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A Proposed Plan for Managing Eastern Nebraska's Saline Wetlands

Vandhana Rabadinanth
University of Nebraska at Lincoln

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By:

Vandhana Rabindranath

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Adviser: Sara Winn

Readers: Steve Spomer & Ed Harvey

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Abstract

Eastern Nebraska's saline wetlands play a major role in Nebraska's environmental place in the world. Besides the role of scientific changes being important, education also is essential in the conservation of these wetlands. Through the observation of Salt Creek tiger beetle (*Cicindela nevadica lincolniana*) and soil electroconductivity, I propose that we need to reform Nebraska's education system to help schools play a bigger part in environmental issues such as this one. There is a drastic trend in the correlations between Salt Creek tiger beetle populations and wetland degradation. Since many Lincoln residents have a limited knowledge of what is happening in this ecosystem, it is time to take action and raise the awareness. Getting involved can save Nebraska's unique wetlands.

Introduction and History

Geography of Eastern Nebraska Saline Wetlands

An extremely important, yet often unnoticed ecosystem lies right in the middle of the United States (see figure 1). This ecosystem exists in southeastern Nebraska. It is composed of saline wetlands that have served as habitat for several communities over several years. The definition of a wetland is "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (USACE 1987). There are alkaline wetlands present in western Nebraska; however, these wetlands are not as threatened as the saline wetlands in eastern Nebraska.

These saline wetlands can be found in Lancaster County and adjacent Saunders County (see figure 2). There are various sites subjected to study that remain today in both restored and natural conditions (see figure 3). Salt Creek and its tributaries form these high saline wetlands and marshes. The effected tributaries include: Little Salt Creek, Haines Creek, Antelope Creek, Middle Creek, and Deadman's Run (Farrar and Gersib 1991). The soils in the eastern geographic region consist of chloride and sulfate salts that have a pH range of 7-8.5 (Steinauer 1994). Many of the flora and fauna communities in southeastern Nebraska are endangered due to the degradation of these wetlands. Some plant species that occur in this saline area include: saltwort, inland salt grass, sea blight, salt marsh aster, spearscale, and foxtail barley (U.S. Soil Conservation Service 1980).

Figure 1. The location of Nebraska in relation to the United States.

Figure 2. The location of Lancaster County in Nebraska

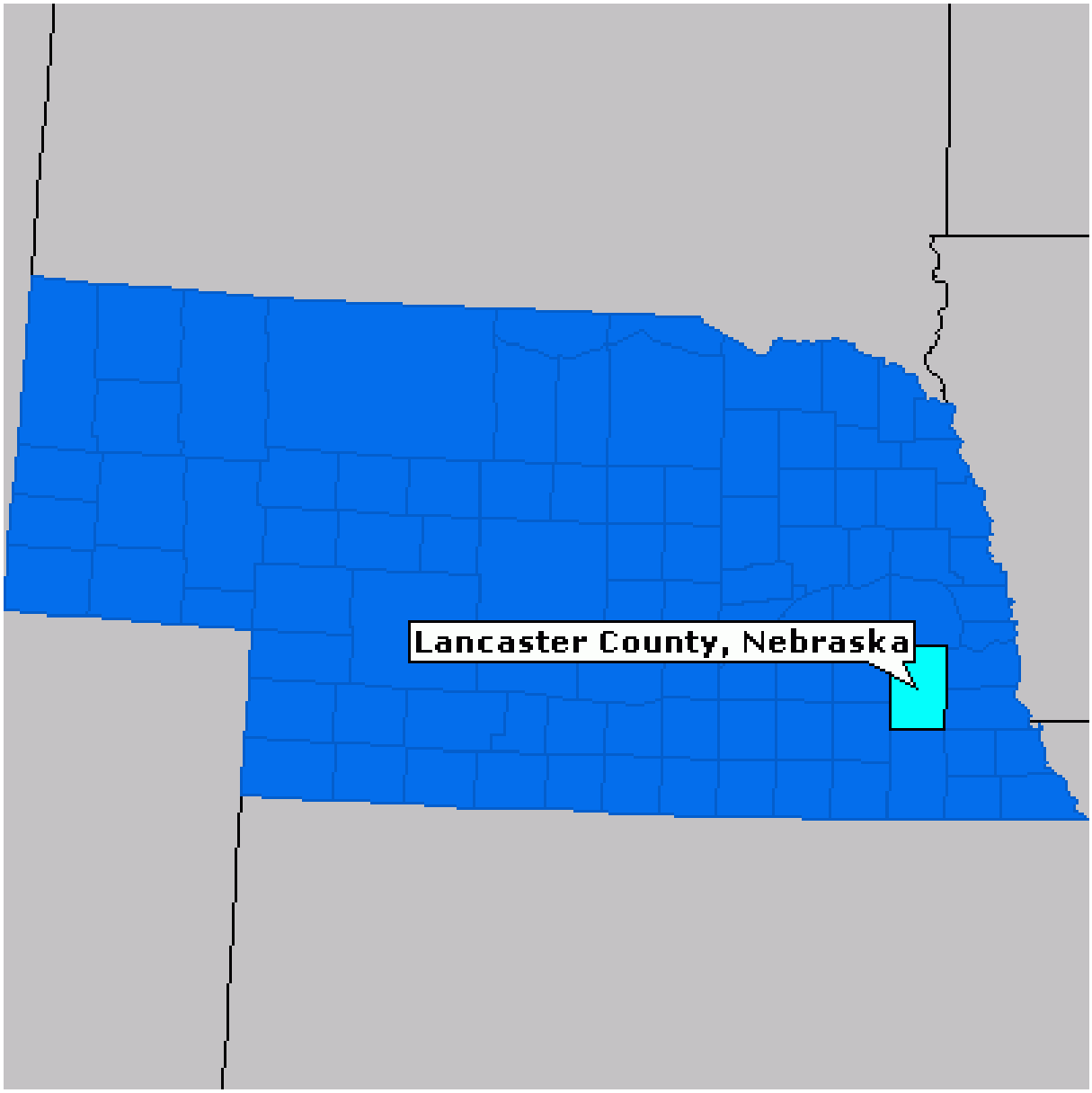

Lancaster County, Nebraska

Figure 3. Link to labeled saline wetland sites.

http://lancaster.ne.gov/city/parks/ParksFacilities/wetlands/links/SalineWetlandsMap.pdf

The Hydrological Formation of the Saline Wetlands

The Eastern Nebraska salt marshes have been stated to be "Nebraska's most rare and most threatened natural community, truly the last of the least" (Farrar and Gersib 1991). These degrading salt wetlands have shaped the founding of Lincoln more than most people would guess. In fact, these salt marshes "influenced the commissioners to unwisely plant the capital city in a semi-basin in its uncomely and otherwise injurious contiguity, from which, year by year, it instinctively shrinks toward the sightlines, salubrity, and unsalted water supply of the adjacent but originally slighted slopes" (Farrar and Gersib 1991). Lincoln is the second largest city in Nebraska and the largest city in Lancaster County. It is believed that the Salt Basin and subsequent salt mining boom in the 1870s contributed to Lincoln becoming the state capital. However, as the salt mining industry fizzled out and Lincoln grew in population, this same Salt Basin was drained and filled to accommodate city growth

The Dakota Aquifer is an important aspect of Salt Creek. The saline waters of all Eastern Nebraska saline wetlands originate from the Dakota aquifer, as well as underlying Pennsylvanian rocks. It is difficult to trace the exact hydrological processes that occurred to originally form this area. This is due to the fact that most of Eastern Nebraska saline wetlands have been drained for agriculture and developmental purposes. Now, the hydrology of this ecosystem appears to be changing properties. The properties of this water play a vital role in the survival of many species.

The hydrology of these wetlands is responsible for controlling the transport and distribution of the salts in certain areas. This produces the necessary saline conditions that most species in these areas need. The distribution of various species along these wetlands exhibits "the existence of different important hydrological processes across the wetland as well" (Harvey et al. 2007). Some species that need a high amount of salt to thrive are seen when highly saline ground water rises to the surface. On the other hand, different freshwater species appear when precipitation or flooding dilutes the saline water.

Human Impacts on Lincoln's Ecosystem

Humans contributed to the past and present degradation of the saline wetlands. Mainly, these actions dealt with the further expansion of Lincoln, the largest city in Lancaster County. As a result, over 90% of the original wetlands were destroyed. The starting figures of the wetlands were approximately 15,000 to 20,000 acres (Farrar and Gersib 1991). As of 2010, less than 4,000 acres of these wetlands remain (NGPC 2010).

From the 1950s through the 1980s, the majority of saline wetlands were filled, affecting much of the ecosystem's biodiversity (Farrar and Gersib 1991). While Lincoln residents could have protected their unique environment, wetlands instead were filled with garbage from the expansion of the city. Anything that had to be disposed was used to fill the marshes and wetlands, including: demolished buildings, trees, bricks, trash, etc.

One detrimental effect to the salt basin was the construction of Interstate 80 in 1958. Salt Lake (Capitol Beach) was drained to about half its original size (Spomer, pers comm. 2010). Salt Creek was channelized from Lincoln to Ashland right before the construction of I-80. It was straightened and most of the loops were cut off. This increased its velocity, along with the width

and depth of the creek. It is possible that all these modifications to Salt Creek and its tributaries contributed to the increased flow of saline waters. This may have contributed to the decreasing salinity levels. "Salt Creek's tributaries began head-cutting, carving deeper into their beds to adjust their gradients, leaving eroded, unstabilized banks. Lowered streambeds had an indirect, but profound, effect on wetlands associated with Salt Creek and its tributaries" (Farrar and Gersib 1991). Water tends to seep away from these wetlands rapidly, bringing salt along with it. Currently, most of the wetlands are shallow and have a limited amount of water they can hold. This has had a tremendous effect on various species.

In 1987, Lincoln obtained 61 acres of saline wetlands north of I-80 from the Nebraska Game and Parks Commission (NGPC 2003). This was compensation for destroyed wetlands, and the area became known as Arbor Lake. Today, Arbor Lake is open to the public, so that people can view and experience the natural beauty of a saline wetland ecosystem. There is also a water control structure to aid the growth of this ecosystem (Harvey et al. 2007). This structure functions to help the saline water move east, making a more desirable environment and conditions for saline-thriving vegetation. Arbor Lake is scheduled for restoration in the summer of 2010.

Thesis Objectives and Purpose

Hydrology plays an important role in Eastern Nebraska saline wetlands. There is so much research left to be done on the relationship between hydrological functions and the flora and fauna of the area, including the Salt Creek tiger beetle (*Cicindela nevadica lincolniana*). This beetle is a great model for studying ecosystems, as it serves as a bio indicator species. The term "bio-indicator" refers to a signal that means a change in the overall condition of an ecosystem. Therefore, a bio-indicator species exhibits activity that show changes occurring in a particular ecosystem; there are usually warning signs in the species that show the degradation of the ecosystem. Studying indicator organisms is important, because it helps to understand the complexity of ecosystem populations and interactions. Hydrological conditions have shaped these wetlands and are a contributing force to the survival of rare organisms that can only thrive in certain environments.

My research is focused on designing an environmental education plan that raises public awareness to improve this ecosystem. I will be taking habitat conservation plans created by governmental organizations into consideration. I will also briefly mention how hydrology is affecting the wetlands' ecosystem. I will be using the Salt Creek tiger beetle as a conservation example as to demonstrate what happens when hydrological properties change. This plan will reflect various interviews, some surface and ground water hydrology of the Little Salt Creek watershed and the effects on the entire ecosystem.

Background Information

The Salt Creek Tiger Beetle

"An endangered endemic species of tiger beetle living within the wetlands has evolved under a unique set of hydrologic conditions, is intolerant to recent anthropogenic changes in hydrology and salinity, and is therefore on the brink of extinction" (Harvey et al. 2007). There are approximately 2,300 tiger beetle species in the world. Almost 200 of these species are in North America (Boyd and Associates 1982). Approximately 30 species are in Nebraska. One species that has obtained much publicity is the Salt Creek tiger beetle, as its preferred habitat includes: moist saline gravel bars, mudflats, and salt flats with limited vegetation. The Salt Creek watershed contains the highest remaining Salt Creek tiger beetle populations. *Cicindela nevadica lincolniana* is the Salt Creek tiger beetle's scientific name. *Cicindela nevadica* originated at the end of the Ice Ages, about 10,000 years ago. The subspecies, *lincolniana,* came to be known in the year 1916 (Casey 1916). In 2000, this particular beetle was put on the State of Nebraska Game and Parks threatened and endangered list. In May 2002, it was proposed as an emergency listed federally endangered insect. As of 2003, approximately 700 beetles were remaining on two sites (Spomer, personal comm.). In 2005, the U.S. Fish and Wildlife Service listed it as federally endangered. This means that population numbers have dropped so low that the species has almost an immediate threat of extinction. The numbers have only decreased since then.

The Salt Creek tiger beetle is a dark olive brown with cream patterns on their wing covers (See figure 5 below). Tiger beetles are predators and some defining characteristics are: large heads, stout mandibles, prominent eyes, and long slender legs (Knisley and Schultz 1997). Adults have a search and capture method; they actively go out and hunt. On the other hand,

larvae use the ambush method. They hide in burrows and wait for their prey to fall into their trap. Advantageous abilities are: strong flying and speedy movement, classified as running.

Figure 5

The beetles have a two year cycle, on average. During the larval stage, the beetle will molt approximately three times. Over a year is spent in the third larval stage in a burrow in the soil. In order to prepare for pupation, the larva constructs a side chamber and then seals the entrance to the burrow. Adults emerge in early June and usually disappear by August. The highest population of adult beetles occurs in June. The cycle starts over again the next summer, with larvae emerging as adults. After the eggs hatch, the larvae form burrows in soil, mostly for their predation strategy. They also use their burrows to avoid bad weather. The location of the burrow and the egg-laying site is vital to the population because they determine how successful survival is. Also, the larvae will have a better chance of surviving to adulthood if there is an abundance of prey. This obviously will yield higher numbers in populations.

Tiger beetles eat a wide variety of small invertebrates, arthropods, and vertebrates. Some prey include: tadpoles, ants, immature fiddler crabs, earthworms, spiders (Cutler 1982),

springtails, millipedes, dead fish, dead lizards (Schultz 1981), dead arthropods, and even dead mammals (Larochelle and Lariviere 2001). Adult beetles generally have a wider variety in their diet because they are active hunters. Larvae, on the other hand, sit and wait in burrows and ambush their prey. Their diet consists of anything with appropriate size that happens to wander near their burrow opening. This highlights the importance of inhabiting an environment that has a rich and diverse supply of food for the beetles to survive.

Living in an environment with minimal predators is an essential factor to the survival of beetles. Some vertebrate predators of tiger beetles include: badgers, foxes, mice, moles, opossums, skunks, raccoons, squirrels, shrews, frogs, toads, lizards, and approximately 50 species of birds (Larochelle and Lariviere 2001). Some invertebrate predators include: robber flies, spiders, dragonflies, scorpions, and mantids (Knisley and Schultz 1997). Where there are numerous beetle predators, it harms the populations through indirect and direct predation. Obviously these predators will consume the beetles. However, they are also likely to consume the beetles' prey, making it harder for the beetle to find food.

The beetle is mostly active when the weather is sunny and warm. They usually hide in cracks and other small spaces to pass the night and unfavorable conditions. When beetles reproduce, the estimated clutch size per season is 50 eggs. There is also evidence of multiple mating between adult beetles. Another factor for the beetle's environment is that the larvae need to have access to a wide variety of species to prey upon, as well as living in appropriate salinity levels.

Wetland Hydrology

"Hydrology is one of the most important determinants for the establishment and maintenance of a wetland and its processes" (Gosselink and Mitsch 1986). Specifically included

in Eastern Nebraska saline wetlands is saline groundwater discharge combined with freshwater precipitation. This major process is creating a rapidly changing wetland ecosystem in Northern Lancaster County, which is perilous to many inhabitants. Current saline conditions are caused by saline ground water upwelling through the Dakota Aquifer and discharging at the surface. The deeper, underlying formations of Pennsylvanian and Permian age are also important as the likely source of the saline water (Coke 2008). This era was approximately 300 million years ago. Over the past 300 million years, there have been significant changes to the geology of the area that affect Eastern Nebraska saline wetlands today.

A major threat to these saline wetlands is streambed erosion or degradation (IDNR 2005). Wetland degradation is characterized by lowered groundwater levels, wetland drainage, and as a decline in the presence of saline-thriving species, such as the Salt Creek tiger beetle (Farrar and Gersib 1991). Due to the fact that there are major water and rock formations that compose Eastern Nebraska's saline wetlands, we need to carefully examine beneath the surface, as well as surface hydrological processes. As an effect of these actions, the chemistry and selection changes the wetlands' biotic community. Water flow patterns, depth, input, output, etc. all create drastic changes in many environments. In these particular wetlands, these water changes were the result of channelization, after the construction of major highway Interstate 80. Water flow has increased as a result of steeper streambed slopes, which causes the channel to downcut. This leads to adjoining tributaries becoming unstable and a new elevation level.

The Importance of the Beetle

The Salt Creek tiger beetle, *Cicindela nevadica lincolniana*, is an endemic species to eastern Nebraska. It inhabits the saline wetlands of Arbor Lake and Little Salt Creek in

Lancaster County. It used to inhabit a small area adjacent to Saunders County, but has disappeared due to the ecosystem's degradation. At the moment, this beetle is listed as a federally endangered species. This is crucial because it serves as a bio-indicator species. The beetles' endangered status and limited population numbers serve as a warning that this saline ecosystem is in terrible condition. There are also many other types of flora and fauna within this unique ecosystem that are rare or endangered due to this status. Just one change can destroy the entire habitat.

It is absolutely critical that salt is present, in abundant amounts, in this beetle's environment. Therefore, it is necessary to examine what I have talked about previously-historical events that may have caused a decrease of salinity in these wetlands (Coke 2008). My research is focused on shaping a policy to restoring this ecosystem by referring to the past and present hydrological events that have occurred or are occurring in the saline wetlands, while taking the public interest into account. The Salt Creek tiger beetle is a conservation example and plays a role in restoring the wetlands.

One of the first factors I will examine in regards to events affecting the beetle in its ecosystem is the salinity. It has been suggested that the salt mining boom and expansion of Lincoln have significantly decreased the salinity of the wetlands that the beetle inhabits (Sorensen 2005). There are still other factors to be examined however. Much of the salt marshes have been drained due to agricultural uses and development. Therefore, the entire ecosystem has been degrading slowly, harming the presence of the beetle. The saline levels are a major contributor to the survival of the beetle and many other flora and fauna species.

Materials and Methods

Population Estimates

The Salt Creek tiger beetle populations were carefully monitored at 11 sites by entomology researchers over a period of 14 years as shown in Table 1. Steve Spomer was in charge of counting and monitoring the beetle populations for consistency. I visited all of the sites listed in the table below. Mitch Paine initially showed me how to conduct the visual counting at some of these sites. It is important to be careful not to make the counter's presence obvious, otherwise the beetles will hide and the counting will be severely effected. Fast motion scares the beetles. Also, caution has to be taken so that beetles are not counted twice.

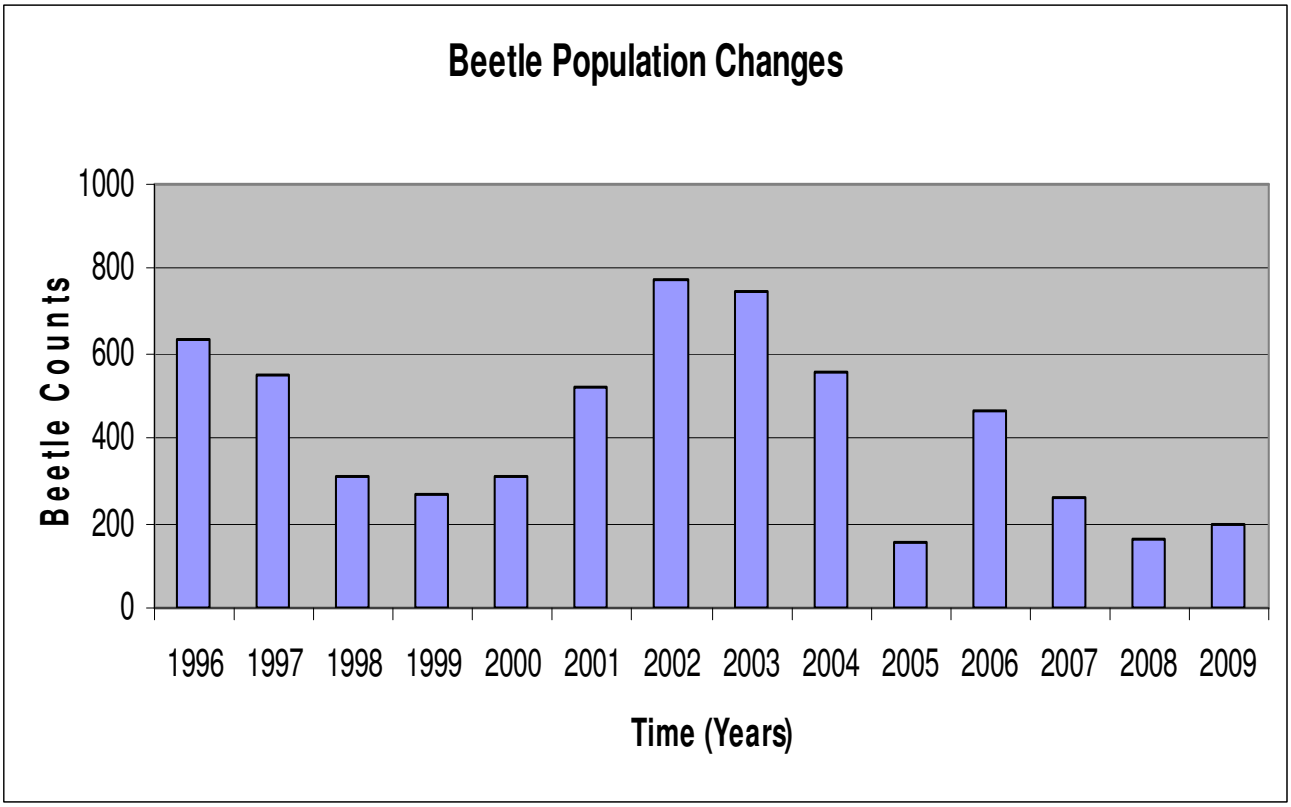
I went out into these wetlands in the late spring and summers of 2008 and 2009. The rest of the year's data originated from the work of Leon Higley, Steve Spomer, and Bill Allgeier. The numbers listed in Table 1 are the official estimates of adult Salt Creek tiger beetles. Mark-recapture methods were used by Bill Allgeier and his team as another strategy for counting beetles. These methods showed that visual estimates were low. Figure 6 shows the fluctuations in adult beetle population estimates from 1996 to 2009.

Table 1

Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Capitol Beach	NA	NA	4	0	NA	0	0	0	0	0	0	0	0	0
Jack Sinn	1	NA	1	0	NA	0	0	0	0	0	0	0	0	0
Arbor Lake	8	40	66	66	24	59	73	75	6	10	46	30	4	2

Little Salt Creek	580	510	232	197	281	432	592	572	460	109	339	176	108	147
Roper	0	0	0	0	0	28	104	98	77	17	51	23	14	20
NW 12th St	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1st St	39	NA	4	8	4	0	7	NA	12	16	24	33	39	25
Little Salt Fork Marsh	NA	NA	0	NA	NA	NA	0	0	0	0	0	0	0	0
Ray-mond Rd	NA	NA	NA	NA	NA	NA	1	0	0	0	0	0	0	0
White-head	NA	NA	1	0	0	0	0	0	0	0	0	0	0	0
King Acq.	NA	NA	NA	NA	NA	NA	NA	NA	3	1	6	1	0	0
Totals	631	550	308	271	309	519	777	745	558	153	466	263	165	194

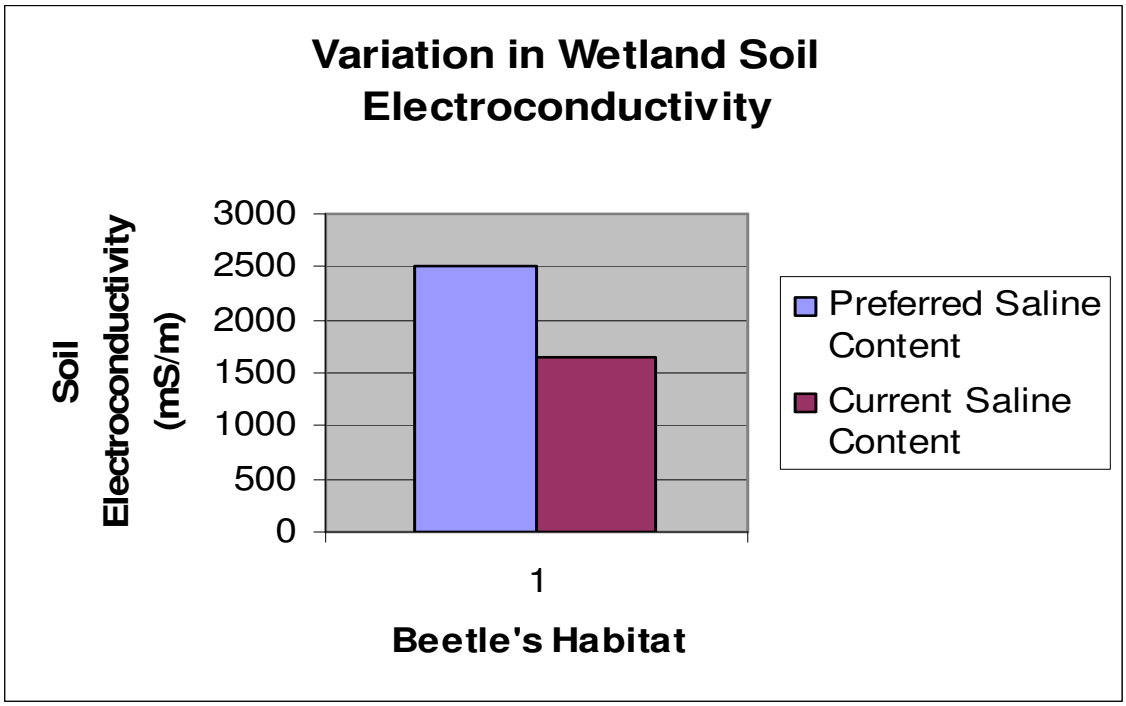
Figure 6. Changes in Beetle Populations over 14-year period.



Salinity Readings

In order to obtain the saline content of the soil at various sites, a Soil Electrical Conductivity Sensor was used to determine the salinity levels. Researchers only recently began studying the correlations between salinity levels and the degradation of these wetlands. James Gilbert and I gathered the salinity readings in the soil at these sites in spring 2010. The average salinity of these soils is 1656 mS/m. The preferred salinity of the soils suitable for the beetle is 2505.1 mS/m (Allgeier 2005). The other two years have readings obtained from the work of Bill Allgeier, James Gilbert, and Gordon Coke. We have years 2008, 2009, and 2010. The reading for 2008 was 1701 mS/m. The reading for 2009 was 1676 mS/m. The reading for 2010 was 1619 mS/m.

Figure 7. Saline content, measured by soil electro conductivity, preferred by the Salt Creek tiger beetle vs. current readings, 2010.



Interviews and Human Perspective

Nebraska Department of Roads Employee

I chose to discuss the fate of the Salt Creek tiger beetle with an employee of Nebraska Department of Roads. He holds a rather carefree view of the beetle's survival. "It is hurting many people and giving them an unnecessary financial burden, all for a silly little insect" (Anonymous, personal comm. 2010). There have been many rules and regulations in road and project development due to the federal endangered listing of the Salt Creek tiger beetle. Pay cuts are common in this job industry. This employee believes that the funding and grant money spent on the tiger beetle could be used to contribute something more to society. He feels that there are enough problems in humanity, without having to worry about the Salt Creek tiger beetle. After talking with people who feel this way, it is important to take financial compensation into consideration for landowners.

A Farmer's View

I chatted with two different farmers that live near the saline wetlands. Both of them have diverse views on the beetle's situation. One farmer believes that the beetle's survival is completely unnecessary to the city of Lincoln and that people should spend their time worrying about other economical situations. Part of the reason this farmer does not like the beetle is that he and his wife have been hearing about it ever since they moved to Lincoln. The only plan he would like to see is a plan that does not depreciate the value of his land. He will be happy when the topic of beetle conservation is over and done with!

Another farmer is absolutely intrigued by the Salt Creek Tiger Beetle. He believes that it has value and there is no reason for it to become extinct. In his eyes, there is absolutely nothing wrong with environmentalists wanting to preserve this insect and ecosystem. The ecosystem

functions to play a major role in the overall community, not just restricted to the wetlands. Degradation of the saline ecosystem could potentially be harmful to other surrounding areas, including the farmland.

An Environmentalist's View

"The Salt Creek tiger beetle lives in our backyard and as a result has become a symbol of Lincoln's environmental conscience" (Mitch Paine, pers comm 2010). Although the beetle does not have as important of a role in today's society, such as a cure for cancer, it truly plays an important role in our understanding of nature. Paine believes that this challenges humans to think about nature in an unselfish way. People should not want to save the beetle just because it can serve our needs currently. Nature is an important aspect of people's lives, whether we can use it as a substitute for basic needs or not. It needs to be appreciated and cared for properly, so things can be as natural and beautiful as possible.

Conservation of the Salt Creek Tiger Beetle and Wetlands

Background on the Endangered Species Act and Listing

Congress found that various species of fish, wildlife, and plants in the United States have become extinct or depleted in numbers. This is often due to human activity, such as economic growth, increased demand for businesses, and development. Congress declared that these species were of esthetic, ecological, educational, historical, recreation, and scientific value to the Nation and its people. Because of these reasons, congress passed the Endangered Species Act of 1973.

The purpose of the Endangered Species Act (ESA) is to protect and recover threatened or endangered species and the ecosystems that they depend on. The ESA is managed by the Interior Department's U.S. Fish and Wildlife Service (FWS) and the Commerce Department's National Marine Fisheries Service (NMFS). The FWS has a main responsibility of terrestrial and freshwater organisms. The NMFS primary responsibility is marine wildlife. It is declared by the policy of Congress that all Federal departments and agencies must aim to conserve endangered and threatened species. They must utilize their authorities to aid in the Endangered Species Act.

In the ESA, a species is required to be listed as either endangered or threatened. Endangered means a species is in danger of extinction throughout all or most of its range. Threatened means a species is likely to become endangered in the future (Endangered Species Act 1973).

In order to be listed, as either endangered or threatened, there are requirements based on biological status and threats to the species existence. FWS considers five factors to determine if they want to list a species. These include damage or destruction of a species habitat, over use of

the species for commercial, scientific, recreational, or educational purposes; disease or predation, inadequacy of existing protection, and other natural or man made factors that affect the existence of the species. When one or more of these factors jeopardizes the survival of a species, the FWS takes action to protect it. FWS determines all listings using sound science and peer review. This way, they know that the data is accurate (Federal Register 2005).

The U.S. Fisheries and Wildlife Service keep a list of candidate species. These are species that the FWS can justify listing, but are often unable to do so due to higher priority species that are in greater need to be listed. The FWS works with states, tribes, private landowners, private partners, and Federal agencies to carry out conservation actions for the species being delayed in being listed (Federal Register 2005). The ESA also states that Federal agencies must consult with the FWS and NMFS to ensure that actions that they authorize, fund, or carry out will not jeopardize the existence of a listed species (Endangered Species Act 1973). The Salt Creek tiger beetle was officially listed as endangered under the ESA on November 7, 2005.

Under the ESA, the Salt Creek tiger beetle and their habitat are protected. It is unlawful for a person to take a listed animal without a permit. Take is defined as: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. It is also unlawful for the interstate or international trade of listed plants and animals (Endangered Species Act 1973).

Previously Proposed Actions

Once support is gained from the public, there needs to be an increase in the critical habitat to serve as the beetle's home. Critical habitat is defined as geographic areas that contain the physical or biological features that are essential to the listed species. A recovery plan always needs to be made once a species is listed as federally endangered. A recovery plan describes the

steps needed to restore the species to ecological health. The FWS biologists write and implement these plans with assistance from species experts, as well as other Federal, State, and local agencies, tribes, nongovernmental organizations, academia, and other stakeholders (Federal Register 2005). On February 20, 2009, a recovery plan outline was created for the Salt Creek tiger beetle. This is the Beetle Habitat Conservation Plan. It involves designating land that serves as critical habitat for the beetle's survival.

For the concerned landowners, there needs to be a financial incentive program, so that they can be assured some money for their cooperation. The amount of critical habitat on their land will directly correspond with the amount of compensation they receive. Although the compensation would only be as much as funding allows, it is certainly a start to getting the general public involved. Environmentalists would get satisfaction out of helping preserve nature's beauty and other people would not be so resistant against the beetle and other federally endangered flora and fauna.

The Green Team Machine Plan

The most important commonplace in enacting a policy for the saline wetlands is having a balance of environmental and economical standards. While it is impractical to spend all government money on preserving every single species, it is impossible to keep the current human activity level and not have to spend money to preserve nature. An extremely pertinent factor to the preserving of nature is the world's education level.

The general public has expressed some very ignorant views of the current environmental issues that exist today. Many times, people hear the negative sides of the issue, and they are automatically against it. Negativity is more common than positivity when it comes to these

major topics. There needs to be a program that facilitates the education of environmental issues. An ideal one would be a program that teaches people how to think about the positive and negative effects of their actions. When people carry out their daily activities, they do not think about the consequences of their actions. There is a consequence to everything we do, whether it is good or bad. Schools need to have a better environmental awareness program. Most school age children are not taught to think of these specific, "minor" issues. Even if they read books concerning the importance of nature, these thoughts are not developed or encouraged in a formal education setting. The common norm is that if something is not taught in a formal setting, it probably is not important in real life. I was never encouraged by teachers before college to think about environmental restoration and preservation, even though I took lots of science courses and was always interested in environmental studies.

The most common question to the Nebraska uninformed public is "Why should I care about some silly wetlands that probably have no effect on me?" The truth is that wetlands everywhere have tremendous impacts on the quality of life people face. Significant reasons to protect wetlands include facts such as: improvement in the quality of public water, habitat for wildlife, reduction in flooding and soil erosion, keeping a fresh water supply, providing food and fiber, and creating public recreational opportunities. Although some wetlands do not serve all of these functions, it is necessary to consider that each of these functions play a major role in the human lifestyle. Saving a wetland that has just one of these characteristics could help improve the way people in this area live.

"The Green Team Machine" would consist of a team of researchers, scientists, and environmental educators that travel globally to inform students of all different ages of the importance of conserving the environment that surrounds them. In Nebraska's case, the subject

would be saline wetlands. The important part of this education would be to help students develop an interest or at least awareness as they grow older. This would ensure that they do not forget what they have learned, such as what happens presently with children's nature books. Children read books such as *How Animal Moms Love their Babies* and they love nature. As they grow older, less emphasis is put on lessons like the ones they gain through reading this book. They forget that nature is a loving, wonderful place and should be cared for. Obviously, older students would view the environment in a more realistic, cynical manner. Then, it is necessary to teach them about the characteristics wetlands or other environments have that could help them live later in life.

There would only be a small portion of lecture in this area; majority of classroom time would consist of wetland projects. Students would be taught to appreciate wetlands by having fun. Part of the reason people have an aloof view of nature is that the only interaction they had in the past was not such a good interaction. Science classes do not really help students with enjoying nature. Many science classes I have had to take that were actually out in the field required us to collect data for long hours. Little emphasis was put on looking at the beauty of nature. Stinging bees, poison ivy, etc are not made better when classes require students to collect data and then go inside. This creates a habit for students to be miserable when getting ready to go outside.

Besides working on environmental restoration projects, student would enjoy recreational activities that wetlands or other environments have to offer. Depending on individual interests, students would be involved in photography, wildlife watching, bird calling, controlled hunting, animal care, sports, etc. Lecture time would be used to teach students about the importance in

their actions and conserving the environment. But in the fields, students would be taught hands on how this benefits them.

Dylan Wall and Lacey Bodnar, science students at the University of Nebraska-Lincoln, state that the problem currently in regards to science classes is that the focus is so broad that people do not have enough time to truly develop an interest in particular aspects. This is definitely the case with Nebraska's saline wetlands and perhaps other types of environments depending on the region. Because such little value is placed on the surrounding issues of certain environmental conditions, people learn to brush these topics aside and continue on in their daily lives. The Green Team Machine would help people in specific areas view the importance of a particular ecosystem in their community. Therefore, at least no one would be undermining the value of the environment. People would see how the environment is practical and valuable in their everyday lives.

Getting Started

The first step with this team would be to gather a group of interested people. These people include volunteers from the University of Nebraska-Lincoln Environmental Studies Program or a related field with an interest in environmental education. It would start with a small group of people, but eventually expand and be open to qualified volunteers all around. There would be a small application to make sure that the people who take on this project are truly passionate about working with Eastern Nebraska saline wetlands. Everyone would be working with the environmental educator at the Natural Resource District to coordinate various events and activities. We would also have to talk to the school officials around the area about our program and what we are trying to accomplish. Getting them to approve the projects to fit the school's curriculum requirements is a major step.

These activities would be carried out in the wetlands with all the Lancaster County schools. Classes would take field trips to the saline wetlands once or twice a week. Each week would have a wide variety of projects to choose from with a different theme. For example, one week's theme could be wildlife and the next week could be plants. According the teacher's requirements for a particular class, students would complete one of the following: a hands-on project, write an essay/poetry, or put together a photography or art portfolio. Every weekly assignment would build up into a huge project the student would take pride in at the end of the class. He or she would end the class remembering the good feeling the students had while gaining a sense of accomplishment in the natural world.

The projects would be based off of the students' education levels in the environmental field. Also, we would check their interest in the natural world and decide what would benefit the school and students the most. Students would take a pre and post assessment to determine the success of the program. We would carefully evaluate and make any changes as necessary. For college students, I would talk with the Biology department at the university about independent study credit. With permission, the class could even take the place of appropriate science and lab credits. The Green Team Machine could even provide a certain number of internships each season, depending on specific needs.

A president will be elected each year to manage the project goals and write the curriculum. There will be a normal executive team consisting of: treasurer, secretary, vice president, and junior project managers. Finances would be handled by the treasurer, but also voted on by a majority. Most money would go towards special equipment such as: cameras, art supplies, or anything else depending on the projects. We would have to take class size into consideration and the number of schools and students signed up.

Conclusion

The complexity of Eastern Nebraska saline wetlands is much greater than most people could ever imagine. Due to the benefits that these wetlands carry, it is extremely important to preserve what we have left. Although people may not understand now why the preservation is so important, they will regret it later if we do not take proper action. The concept of cherishing these wetlands because they are unique to Nebraska is not quite understood by the majority of the general public. Therefore, it is important to educate on the benefits wetland's carry, especially the recreational activities, and relate them to humans. Because majority of human nature is selfish, we care more about our needs than the needs of endangered species. Education can make or break the condition of these wetlands. It is valuable to share the connections that humans have with Eastern Nebraska saline wetlands, especially Lincoln and surrounding suburbia residents.

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