36: Activity Break
 - Divide students into small groups of 2-4 for the activity.
 - Have each group pick 1 to 2 plants from the chart to complete the activity and compare their roots.
 - Step 1: Use the scale along the side of the chart to determine the length in feet that the plant roots grow.
 - Step 2: With the yarn, measure the length of the roots and cut it to the correct length.
 - Step 3: Repeat with each plant you will compare.
 - Compare the roots. Suggestions.
 - See how far across the room they reach
 - Have students measure themselves against the yarn or see how many of them it would take to reach that length.
 - See how far students can jump or how few steps they can take to cover the distance of the roots.
 - Additional Activity:
 - Use the root depth chart to see how dense the roots are, replicate this with the yarn.
 - Cut out more pieces of similar (or shorter depending on the plant or your instruction) lengths and tie them together to recreate the entire root structure.
 - Students can then make further observations and comparisons.
 - Have students write their observations and takeaways down.

Additional Info:
Drought: The absence of precipitation; a drier than normal period.

Erosion: The geological processes that remove soil, rock, or other materials and moves it to another.

Regrowth: When a plant grows again after injury or interruption.

Slides 39–40

Slide 42

Additional Info:
This will be determined by the field trip chosen.

11. *Root depth activity (continued)*
- Slide 37: Why might deeper roots be better?
 - Have students share their guesses for why deeper roots may be better for survival in the prairie.
 - Slide 38: Reveal and share the 3 primary reasons.
 - Ensure students understand each term.
12. Do you know any prairies in Manhattan?
- Slide 40: See how many local prairies students can name.
 - Slide 41: Reveal the map of prairies in Manhattan.
 - *See how many students named and if any are missing from the map.*
 - *Are there any close to you? Has anyone been to all or any of them?*
1. Field Trip Preparation
- Slide 40: Give students an overview of what the field trip will entail.
 - *For the Beach Museum share which tour you will be completing. Additionally, the teacher notes on the next page provide an overview of the tour process which can be shared with the students.*
 - *The museum will provide art supplies and a tour guide but if you choose to do the optional scavenger hunt you will need to provide physical or digital copies to the class and complete it outside of the tour time frame.*

Teacher Notes

Additional Info:
<https://beach.k-state.edu/visit/>

The museum is located on the southeast corner of the K-State campus, adjacent to the K-State Meadow.

Tours at the Beach Museum are free and bus funds are available for transportation costs.

Tours should be scheduled 30 days in advance.

All tours are 1.5 hours with 30 minutes spent in the galleries, 30 minutes spent in the classroom, and 30 minutes spent in the Meadow (as long as the weather permits).

3 groups can be scheduled for tours at a time allowing for several classes to attend at the same time.

- Part 2: Beach Museum of Art and K-State Meadow Field Trip
2. Marianna Kistler Beach Museum of Art Tour
- To further the learning from the lesson complete 1 of 2 tours offered at the Beach Museum.
 - Option 1: The Fine Art of Observation.
 - This tour includes activities in the permanent collection such as comparing and contrasting art, visual observation and evidence, and descriptive words and observations of art pieces.
 - Weather permitting, activities take place in the Meadow such as scientific drawing of plants with measuring and descriptions.
 - In the classroom space students handle nature objects and magnifiers to practice visual thinking, observation, and expressive language.
 - Option 2: Picturing Kansas: Prairie Views.
 - This tour and lesson focus on the prairie and plant life cycles.
 - It addresses the importance of water and controlled burns on the prairie.
 - The activities include a poetry project, an art project, a food web activity, and a visit to the Meadow with weather permitting.
 - *Additional optional Meadow Activity*
 - *Scavenger hunt:*
 - *Provide each student with a copy (physical or digital) of the scavenger hunt worksheet.*
 - *Each item can be found in the Meadow at different times of the year. See how many students can find.*
 - *Encourage them to look deeper, if something is not present, can they find evidence that it was there or something that relates to it. A flower, leaves, seeds, a different insect, where an insect may be, etc.*
 - *See if anyone can find every item.*
 - *Have students document their finds through pictures, notes, drawings, etc.*

Figure 7.3 G

Figure 7.3 H

Teacher Notes

Additional Info:
<https://keep.konza.k-state.edu/education/index.html>

You can visit Konza Prairie without a guided tour but for educational purposes and ease for the teacher a guided tour is recommended.

Konza Prairie also does not cover bus funding for a visit.

Part 3: Immersive Field Trip

2. Konza Prairie Field Trip

- To further the learning from the lesson complete an immersive site visit to a real Kansas Prairie
- If possible, the same day or next day visit the Konza Prairie.
- The Konza Environmental Education Program (KEEP) offers school tours led by trained volunteers. These tours highlight the biology, ecology, geology, and history of the tallgrass prairie.
- There are 3 tour options that fit the theme of this lesson.
 - Option 1: Nature Trail Hike.
 - Guided or unguided trail that is 2.6 miles long and takes 2-2.5 hours to complete.
 - This tour is not recommended for children under second grade due to terrain and length.
 - Option 2: Butterfly Hill Hike.
 - Guided tour for all ages that takes 1-1.5 hours to complete.
 - It is in an area not open to the public.
 - Option 3: Bison Loop Driving Tour.
 - The attending group must provide a vehicle for this tour, one is not provided.
 - This is a guided 10 mile tour of the Konza Bison enclosure that covers bison herd management, survival, and prairie ecology.
 - This tour takes 1-1.5 hours to complete.
- If time and funds allow, the Konza Experience tour may also be completed which includes a cooperative tour of the Flint Hills Discovery Center and the Konza Prairie. A scavenger hunt is completed at each location and each tour is 1.5 hours long. 30 minutes should be allocated between locations for a total of 3.5 hours. A charge is required for admission to the Discovery Center and the reservation will need to be made by the touring group.

Figure 7.3 /

Presentation



1



2



3



4



5



6

Figure 7.4 A



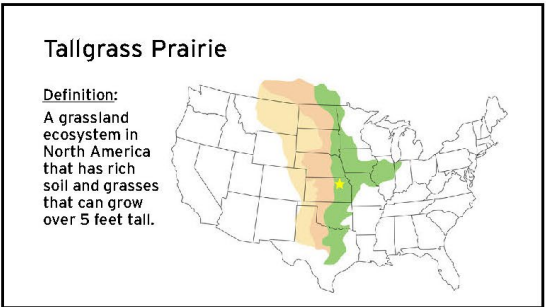
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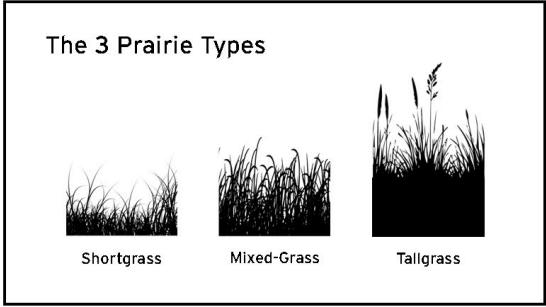
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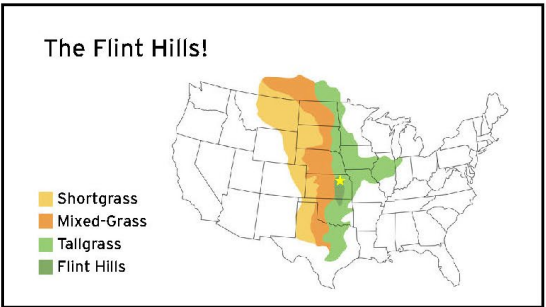
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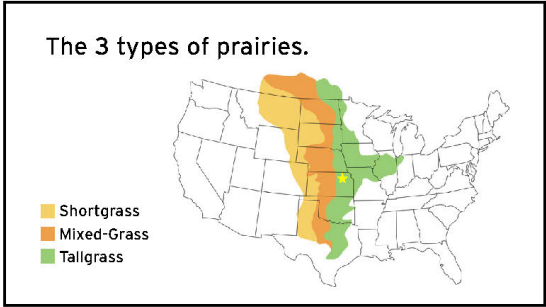
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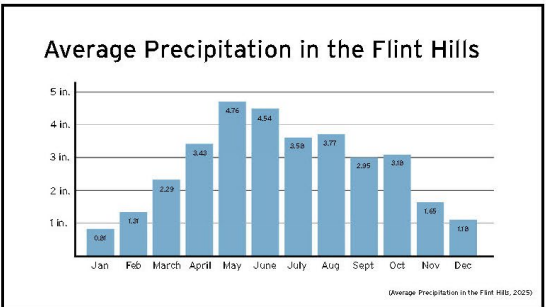
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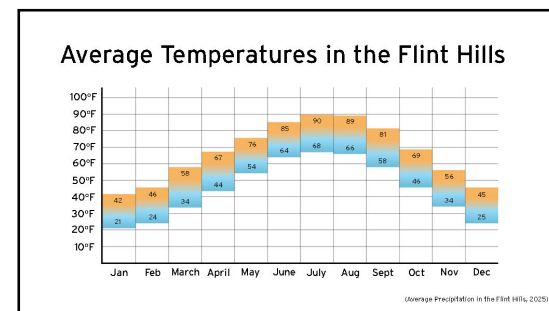
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18

Figure 7.4 B

Figure 7.4 C



19



20



25



26



21



22



27



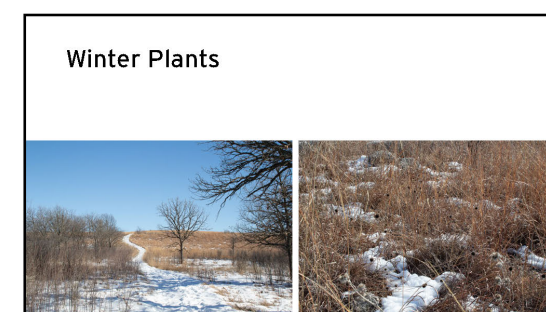
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23



24



29



30

Figure 7.4 D

Figure 7.4 E



31



32



37

Deeper Roots are Better...

- For drought resistance.
 - Deeper roots help the plants find water in the dry summers, non-native plants can't do this
- At fighting erosion.
 - The plant roots hold the soil in place which prevents erosion from wind and rain.
- For regrowth after fires.
 - The prairie burns which makes the above-ground vegetation release nutrients into the soil. Prairie roots stay deep and protected from heat so they can send up new shoots after the flames are gone.

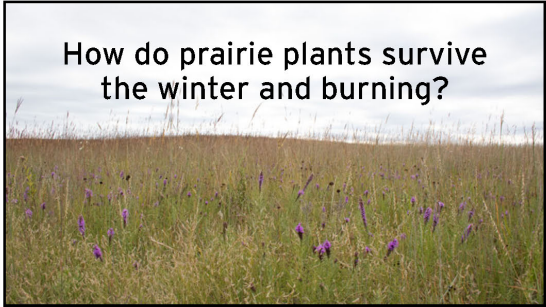
38

Why we burn the prairie.

To suppress woody plants like trees and shrubs.

To stimulate the growth, seed production, and development of new grass shoots of prairie grasses.

33



34



39

Prairies in Manhattan

- Washington Marlatt Park
- K-State Gardens
- Girl Scout Park
- Memorial Stadium Green Roofs
- K-State Meadow
- Flint Hills Discovery Center
- Konza Prairie

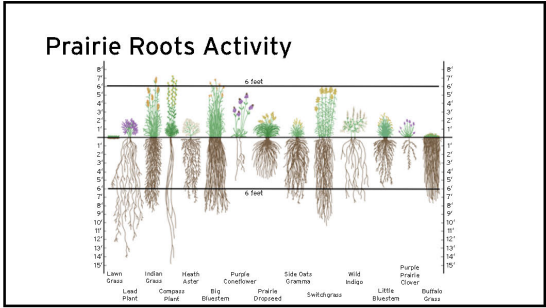
40

Their roots!

How deep do you think their roots can grow?

They can grow up to 15 feet deep!

35



36

Field Trip!

- Where: The Marianna Kistler Beach Museum of Art and the K-State Meadow.

41

Figure 7.4 F

Figure 7.4 G

U.S. Map Worksheet



Figure 7.5 Map worksheet (Smith 2025).

I see, I think, I wonder Worksheet

I see...	I think...	I wonder...

Figure 7.6 I see, I think, I wonder worksheet (Smith 2025).

Optional K-State Meadow Scavenger Hunt

Name: _____

K-State Meadow: **Nature Scavenger Hunt** 

 ☐ Compass Plant	 ☐ Butterfly or Moth	 ☐ Meadow Mission Sign	 ☐ Purple Coneflower
 ☐ Chemical-Free Landscape Sign	 ☐ Northern Sea Oats	 ☐ Bee	 ☐ Water Pump
 ☐ Canada Wild Rye	 ☐ Water Savings Sign	 ☐ Eastern Red Cedar Cone	 ☐ Black-eyed Susan
 ☐ Grasshopper	 ☐ Heath Aster	 ☐ Goldenrod	 ☐ Pollinator Insects Sign

Figure 7.7 K-State Meadow Scavenger Hunt (Smith 2025).

APPENDIX B

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APPENDIX C

Figure References

Chapter 1

- Figure 1.1** Smith, Gabrielle. *Cover Image*. Graphic. March, 18, 2025.
- Figure 1.2** Smith, Gabrielle. *Illinois bundle-flower in fall*. Photograph. November 14, 2024.
- Figure 1.3** Smith, Gabrielle. *A moth on heath aster*. Photograph. November 6, 2024.

Chapter 2

- Figure 2.1** Smith, Gabrielle. *Rough blazing star in the Konza Prairie*. Photograph. September 6, 2024.
- Figure 2.2** Smith, Gabrielle. *Narrow-leaf four-o'clock at the Konza Prairie*. Photograph. September 6, 2024.

Chapter 3

- Figure 3.1** Smith, Gabrielle. *Goldenrod in the K-State Meadow*. Photograph. September 3, 2024.
- Figure 3.2** Smith, Gabrielle. *Yellow moth on heath aster*. Photograph. November 6, 2024.
- Figure 3.3** BC Gov Photos. *Sales of BC Parks licence plate support outdoor education*. June 19, 2018. Flickr. Accessed January 22, 2025. Reproduced from <https://www.flickr.com/photos/bcgovphotos/42006023645/>. Used under Creative Commons Attribution Noncommercial NoDerivs
- Figure 3.4** Nilov, Mikhail. *A Teacher Showing the Apple to the Kids*. July 26, 2021. Pexels. Accessed January 22, 2025. Reproduced from <https://www.pexels.com/photo/a-teacher-showing-the-apple-to-the-kids-8922644/>.

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Figure 3.6 Schneider, Paul. *a boy and girl sitting at a table with food*. August 31, 2022. Pexels. Accessed January 22, 2025. Reproduced from <https://unsplash.com/photos/a-boy-and-girl-sitting-at-a-table-with-food-Wohh3rNe2wk>.

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Figure 3.8 Forest Service Pacific Northwest Region. *Free Fish Day_Youth outdoor education_Deschutes NF*. June 9, 2017. Flickr. Accessed January 22, 2025. Reproduced from <https://www.flickr.com/photos/forestservicenw/36969400081/>. Used under Creative Commons Public Domain Mark 1.0 Universal.

Chapter 4

- Figure 4.1** Smith, Gabrielle. *Trail at Washington Marlatt Memorial Park*. Photograph. September 10, 2024.
- Figure 4.2** Smith, Gabrielle. *Grasshopper on heath aster*. Photograph. September 10, 2024.
- Figure 4.3** Smith, Gabrielle. *Methodology to conclusion process diagram*. Graphic. February 27, 2025.
- Figure 4.4** Smith, Gabrielle. *Manhattan, KS prairie education sites map*. Graphic. February 22, 2025.
- Figure 4.5** Smith, Gabrielle. *Konza Prairie*. Photograph. September 6, 2024.
- Figure 4.6** Smith, Gabrielle. *Flint Hills Discovery Center entrance*. Photograph. March 2, 2025.

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