Buena Vista County Conservation Park Restoration Plan

Dordt College Restoration Ecology Class
Spring 2017

Property Location: 375 440th St. Peterson, IA 51047

Restoration Ecology Team Members:
Dylan Bartels: Biology, Agriculture, Chemistry
Jordan Peters: Biology
Katie Eshelman: Environmental Science
Lindsay Mouw: Biology, Environmental Science, Political Science
Nathan Struyk: Environmental Science
Neil Brower: Natural Resource Management, Biology
Sarah Grubbs: Environmental Science
Advisor: Dr. Robert De Haan

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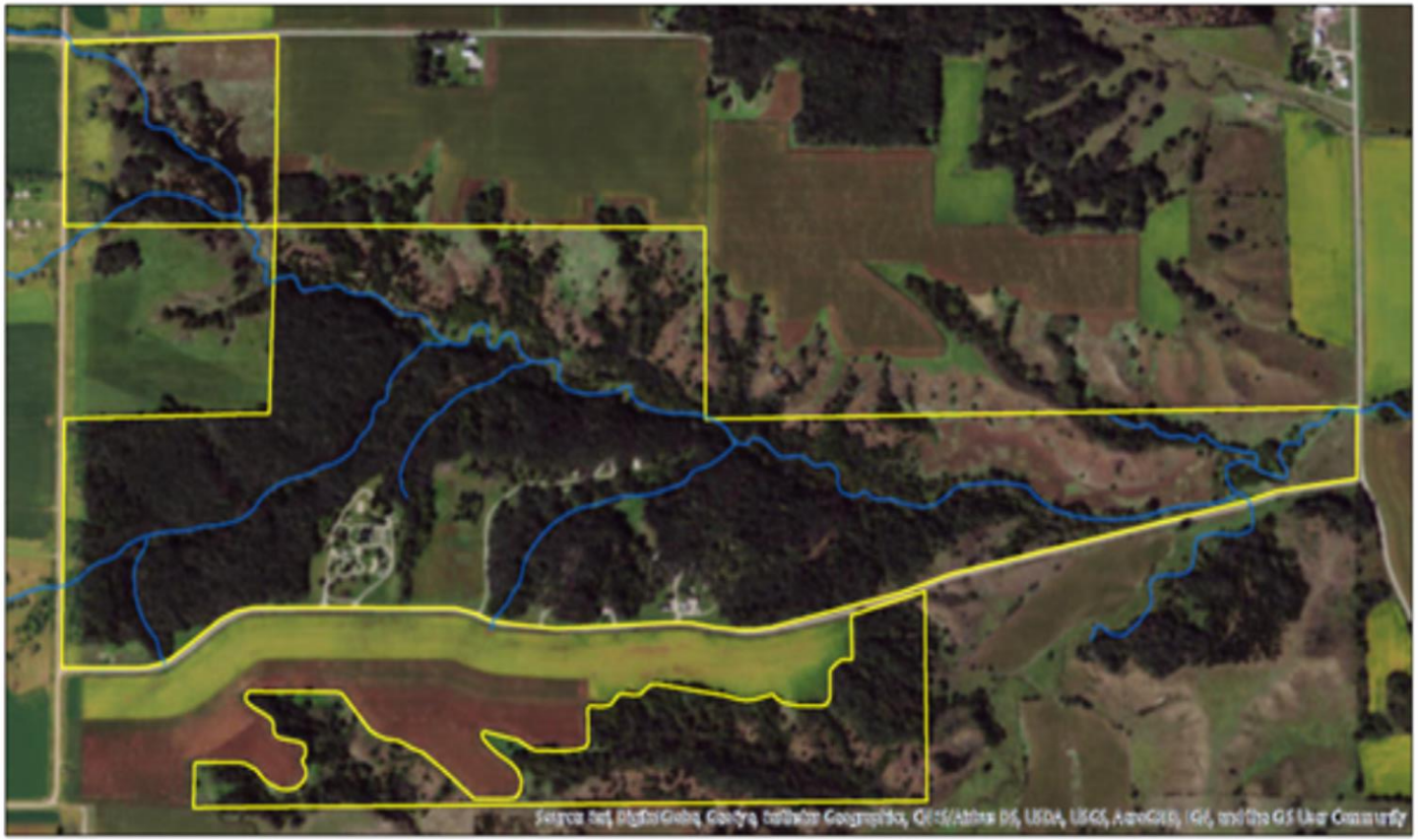
BVCCP Property Lines



0 0.125 0.25 0.5 Miles

N

Streams

Property Border

This map shows the extent of the parks property. The area to the south of the road is in a 50 year easement, that was renewed in 2016.

Created by Neil Brouwer and Sarah Grubbs

I. PROJECT INTRODUCTION

a. ABSTRACT -

Restoration ecology is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Galatowitsch). The Restoration Ecology class from Dordt College created this plan to assist with the restoration of land in the Buena Vista County Conservation Park. The park has excellent potential, displaying an array of ecosystems in relatively good condition. Many of these ecosystems are now rare in Northwest Iowa giving this property additional value. This document provides background information regarding each of these habitats and includes plans for their long-term management and success. Ultimately, we would like to see the park flourishing with diverse, high quality habitats for wildlife use and human interaction.

b. BACKGROUND

i. Project Selection

The ENVR-325 class at Dordt College (Restoration Ecology and Stewardship) seeks to help students studying environmental studies learn valuable skills necessary for conservationists in the real world. Restoration ecology is defined as the study of ecosystems that are under repair; ecological restoration is the implementation of these studies. One of the most important parts of ecological restoration is constructing a plan for a property. First taught in 2015, class members of ENVR-325 choose a property they would like to study in order to create a distinctive and in depth restoration plan. In February 2017, the class decided to partner with the Buena Vista County Conservation Board to construct a restoration plan for their flagship park, the Buena Vista County Conservation Park.

ii. Site History

Originally Purchased in 1960 by Buena Vista County, the Buena Vista County Conservation Park (BVCCP) now serves as the headquarters of the Buena Vista County Conservation Board. Before it was purchased by the county, the land that now makes up the park was used as pasture by European settlers, and before that played a role in the Native American Mill Creek culture.

1. Cultural

Before the Native American Sioux Tribe would have inhabited this area during the time of western settlement, an ancient group of Native Americans called areas like the BVCCP home. The Mill Creek culture of Native Americans were mostly a settled people building villages from wood. The villages were

often surrounded by three ditches with a stream on the fourth side to protect against their enemies (Anderson). The Mill Creek culture practiced agriculture and generally obtained most of their vegetable intake from these farmed goods. However, they did not shy away from big game like bison and elk. Today, it is assumed that once a year, these people would form a hunting party of all who were able. They would then bring back meat from the bison they harvested along with various bones and hides to use as tools. One of the most common tools to find in a Mill Creek archeological site is the bison scapula hoe that was used to work the relatively supple ground of the river bottom as opposed to the tough prairie sod (Anderson). The historic ecosystems on this land would have provided excellent cover for game species such as deer, elk, and bison which would have been sought after by peoples long ago. In more recent history, much of the property, especially the oak savanna and prairie, were grazed by cattle. Signs of grazing are especially evident in the oak savanna on the western side of the property. The many bur oak trees with forked trunks attest to the logging of the property by settlers moving west.

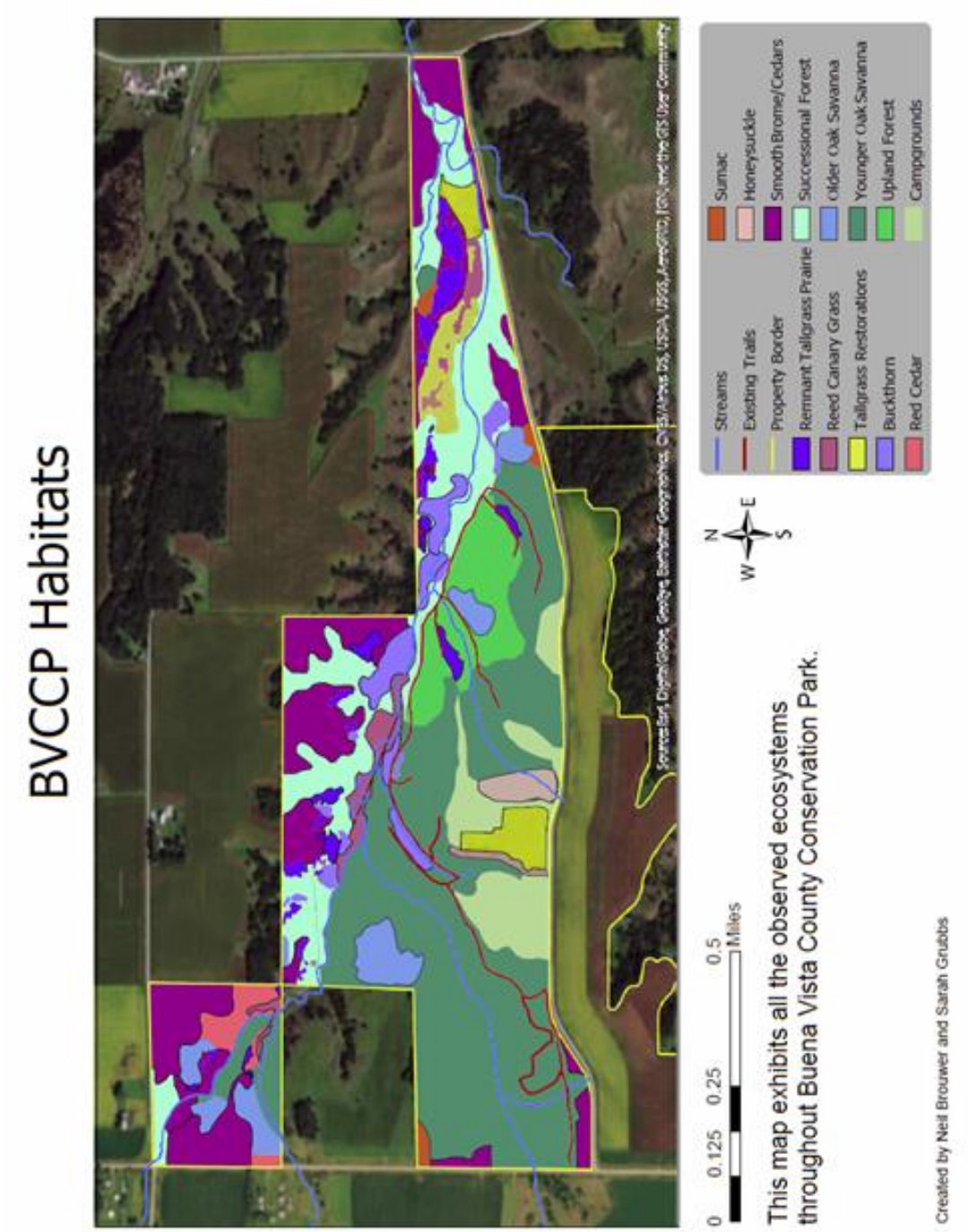
2. Ecological

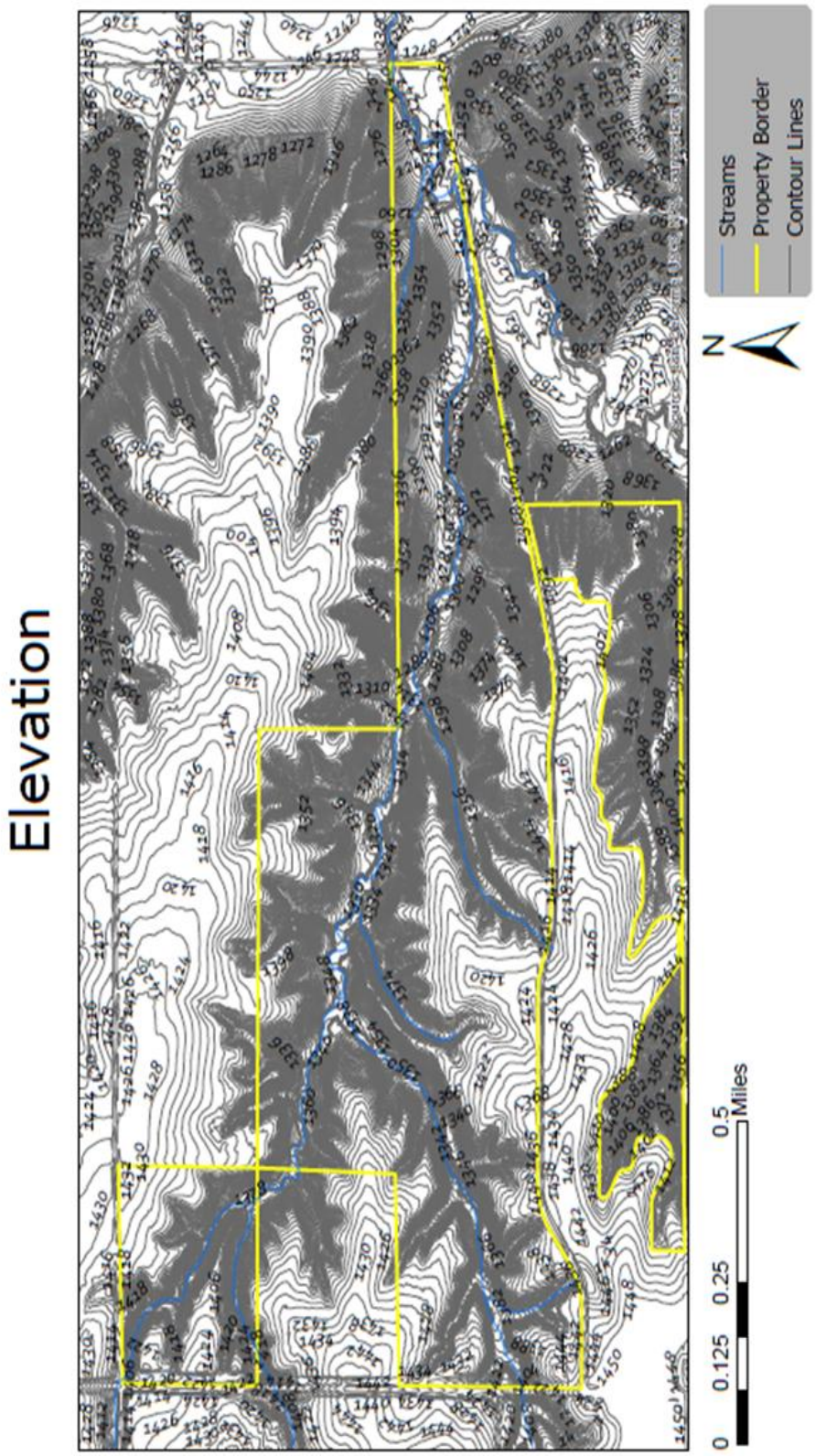
The property was historically composed of four main ecosystems: oak savanna, upland forest, tall grass prairie, and riparian areas along the creek. Oak savannas historically were dependent on fire and grazing pressure to maintain an area with abundant ground vegetation interspersed with large bur oak trees. These areas provided a transition between the prairie and more wooded areas. A couple of areas in the park contain fire-intolerant basswood trees mixed in with bur oak, and are probably best classified as upland forest. In the case of the BVCCP, trees thrived on north facing slopes where the oak and basswood trees received respite from the hot summer sun and there was not enough fuel for intense prairie fires. While bur oak trees were the dominant woody species, various woodland grasses and forbs blanketed the earth below providing ample grazing opportunities for animals as well as fuel for slow-burning fires. Tall grass prairie is currently one of the rarest native ecosystems in North America. The rich soil created by the deep root masses of prairie plants was attractive to settlers as they continued to move west. This eventually led to most of the prairie acreage being converted into farmland. Tall grass prairie was dominated by grasses such as big blue stem and Indian

grass, as well as forbs like sunflowers. Prairie vegetation could grow to heights of 10 feet in some places. Lastly, the riparian area along the creek bottom is an ecosystem characterized by vegetation that does well along the meandering creek that cuts through BVCCP. Here, eastern cottonwood trees towered above the earth and raspberries and other shrubs and grasses held the soil in place when spring snow melts and other large rain events caused the creek level to rise.

c. Current Conditions

i. Maps and data





BVCCP in the 1930's

ii. Current native and invasive species

Prior to European settlement BVCCP had a diverse array of ecosystems, including oak savanna, tall grass prairie, upland forest, and riparian areas. Oak savannas were dominated by large bur oak trees, big bluestem, little bluestem, and sideoats gramma. These were historically and naturally maintained by lightning induced fires and by Native Americans. The fires suppressed growth of smaller woody vegetation and kept the understory open for the growth of native forbs and grasses. Oak savannas suffered due to logging of the bur oak trees, which opened up the ecosystem for other species such as smooth brome and eastern red cedar.

Tall grass prairies were dominated by big bluestem, little bluestem, sideoats gramma, Indian grass, coneflowers, and various sunflowers. Tall prairies, like oak savannas, were also maintained by fire events that inhibited the growth of woody plants. In addition, tall grass prairies were maintained by disturbance events, such as periods of heavy grazing by bison herds which inhabited the plains as well. Due to human prevention of these disturbance events, the tall grass prairies are now dominated by eastern red cedar, smooth brome and crown vetch.

The upland upland forest is composed of mainly bur oaks and basswood trees. Upland forest primarily grows on well-drained soil on the north facing slopes of hills. This type of habitat was historically fairly open with a diverse understory. Today, the upland forest in BVCCP is still fairly open, with only a few areas that need to be thinned or have invasive species removed.

The riparian areas were historically blanketed by scattered eastern cottonwood, green ash, and elm trees, along with sedges, forbs, cord grass, and bulrushes. The streams flowing through this area would have flooded occasionally, but the main disturbance event would have been infrequent fires. Today, this part of the landscape is dominated by a successional forest characterized by invasive species such as reed canary grass, common buckthorn, and tartarian honeysuckle.

iii. Site usage

The Buena Vista County Conservation Board has made the Buena Vista County Conservation Park a high priority. The site is currently being utilized by the public for camping, hiking, hunting, birdwatching, and education. The park consists of three camping areas; thirty-six modern campsites are located in two areas while the third contains ten primitive campsites. According to Greg Johnson, the average summer weekend sees the sites around 70% full with visitors coming from all across Iowa. During the winter, however, there is

typically no camping being done so they figure the current camping rates to be somewhere around 30% on the year. During the spring and summer, the park naturalist also conducts what are referred to as “pioneer talks”, which are educational trail hikes designed to inform participants (mainly children) about the past. There are also spring wildflower hikes and a pretty substantial monarch tagging event. The monarch event consists of tagging approximately 200 butterflies and is held in the reconstructed prairie. During the winter the site is open to bow hunting for deer, along with hiking and bird watching. The site has a lot of public interaction and provides the perfect platform to engage the community with conservation.

iv. Labor availability

The park employs two full time maintenance workers with two additional seasonal workers in the spring/summer months. The Conservation Board also discussed the potential to hire CCI (Conservation Core of Iowa) crews to help with the removal of invasive species. In addition to this, the Board is also hiring a full time IRVM (Integrated Roadside Vegetation Management) specialist to deal with and manage roadsides along with conservation areas. The Nature Conservancy (TNC) also has a mutual management agreement to assist the Conservation Board in restoration/conservation action land, as TNC has land adjacent to the BVCCP. Currently, there are some volunteers with the potential for many more. The park is also within reasonable driving distance of both Dordt College and Buena Vista University, providing the potential to attract help from the biology and environmental studies departments of both schools. Although funding limits the number of full time staff members, the park has great potential to involve the community and students from nearby schools.

II. Project Summary

a. Problem Statement

The BVCCP was historically composed of oak savanna, upland forest, prairie, and riparian ecosystems. However, since European settlement natural disturbance events like grazing and fire no longer occur as they would have, and introduced species have slowly taken over the parks ecosystems. In addition, the effects of logging and agriculture have had an impact upon the current conditions of the park. As a result, there are few high quality natural ecosystems left, with most of the remnants being affected by invasive species which have reduced the presence of natural vegetation, and had an impact on the native wildlife species that reside in the BVCCP.

b. Mission Statement

Restore the structure and function of remnant ecosystems to their original state through the removal of invasive species and reintroduction of natural disturbances, and

increase the number of educational programs and opportunities for recreation in the park.

c. Stakeholder Desires

Realistically the stakeholders hope that additional management activities in the park will result in fewer invasive species, trail improvements, and the restoration of oak savannas and native prairies. The majority of stakeholders would like to see the property combine recreational opportunities that engage the public with conservation activities that enhance the natural ecosystems present in the park. The three main species they hope to see reduced on the site are eastern red cedar, tartarian honey suckle, and common buckthorn. There is also a strong desire to establish a regular fire regime. They would like to improve the current trail system and increase the number of trails on the site. Additionally, maps and educational signs along the trails would increase educational opportunities in the park and increase user navigability of the trails. Lastly, the stakeholders would like to see implementation of pollinator plantings that bees, monarchs, and birds.

d. Reference Site Description: Christiansen Area/Vaudt Property

i. Descriptions of Prairie Reference Site

The tall grass prairie found in the Christiansen Area provides a suitable reference site for the prairie ecosystem found in the BVCCP. The sites are in close proximity to each other, meaning they would have had similar disturbances in the past, as well as similar plant species. The prairie reference site is about a 20 minute drive from the BVCCP.

1. Directions:

   * 420th Ave. to IA-10
   * Right onto IA-10
   * Turn right onto 55th Ave.
   * Follow until arrival
2. See appendix for species list.

ii. Description of Oak Savanna Reference Site

Denny Vaudt's property (and the Martin Area across the road) provides a suitable reference site for the oak savanna restoration. The objectives for the oak savanna on these properties mirror the plans for the BVCCP. These properties provide a great example of how the remnant oak savanna in the park could look with the proper care and attention.

1. Directions:
   1. East of the Martin Area County Park
   2. Martin Access Road near Cherokee, IA

2. Species list found in Sheridan Restoration Plan document.

e. Leitbild Model

Restoration projects begin with an overall site analysis. An important part of a site analysis involves developing a Leitbild concept for the project area. A Leitbild model describes the ideal condition of the restoration site, assuming there are no constraints limiting the restoration work. The model serves as a guiding principle for visualizing and developing a project. It is developed by considering the ecological conditions of the site, along with stakeholder desires.

The ideal condition for this property is to be free of all invasive species and to have richness and diversity in native species. Eastern red cedar is a major invasive species in BVCCP. Regulation of eastern red cedar and other invasive species would be done through the reestablishment of regular disturbance events. Establishing regular fire intervals would control the spread of woody invasive species, including cedar, and would promote native prairie species. Grazing is also an available disturbance option that would suppress invasive species and promote species richness.

The Leitbild model envisions restoring the site back to a dynamic ecosystem. This includes returning ecosystems back to their state prior to European settlement. Oak savanna restoration on this property could be very successful. Oak savannas are one of the most endangered ecosystems on the planet, so this is an area of high concern. Promotion of oak savannas can be done through thinning of woodlands and promoting herbaceous undergrowth. Additionally, an increase in the area of native prairie ecosystems and pollinator plots on the property would be ideal with promotion of more wildflowers present in the prairies and an overall increase in native species richness.

In regard to human recreation, access to the Little Sioux River would serve as an attraction to the property. This would potentially increase the popularity of the park by providing access to more recreation opportunities. With more attention brought to the water ways, it would also be ideal to improve water conservation on the park through the creation of ox bows, wetlands, and buffer strips along water ways.

In Addition, an increase in educational opportunities on the property could serve many purposes and help get the public more involved. Establishment of research plots, such as prairie restoration sites, could be used by Buena Vista University and other students. Education could also be increased through greater signage around the property, such as maps, brochures, and kiosks, (especially along trails), which would increase the public's knowledge of conservation issues and restoration work that is being done

f. Risks and Constraints

The risks and constraints threatening the BVCCP are important to note, but are not easily addressed. The main risks threatening the park are the potential loss of funding and the continual encroachment of invasive species on the remnant native ecosystems.

The invasive species present in the park are manageable, but will need constant attention. Species of concern are eastern red cedar, tartarian honey suckle, common buckthorn, crown vetch, Kentucky bluegrass, smooth brome, reed canary grass, and common mullein. Minimal amounts of government funding mean that the park has a limited workforce available. The already limited funds could mean that parts of the restoration project could be postponed, or ignored altogether. The budget that the park has for the restoration project still needs to be estimated by the Buena Vista County Conservation Board. The last constraint to the BVCCP restoration plan is time. Creating the right timeline to complete work is crucial to the success of the restoration project. This timeline also must be attainable with the work force that is available. Ideally, there would be a large group of volunteers but with the park not being conveniently located near a city, volunteer help may be limited,

III. Implementation

a. Public Involvement

An important part of any restoration project is deciding how it will be relayed to the public. Because the BVCCP is a county park with campsites, day-use sites, and hiking trails, the Buena Vista County Conservation Board has a great opportunity to draw in volunteers and generally educate people about conservation, specifically conservation done within the BVCCP. Volunteers can be hard to come by, but by publicizing the BVCCP to the greater public, more people will grow to appreciate the park and work to make it as beautiful as possible.

The labor availability section (pg. 11) lays out different opportunities that the park may have when it comes to prescribed burns, pesticide application, and cedar/buckthorn removal. As stated previously, the park is kind of off the beaten path, which makes it hard to stumble upon by accident. One way that the Buena Vista County Conservation Board can direct more people towards the park would be to establish bigger and better signs directing Highway 10 passersby to the beautiful nature park. It may be hard to find, but the BVCCP is only a few miles off highly used Highway 10, which could potentially raise awareness for the park.

Social Media is also a good way to reach out to the public. Both the Buena Vista County Conservation Board and the park itself have individual Facebook pages. As more people are drawn to the park, more people will like the park on Facebook, which will increase the park's audience. By prompting people to check out the Facebook pages after they register for campsites, the park can better utilize their Facebook page to reach out to the community. This would be a great way to raise the awareness of the park as well.

The campsites, cabin, and trails seem to be very well maintained. However, the trails would benefit from better mapping. This document contains maps of all the trails that currently exist in the park. By creating a trail map kiosk at each of the entrances to the trail system, people can get an idea of where the trails will take them along with what they may see along the way. Naming the trails and the various spurs that fork off of them can be a good way for the Buena Vista County Conservation Board to give the park

some character. Naming trails can be another way that the Board can reach out to people who are interested in the park. In addition, providing points of interest (raspberry patches, gravel pit, old oak trees etc.), habitat types, and possible observable species, will give the people using the trail system a more interactive experience and possibly create more memories along the way, engraining within them a positive feeling towards the park. As more people hear about the park, experience what it has to offer (in terms of campsites and trails), and create memories in the park, more people are likely to support the preservation and conservation of the park.

The park has a bright future in terms of what it could do for not only the Conservation Board, but also, what it can do for the conservation field as a whole. People will be more in touch with conservation if they understand the work that goes into it and what results from that hard work. The BVCCP has beautiful existing habitats, but also has potential for even more beautiful habitat creation that can draw more people to the park and allow them to experience something special.

b. Permits and Approvals

Based upon the preliminary discussions with Greg Johnson, it should not be difficult to get permits for restoration work in the BVCCP. The only potential problem area identified was the ammonia pipeline running through Gary's area. Should any of our restoration activities involve burning Gary's area or any type of digging there may be some permits required to do so safely. Greg is quite confident however that this will not be an issue as he has close contacts with the company owning and operating the pipeline. Obviously, any substantial changes on the property beyond restoration would need to be approved by the BVCCB and the board of supervisors.

c. Restoration Work by Habitat

i. Prairie Remnants

1. Habitat Description

Prairie remnants are fragments of the original prairie landscape with their native plant communities still intact. This means that the soil has never been tilled or altered in any substantial way. This also implies that a diverse population of native species has managed to survive through time on the site. Less than 0.1% of Iowa's original native prairie remains today so it is vital that steps be taken to preserve these native areas before they are lost as well (Houseal).

These remnants are repositories for biological, cultural, and ecological values. They often contain species that are threatened with extinction or contain rare genetic traits or adaptations. Prairie remnants are also used as reference sites for prairie restoration work done today, as they provide a look into what the composition of species, soil health, and function of a healthy ecosystem should be. Currently prairie remnants are being threatened by fragmentation and encroachment by invasive species. As the remnants become more and more fragmented they lose their biodiversity and the gene pool becomes threatened (Houseal). Invasive species like eastern red cedar, common buckthorn, and smooth brome are slowly forcing their way into the prairie remnants and taking over the area the native species have left.

On the Buena Vista County Conservation Park there are several areas

that contain high quality remnant prairie. These are mostly located on the south facing slopes present in the park that were too steep to be tilled or heavily grazed. The warm dry slopes could have also helped to reduce the amount of smooth brome that has encroached in these areas, as smooth brome is a cool season species (Brahm et al.). There are several options available to help reinvigorate the native prairie remnants and if utilized could prove to be quite successful.

2. Objectives and Procedures

    1. Objective 1: Establish a regular prescribed fire regime.
        i. Procedures: Divide the prairie area into manageable burn parcels and begin rotational burning patterns. Mow firebreaks between sites or use natural firebreaks to separate prairie patches into small, easily managed burn units. Try to burn each parcel every 3-4 years, unless the goal is to set back woody vegetation. In that case, burning the same unit in consecutive years is needed. Never burn more than 1/3 of the total prairie on the park in one year (Shirley, 51).

            1. Justification: Regular burns are a natural part of a prairie ecosystem. Smaller burns are easier to manage with a small crew and are also safer. Burning only a certain percentage of the prairie each year is also necessary so that rare, sensitive invertebrate and insect populations do not lose all their habitat in any given year (Shirley, 50).

    2. Objective 2: Remove most eastern red cedars to allow prairie remnants to reestablish themselves.

        i. Procedures: Mechanically remove cedars and chemically treat stumps if any green branches remain. Identify the areas of remnant prairie and begin the cedar removal by eliminating the scattered trees within the perimeter of the remnant area. Then begin removing cedars around the perimeter to enlarge the area that the native vegetation can expand into. Mechanical shears should be used where appropriate and chainsaws where the larger machinery cannot go (Packard, 256). Begin this task as soon as possible. This will be a continuous project that requires monitoring for

regrowth after the cedars have been removed.

1. Justification: Removing the cedars removes their suppressive canopy and gives the native vegetation an opportunity to sprout and become established. This also helps prepare the area for a more effective prescribed burn in the future.

3. Objective 3: Harvest seed from native prairie remnants.

   i. Procedures: Perform seed harvest operations on native grasses and forbs when the target species have fully matured, which is usually during the fall. Handpick seeds from the desired plant species using hand seed strippers. Leave enough seeds on the site so that the population's growth potential is not hindered. 10-75% of seed heads can be collected depending on the species local abundance (Shirley, 20-21). Handpicked seeds need to be threshed and screened to sort the seed from other vegetative material. Store the seed in an airtight container at cool temperatures (Shirley, 23). In the winter the seeds can then be used to seed prairie restoration sites in the park. Seed collection would be a good activity to engage public volunteers. This task will need to occur the fall before the planned seeding of a prairie restoration project.

      1. Justification: The harvest of native seeds from the park ensures that quality seed is being used for prairie restorations in the park as well as providing the highest germination rates, as the seed should be composed of ecotypes adapted to the parks specific environment (Shirley, 24). It also provides a seed stock that will not contain possible new species. Furthermore, harvesting your own seed will also help reduce those costs in other prairie restorations completed in the park.

4. Objective 4: Grazing

   i. Procedures: Use cattle or other large herbivores, such as elk or bison, to establish a historical grazing

disturbance on prairie remnants. Fence in the northern half and eastern side of the park. If funds are available build a fence that could hold an elk herd. Otherwise, install a 4-5 strand barbed wire fence for cattle and bison. Introduce a small herd of cow calf pairs, bison, or elk to graze the fenced off area. If a regular burning regime is established, there is little need for internal fencing, as the cattle will graze most heavily in the most recently burned areas (Fuhlendorf, et al. 2004). This objective should only be implemented after significant progress has been made on objectives 1 to 3. Begin this objective by grazing the eastern side of the park and as the grazing program becomes established, it can be moved to other areas of the park. Evaluate species composition on the grazed areas every 3 years.

1. Justification: Grazing is a natural disturbance that a healthy prairie needs in addition to fire. Grazing has a similar effect as mowing and is more effective on steep slopes (Shirley, 49).

Tallgrass Prairie Remnants

0 0.125 0.25 0.5 Miles

N

Streams
Existing Trails
Property Border
Remnant Tallgrass Prairie

This map shows the native remnant prairie in the park. Total area of remnant prairie is 9.86 acres.

Created by Neil Brouwer and Sarah Grubbs

ii. Grassland Dominated by Smooth Brome

1. Habitat Description

Smooth brome (*Bromus inermis*) is a cool season perennial grass native to much of Europe. Brought over to the United States in the late 1800's, smooth brome has become naturalized across North America (Salesman). Smooth brome was introduced as a candidate for livestock feed on rangeland and farmland, and eventually displaced native grasses in many prairie remnants. The grass is considered an invasive species by restoration ecologists. The grass is drought tolerant and tends to establish quickly in new habitats preventing other more desirable species from flourishing (Salesman). The BVCCP has approximately 61 acres of smooth brome dominated grasslands making it a definite concern. Not only is smooth brome quick to establish, it also tends to create a monoculture by out competing prairie plants. Since fields with flat and even terrain are easily accessible by farmers, these areas were most often seeded with smooth brome. This is especially true at the Buena Vista County Conservation Park as many of the relatively flat grasslands are predominantly smooth brome.

2. Objectives and Procedures

1. Objective 1: Use herbicides to reduce smooth brome prevalence and clear areas for native species reintroduction.

i. Procedures: If there are no desirable species present, a mixture of sulfosulfuron and glyphosate should be used to suppress smooth brome. Some areas dominated by smooth brome may contain pockets of desired native forbs which would be best treated by clethodim, a grass selective herbicide. An initial herbicide application should occur in July (clethodim) or August (sulfosulfuron and glyphosate) to knock this perennial grass back. After the initial application, a second application of herbicide (sulfosulfuron and glyphosate) should follow in October.

1. Justification: A study published in 2011 showed that herbicide application is a good way to suppress smooth brome growth (Bahm). When compared with other pesticides and pesticide combinations, the sulfosulfuron and glyphosate mixture proved to be the most successful in suppressing the growth of smooth brome in

areas where it was dominant. It was also shown that native plant response to pesticide application varied, but a planting 2 to 3 weeks after application usually allowed for successful native plant establishment (Bahm).

2. Objective 2: Use prescribed burns to reduce smooth brome prevalence in preparation for native species reintroduction.

    i. Procedures: A year after the initial pesticide application and seeding, a burn should be conducted in the prairie. This burn should take place in the spring of the second growth year. Burns can be used in conjunction with pesticide application to further minimize smooth brome presence. Prescribed burns also play an important role in the reproductive cycle of some prairie species. By using burns in conjunction with pesticide applications, smooth brome can be suppressed, allowing for crucial establishment of native species. Following the initial burn, late spring burns should be conducted as necessary or when possible.

        1. Justification: Fire was an important disturbance event in North American prairies before much of the land was converted to agricultural use. Native plants have had the opportunity to evolve with fire, while smooth brome has not evolved with fire in the same way (Salesman). Fire therefore has the ability to increase the biomass of native plant species as they recharge after a fire event. It is important to burn in late spring, however, as a burn that occurs too early may not remove the growth point of smooth brome allowing for rapid resurgence after a burn. Professionals often suggest burning smooth brome when it is at boot height to help get rid of the tillers and the growth point (Bahm).

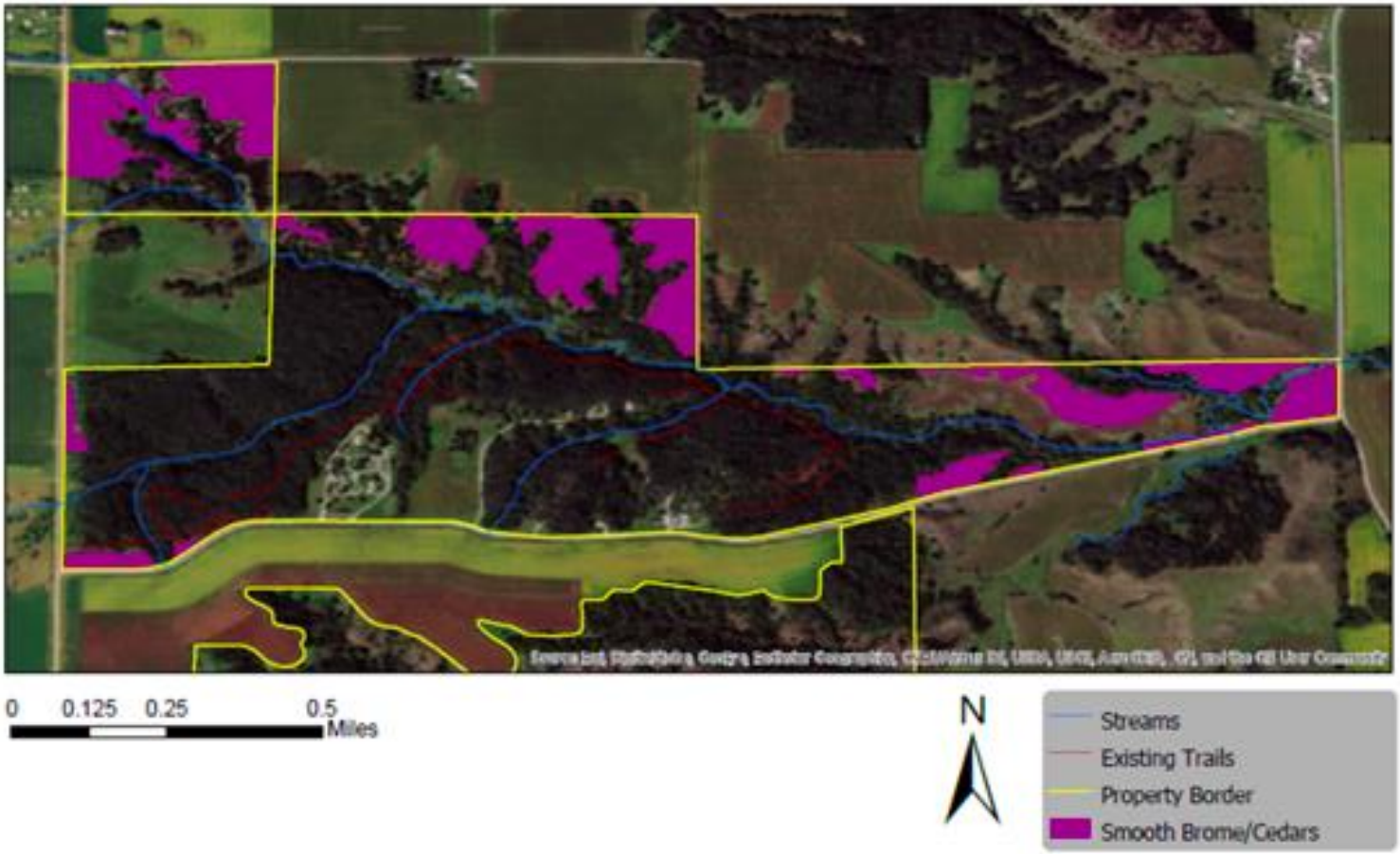
3. Objective 3: Reintroduce a native prairie plant community characteristic of the prairie remnants seen at the BVCCP.

    i. Procedures: This is perhaps the most important part of restoring smooth brome dominated grasslands to a

native prairie landscape. A seed mix can be obtained by mixing desired native species akin to species present on the native prairie remnants located in the BVCCP. Prairie Moon Nursery (and other seed suppliers) allows customers to construct a customized seed mix based on soil, shade, moisture, and desired height. The seed mix should be broadcast spread using a Vicon-like spreader. If seeding takes place along with a pattern of herbicide application and prescribed burns, more plants that are native can reestablish themselves. Seeds can also be drilled instead of broadcast spread. Using this approach, following the October pesticide application, the smooth brome should be burned and the area seeded using a no-till drill.

1. Justification: Through the use of the species list (see species list for BVCCP) and a self-assessment of native prairie remnants, a good idea of local native plant species can be gained in order to formulate a seed mix that is representative of the historical native prairie populations. Spreading seeds of native prairie plants is a necessity if a more diverse prairie is desired (Bahm).

Smooth Brome



Created by Neil Brouwer and Sarah Grubbs

iii. Oak Savanna

1. Habitat Descriptions

Bur oak savanna was a unique ecosystem in the 1800's. Savanna remnants are characterized by widely spread oak trees, interspersed with native grasses and plants. However, over time these ecosystems have become degraded pockets surrounded by agriculture. Logging has resulted in the loss of many of the very large, old oak trees. These savannas have also slowly been taken over by invasive tree species, creating more woodland like ecosystems. Historically, fire was a major part of upkeep for the oak savanna ecosystem. These fires played a key role in the way bur oak savannas looked. The fire disturbance maintained oak savannas by limiting invasive species growth, promoting native grasses, and reducing the amount of trees growing throughout the savanna.

2. Objectives and Procedures

1. Objective 1: Remove trees to reopen bur oak savanna.

i. Procedures: Remove all trees that are not bur oak species. These trees are mostly basswood and eastern red cedars. Furthermore, most bur oak trees with a DBH of 24” or less should also be removed.

1. Justification: bur oak savannas are characterized by wide spaces between large oak trees. The BVCCP already has a great stand of many large bur oaks. However, this stand has been overpopulated with surrounding growth. Performing these tasks will allow for more sunlight to penetrate the canopy and begin growth of more non-woody forbs and grasses in the understory.

2. Objective 2: Establish consistent burning and mowing.

i. Procedure: Divide the oak savanna into sections. Before burning is conducted, firebreaks should be put in place by mowing, or using natural firebreaks on the landscape. Burns should be conducted annually on a new section of oak savanna. Annual burns should be light, and the same area should only be burned every 3-

4 years.

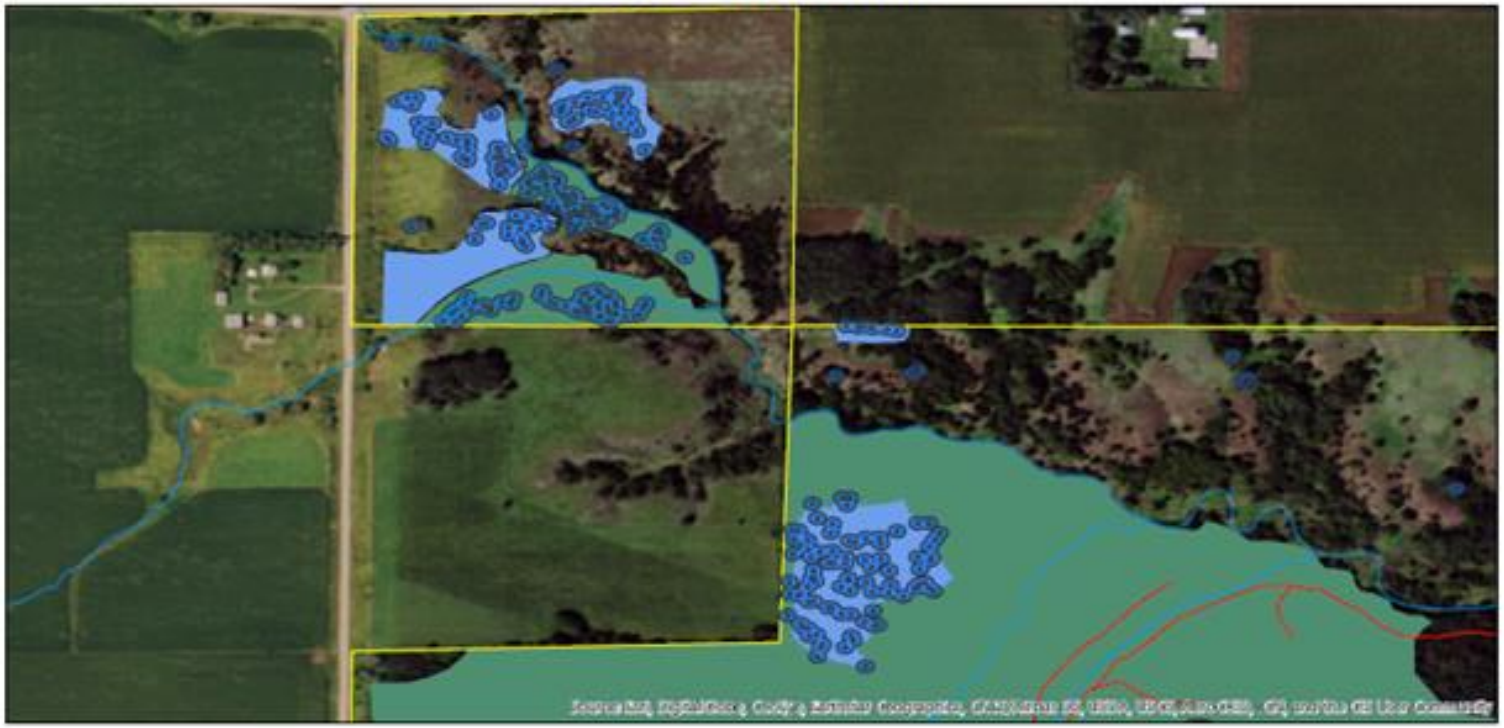
1. Justification: Fire has historically played a major role in oak savanna ecosystems. These burns kept the natural diversity of the ecosystem intact and set back invasive species and woody vegetation that would otherwise invade the landscape. Establishing a consistent burning pattern will suppress the invasive plant species, such as burdock, that are currently found in this area of the park.

3. Objective 3: Establish a grazing regime.

   i. Procedures: Grazing can be introduced in the form of cattle, elk, or bison. The desired area of the park to be grazed should be fenced off. From there, a small animal herd can be introduced to begin grazing on desired sections.

      1. Justification: Grazing was a part of the natural disturbances that occurred in oak savanna ecosystems. Grazing pressure was usually concentrated on areas that had recently been burned.

Oak Savanna



0 0.1 0.2 Miles

N

- Streams
- >18in dbh Burr Oaks
- Burr Oaks 50ft Buffer
- Trails
- Property Border
- Older Oak Savanna
- Younger Oak Savanna

This map displays the NW area of the park. This is where the largest concentrations of Burr Oaks greater than 18 inch dbh (diameter at breast height) were found.

Created by Neil Brouwer

iv. Upland Forest

1. Habitat Descriptions

There are six main natural forest communities described by J. Thompson: oak-hickory, oak-basswood, bottomland hardwoods, riparian, northern conifer and hardwoods, and oak-cedar glade. The upland forest on BVCCP consists of an oak-basswood community. This forest community tends to form on well-drained uplands, hence the name upland forest. They tend to form on the upper northern and/or eastern-facing side of the upper topography of a landscape with a tree canopy coverage of 50-100%. Upland forests can also be found on the upper terrace of stream valleys (J. Thompson).

The BVCCP upland forest consists mostly of bur oaks, basswood trees, and a few eastern cottonwood trees. The mix of bur oak and large basswood trees suggests that the area has been an upland forest for a number of years. This ecosystem has a distinct understory, sub-canopy, and canopy layer, creating a diverse array of habitats to host a great range of species, including both invertebrates and vertebrates. However, at BVCCP, the understory and sub-canopy layers of the forest are impoverished and would benefit from the reintroduction of native species. For the most part, the upland forest at BVCCP is in good condition. Besides the limited variety of understory species, the main concern with this ecosystem is the presence of a few eastern red cedars scattered throughout the upland forest. These cedars should be removed before they spread.

2. Objectives and Procedures
    1. Objective 1: Remove the eastern red cedars from the upland forest.

        i. Procedures: Cut down the existing eastern red cedar trees and chemically treat the stumps if any green branches remain. Identify areas with the densest cedar growth. Use brush-saws, chainsaws, and handsaws to cut down the cedars. Treat the stumps with glyphosate in the late summer to early winter if green branches remain. Stumps without green branches will not re-sprout.

            1. Justification: Cedars have continued to spread and take over areas of BVCCP. Their removal facilitates the establishment of native species previously suppressed by the red cedar canopy.

    2. Objective 2: Develop a better understanding of the current plant community.

        i. Procedures: Create a species list that contains the plant species present in the upland forest. Comb through the forest at least twice a month for a year and record all of the species observed. Common woodland understory wildflowers include bloodroot, Dutchman's britches, trout lily, Virginia waterleaf, and columbine (IAN). See Appendix for a list of species already observed.

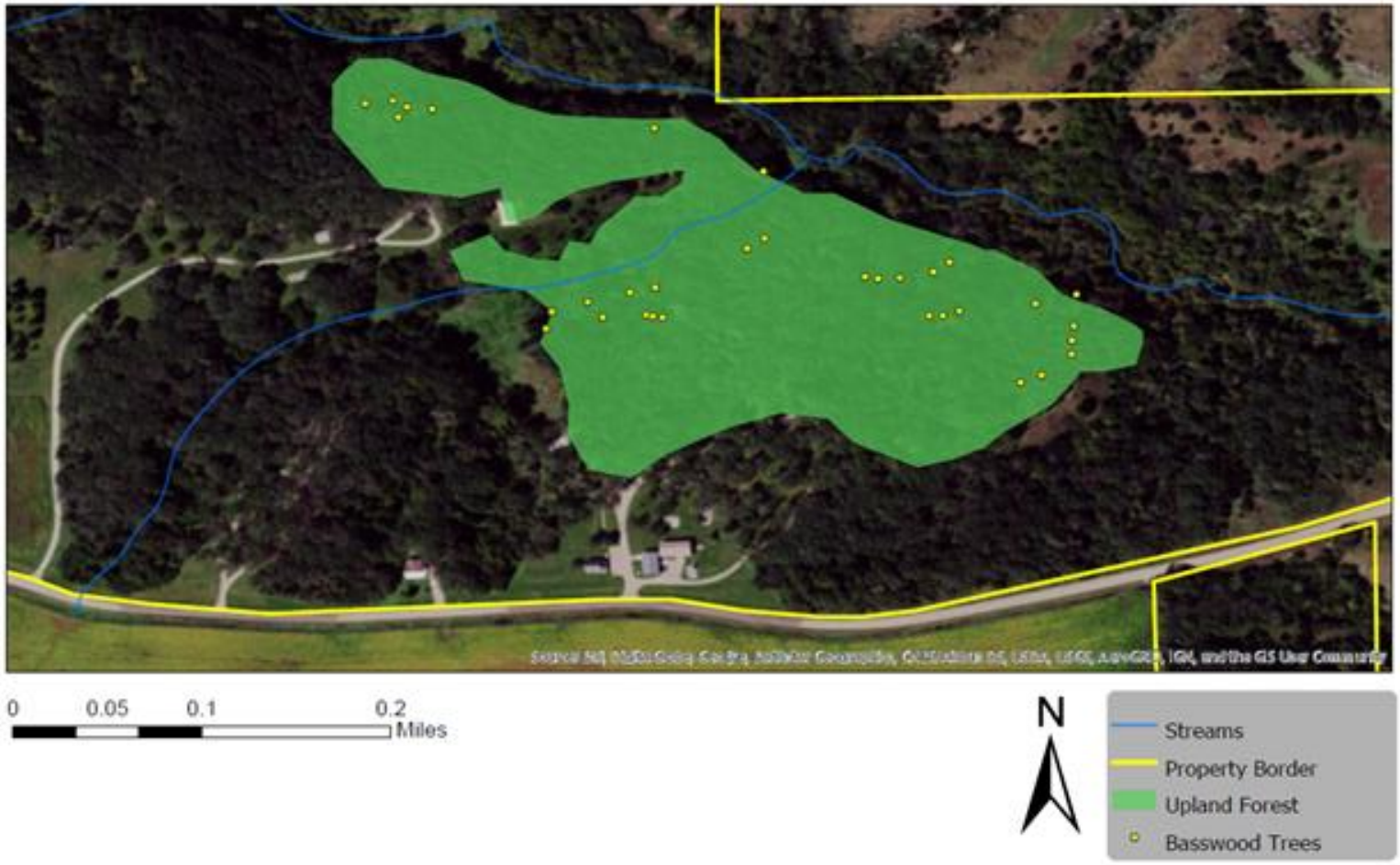
            1. Justification: Currently, the understory of the upland forest appears impoverished. The current species are not completely known as there was not enough time to compile a complete species list. Therefore, in order to improve the diversity of the habitat, what is present and what is not must first be determined.

    3. Objective 3: Introduce missing species and increase the prevalence of desired species.

i. Procedures: Using already existing populations on the property, harvest desirable seeds and sow seed in patches throughout the upland forest. For non-existing populations, purchase seed and plant it in suitable sites throughout the habitat.

    1. Justification: Spreading existing desirable species and introducing desirable species that are not currently present increases the diversity in the habitat. Not only do these species add to the ecological integrity and beauty of the system, they also provide necessary services for wildlife.

Upland Forest



Created by Nell Brouwer

v. Successional Forest

1. Habitat Descriptions

Succession is best defined, ecologically speaking, as the transition from one species assemblage to another following a disturbance event such as an altered frequency of fire or grazing. This could involve the transition from a prairie/grassland type ecosystem into more of a forested area when disturbance events such as fire become infrequent. This has become common throughout most of the Midwest. Since these transitions do not occur overnight there are many stages present in a successional forest. These stages include early successional, middle successional, and late successional stages. The early successional stage is trademarked by an abundance of early pioneer species (grasses and herbaceous material). Middle successional forests are characterized by a more even distribution of youthful upper canopy of woody species and low ground shrubbery. The late successional forest, on the other hand, is dominated by the larger trees and shade tolerant shrubbery (Swanson).

Successional forest areas in the BVCCP are located along the edges of the stream (riparian areas). This area had primarily consisted of grassland in the 1930's. Many of these areas are covered with common buckthorn, a widewpread invasive species in Iowa. In addition to common buckthorn, these areas also contain other successional tree species, such as American elm, eastern cottonwood, green ash, and silver maple. Common buckthorn is particularly problematic as it will outcompete many native plants, leading to a decrease in diversity. In addition, buckthorn limits the growth of moderately shade tolerant species on the forest floor. Without these herbaceous plants the soil is more susceptible to erosion when the stream floods.

Traditionally, disturbance events will set back the succession of the affected region, transforming it back to an earlier successional stage. For the successional forests in BVCCP the dominant issue is common buckthorn and reed canary grass encroachment. The lack of disturbance events has favored common buckthorn and reed canary grass, which are limiting the growth of native, herbaceous, moderately shade tolerant species. Fortunately, the Minnesota DNR has plenty of information on controlling and limiting invasive buckthorn (MDNR). Unfortunately, the buckthorn found in the park is quite prominent and well established so removal will take time and effort.

Our hope is that after removal and constant monitoring of common buckthorn and other species, the successional forest regions along the

stream bank will return to native grasses and forbs and other historically common species. This will not only improve the habitat quality along the stream bank, but also help reduce soil erosion caused by the stream.

2. Objectives and Procedures

    1. Objective 1: Tree removal (primarily common buckthorn, but also elm and ash).

        i. Procedures: By mechanical means begin removal of buckthorn and other trees. Not all green ash or American elm need to be removed from the area, but their numbers should be reduced. To prevent resprouting, stumps should be treated with an herbicide (glyphosate or triclopyr amine when above 32°F or triclopyr ester when below 32°F) mixed with a color indicator. During the following years follow-up removal of seedlings should be done to ensure common buckthorn does not take hold again.

            1. Justification: The Minnesota DNR outlined many of the steps described above for the control of

common buckthorn. Herbicide with a color indicator is important because it helps easily distinguish which stumps have already been chemically treated. It is critical to continually monitor the treated areas in the following years as common buckthorn seeds can remain viable in the soil for up to 3 years before sprouting.

2. Objective 2: Seed native species to fill the open niche.

    i. Procedures: Obtain a native seed mixture and begin planting in the fall after the trees have been removed. An aggressive, fast growing mix is recommended. Prairie Moon Nursery has a pretty darn quick (PDQ) mixture that consists of a native mix that is meant to establish quickly and flourish in moist, nutrient rich soil.

        1. Justification: When removing species from an area, a niche is opened up that other species can easily take advantage of. It is important that the open niche is filled with desired native herbaceous plants early on to keep undesired plants from dominating the area.

3. Objective 3: Establish a burn regimen.

    i. Procedures: After removal and treatment of common buckthorn, a burn should be conducted every 2 years to help setback woody plants.

        1. Justification: Burns are common to this area and help set back the rate of succession. The burns would allow for early successional species, such as grasses and other non-woody vegetation, to prosper and increase diversity.

Common Buckthorn

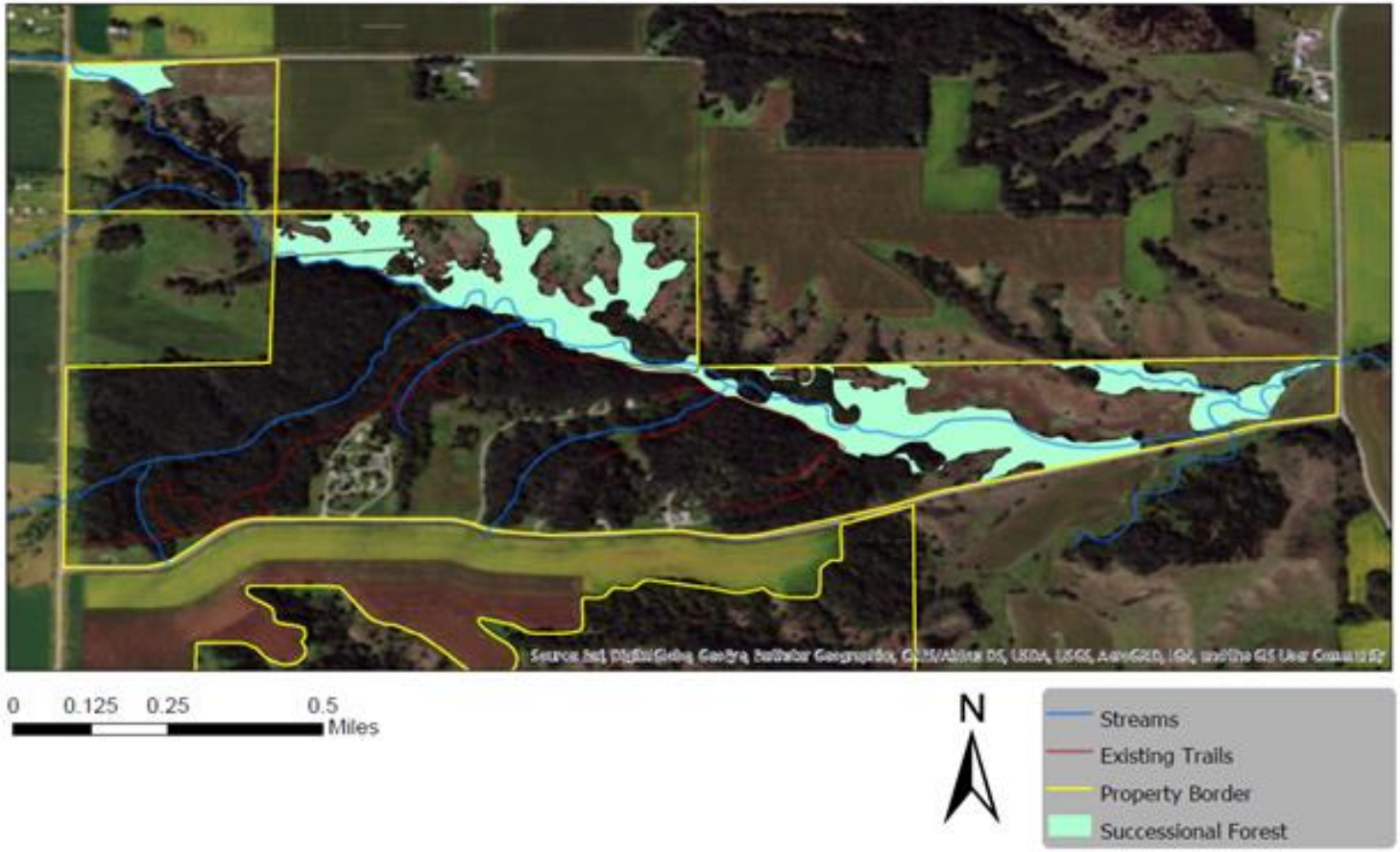
0 0.125 0.25 Miles

N

Streams
Existing Trails
Property Border
Buckthorn

Created by Neil Brouwer and Sarah Grubbs

Successional Forest



Created by Neil Brouwer and Sarah Grubbs

vi. Streams

1. Habitat Descriptions

Streams play an ecologically important role in ecosystems, as they shape the landscape, drain water from the land, filter pollutants, and provide critical habitat for many aquatic species. Streams are part of a vast interconnected circulatory system that carry water, sediment, and organic material from high elevations to the oceans (EPA). Riparian zones around the stream are high in biological productivity due to nutrient availability and sufficient water supply. Riparian vegetation serves several important roles in stream quality. Vegetation along the stream stabilizes the stream bank. Roots of riparian grasses, shrubs, and trees hold the stream bank in place and therefore prevent erosion (King County). Riparian vegetation also filters the water by trapping pollutants and sediments, thus reducing the amount that enters the water flow. Plants also uptake a large amount of Nitrogen and small amounts of Phosphorus as well as small amounts of other nutrients. In addition, plant roots also take up small amounts of heavy metals (Cd, Cr, Hg, Ni, Pb), metalloids (As, Se), and other elements (B, Cs, Sr) that may be present in the water and store them in plant tissues (Dosskey). Excess nutrients in streams cause ecological stress, so uptake of these nutrients by vegetation improves the stream quality. Additionally, riparian vegetation helps regulate stream temperature. Vegetative cover over a stream helps keep the stream cool during warm summer months. Shaded streams that are cooler in temperature have less algal growth and hold more oxygen (King County).

The stream that flows through BVCCP is a semi-entrenched headwater stream that is a direct tributary to the Little Sioux River (Cunningham). There are several first order headwater streams that run through the property as shown on the map on pages 35 and 41. These join together to form the main stream that flows through the valley of the property. As a restoration team, we named this stream Hidden Creek. These streams join up with Cottonwood Creek, which is a 3rd order stream, in the southeast corner of the property. Historically, this stream ran through a landscape shaped by recent glacial activity (moraines) blanketed by tall grass prairie (Cunningham). However, more recently common buckthorn has invaded the area around the stream, and has shaded out native vegetation along the stream edge. These native prairie grasses were vital to stream quality because their fine roots held the soil in place and prevented the stream bank from eroding during heavy rain events. Due to the establishment of buckthorn and other early-mid successional forest species, such as elm, and loss of native

grasses, there are areas along the stream that are suffering from erosion. The habitat types within the stream itself include, shallow runs, well vegetated undercut banks, eroded steep bank, meander pools, and deep pools. Substrate found in the deep pools was a combination of gravel and silt. Overall the water is clear and the water temperature was cool as well (Cunningham). Most of the stream meanders nicely, which slows the velocity of the stream. Hidden Creek also supports a variety of fish species, mainly small minnows and shiners (see p. 60).

As with many streams in Northwest Iowa, the stream that flows through BVCCP is threatened by agricultural run-off and land modification. Erosion transports sediments and excess nutrients into the stream. Nitrogen and Phosphorus are natural elements of an aquatic ecosystem, but when they are in excess algae grows faster than ecosystems can handle. Algal blooms lead to a decrease in the oxygen supply of the water that aquatic organisms need to survive, thus harming water quality, food supply, and habitat (EPA). However, chemical analysis results of the BVCCP stream indicate that the nitrate levels are currently not of concern (see p. 51). Current nitrate levels range between 1.9 - 4.9 mg/L. Natural levels of nitrate are less than 1 mg/L, so these levels are higher than the natural state but do not pose a threat to stream quality

or aquatic life (Behar).

2. Objectives and Procedures

    1. Objective 1: Maintain the water quality of Hidden Creek.
        i. Procedure 1: Encourage surrounding land owners to incorporate buffer strips. Identify areas along the stream outside of the BVCCP property that are bordered by agricultural fields or other areas that seem especially susceptible to erosion and run-off. Provide landowners with information about the benefits of buffer strips and opportunities for CRP land to encourage them to create buffer strips along the stream.

            1. Justification: Erosion and nutrient run-off from agricultural lands pose a large threat to the health of streams and rivers. Buffer strips will help prevent excess nutrients, chemicals, and soil erosion from entering the stream.

        ii. Procedure 2: Monitor water quality twice a year, every 3 years, checking for variables such as dissolved oxygen content, phosphorus levels, nitrate levels, pH, and turbidity. If only some tests can be accomplished, give the greatest priority to measuring phosphorus and nitrate levels, and try to maintain or decrease these levels from the results obtained in spring 2017 (see the data table on p. 51).

            1. Justification: Water quality should be measured to monitor any changes in stream health. This can be used to track increases or decreases in nutrient content over time, and the data can help inform management for improving the quality of the stream.

    2. Objective 2: Stabilizing the stream bank in BVCCP.

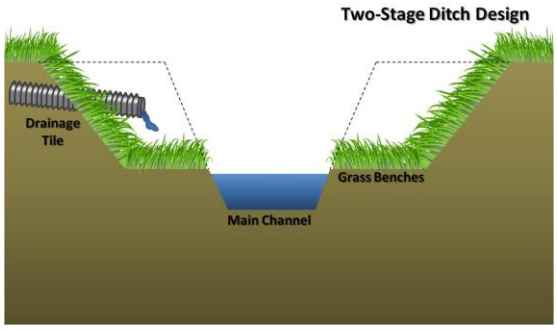
        i. Procedure 1: Prevent further stream back cutting during heavy rain events. Two areas along the stream are experiencing back cutting, which occurs during heavy rains, and the stream cuts further back away from the stream flow into the landscape. To prevent further back

cutting, the area that is being eroded away needs to be stabilized. First, the grade of the slope can be decreased to a more even grade. Then an erosion control blanket should be installed to protect barren soil from erosion (Mahacek). After the installation of the erosion control blanket, the riparian bank can be further stabilized with the addition of rock. Large rocks can be placed over the area to protect the soil and new vegetation can be propagated in the area as well.

1. Justification: Stabilizing the areas of the stream that are experiencing back cutting will prevent further erosion and degradation of the landscape. This will keep the soil in place and facilitate the growth of vegetation.

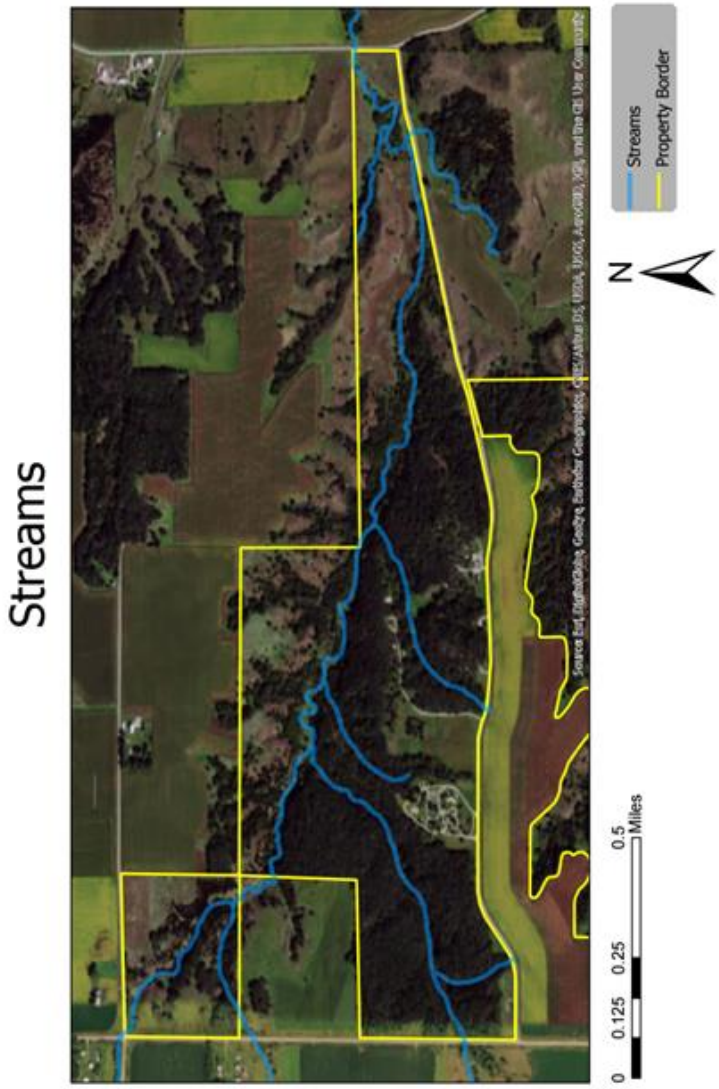
ii. Procedure 2: Control erosion with a two-stage bank design for creeks. In order to reduce the steepness and smoothness of the stream banks, create a two-stage stream bank, as shown in the figure below. For more information, see The Nature Conservancy on Landscape Conservation Cooperatives, hydrological restoration.

1. Justification: Some areas of the stream have had a fair amount of down cutting over the years, creating smoother, steeper, and deeper stream banks, which increases the velocity of the water moving through it and increases soil erosion (Galatowitsch). A two-stage stream bank will create a floodplain for the stream during heavy rains, so that the rains no longer erode the banks of the stream and cause further down cutting. The two-stage stream consists of the main channel, which is large enough to handle the usual discharge of water, and a bench that serves as the flood plain for the main channel.



iii. Procedure 3: Control erosion with vegetation. Most of the stream has a high percentage of vegetative cover along the stream banks. However, there are areas that have been invaded by common buckthorn, which has consequently displaced the native prairie grasses. The buckthorn needs to be removed and then the stream banks need to be reseeded with native prairie grasses to re-stabilize the soil. See successional forest (p.32).

1. Justification: Vegetation along stream banks stabilizes the soil by holding the soil in place via the plant roots. This prevents the soil from eroding into the stream during heavy rain events.



Created by Neil Brouwer

vii. Campgrounds, Trails, and Public Areas

1. Habitat Description, Objectives, Procedures, and Justification

Effective maintenance of trails during extreme rain events and heavy use conditions is an important consideration for park maintenance crews. The existing trails at BVCCP are in relatively good shape with only a few areas where erosion has degraded the trail conditions. There are also a few parts of the existing trail system that would benefit from restoration of the existing steps as they have been degraded by weathering and use. Continued maintenance and care of these beautiful trails will ensure enjoyment for trail users through many years at BVCCP.

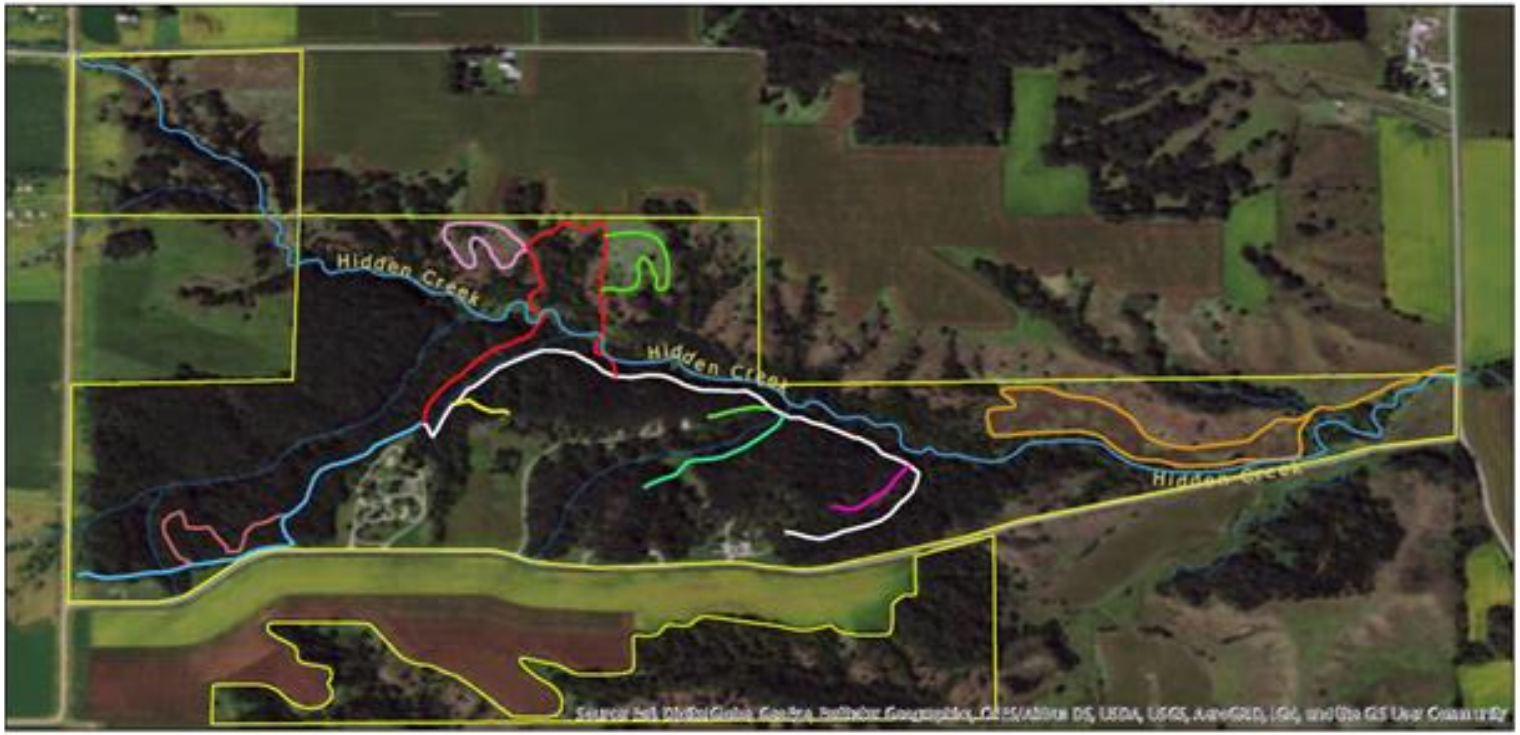
A few of the lower spots on the Hidden Creek Trail (see maps on pg. 44-45) have become washed out from the periodic streams that are present after rainfall, but much of the trail is intact and safe from too much water erosion. Many trail builders suggest that hiking trails be elevated above the ground in areas where water runoff may cause some of the trail to be washed away. Elevating the trail in dry areas will provide better defined trails that will help keep hikers on the trails maintained by the park rather than creating their own to explore on. In order to elevate the trails, gravel may be used as a filler that can not only elevate the trail, but also provide a water erosion resistant trail material. Near where Hidden Creek Trail meets Bur Oak Bend, there is a spot where the stream crosses part of the trail that has been partially washed away leaving a 3-foot-wide gulch in the middle of the path. More often than not, it is better to move the trail instead of moving water because water flows via the path of least resistance and is not easily changed. However, with such a well-established trail already present, it might be wise to use a small culvert that can be overlain with gravel to allow the stream to safely flow under the trail without washing it away.

In the lower areas closer to the bigger stream, a useful tactic used to keep water from settling on the trail is the construction of knicks. Knicks can divert water naturally off the trail in areas where running water is common. At the same time, being only gradually sloped, knicks can keep a trail accessible to most trail users. A knick is a circular, outsloping area of a trail with a maximum grade of 15%. Knicks should be placed in carefully selected areas where water is likely to run over the trail.

The addition of steps is a simple way to facilitate an easier hike in areas with steep terrain. A few spots on the trail have steps right now, specifically the Shelter Spur. Another area that could benefit from steps would be potential extensions from the Rhus Ridge, across the stream and up into the northern part of the BVCCP into the prairie (see

proposed trail maps on pg. 44, 46). There are several good types of trail steps, but for these trails, wood may be the most cost effective option. Large rocks are not as easily available in Northwest Iowa, although they do provide for excellent step material. Alternatively, wood steps from old salvage lumber or railroad ties can work well.

Current and Proposed Trails



0 0.125 0.25 0.5 Miles

N

- Streams
- Property Border
- Hidden Creek Trail 0.87mi
- Nuthatch Trail 0.11mi
- Basswood Trail 0.2mi
- Shelter Spur 0.07mi
- Gooseberry Loop 0.29mi
- Burr Oak Bend 0.51mi
- Rhus Ridge 0.67mi
- Cabin Crossing 0.07mi
- Ground Cherry Trail 0.33mi
- Prairie Trail 0.28mi
- Hidden Creek
- Prairie View Trail 1.08mi

Created by Neil Brouwer

BVCCP Trails

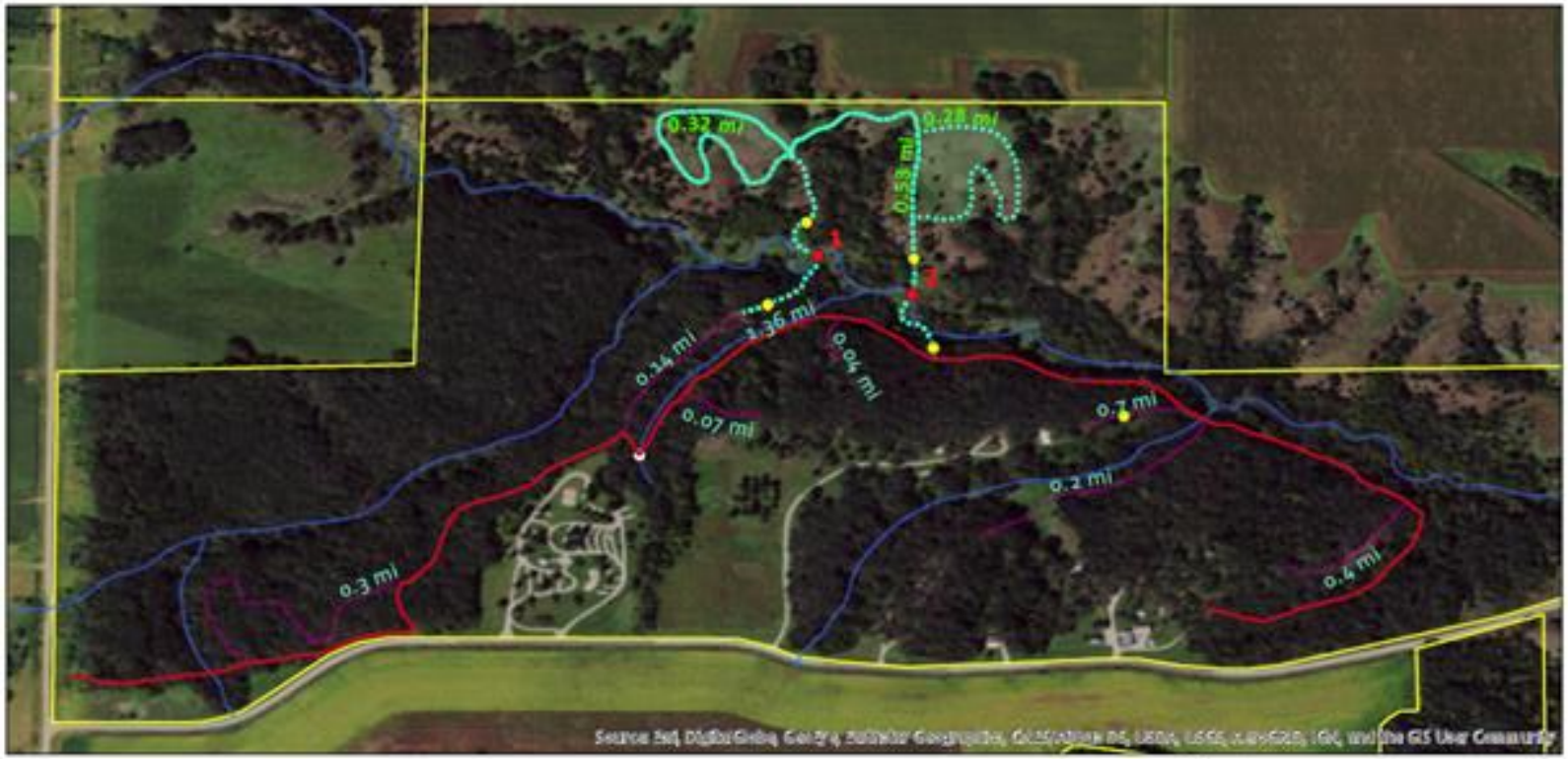
0 0.125 0.25 Miles

N

- Camping_Sites
- Streams
- Shelters
- Property Border
- Hidden Creek Trail 0.87mi
- Nuthatch Trail 0.11mi
- Basswood Trail 0.2mi
- Shelter Spur 0.07mi
- Gooseberry Loop 0.29mi
- Burr Oak Bend 0.51mi
- Cabin Crossing 0.07mi
- Hidden Creek
- Rhus Ridge 0.14mi

Created by Neil Brouwer

Trail System



0 0.125 0.25 Miles

N

- Existing Bridge
- Steps
- Proposed New Trails
- Streams
- Spurs
- Property Border
- New Bridges
- Main Trail

Created by Neil Brouwer

d. Summary of Objectives and Procedures

The Buena Vista County Conservation Park's 300 acres of land provide a unique opportunity for restoration work. The objectives of highest priority (based on interviews) include removal of invasive plants and encouraging or reintroducing native species, increasing the water quality throughout the park, increasing availability of education and interaction with the public, restoration of oak savanna and prairie, and providing maps of trails and other recreation activities within the park. Desired long term objectives include developing a pollinator program, implementing a grazing program, and possibly installing a small pond.

High priority objectives:

1. Removal of invasive species
2. Encouraging or reintroducing native species
3. Increasing water quality
4. Enhancing education and interaction with the public
5. Restoring oak savanna and prairie ecosystems

Other lower priority /long-term objectives:

1. Developing a pollinator program
2. Implementing a grazing program
3. Installing a small pond

e. Gantt Chart

Objective	Area	Season	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cedar Removal	Garry's Area	Spring to early winter 2017									
Burn regime on prairie	Remnant prairie in Garry's area	Spring or fall 2017									
Harvest native seeds	Remnant prairie	Fall 2017									
Herbicide on smooth brome (Sulfosulfuron)	Smooth brome grassland	Fall 2018 / spring 2019									
Burn regime on grassland	Smooth brome grassland	Fall 2018									
Reseed prairie	Prairie remnants	Late summer – fall 2019									

Oak Savanna:

Objective	Area	Season	2017	2018	2019	2020	2021	2022	2023	2024	2025
Removal of invasive trees in oak savanna	Remnant oak savanna on West side of park	Spring 2020 – spring 2021									
Burning oak savanna	Remnant oak savanna on west side of park	Annual burn starting in 2020									

Upland Forest:

Objective	Area	Season	2017	2018	2019	2020	2021	2022	2023	2024	2025
Remove invasive cedars	Oak and basswood Upland forest area	Spring 2021									

Successional Forest and Stream:

Objective	Area	Season	2017	2018	2019	2020	2021	2022	2023	2024	2025
Remove invasive Buckthorn (mechanical)	Successional forest along N stream bank	Summer 2021									
Remove invasive Buckthorn (chemical)	Successional Forest along N stream bank	Fall/Winter 2021									
Buckthorn follow up removal	Successional Forest along N stream bank	2 yr following removal									
Plant native PDQ mix	N stream bank	Spring 2025									
Sample water in streams	Streams	2x per year every 4 years									
Stabilize stream bank	Stream banks (cutback areas)	By 2020									
Two Stage Ditch System	Stream	Summer 2025									

f. Budget

Task	Estimated Cost Per Unit	Total Units	Estimated Total Cost
Hire a crew to remove cedar trees in the prairie	$4,680/week	2 weeks	$9,360
Apply herbicide mix (glyphosate + sulfosulfuron) to smooth brome grassland	$75-100	61.07 acres	$4,575-6,100
Purchase and sow seed for smooth brome grassland sites	$700-1300	61.07 acres	$42,700-79,300
Purchase skid loader tree shear with grapple	$9,000 (3,710 for grapple)	1	$9,000-12,710
Hire a crew to remove cedars in upland forest areas	$1,170/day	2 days	$2,340
Remove buckthorn in successional forest and treat stumps with glyphosate	$4,680/week	2-3 weeks	$9,360-14,040
Purchase seed for oak savanna and upland forest	$600-7,936	TBD	TBD
Sample streams for chemical concentrations	$45-70/test requested	4 (one per season)	$180-280
Buy and sow a prairie seed mix on the stream bottom area.	$700-1,000/acre	10 acres	$7,000-10,000
Purchase railroad ties and gravel to enhance trail water shedding ability and restore old steps on the trail	$15-20/railroad tie $20-50/ton	40 railroad ties 300 tons	$600-800 $6,000-15,000
Hire contractor to create two stage ditches for the streams	$5-20/linear foot	TBD	TBD
Total Cost			$90,000-150,000

g. Follow-up and Monitoring Program

Data should be collected, monitored and evaluated throughout the implementation of this plan. This helps measure the success of the project as well as form a database of information of the history of BVCCP. The data collected will serve as a guide for future restoration projects with similar habitats.

Prairie remnant and grassland: These habitats are subject to change after cedar and smooth brome removal, therefore adaptive management is necessary in this process. Once the main invasive species are removed, the prairie and grassland will need to be closely monitored in order to ensure the invasive species do not reestablish. A species list should be assembled every three years in order to determine if the prairie and grassland have the desired diversity of native species. If they do not meet the desired specifications, a native prairie seed mix should be planted in the area. If native species are present, then the prescribed burn routine needs to be kept up to promote desired native species and suppress invasive species.

Upland and Successional Forest: The main goal for these areas is the removal of Common Buckthorn. After their initial removal, there will need to be a yearly upkeep and removal of young buckthorn. Yearly monitoring is important to prevent the buckthorn from taking over again and to ensure that native species are growing up in its place. Species lists should also be assembled every 3 years in these habitats. Furthermore, water quality should be analyzed during the spring and fall, every 3 years, to check if nutrient levels are fluctuating in the waterways.

IV. Appendix

a. Data

Water Sample	Phosphorous: PO_4^{3-} (mg/L)	Nitrate NO_3 (mg/L)
1	3.3	2.2
2	2.66	3.1
3	2.36	1.9
4	2.28	4.1
5	3.19	4.2
6	4.14	4.9
7	2.78	4.6

b. SWOT-C

Strengths	• Diverse Habitats • Recreational opportunities for all seasons • Widespread Public Support
Weaknesses	• Secluded location
Opportunities	• Education • Grant applications • Volunteer Involvement
Threats	• Invasive species • Agricultural runoff
Constraints	• Limited Staff • Funding • Time

c. Site Analysis

	SWOT-C	Observations
GENERAL FACTORS		
Ownership of candidate site	Strength	BVCCP is a county park directed by Greg Johnson and supervised by a board of directors. They are very supportive of this project.
Easements, prior rights, other conditions	Strength	There are no permits or approvals that are not easy to obtain. There is an ammonia pipeline going through Gary's area but it is easy to get approval on work in this area.
Historical context	Strength	Historically, the area was tallgrass prairie and oak savanna
Prior land use	Strength	Historically, the land was used as farmland and pastureland. The wooded areas, specifically the oaks, were logged.
Unique site features, structures, landforms	Strength	BVCCP is a unique site for Northwest Iowa. The topography is a mixture of hills and ravines with multiple streams running through them. The habitats in the area include oak savanna, remnant prairie, upland forest, and successional forest.
Current land use	Opportunity	The park is mostly used for recreation, which receives a lot of public attention. This gives

		the plan an opportunity to increase public awareness of restoration work.
Political considerations	Strength	Greg is the main person in charge for the project and he is extremely supportive of it, as is the board of directors. The relationships with neighboring land owners are in good standing. The park is supported via grants from USFWS.
Access/access control/human use patterns	Strength	BVCCP is open to the public. It has hiking trails, camping sites, and is also open to bow hunting. The park hosts monarch tagging and spring wildlife hikes. Vandalism does not seem to be an issue.
Cultural resources (historical, archaeological)	Opportunity	The Little Sioux River valley was used by Native Americans and there is a high chance that archeological sites exist in the area. The Little Sioux River was most likely a bison kill site.
Agricultural or other quarantines	Threat	The area is surrounded by farmland that produces runoff which flows into the streams that flow through BVCCP. Currently, the surrounding agricultural effect is minimal, but problems could arise in the future.
Hazardous waste, debris, etc	Opportunity	There are a couple of junk piles in the park; one of these is located in Gary's area. However, these areas will not take long to clear and once they are gone, the park will not have any hazardous waste or debris.
Stressors on existing ecosystem	Threats	There are many stressors on the ecosystem at the park. These include runoff from surrounding farms, roads running on the edge of the property, erosion in the streambeds, and heavy human use during the busy season
PHYSICAL FACTORS		
Topography	Strength	BVCCP has a varied landscape, including ravines and hills. Although this can make restoration work more difficult, it adds to the diversity of habitats on the site for wildlife and native species and makes the site more unique.
Slope and aspect	Threat	The steep slopes and ridges on the property are likely to erode if vegetation is removed. They also make navigation of the property and maintenance work much more difficult.
Elevation	Opportunity	The elevation of the park is roughly between 1250-1450 feet above sea level. This height

		variation can affect species composition at different levels.
Geology	Strength	Loess drift currently makes up the superficial deposits in this area. Loess is sediment drift that blew in from glacial outflow to the west.
Soils	Insufficient information	Insufficient information
Soil chemistry and nutrient status issues	Insufficient information	Insufficient information
Topsoil profile and subsoil profile	Insufficient information	Insufficient information
Hydrology	Strength and threat	Multiple streams run through BVCCP adding to the unique diversity of habitats at BVCCP and providing essential ecological services. However, at the same time, the system of streams has caused a lot of erosion and will continue to do so if nothing is done about it.
Groundwater status	Insufficient information	Insufficient information
Surface runoff	Threat	Agricultural runoff and land modification are present at BVCCP. There is also a large amount of erosion on the stream banks, which deposits excess nutrients and sediments into the stream.
Water quality status	Opportunity	Currently, the chemical analysis of water samples indicated that nitrate levels are not of concern, being only 0.9-3.9 mg/L above the natural level. It would be ideal to lower the nitrate level, but as of right now, it does not threaten any species.
Landscape ecology considerations for movement of animals, pollinators, etc.	Opportunity	Although often difficult for humans to navigate, the landscape ecology of BVCCP is very varied and navigable for most wildlife. The ravines cut out by the streams provide plenty of shelter and the open prairie is great for pollinators.
BIOLOGICAL FACTORS		
Existing vegetation communities	Strength	Bur oak savanna, remnant prairie, upland forest, successional forest, and smooth brome grassland.
Vegetation dynamics of existing communities	Opportunity	The vegetation communities are lacking natural disturbances such as a fire regime (only certain regions of the park) and grazing. The re-introduction of these processes, where appropriate, will substantially increase the health of the ecosystems

Assess degree of degradation	Weakness	Many of the habitats on the property have been moderately degraded through human use: agriculture, heavy grazing, recreation, etc. and through suppression of natural disturbances.
Invasive nonnative species	Weakness	Invasive species are taking over multiple regions of the park. The major invasive species include eastern red cedar (native), smooth brome (nonnative), common buckthorn (nonnative), and tartarian honeysuckle (nonnative).
Habitat value and features	Strength	The habitats at BVCCP are invaluable and extremely rare. Bur oak savannas are rare and more than 99% of the native tallgrass prairie has been converted to other land uses. Therefore, this property is pivotal in the process of restoring these ecosystems.
Wildlife resources	Strength	This park provides habitat for many species, both seasonally and year-round. Evidence of wildlife is found in scat, burrows, tracks, and nests. There are old trees for cavity nesters as well as crags in the landscape for shelter. See species lists.
Endangered, threatened, species at risk, sensitive species presence, or habitat of seasonal use	Strength	Threatened and endangered animals found in the park include the Northern long-eared bat and Topeka shiner. Both the remnant prairie and bur oak savanna are endangered habitats. Threatened plant species include the prairie bush clover and western prairie fringed orchid.
ANTICIPATED SITE IMPROVEMENTS OR CONSIDERATIONS		
Grading	Constraint	The stream banks need to be modified to prevent further erosion. This is expensive and time consuming.
Soil import/export	Strength/insufficient information	Not needed
Water features	Strength	The water has been tested and was shown to be in good condition. See data in appendix.

Drainage/flood control	Strength	The stream drains the park and the deep ravines protect surrounding land from flooding.
Irrigation system	Strength	None needed
Buffer zone issues or requirements	Constraint	Buffer strips are needed between the park and surrounding agricultural lands but farmers can only be encouraged to put them in place.
Access control and access to site	Strength	The park is public property and easy to access. There are multiple roads leading into the park for campers and trails throughout the park to travel on.
Vandalism issues, need for control features	Strength	Vandalism is not a major problem on this property
Defined candidate area for work	Strength	The park is divided into different ecosystems with objectives for each section. See objectives.

d. Species List
   i. Forbs

Forbs	Scientific Name	Family	Invasive/Native
American Pasqueflower	*Pulsatilla patens*	Ranunculaceae	N
Aster, Aromatic	*Symphyotrichum aromatica*	Asteraceae	N
Aster, Heath	Symphyotrichum ericoides	Asteraceae	N
Aster, Silky	*Symphyotrichum sericeus*	Asteraceae	N
Bastard Toadflax	*Comandra umbellata*	Santalaceae	N
Blazing Star, Dotted	*Liatris punctata*	Asteraceae	N
Blazing Star, Rough	*Liatris aspera*	Asteraceae	N
Bull Thistle	*Cirsium vulgare*	Asteraceae	I

Burdock, Common	*Arctium minus*	Asteraceae	I
Canada Anemone	*Anemone canadensis*	Ranunculaceae	N
Canada Thistle	*Cirsium arvense*	Asteraceae	I
Canada Milkvetch	*Astragalus canadensis*	Fabaceae	N
Catnip	*Nepeta cataria*	Lamiaceae	I
Coneflower, Pale Purple	*Echinacea pallida*	Asteraceae	N
Coneflower, Gray-headed	*Ratibida pinnata*	Asteraceae	N
Compass Plant	*Silphium Lanceolatum*	Asteraceae	N
Crown Vetch	*Securigera varia*	Fabaceae	I
Cup Plant	*Silphium perfoliatum*	Asteraceae	N
Dandelion, Common	*Taraxacum officinale*	Asteraceae	I/N*
Dutchman's Breeches	*Dicentra cucullaria*	Papaveraceae	N
Evening Primrose, Toothed	Calylophus serrulatus	Onagraceae	N
False Boneset	*Brickellia eupatorioides*	Asteraceae	N
Garlic Mustard	*Alliaria petiolata*	Brassicaceae	I
Gooseberry	*Ribes americanum*	Grossulariaceae	N
Golden Alexanders	*Zizia aurea*	Apiaceae	N
Goldenrod, Canada	*Solidago canadensis*	Asteraceae	N
Goldenrod, Early	*Solidago juncea*	Asteraceae	N
Goldenrod, Field	*Solidago nemoralis*	Asteraceae	N
Goldenrod, Missouri	*Solidago missouriensis*	Asteraceae	N
Goldenrod, Stiff	*Oligoneuron rigidum*	Asteraceae	N
Ground Plum Milkvetch	*Astragalus crassicarpus*	Fabaceae	N
Hoary Puccoon	*Lithospermum canescens*	Boraginaceae	N
Hoary Vervain	*Verbena stricta*	Lamiaceae	N

Leafy Spurge	*Euphorbia esula*	Euphorbaceae	I
Leadplant	*Amorpha canescens*	Fabaceae	N
Milkweed, Common	*Asclepias syriaca*	Asclepiadaceae	N
Milkweed, Green	*Asclepias viridiflora*	Asclepiadaceae	N
Milkweed, Whorled	*Asclepias verticillata*	Asclepiadaceae	N
Motherwort	*Leonurus cardiaca*	Lamiaceae	I
Mullein, Common	*Verbascum thaspus*	Scrophulariaceae	I
Musk Thistle	*Carduus nutans*	Asteraceae	I
New Jersey Tea	*Ceanothus americanus*	Rhamnaceae	N
Prairie Cinquefoil	*Drymocallis arguta*	Rosaceae	N
Prairie Clover, Purple	*Dalea purpurea*	Fabaceae	N
Prairie Clover, White	*Dalea candida*	Fabaceae	N
Prairie Coreopsis	*Coreopsis palmata*	Asteraceae	N
Prairie Phlox	*Phlox pilosa*	Polemoniaceae	N
Prairie Rose	*Rosa arkansana*	Rosaceae	N
Prairie Turnip	*Pediomelum esculentum*	Fabaceae	N
Prairie Violet	*Viola pedatifida*	Violaceae	N
Pussytoes, Field	*Antennaria neglecta*	Asteraceae	N
Queen Anne's Lace	*Daucus carota*	Apiaceae	I
Raspberry, American Red	*Rubus strigosus*	Rosaceae	N
Red Clover	*Trifolium pratense*	Fabaceae	I
Silver-Leaf Scurfpea	*Pediomelum argophyllum*	Fabaceae	N
Stinging Nettle	*Urtica dioica*	Urticaceae	N
Sunflower, Maximillian	*Helianthus maximilliani*	Asteraceae	N
Sunflower, Sawtooth	*Helianthus grosseserratus*	Asteraceae	N
Switchgrass	*Panicum virgatum*	Poaceae	N

Thimbleweed	*Anemone cylindrica*	Ranunculaceae	N
Virginia Waterleaf	*Hydrophyllum virginianum*	Boraginaceae	N
Wild Bergamot	*Monarda fistulosa*	Lamiaceae	N
Wild Onion, Autumn	*Allium stellatum*	Allioideae	N
Yarrow, Common	*Achillea millefolium*	Asteraceae	N

ii. Tress/Shrubs

Trees/Shrubs	Scientific Name	Family	Invasive/Native
American Basswood	*Tilia americana*	Tiliaceae	N
Ash, Green	*Fraxinus pennsylvanica*	Oleaceae	N
Boxelder	*Acer negundo*	Sapindaceae	N
Buckthorn, Common	*Rhamnus carthartica*	Rhamnaceae	I
Bur Oak	*Quercus macrocarpa*	Fagaceae	N
Cottonwood	*Populus deltoids*	Salicaceae	N
Cedar, Eastern Red	*Juniperus virginiana*	Cupressaceae	N*
Elm, American	*Ulmus americana*	Ulmaceae	N
Elm, Red	*Ulmus rubra*	Ulmaceae	N
Honeysuckle, Tartarian	*Lonicera tatarica*	Caprifoliaceae	I
Mulberry, White	*Morus alba*	Moraceae	I
Red Osier Dogwood	*Cornus sericea*	Cornaceae	N
Smooth Sumac	*Rhus glabra*	Anacardiaceae	N
Walnut, Black	*Juglans nigra*	Juglandaceae	N

**Both Eastern Red Cedar and Reed Canary Grass are plants that are native to North America however, as the prevalence of fire has diminished over the years, they have become more prevalent, often displacing species that are more desirable.*

iii. Grasses

Grasses	Scientific Name	Invasive/Native
Big Bluestem	*Andropogon gerardii*	N
Brome, Smooth	*Bromus inermis*	I
Canada Wild Rye	*Elymus canadensis*	N
Indiangrass	*Sorghastrum nutans*	N
Kentucky Bluegrass	*Poa pratensis*	I
Little Bluestem	*Schizachyrium scoparium*	N
June Grass	*Koeleria macrantha*	N
Porcupine Grass	*Hesperostipa spartea*	N
Prairie Cordgrass	*Spartina pectinata*	N
Prairie Dropseed	*Sporobolus heterolepis*	N
Prairie Muhly	*Muhlenbergia cuspidata*	N
Reed Canary Grass	*Phalaris arundinacea*	N*
Scribner's Panic Grass	*Dicanthelium oligosanthes*	N
Side-oats Grama	*Bouteloua curtipendula*	N
Switchgrass	*Panicum virgatum*	N
Tall Dropseed	*Sporobolus asper*	N
Timothy	*Phleum pretense*	I

**Both Eastern Red Cedar and Reed Canary Grass are plants that are native to North America however, as the prevalence of fire has diminished over the years, they have become more prevalent, often overtaking species that are more desirable.*

iv. Aquatic

Fish		
Common Name	**Scientific Name**	**Family**
Bigmouth Shiner	Notropis dorsalis	Cyprinadae
Blacknose Dace	Rhinichthys atratulus	Cyprinadae
Bluntnose Minnow	Pimephales notatus	Cyprinadae

Brassy Minnow	Hybognathus hankinsoni	Cyprinadae
Central Stoneroller	Campostoma anomalum	Cyprinadae
Common Shiner	Luxilus cornutus	Cyprinadae
Creek Chub	Semotilus atromaculatus	Cyprinadae
Fathead Minnow	Pimephales promelas	Cyprinadae
Johnny Darter	Etheostoma nigrum	Percidae
Largemouth Bass	Micropterus salmoides	Centrachadae
Red Shiner	Cyprinella lutrensis	Cyprinadae
Southern Redbelly Dace	Chrosomus erythrogaster	Cyprinadae
Stonecat	Noturus flavus	Catostomidae
White Sucker	Catostomus commersonii	Catostomidae

v. Mammals, Amphibians, and Reptiles

Mammals	Scientific Name
American Badger	*Taxidea taxus*
American Beaver	*Castor canandensis*
American Mink	*Mustela vison*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*
Eastern Chipmunk	*Tamias striatus*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Fox Squirrel	*Sciurus niger*
Eastern Mole	*Scalopus aquaticus*
Ermine	*Mustela erminea*
House Cat	*Felis catus*
House Mouse	*Mus musculus*
Least Shrew	*Cryptotis parva*
Least Weasel	*Mustela nivalis*
Masked Shrew	*Sorex cinereus*
Meadow Jumping Mouse	*Microtus pennsylvanicus*
Meadow Vole	*Zapus hudsonius*
Muskrat	*Ondatra zibethicus*
Native Mice	*Peromyscus spp.*
North American Deermouse	*Peromyscus maniculatus*
Northern Raccoon	*Procyon lotor*
Northern Short-tail Shew	*Blarina brevicauda*
Prairie Vole	*Microtus ochrogaster*
Red Fox	*Vulpes vulpes*
River Otter	*Lontra canadensis*
Striped Skunk	*Mephitis mephitis*
Thirteen-lined Ground Squirrel	*Ictidomys tridecemlineatus*
Virginia Opossum	*Didelphis virginiana*
Western Harvest Mouse	*Reithrodontomys megalotis*
White-tailed Deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*

Amphibians and Reptiles	Scientific Name
American Bullfrog	*Lithobates catesbeianus*
American Toad	*Anaxyrus americanus*
Eastern Garter Snake	*Thamnophis sirtalis*
Eastern Gray Treefrog	*Hyla versicolor*
Fox Snake	*Pantherophis vulpinus*
Painted Turtle	*Chrysemys picta*
Milk Snake	*Lampropeltis triangulum*
Northern Cricket Frog	*Acris crepitans*
Nothern Leopard Frog	*Lithobates pipiens*
Northern Lined Snake	*Trapidoclonion lineatum*
Northern Prairie Skink	*Plestiodon septentrionalis*
Nothern Redbelly Snake	*Storeria occipitomaculata*
Snapping Turtle	*Chelydra serpentina*
Western chorus Frog	*Pseudacris triseriata*

vi. Birds

Birds	Scientific Name
Alder Flycatcher	*Empidonax alnorum*
American Bittern	*Botaurus lentiginosus*
American Coot	*Fulica americana*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
American Pipit	*Anthus rubescens*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
American Tree Sparrow	*Spizella arborea*
American Wigeon	*Anas americana*
American White Pelican	*Pelecanus erythrorhynchos*
American Woodcock	*Scolopax minor*
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole	*Icterus galbula*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirunda rustica*
Barred Owl	*Strix varia*
Bell's Vireo	*Vireo bellii*
Belted Kingfisher	*Megaceryl alcyon*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Black-capped Chickadee	*Poecile atricapillus*
Blackpoll Warbler	*Setophaga striata*
Black Tern	*Childoniar niger*

Blue-headed Vireo	*Vireo solitarius*
Blue-gray Gnatcatcher	*Poliioptila caerulea*
Blue Grosbeak	*Passerina caerulea*
Blue Jay	*Cyanocitta cristata*
Blue-winged Teal	*Anas discors*
Blue-winged Warbler	*Vermicora cyanoptera*
Bobolink	*Dolichonyx oryzivorus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Broad-winged Hawk	*Buteo platypterus*
Brown Creeper	*Certhia americana*
Brown Headed Cowbird	*Molothrus ater*
Brown Thrasher	*Toxostoma rufum*
Bufflehead	*Bucephala albeola*
Canada Goose	*Branta canadensis*
Canada Warbler	*Cardellina canadensis*
Canvasback	*Aythya valisineria*
Cape May Warbler	*Setophaga tigrina*
Cedar Waxwing	*Bombycilla cedrorum*
Cerulean Warbler	*Setophaga cerulea*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Grackle	*Quiscalus quiscula*
Common Nighthawk	*Nyctidromus albicollis*

Common Snipe	*Gallinago gallinago*
Common Yellowthroat	*Geothlypis trichas*
Cooper's Hawk	*Accipiter cooperii*
Dark-eyed Junco	*Junco hyemalis*
Dickcissel	*Spiza americana*
Double-crested cormorant	*Phalacrocorax auritus*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Bluebird	*Sialia sialis*
Eastern Meadowlark	*Sturnella magna*
Eastern Phoebe	*Sayornis phoebe*
Eastern Screech Owl	*Megascops asio*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Wood-Pewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Forster's Tern	*Sterna forsteri*
Fox Sparrow	*Passerella iliaca*
Franklin's Gull	*Leucophaeus pipixcan*
Golden-crowned Kinglet	*Regulus satrapa*
Grasshopper Sparrow	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Gray-cheeked Thrush	*Catharus minimus*
Gray Partridge	*Perdix perdix*
Great Blue Heron	*Ardea herodias*
Great Crested Flycatcher	*Myiarchus crinitus*

Great Egret	*Ardea alba*
Great horned Owl	*Bubo virginianus*
Greater Yellowlegs	*Tringa melanoleuca*
Green Heron	*Butorides virescens*
Hairy Woodpecker	*Picoides villosus*
Harris's Sparrow	*Zonotrichia querula*
Hermit Thrush	*Catharus guttatus*
Horned Lark	*Eremophila alpestris*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Indigo Bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Lark Sparrow	*Chondestes grammacus*
Least Flycatcher	*Empidonax minimus*
Least Sandpiper	*Calidris minutilla*
Le Conte's Sparrow	*Ammodramus leconteii*
Lesser Scaup	*Aythya affinis*
Lesser Yellowlegs	*Tringa flavipes*
Lincoln's Sparrow	*Melospiza lincolnii*
Magnolia Warbler	*Setophaga magnolia*
Mallard Duck	*Anas platyrhynchos*
Marsh Wren	*Cistothorus palustris*
Merlin	*Falco columbarius*
Mourning Dove	*Zenaida macroura*
Mourning Warbler	*Geothlypis philadelphia*
Nashville Warbler	*Oreothlypis ruficapilla*

Northern Bobwhite	*Colinus virginianus*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Harrier	*Circus cyaneus*
Northern Mockingbird	*Mimus polyglottos*
Northern Parula	*Setophaga americana*
N. Rough-winged Swallow	*Stelgidopteryx serripennis*
Northern Shoveler	*Anas clypeata*
Northern Waterthrush	*Parkesia noveboracensis*
Olive-sided Flycatcher	*Contopus cooperi*
Orange-crowned Warbler	*Oreothlypis celata*
Orchard Oriole	*Icterus spurius*
Osprey	*Pandion haliaetus*
Ovenbird	*Protonotaria citrea*
Pectoral Sandpiper	*Calidris melanotos*
Philadelphia Vireo	*Vireo philadelphicus*
Pied-billed grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Purple Finch	*Haemorhous purpureus*
Purple Martin	*Progne subis*
Red-breasted Nuthatch	*Sitta canadensis*
Red-eyed Vireo	*Vireo olivaceus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-necked Phalarope	*Phalaropus lobatus*
Red-tailed Hawk	*Buteo jamaicensis*

Red-winged Blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Ring-necked Pheasant	*Phasianus colchicus*
Rock Pigeon	*Columba livia*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruby-crowned Kinglet	*Regulus calendula*
Ruby-throated Hummingbird	*Archilochus colubris*
Rufous Hummingbird	*Selasphorus rufus*
Rusty Blackbird	*Euphagus carolinus*
Sandhill Crane	*Grus canadensis*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Sedge Wren	*Cistothorus platensis*
Semipalmated Plover	*Charadrius semipalmatus*
Semipalmated Sandpiper	*Calidris pusilla*
Sharp-shinned Hawk	*Accipiter striatus*
Snow Goose	*Chen caerulescens*
Solitary Sandpiper	*Tringa solitaria*
Song Sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted Sandpiper	*Actitis macularius*
Swainson's Thrush	*Catharus ustulatus*
Swampt Sparrow	*Melospiza georgiana*
Tennessee Warbler	*Oreothlypis peregrina*
Tree Swallow	*Tachycineta bicolor*
Trumpeter Swan	*Cygnus buccinator*

Tufted Titmouse	*Baeolophus bicolor*
Tundra Swan	*Cygnus columbianus*
Turkey Vulture	*Cathertes aura*
Upland Sandpiper	*Bartramia longicauda*
Veery	*Catharus fuscescens*
Vesper Sparrow	*Pooecetes gramineus*
Virginia Rail	*Rallus limicola*
Warbling Vireo	*Vireo gilvus*
Western Kingbird	*Tyrannus verticalis*
Western Meadowlark	*Sturnella neglecta*
White-breasted Nuthatch	*Sitta carolinensis*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-throated Sparrow	*Zonotrichia albicollis*
Wild Turkey	*Meleagris gallopavo*
Willow Flycatcher	*Empidonax traillii*
Wilson's Phalarope	*Phalaropus tricolor*
Wilson's Snipe	*Gallinaga delicata*
Wilson's Warbler	*Cardellina pusilla*
Winter Wren	*Troglodytes hiemalis*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylacichla mustelina*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed cuckoo	*Coccyzus americanus*
Yellow-breasted Chat	*Icteria virens*

Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow Throated Vireo	*Vireo griseus*
Yellow-throated Warbler	*Setophaga dominica*
Yellow Warbler	*Setophaga petechia*

e. Timeline

Native Prairie and Smooth Brome Grassland:

Objective	Area	Season
Cedar Removal	Garry's Area	Spring to early winter 2017
Burn regime on prairie	Remnant prairie in Garry's area	Spring or fall 2017
Harvest native seeds	Remnant prairie and grassland	Fall 2017
Herbicide on brome (Sulfosulfuron)	Brome grassland	Fall 2018 / spring 2019
Burn on regime on grassland	Brome grassland	Fall 2018
Reseed prairie	Prairie remnants and grassland	Late summer – fall 2019

Oak Savanna:

Objective	Area	Season
Removal of invasive trees in oak savanna	Remnant oak savanna on West side of park	Spring 2020 – spring 2021
Burning oak savanna	Remnant oak savanna on west side of park	Annual burn starting in 2020

Upland Forest:

Objective	Area	Season
Remove invasive Cedars	Basswood Upland forest area	Spring 2021

Successional Forest and Stream:

Objective	Area	Season
Remove invasive Buckthorn (mechanical)	Successional forest along N stream bank	Summer 2021
Remove invasive Buckthorn (chemical)	Successional Forest along N stream bank	Fall/Winter 2021-22
Buckthorn follow up removal	Successional Forest along N stream bank	Summer 2022-24 (2 yr following removal)
Plant native PDQ mix	N stream bank	Spring 2025
Sample water in streams	Streams	2x per year every 4 years
Stabilize stream bank	Stream banks (cutback areas)	By 2020
Two Stage Ditch System	Stream	Summer 2025

f. Contact Information

i. Greg Johnson – Director of Buena Vista County Park
Office Phone; 712-295-7985
Email: gregbvcc@webbwireless.net

ii. Dordt College: Dr. Robert De Haan
Office Phone: 712-722-6220
Home: 712-722-2384
Email: Robert.DeHaan@dordt.edu

g. Acknowledgements

i. Advisor: Dr. Robert De Haan

ii. Site Director: Greg Johnson

iii. TNC: Amy Crouch

iv. BVCCP staff and board

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