

DISSERTATION

A TRIADIC RELATIONSHIP ON THE NORTHERN GREAT PLAINS:  
BISON (*Bison bison*), NATIVE PLANTS, AND NATIVE PEOPLE

Submitted by

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In partial fulfillment of the requirements

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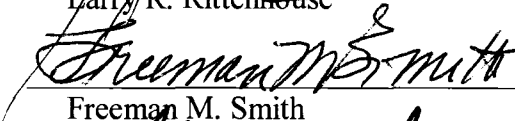
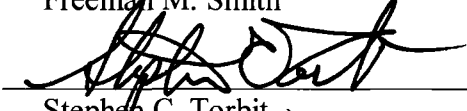
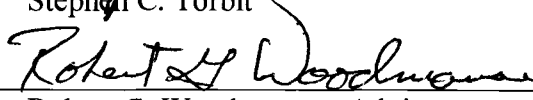
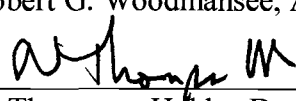
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## ABSTRACT OF DISSERTATION

### A TRIADIC RELATIONSHIP ON THE NORTHERN GREAT PLAINS:

### BISON (*Bison bison*), NATIVE PLANTS, AND NATIVE PEOPLE

The dissertation investigates and documents the historic relationship that exists among *Bison bison*, native plants, and Native People. An exhaustive in-depth review of each ecological component is given. *Lakota* Indian participants were interviewed for their qualitative knowledge of the three ecological components being studied. Interviewees were selected for their individual expertise in ethnobotany, *Lakota* culture, and/or indigenous ecological knowledge. Participant contributions are synthesized into a running narrative that describes the relationship in intimate detail. Detailed analysis shows that there are many facets to the relationship that exists among the three major ecological components. Recommendations are made for further research and the appendices include *Lakota* terminology, interview protocol and questions, data codes, and maps of *Lakota* territory before and after colonization.

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## ACKNOWLEDGEMENTS

I dedicate this work to the memory of my loving parents, Carlin and LaVonne Garrett. I give this to them in appreciation for the wonderful life they gave me, along with their unconditional love, support, and guidance they provided, come rain or shine. I believe that my life has been extremely blessed because of my having had such peaceful, knowledgeable, and caring parents.

I would also like to express appreciation to my major advisor Bob Woodmansee and to committee members, Larry R. Rittenhouse, Freeman Smith, Stephen C. Torbit, Kathleen J. Martin, Ph.D., Assistant Professor at California Polytechnic University, San Luis Obispo. CA has acted in the capacity of *de facto* committee member and I am indebted to her for both professional comment and encouragement. They never lost faith in me and I thank them for their patient understanding, technical support, and especially the guidance and advice they have given so freely.

There is one very special person that I am also indebted to. That person is the late Vine Deloria, Jr., Professor *Emeritus* at the University of Colorado @ Boulder. Vine gave me inspiration by example, provided guidance, treated me like a true colleague, and offered his hand when it was most needed; for this I will be eternally grateful. I will always be proud of the fact that Vine actually asked me if he could sit on my doctoral committee. I will always be proud that he called me a friend. His prolific writings, on a wide variety of subjects, almost always touched my inner-core and inspired me in many ways that I needed in order to complete this long arduous journey. On a personal note, as I sat in my home in South Dakota watching a Denver news channel one day, I saw that

Vine's and my favorite place to meet called The Old Capitol Grille in Golden, CO was on fire and burning. This event was newsworthy because at one time, it was actually the capitol building of Colorado. Because he was very ill at the time, it appeared rather ominous. Sadly, it was not too long after this fire that I received word from my long-time friend Richard B. Williams that Vine had passed into the spirit world. Part of my journey down to Golden to attend his burial and memorial included sitting outside the burned-out hulk of the Old Capitol Grille for a long time. And as I sat looking at the place, I could imagine Vine's contagious laugh so well that it seemed real. I wondered if anyone else had experienced the same feelings when they saw this historic place burning down on the daily news. I sincerely hope that this work measures up to Vine's standards and that he will give it his blessings wherever he is.

I also want to thank Dr. Arent Schuyler and Jean K. Schuyler for their invaluable, faithful, and enduring friendship, timely advice, and the hospitality they have given at crucial moments throughout my rather lengthy academic career. I want to express appreciation to my colleagues, Rocke A. Hawk, T. Bull Bennett, Albert Jewett, John Kossler, John L. Phillips, and Stewart Sarkozy-Banocy for their moral support, friendly guidance, and their constant nudging when it was needed. Special thanks go to my research assistant Maria Celeste *Mimiqua* Flynn who always had strong positive comments to offer and never doubted for a moment the completion and the importance of this project. Maria was an inspiration to work with and is a great example of the superb quality of Indian scholars to come. Many thanks go to my *leksi* Clarence Mortenson and *tahansi* Jeff Mortenson for spending much time in discussion with me about grassland ecology, recovery processes, and the family's long-term ecological restoration project.

Throughout our numerous discussions. I was inspired to give this research project the light of day.

I am grateful to the Colorado State University Department of Rangeland Ecosystem Science, and especially former Department Head R. Dennis Child, for providing critical funding for my studies. I owe a special thanks to the National Wildlife Federation and especially Steve Torbit, Senior Scientist and Director of the Rocky Mountain Center, for their financial support. The Colorado Alliance for Minority Participation Program (COAMP) deserves special recognition for their financial support as well. I want to express my gratitude to the American Indian College Fund and the Mellon Foundation for their generous financial support without which I may have thrown in the towel. I apologize to them for taking longer than estimated to complete the dissertation.

## PREFACE

There is some usage of terms that I would like to explain to the reader about this manuscript. First of all, I have included a *Lakota* language terminology list in this document (Appendix A). The reader will notice as they proceed that I interchangeably use three terms to describe the same animal: bison, buffalo, and *Tatanka*. Interchangeable use of this terminology is with purpose. I begin with the term “bison” because, first and foremost, this is an academic paper and the correct taxonomic name for this animal is *Bison bison*. I make a conscious shift to the term “buffalo” because this is the name by which the animal is best known and most Americans believe this to be the species’ correct name. However, the name “buffalo” is taxonomically incorrect because there are no buffalo that are native to North America. Finally, I end this report with the *Lakota* name “*Tatanka*” for our bison brother because this is my people’s term for this animal. To me, the *Lakota* name *Tatanka*, and the animal the term represents, has more depth than just the designation of a species of animal; it describes behavior, character, demeanor, social standing, and *Tatanka* is the representative of all buffalo in form, grace, and beauty. The term “*Tatanka*” is also one that is used to describe that majestic buffalo bull that is obviously in charge of the whole herd and will take on all challengers to his authority.

I use different terminology for the buffalo because my hope is that future native scholars will understand that to mix terminology sometimes gives added meaning. Sometimes words in different languages can convey different meaning and this is the case here. I believe that such mixing of terminology can emphasize meaning more



articulately than scientific taxonomy can capture in a brief word or two. Above all else though, this manuscript represents a baseline of information that attempts to introduce a new and innovative knowledge base that combines and blends traditional western scientific knowledge and indigenous ecological knowledge. It can also provide a lesson in how science can develop a spirit. Rarely has anyone assembled and incorporated western ecology and indigenous ecological knowledge together into a single document. I envision this effort to be a “science with soul” or “spirit-based science” as stated in my 2001 Master of Science thesis (Garrett 2001). I hope this baseline of information will give assistance to scholars who struggle to derive meaning from cultural-ecological recovery processes that require the use of multi-cultural knowledge bases and systems. I especially wish to assist the younger native scholars who may be struggling to understand the meaning of the knowledge they are gaining in western education based colleges and universities when it sometimes conflicts with and contradicts their own experiences and what their elders taught them while they were growing up.

I feel compelled to introduce into this dialogue a point that I would like to make about how language can influence a reader. In this report, I capitalize the term “Native Peoples” principally because its counterpart, the term “European”, is always capitalized in academic discourse. Almost always, “native” or “indigenous”, etc., is not capitalized and to the reader, in a very subtle and indistinguishable way, this may reflect a hierarchical view of the power dynamics inherent in the contrasting of western and indigenous knowledge.

I must add that this document represents an important step in the process for Tribal People to emphasize their own educational methodology based upon the principle

that their notion of science, or ecological knowledge, is just as valid as any other knowledge base. The Native American is recovering from a dark period of colonization that included forcing a different educational system upon them.

The history of American Indian higher education over the last one hundred years is one of compulsory western methods of learning and this model does not seem to work very well for tribal students because they have traditionally suffered high dropout rates while attempting to study at mainstream institutions of higher learning (Phillips 2000).

Tribal colleges were established in part due to the failure of mainstream colleges to adequately address the tribal student's needs. Besides addressing the tribal student's needs in a more holistic fashion, tribal colleges began establishing their own curriculum that was much more apropos to their own history such as culture, economy, ethnoecology, ethnobotany, ethnoastronomy. In my experience, tribal colleges and universities (TCU's) meet the needs of Native American students and instructors more effectively than do mainstream colleges and universities.

Finally, the reader will discover that this report is really about how some Native American communities continue to struggle for their very survival. This is true not only within the human community but also within the natural animal and plant communities as well. This is especially true of those species such as the bison and black-footed ferret that were very nearly extirpated. Although some species may no longer face extinction as a major issue, they nevertheless remain precariously positioned in today's world. There is constant comparison between the fates of both Native Americans and the *Bison bison* throughout this report because the legacy of the *Lakota* community is one that represents the survivors of the great American holocaust. The *Pte Oyate* (Buffalo Nation) that live

today share the very same legacy: for the buffalo that exist today are survivors of the holocaust as well (Afraid of Hawk and Garrett 1994).

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## INTRODUCTION

The focus of this dissertation is on those “hunter/gatherer” societies that relied principally upon hunting wild game and gathering roots, herbs, and berries for food, medicines, and materials from the grassland environment they called home. This investigation revolves around what is the relationship that connects the buffalo, native plants, and the Native People. Obviously there is the one of being components of the food chain, but I believe there is much more to the story than the obvious. There is the physical connection between the three components, but what about the spiritual association and the social context of this relationship? How did each of these major ecosystem components shape each other over time?

The prairie was much different in the past because of the contributions of each component to the ecosystem as a whole. I see it as a classic example of a synergistic effect where the whole equals more than the sum of its parts. In this particular case, the plants may no longer be as vigorous as they once were because the Native People are no longer free to burn the prairie when it is needed and they have not harvested as consistently as they once did in pre-reservation times. The buffalo, as a species, has been severely reduced and fenced within reservations too, thus causing the ratio of grasses, forbs, and woody plant populations to go out of balance as well. One also needs to factor in several other major disturbances that have occurred such as the decimation of the beaver population that created wetland areas. Another example would be plowing the grasslands under and what the consequences of this particular land-use practice are over

both the long and short-terms. Exactly how did each component contribute to the shaping of the Northern Great Plains ecosystem?

In this dissertation, I detail the histories of the bison, native plants and the *Lakota* Nation and then move on to discuss my interview participants, the methods of their selection, and their contributions. The information they supply is then constructed as a running narrative that attempts to get the reader to understand the native viewpoint of the grassland ecosystem and its components. I consider the knowledge they've contributed to this investigation to be "sacred" or "kincentric ecology," a concept where the term "kin" is used to refer to our relatives (Salmon 2000b). So, I interpret kincentric ecology to mean relative-centered ecology. This term documents and captures my interview participant's contributions exactly because they all centered their discussion of the subject on how everything in this world is related. It then becomes quite evident that the Native People that are interviewed consider both the buffalo and the native plants to be "nations of people" too and are close relatives (Valandra 1993). Most of the participants referred to each of the ecosystem components as "nations." Obviously, if the three components are considered to be closely related to one another, then in the minds of the *Lakota* people, they've contributed to the environmental shaping of one another as well because brothers, sisters, and many times cousins are often more alike than they are different.

There is no doubt when one reads through the results section of this dissertation that indigenous cultures, and specifically in the present case the *Lakota* culture, are heavily influenced by knowledge gained through both individual and group spiritual experiences. I designed this study to include the three ecosystem components but was

unprepared on how to incorporate the spiritual realm of the Native People's knowledge into the report.

## LITERATURE REVIEW

### The Grassland Ecosystem

The historic Great Plains of North America consist of grasslands that extend south from Alberta and Saskatchewan, Canada to Northern Mexico and east from the Rocky Mountains to western Indiana and Wisconsin (Chadwick 1995; Berger and Cunningham 1995; Samson and Knopf 1994). The Great Plains grasslands comprise the largest contiguous ecosystem in North America and historically consisted of an area approximately 400 million acres in size (Chadwick 1995; Samson and Knopf 1994). They are often characterized as enduring consistent ecological disturbance (Knopf and Samson 1997) including major historical disturbance, such as drought, fire and grazing. In fact "Probably the most 'disturbed' North American ecosystem historically was the Great Plains" (Knopf and Samson 1997). Each of these disturbances play a vital role in directing the evolution of the grassland biota (Knopf and Samson 1997). Bison have historically assisted in the shaping of these grasslands with their dynamic patch-type grazing patterns (Knapp and others 1999). Humans have also played major roles in directing this evolution with the significant use of fire by Native People in the past and with the absolute fire suppression and the plowing practices of colonizing Europeans (Kimmerer and Lake 2001).

The prairie ecosystem consists of three sections of which are based almost entirely on climatic factors (Chadwick 1995). Because of the orographic effect on the



west side of the Rocky Mountains, a “rain shadow effect” is created immediately to the east of the mountains where there is little moisture and the moisture gradient gradually rises as one travels eastward (Chadwick 1995; Davitt and others 1996). As a result, the grass is shorter in the western areas of the prairie and gradually becomes taller to the east until the grasses were, in pre-settlement times, “as tall as a man on horseback” (Chadwick 1995). As one traverses the Great Plains from either west to east or from north to south, there is a diverse change in the species composition as well. In the western semi-arid short-grass section, the annual precipitation averages around 11-inches, whereas the sub-humid eastern tall-grass areas receive an average of 33-inches per annum (Lauenroth and others 1994).

Since the beginning of agricultural settlement of the eastern-most prairie regions in the 1830's, the total land area of North America's grasslands has steadily declined on an east-west gradient primarily due to the conversion of grasslands to farmland (Samson and Knopf 1994). The decline in tall-grass prairie is thought to be as high as 99%, while mixed-grass decline varies from 30-99% in differing areas, and the shortgrass prairie has decreased by 20% in Wyoming and as much as 85% in Saskatchewan (Samson and Knopf 1994). In addition to direct loss from farming, exploitation by overgrazing and recreation further stresses remnant prairie. Some say that once the prairie is destroyed, complete restoration may require up to a century or more (Samson and Knopf 1994). Research studies within the Pawnee National Grasslands in northeastern Colorado have shown that in the restored farmland the dominant grass species of the shortgrass region, such as buffalo grass (*Buchloe dactyloides*) and blue grama (*Bouteloua gracilis*) can take upwards of 55-years to re-establish themselves to viable populations (Lauenroth and

others 1999). Today, agricultural-related soil erosion in many farmland areas is so great that it exceeds the capacity of the soil to regenerate itself, thus threatening a resource that is essential to sustaining future generations of humans as well as other animals (Samson 1981). This is extremely alarming because the global carbon cycle may be significantly affected by the degradation of the prairie grassland soils as intact grasslands are considered superior carbon sinks, comparable to some forests (Samson and Knopf 1994; Chadwick 1995).

Many wildlife species populations have suffered tremendous damage because of land management methods employed by Euro-American settlers. Several species, including the eskimo curlew (*Numenius borealis*), the bighorn sheep (*Ovis canadensis*), and some subspecies including the plains wolf (*Canis lupus nubilus*) and plains grizzly bear (*Ursus arctos horribilis*), no longer exist at all due to over-hunting and habitat loss. Today, 55 grassland species are either threatened or endangered and another 728 are designated as candidates for this status (Samson and Knopf 1994). Perhaps the most adaptive of all native prairie species is the elk (*Cervus canadensis*). The decline of the black-tailed prairie dog (*Cynomys ludovicianus*), the second most significant herbivore on the Great Plains, is estimated at 98% since Euro-American settlement of the Great Plains and it continues to be under direct assault by cattle ranchers, urban development, government agencies, and even in some cases, academic researchers (Samson and Knopf 1994).

Prairie dogs once occupied extensive areas throughout the Great Plains (Sharps and Uresk 1990) and have been an extensive part of the grassland community for at least a million years and have, at times, quite possibly numbered in the billions (Sharps and

Uresk 1990; Chadwick 1995). Since the arrival of the Euro-Americans though, the prairie dog has been viewed by many as vermin and a continual war of eradication has been waged upon them (Davitt and others 1996). The fear that prairie dogs compete with livestock for forage and destroy rangeland still drives current policies and management actions on both public and most private lands (Davitt and others 1996).

Some biologists want to recognize prairie dogs as a key species of the prairie ecosystem because they believe they are essential to the health and welfare of many native wildlife species and to the ecosystem as a whole (Davitt and others 1996, Sharps and Uresk 1990). At the same time, many others remain intent on proving that prairie dogs take away valuable forage from livestock. According to Sharps and Uresk (1990) and Davitt and others (1996), the significance of the prairie dog to the prairie ecosystem is illustrated by the fact that 134 vertebrate wildlife species once relied directly and indirectly upon the prairie dog and its village complex for subsistence and/or habitat. Not surprisingly, a variety of species associated with the prairie dog and its village complex have also suffered severe and dramatic population declines, most notably the black-footed ferret (*Mustela nigripes*), which is considered to be the most endangered mammal in North America (Samson and Knopf 1994; Miller and others 1996).

A mutualistic relationship exists among the bison and the black-tailed prairie dog where bison are attracted to the prairie dog village complex (Krueger 1986; Shaw 1997). The true depth and meaning of the relationship remains elusive and undefined although research illustrates how each uses the same areas of the ecosystem to their advantage (Krueger 1986). Prairie dog populations are in severe decline today and we may never discover the true meaning of the relationship because of drastic alteration of the natural

system. The prairie dog village complex appears to be especially important to large herbivores, such as the bison (*Bison bison*) and the pronghorn (*Antilocapra americana*), as the plant-life within a prairie dog village complex remains in a highly nutritious and rapid growing (phase-one) vegetative state due to the dogs keeping the plants mowed down in order to protect themselves from predators (Davitt and others 1996). When the larger herbivores graze these areas, they do not have to expend as much energy seeking out quality forage. In turn, the grazers assist in keeping the plants trimmed down for the prairie dogs. The bison and the pronghorn antelope consistently utilize the prairie dog village complex in a pattern that allows the three species to assist each other's survival to a small degree (Krueger 1986). Less obvious ecological processes once maintained by prairie dogs when their populations were more dynamic include making available and the recycling nutrients through the mixing of soils (Samson and Knopf 1994). Soils in prairie dog village complexes have been shown to be richer in nutrients than are soils in adjacent grasslands (Sharps and Uresk 1990). The *Lakota* people refer to the prairie dog as the "little farmers" because they constantly manipulate soils. They have also been a useful food source to some Indian Tribes (Standing Bear 1933).

The prairie is "critical breeding habitat" for many bird species, including at least half of the waterfowl on this continent (Chadwick 1995). Research has shown that populations of grassland-dependent bird species have declined by as much as 25-65% since the 1960's (Knopf 1992). Declining populations can be attributed largely to the loss of grassland habitat through agriculture. Increases in woody species, such as planted trees in farm windbreaks and yards, provide habitat for competitive forest-edge birds that are non-native to the prairie (Knopf 1986). These recent non-historic and non-native forest

patches also enhance migration of eastern bird species that further degrade the historic biology of the Great Plains (Samson and Knopf 1994). In addition, the fire suppression mentality of the Euro-American plays a critical role in habitat displacement of many types of grassland-dependent bird species because many native bird species require either lightly, moderately, or heavily-grazed prairie as habitat. Fire suppression also adds to woody species invasion. New ecological theories such as patch dynamics are adding entirely new understandings of grassland ecology (Knopf 1986).

### Bison

There are two extant species of bison in the world today, the American bison (*B. bison*) and the European bison (*B. bonasus*) (Dary 1974; McHugh 1972; Danz 1997). Bison are members of the subfamily *Bovinae* (Berger and Cunningham 1994). This subfamily consists of an ox-like tribe that includes the true buffalo (both Asian and African), wild cattle, and bison (Berger and Cunningham 1994). The American bison is of the genus *Bison* and of the species *bison*. There are two identified subspecies of the *B. bison*, the woodland bison (*B. b. athabasca*) and the plains bison (*B. b. bison*) (Berger and Cunningham 1994). Geist (1996), a prominent zoologist, disputes the idea that there are two sub-species of *B. bison* and argues that there are two ecotypes instead. According to Geist (1996), the only difference between *B. b. athabasca* and *B. b. bison* is that they inhabit different ecosystems and have developed characteristics necessary for survival accordingly.

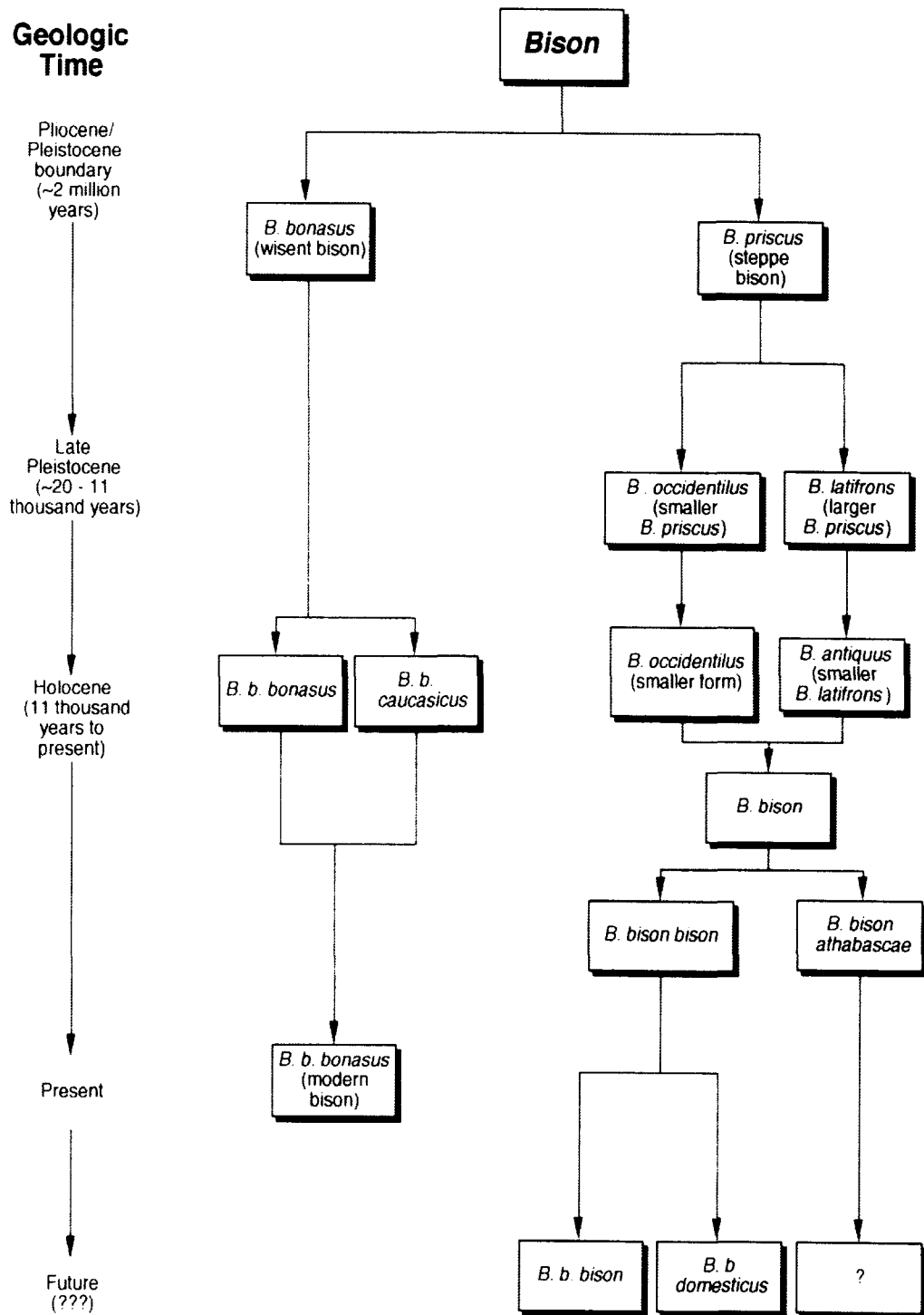
Contemporary bison have evolved from earlier species that were between 2-3m tall, with a horn-spread of 2m wide, to that of slightly more than half its previous size, but

with far greater agility (Danz 1997). Although Americans are very familiar with the American buffalo, most do not know that this creature is classified and named bison and that there are no buffalo species that are native to the American continent (Danz 1997).

The genus *Bison* (*B.*) first appeared on the Asian subcontinent during the late Pliocene geologic epoch (~2 million years ago) and expanded their territory by radiating into the northern climes of the steppe regions (Berger and Cunningham 1994; Guthrie 1990) (Figure 1). From the steppe regions of Northern Asia, the bison expanded its range as far westward as England and Spain and eastward into North America (Guthrie 1990). Early in the Pleistocene the steppe bison, *B. priscus*, arose in form and was considerably larger and had longer, stouter horns than its Pliocene predecessor (Danz 1997, Berger and Cunningham 1994, Guthrie 1990). *B. priscus* persisted throughout the rest of the Pleistocene, disappearing only at the beginning of the Holocene (Guthrie 1990).

Evidence shows us that the bison was present in prehistoric times in many parts of North America. In prehistoric times, their range included most of North America. How far south their range extended is not known at this time. There are accounts that bison were present in the private zoo of the Aztec ruler Montezuma when the Spaniards overthrew his kingdom near present day Mexico City (Danz 1997). It remains a mystery as to whether the species had expanded its range that far south or whether animals were captured and transported to that geographical area.

# Bison Phylogeny



**Figure 1. The evolution of the Bison (Garrett 2001)**

There is much debate over exactly how many bison existed upon the Great Plains prior to the arrival of the Euro-American. There is evidence that their population may have fluctuated widely with climatic changes that occurred during the Holocene period. It is thought that perhaps the bison population peak was around 1700-1800 AD (Whitney-Smith 1997; Flores 1996). Although it remains conjecture, the estimates range from 25-70 million bison (Danz 1997; Flores 1996; McHugh 1974; Dary 1972). Many researchers have attempted to calculate bison numbers based on a host of factors over the past century. However, their population numbers will always be shrouded in mystery, as near-extirpation in the nineteenth century prevented a thorough description of their ecology and habitat. Therefore, information of their abundance is limited to the eye-witness accounts of explorers, traders, voyageurs, etc. which can sometimes be suspect. The bison's distribution is limited to archeological knowledge (Hornaday 2002; Flores 1994). Peak buffalo population numbers may have roughly coincided with the introduction of major European diseases that decimated Plains Indian tribal populations. This in turn, may have relieved hunting pressures long enough for the buffalo population density to make a dramatic upward swing during the eighteenth and nineteenth centuries (Danz 1997).

Prior to the Euro-American arrival, the great bison herds of the North American Great Plains were more numerous than, and just as spectacular as, the wildlife herds on the Serengeti Plains of Africa (Danz 1997). Early accounts of Great Plains explorers and travelers reveal that many of the early travelers were overwhelmed with having to make an attempt at estimating the numbers of bison (Dary 1974; McHugh 1972). A famous observation made by William T. Hornaday, prominent government zoologist, was that in



effect it would be easier to count the leaves of an entire forest than to count the number of bison on the Plains (Danz 1997). The following is a compendium of Euro- American shortened written accounts that have survived and are occasionally used to convey the immense numbers of bison in pre-settlement times:

the plains were black and appeared as if in motion; the country was one robe; numerous as the locusts in Egypt; 20-miles wide and 60-miles long; as far as the eye could discern; 5-days in passing and more than 50-miles deep; when bison stampede, it is like a continuous roll of distant thunder; one black, living, moving mass; they extended the whole length of our afternoon's travel; impossible for mortal man to number them. (Danz 1997; Dary 1974; McHugh 1972).

Bison display great strength, boldness, and determination. They are not like other wild species that hide in the shadows or darkness or run when humans approach; the bison boldly occupies the land. Evolution has crafted the bison to be extremely well-suited to the grassland's harsh climate (Danz 1997; Knapp and others 1999). Their physical makeup, consisting of long shaggy pelages on their front shoulders and long hair on their faces, allows them to withstand the harsh northern climes. The bison will face into a freezing storm with ease (Danz 1997). Nineteenth century buffalo enthusiast Charles "Buffalo" Jones is said to have remarked, "The buffalo is so constructed that it faces every danger, whether it is a pitiless storm or its natural enemy, the gray wolf" (Danz 1997). Indeed, Indian accounts of bison behavior relate that the bison will form a "V" that faces into a raging blizzard with the males facing into the wind on the outside and the females and calves on the inside. Bison behavior contrasts quite sharply with that of the European domestic cow, which turns its tail to the wind and walks away from the storm.

The bison are high-humped in the shoulders and this feature allows them to be very efficient canterers and gallopers. The bison can maintain their rocking distance-eating canter for hours and even days. Their propensity for mobility has given them a reputation of being here today in the thousands and tomorrow gone to some distant pasture, not to be seen for a while (Guthrie 1990). There are accounts of tribes experiencing starvation because the buffalo have moved to very distant pastures and have not returned in sufficient time for a particular tribe's fall hunt (Clow 1995).

The bison is considered a keystone "engineer" species in that they have tremendous influence upon both ecosystem structure and function (Knapp and others 1999; Vinton and Collins 1997). According to Knapp and others (1999), the bison, as a keystone species, enables and enhances the growth cycles of certain grass types while inhibiting others, thus greatly affecting the species composition, particularly forbs and annuals, that make up the grassland community of the particular area being grazed. When the great bison herds were still intact, they also had a significant positive effect on soil chemistry at death, as their bodily fluids drained into the soil as their bodies decayed.

Horning, rubbing, dunging, urinating, hoofing, seed dispersal, and wallowing (in some cases, the creation of prairie potholes) are examples of non-grazing impacts of the bison (Shaw 1997). The buffalo create micro-sites through their wallowing, rubbing, pawing, and patchy pattern of grazing that increases plant diversity in pastures by 19-54%, as compared to cattle increasing plant diversity at a site by only 2-24% (Chadwick 1995).

The bison's lifestyle of upland grazing and their near-constant motion is key to their role as an ecological force that assists in shaping the grassland ecosystem (Manning

1995; Knowles and others 1998). Free-roaming bison graze as they move and this disturbance is vital to the heterogeneity of the grasslands (Meagher and Wallace 1993). The bison will intensively graze a particular area only once a season if they have the necessary room to move. Scientists have used the phrase, "Take a bite, take a step, bed down and ruminate, get up and move on" to describe the bison behavior of constantly seeking new habitat (Meagher and Wallace 1993). Bison can physically alter grassland structure in ways that increase environmental heterogeneity (Knapp and others 1999). Although the research of Plumb and Dodd (1993) clearly illustrates that the foraging ecology of bison and cattle may be similar, the research of Knapp and others (1999) has verified that through their specific grazing style, bison are key instruments of biodiversity within the grassland community.

Bison as a species are safe. But bison *as an ecological force* (italics mine), the same force that helped shape the North American Great Plains, appear to be in jeopardy. In our efforts to tame the rangelands, the fencing of the bison has greatly impacted a natural system (Meagher and Wallace 1993).

The bison have ecological relationships with several species within the grassland community. Although many of these relationships have been severely altered, and in some cases appear to be non-existent today, ancient instinctive ties are hard to break and as long as there remain a few wild buffalo, a few prairie dogs, and a few native grasses, these inter-species relationships will continue to flourish and even re-establish, given proper conditions (Meagher and Wallace 1993).

A recent example of unforeseen ecological situations is playing itself in the Yellowstone National Park ecosystem. Upon the reintroduction of wolves there, the renewed relationship among wolves and elk (*Cervus canadensis*) has produced some unforeseen changes in the riparian vegetation. The reintroduction of wolves into the

ecosystem has triggered a trophic cascade effect in Yellowstone National Park, USA and Banff National Park, Canada (Fortin and others 2005). The cascade effect is caused by wolves altering elk behavior in riparian areas. With the potential of wolf predation in these often brush-covered areas, the elk no longer lollygag around the streams or watering holes. They come to water to drink and quickly move to other areas that can afford better protection and security. This amendment of behavior has caused the willows to become invigorated and to explode in both quantity and quality. This has been an entirely unexpected result of the restoration of this predator-prey relationship (Fortin and others 2005; Hebblewhite and others 2005; Smith and others 2003).

A very important aspect of the alteration of the natural grassland ecosystem is the extinction of two endemic subspecies, the Plains gray wolf (*Canis lupus nubilus*) and the Plains grizzly bear (*Ursus arctus horribilis*) (Danz 1997). The two subspecies were primary non-human predators of the bison species (Fisher and Roll 1998). There were perhaps as many as one million prairie wolves that followed and preyed upon the herds of bison. Captain Meriwether Lewis referred to wolves in his journal as “the shepherd of the bison” because wherever the expedition saw bison, they were accompanied by wolves (Danz 1997). With the near-extinction of the bison, the wolf was displaced as a predator and was eventually extirpated for preying upon domestic livestock (Danz 1997).

The grizzly bear is considered to be a predator of bison although there is scant evidence of actual grizzly bear-bison encounters. Danz (1997) notes that there are few, if any, first-hand accounts attesting to grizzly bear predation on bison. A park biologist at Yellowstone National Park found direct evidence of one recent, violent encounter between a bison and a grizzly bear, the result being that the grizzly lost the battle and its

life (Danz 1997). Gone, at least for now in the U.S., are some of the key elements of natural selection for the bison as a species (Luoma 1993). Wolf predation on bison occurs regularly in the parks in Canada. With the relatively recent reintroduction of wolves back into the Yellowstone ecosystem, it appears to be only a matter of time before we begin to see predation upon bison resume once again after a 100-year hiatus.

### Human Settlement of the Great Plains

Accepted archeological evidence confirms that humans have been hunting bison on the Great Plains for at least 13,000-years Before Present (BP) and firmly establishes humans as a significant component of the ecosystem over this time period (Fisher and Roll 1998; Danz 1997). Many scholars are now challenging the assumption that human presence dates to 13,000 BP (Deloria 1995). Deloria (1995) presents a detailed argument that Paleo-Indians may have been present on this continent for a much longer time period than is generally accepted. A recent report by Walton and Coren (2004) also provides evidence to suggest that humans may have been in residence in North America much earlier than previously thought. They discuss the merits of recent evidence discovered at the Topper archeological site in North Carolina. Although the Topper site remains controversial among archeologists, it is the oldest radiocarbon dated site in North America. If the carbon-dating of the archeological artifacts found at the Topper site remain intact, this site would document human presence in North America back to 50,000-years BP (Walton and Coren 2004) which may refute an archeological hypothesis that has held sway for 75-years. Since the 1930's, archeologists have generally believed that North America was settled by hunters about 13,000-years ago when they followed

large game from Asia. Dennis Stanford, curator of archeology at the Smithsonian Institution states, “This (theory) had been repeated so many times in textbooks and lectures it became part of the common lore. People forgot it was only an unproven hypothesis” (Walton and Coren 2004). Stanford brings up an important point here about the dangers that are inherent in ‘consensus science’ where a hypothesis is accepted if it fits the currently accepted paradigm.

Detailed accounts of hunting procurement, processing, and subsistence patterns substantiate bison predation by human populations during the Holocene geologic epoch in an area reaching from Texas to Alberta and from Minnesota to Siberia (Berger and Cunningham 1994). Indigenous humans were efficient hunters and gatherers employing varying techniques in gathering their necessary resources. They hunted many types of animals, gathered plants for food and medicines, searched for and found obsidian and other types of stone for tools, and used fire to manage plant and animal habitat (Fisher and Roll 1998; Phillips 2000; Pyne 1986; Shay 1986). According to Berger and Cunningham (1994), “Bison were hunted on horseback, snowshoes, and foot, on prairies, in canyons, on mountains; arrows, spears, and later guns were used in the hunt.” Prior to the reappearance of the horse in the seventeenth century in North America, indigenous populations used cliffs and arroyos for buffalo jump kill-sites and also built impoundments to contain the bison so they could then be killed (Danz 1997; Johnson 1999; Dary 1974; McHugh 1972). Fisher and Roll (1998) note that most newly constructed museum exhibit depictions of bison jump kill sites are imaginative at best and this type of kill was only achieved with much finesse on the part of the hunters for bison had to be very shrewdly enticed into the trap. Although hundreds, if not thousands,

of bison jump-sites exist on the Great Plains, there is no direct evidence that human hunting negatively impacted bison population numbers and there is certainly no evidence of waste (Danz 1997: Fisher and Roll 1998: Vecsey and Venables 1980). Bison jump kill-sites have also been documented in Europe indicating that *B. bonasus*, or the wisent bison, were hunted extensively in that region of the world as well (Danz 1997). Many cave paintings have been found in the region as well and Guthrie (1990a) describes the ancient, intricate depictions of bison as empirical evidence of bison ecology.

It has been said that if one wants to know about the Indians of the Great Plains, then one must study the bison (Danz 1997). Humans residing in the Great Plains in pre-European contact times were so environmentally in synch with the bison that some of the Indian Tribes are referred to as a 'buffalo culture.' The *Lakota* people have a relationship with the bison that appears to be symbiotic and definitely extends deeper than mere dependence. Some refer to this relationship as a sacred symbiosis, while others describe it as a synergistic effect the two species have on one another (Ecoffey and Garrett 2000). The *Lakota* have lived among the buffalo for a long time and have intimate knowledge of the buffalo that modern science is only recently approaching in its understanding. As an example, zoologist Tom McHugh remarked in his modern study of the buffalo that the species seem to exhibit a complexity of interactions and appears to be organized into a complex and discernible order of rank (McHugh 1974). The *Lakota* possess a much deeper understanding and knowledge of the buffalo social structure and reverently speak of buffalo character regarding their behavioral patterns that discern them from other nations of animals (Valandra 1993). The *Lakota* observe that the buffalo exhibit grief associated with death, care associated with illness, play associated with leisure, and

spirituality associated with celestial ceremonial times cavorting and playing. *Lakota* people have witnessed buffalo cavorting and playing in great fields of sunflowers in what appears to be a sacred manner during celestially important times of the year (Valandra 1993; Goodman 1992). The *Lakota* people say that the buffalo's thundering hooves awaken the plants in the springtime by vibrating the earth alerting the plants' root systems that it is time to begin allocating resources to their above-ground parts (Valandra 1993). They also understood that the hooves of 30-50 million buffalo broke the prairie soil's crust and allowed valuable moisture to infiltrate into the soil rather than runoff into surface waters.

Beginning with the 1738-43 *La Verendrye* Expedition across the Northern Great Plains (Shay 1986) and following the 1804-06 Lewis and Clark Expedition along the Missouri River, Euro-Americans came out onto the Great Plains to trap and hunt fur-bearing animals and to trade for furs for an eastern fur industry (Martin 1978). As the beaver populations began to be depleted, the fur industry turned towards exploitation of the bison for their hides and tongues (Danz 1995). Soon after the U.S. Civil War, many displaced war veterans began appearing on the Great Plains taking up the occupation of buffalo hunting. Hunting may be a misnomer in this particular case because when one uses a firearm (even with nineteenth century technology) to shoot a buffalo it is more like shooting one's couch from afar. The huge numbers of Euro-Americans that were either hunting buffalo for their hides, were hunting along the way to the California and Montana goldfields, or were shooting buffalo for pure sport from the newly constructed railroad disrupted the buffalo herds. This led to further, more intense hostilities between the U.S. Government and the Plains Indian Tribes (Danz 1997). This disruption actually split the



buffalo into two herds, in the North and the South, and because the economies of many of the Great Plains Tribes relied solely on the buffalo, they began feeling the impacts of the split early on. Many of the Indian Tribes, e.g., *Lakota*, *Cheyenne*, and *Arapahoe*, fought hard to protect their land-base and natural resources such as the bison (Williams 1995; Danz 1997).

As early as 1874, Congress had passed a legislative bill to protect the buffalo from total extirpation, however President Grant pocket-vetoed the bill and it died (Danz 1997; Hodgson 1994). It is assumed that President Grant vetoed this legislation because, as the former General of the Army, he knew exactly how to deprive the enemy of their general stores. In the same year, the Texas state legislature debated protection of the buffalo. When General Phillip Sheridan, U.S. Army, heard of this debate, he rushed to San Antonio and addressed the Texas lawmakers:

(Buffalo hunters) have done in the last two years, and will do more in the next year, to settle the vexed Indian question than the entire regular army has done in the last thirty years. They are destroying the Indians' commissary; and it is a well-known fact that an army losing its base of supplies is placed at a great disadvantage. Send them powder and lead, if you will; for the sake of a lasting peace, let them kill, skin and sell until the buffaloes are exterminated. (Sheridan, In: McHugh 1972; Spry 1990).

The abundance of the buffalo was thus identified as a serious obstruction to the subjugation of Indians and the acquisition of their territorial lands and so by default, it became federal policy to allow the extermination of the bison to go forward (Williams 1995; Goodstein 1995; Danz 1997).

As a direct result of excessive hunting, the Buffalo Nation experienced a severe decline and they were almost extirpated during the nineteenth century (Fisher and Roll 1998). The fragile buffalo-based economies of many tribal groups were devastated

beyond repair, resulting in the displacement of many tribes onto reservations along with a near-total dependency upon the U.S. government for their food, shelter, clothing, medicines, etc. (Danz 1997; Williams 1995). The Plains tribal groups had lived in ecological harmony with the natural environment for millennia and in an abrupt 40-year period, it all came to an end. There is evidence that indigenous people understood the concept of “sustained-yield” long before the arrival of the Euro-Americans (Deloria 1995; Danz 1997).

It remains fact that a very serious misconception was that the great bison herds were an inexhaustible natural resource. It has been widely recognized that Euro-Americans exacted a wholesale and wanton destruction of the great bison herds for a variety of reasons; chief among them being the desire of the federal government to deprive the Indian people of a food supply and resource base and secondly, it was simple economics (Berger and Cunningham 1994; McHugh 1972; Spry 1990; Williams 1995).

In less than a 50-year time span, the great buffalo herds were nearly extirpated (Danz 1997; Smith 1980). This basic fact contradicts recent arguments being put forth by some environmental historians claiming that the Indian is primarily to blame for the near extinction of the buffalo, or at least responsible for their deteriorating population numbers (Flores 1991, 1996; Isenberg 2000; Krech 1999; Kay 1995). Although many try to claim there were Native American impacts on megafaunal species, it remains only a hypothesis that some attempt to exploit for their own academic benefit (Martin and Klein 1984; Flores 1991, 1996; Isenberg 2000; Krech 1999; Kay 1995). No evidence has ever been found that indicates Native Americans are responsible for the depletion or consequent extinction of any animal species (Deloria 1995; Spry 1990).

There is however sufficient and irrefutable evidence that the Euro-American is directly responsible for the extinction of species such as the passenger pigeon, prairie wolf, and prairie grizzly bear (Ponting 1993; Zontek 1995). There is also ample evidence that Euro-Americans are directly responsible for the near extirpation of several other species such as the black-footed ferret and indirectly responsible because of their land management practices for threatening such species as the prairie dogs, pallid sturgeon, least tern, piping plover, etc. (Miller and others 1986; Davitt and others 1996). Contemporary criticisms by some environmental historians of Native American hunting practices and philosophies appear to be hypocritical at best and racist at worst (Roe 1951; Hornaday 2002; Flores 1991, 1996; Isenberg 2000; Krech 1999; Kay 1995).

#### Cultural-Ecology of the *Lakota*

People commonly and incorrectly refer to the *Lakota* as the “*Sioux*” Indians of the Great Plains. A more accurate name is the *Titowan Oyate* of which the *Lakota*, *Dakota*, and the *Nakota* are sub-divisions (Valandra 1994). The three divisions speak different dialects of the same language. An English interpretation of all three names is “allies” or “friends.”

According to current anthropological hypothesis, the *Lakota* were the first of the *Titowan Oyate* to give up a farming/hunting existence on the edges of the Minnesota forests to exclusively make their living out on the grasslands by hunting buffalo. Many of the indigenous nations of the northern plains region developed similar cultural-ecological systems of living.

In addition to the *Lakota* Nation, there were approximately 25 other Indian tribes that hunted buffalo (Danz 1997). Of these tribes, many relied almost exclusively on buffalo hunting, while others were sedentary river-bottom agriculturalists that used buffalo as a supplemental food source (Danz 1997). Their environment shaped their lives and around 1700, the horse began making its way to the Great Plains and was eventually adopted as a bison hunting tool (Fisher and Roll 1997). The *Lakota* are well recognized because of their image as the noble and majestic horseback buffalo hunting Indians of western movies. The plains bison (*B. b. bison*) has always been extremely important culturally, spiritually, and economically to the *Lakota* Nation of the Northern Great Plains (Garrett 1995; Null 1998).

The buffalo once ranged across the entire Great Plains of North America and beyond now live within scattered fenced-in areas that many Indian people refer to as reservations (Berger and Cunningham 1995; Isenberg 2000). Instances of symbiotic relationships among people and certain animal species have been documented (Mossman and Mossman 1976) and a long association between the *Lakota* and bison is historically one of direct involvement where they have interacted symbiotically for centuries. The *Lakota* people refer to the bison species as a nation of people or the “Buffalo Nation” (Valandra 1993). This relationship is one of direct-dependence and is referred to by some as “sacred symbiosis” (Ecoffey and Garrett 2000; Garrett 1995; Zontek 2003).

Both the *Lakota* and Buffalo Nations survived the complete domination of the Euro-Americans, albeit in dramatically reduced numbers (Thornton 1987). The buffalo, which once numbered in the tens of millions, were reduced to less than 500-individuals by the late nineteenth century with the species barely surviving extinction (Berger and

Cunningham 1995; Isenberg 2000). The *Lakota* population was greatly reduced both by introduced disease and warfare in the protection of their homelands (Williams 1995). While the *Lakota* Nation once held territory in large portions of the states of North Dakota, South Dakota, Nebraska, Colorado, and Wyoming, they were driven onto increasingly smaller tracts of land called reservations and are now settled on six reservations in Western South Dakota (Williams 1995). The survivors of both the *Lakota* Nation and the Buffalo Nation were placed upon reservations with conditions that were not unlike concentration camps (Standing Bear 1933; Danz 1997). Although conditions have improved dramatically from those days, the contemporary Indian reservation most often resembles a third-world country with an economy that is in shambles, seriously conflicting jurisdictional issues, and an alteration of the social system that was in place long ago. The buffalo reserve of today varies in size, shape, and conditions that range from very large natural grassland reserves to very small zoo-like pens with absolutely no grass at all and out of necessity, the inhabitants are fed supplemental feeds everyday.

Although over one hundred years have passed since the forced settlement of these two formerly nomadic nations, both the populations of the *Lakota* people and the *Pte Oyate* are once again on the rise (Thornton 1987; Williams 1993). In the sacred narratives of the *Lakota*, the covenant between the two nations began many generations ago when the Buffalo Nation sent a delegate to talk with the *Lakota* Nation (Valandra 1993; Null 1998). The representative gave instructions on how to live a spiritual life that would ensure their survival and this encounter established a sacred relationship between the two nations (Garrett 1995). The *Pte Oyate* (Buffalo Nation) wished to provide the necessary nourishment and protein for the *Lakota* to survive the typically harsh winter climate of

the prairie. The delegate gave them a sacred pipe and told them the smoke would represent their prayers. She then taught the people certain spiritual ceremonies that would ensure good and fruitful lives which are referred to as the ‘Seven Sacred Rites’ of the *Lakota* Nation (Valandra 1993; Brown 1989). In turn, the people paid the ultimate respect and reverence by developing methods of utilizing approximately 100-parts of the buffalo for their various needs, thus ensuring no waste (Brown 1992) (Table 1). The buffalo has been compared to a modern supermarket due to the great variety of material goods they provided the people (Goodstein 1995).

**Table 1.** Uses of buffalo by Native Americans (Garrett 2001)

<b>Animal Part</b>	<b>List of Traditional Usage (Partial)</b>
Horns	Spoon ladles, Headdresses, Hide Scrapers, Bow Manufacturing
Hide (Raw)	Parfleche Containers, Rattles, Glue, Mortar, Shield, Ropes (Lariats), Cases, Saddles
Hide (Tanned)	Robes, Tipi Covers, Moccasins, Bedding, Floor Covering, Calendars
Hair/Fur	Halters, Moccasin Stuffing, Saddles Padding, Balls, Paint Brushes
Bone	Needles/Awls, Arrow Points, Sled Runners, Knives, Tanning Tools
Paunch	Water and Cooking Containers
Bladder	Tobacco and Water Containers
Scrotum	Rattles
Sinew	Backing for Bows, Bow Strings, Sewing Thread, Ropes, Cordage, Bindings, Glue
Tripe	Buckets, Food Storage
Tail	War Club, Water Switch in Steambath
Hoof	Hatchet, Glue, Rattles, Pendants
Intestines	Sacks, Sausage Manufacturing, Water Bags
Blood	Smearred on Arrow Points for Greater Penetration
Tallow	Healing Wounds, Sealing Tobacco in Pipes, Mixing with Paints
Gristle	Glue, Chewed by Teething Babies
Heart	Bag from Inner Lining
Dung	Fuel, Baby Powder, Incense, Arrow Targets

When the Euro-American explorers and settlers came to the North American continent and began advancing west, they characterized the land as “wilderness.” From the very beginning of their occupation of the land, this designation initiated an adversarial

relationship with the land and all its inhabitants (Kimmerer 2000; Cajete 2000). For most Native People, the land was not considered to be wild:

We did not think of the great open plains, the beautiful rolling hills, and winding streams with tangled growth, as 'wild'. Only to the white man was nature a 'wilderness' and only to him was the land infested with wild animals and savage people. To us it was tame. Earth was bountiful and we were surrounded with the blessings of the Great Mystery. Not until the hairy man from the east came and with brutal frenzy heaped injustices upon us and the families we loved was it wild for us. When the very animals of the forest began fleeing from his approach, then it was that for us the 'Wild West' began (Standing Bear 1933).

According to Kimmerer (2000) and Rasmussen (2000), the land was far from being a wilderness, for the land had been intensively managed by Native People for centuries to increase the availability of food resources. The Native People had been manipulating their environment using many different types of temporary ecosystem disturbances and as a direct result it was literally a garden (Nabhan 1997, Rasmussen 2000; Peacock and Turner 2000). By far, the most extensive disturbance used was fire and Native People residing on the Northern Great Plains used it as an environmental management tool to attract the bison and to enhance the biodiversity of the plant life within their territory (Fisher and Roll 1998; Rasmussen 2000).

Many Native People believe that they have a spiritual responsibility and an obligation to manipulate wild species through the practice of culling a plant or an animal population and the habitat manipulation through ecological disturbance (Kimmerer 2000; Martinez 1994; Salmon 2000). In fact, many species degenerate if not subjected to the indigenous conservation tradition of disturbance (Nabhan 1997; Peacock and Turner 2000). And, although the bison is perceived to have been the primary food source for the *Lakota*, they in fact used large numbers of native prairie plants and other animals as food sources (Phillips 2000).

The killing off of the great bison herds caused the *Lakota Oyate* to suffer dramatic and irreversible changes because the territorial and resource war that was fought ended with the Indians' land base reduced to a small fraction of what it once was (Standing Bear 1933). The *Lakota* Nation was divided into single bands, isolated from each other on different reservations and, seemingly forever sentenced to a sedentary lifestyle (Standing Bear 1933; Mooney 1991). The Indians lost control of their fate and many freedoms were taken away (Standing Bear 1933). The federal government took away the *Lakota* people's right to practice their religious traditions, along with the right to choose their own leadership, in 1884 (Mooney 1991). The enactment of the Indian Reorganization Act of 1934 created the modern tribal government and returned the right to choose their own leaders and to form their own government once again. However, a model form of government that was loosely-based on the U.S. Government was the only choice given. Tribal people were not given the freedom to observe and practice their religious traditions until the passage of the American Indian Religious Freedom Act of 1978. The denial of these two basic rights was unquestionably the worst offenses imposed upon the *Lakota*. A third offense that comes close in magnitude was the kidnapping of Indian children by the federal government, who then sent them, first to abusive government schools, and then later to Christian mission schools that also abused the children. Secondary effects of these boarding school experiences include the loss of religious traditions and beliefs, loss of native language, no parental nurturing, and the decline in traditional knowledge altogether. This single act thoroughly dislocated and displaced the future generations of *Lakota* people, and as a direct result much of native cultural thought and philosophy have been undermined (Standing Bear 1933).



The modern-day reservation era officially began in 1889 with the establishment of much smaller reservations cut from the larger “Great Sioux Reservation of 1868” and for the *Lakota*, this meant confinement to their specific reservation lands. The seven bands of the *Lakota* Nation were split up and given different reservations. It marked a time when many tribes were facing a religious crisis (Mooney 1991). This crisis was precipitated by the fact that it looked as if the Creator had abandoned the Indian people. At about the same time around the late-1880’s, a man far to the West arose who was being hailed as a prophet because he was prophesizing the return of Indian Nations back to harmony and balance with a new religious faith. The *Lakota Oyate* sent a delegation to the *Paiute* Nation in Nevada to find out firsthand what this prophecy was about and whether it was true or not. Although the ethnographer James Mooney referred to this spiritual movement as ‘The Ghost Dance Religion,’ it was not a religion to the *Lakota* people and was not referred to as such by them for it was really another type of ceremony for them (Sansom-Flood 1997; Mooney 1991). Alice Ghost Horse, a 13-year old survivor of the Wounded Knee Massacre of 1890, later described it as a spiritual ceremony called the ‘*Wanagi Wacipi*’ and should be interpreted as ‘Spirit’ or Medicine Dance’ (Sansom-Flood 1997).

The underlying principles of the *Wanagi Wacipi* ceremony were that if certain ceremonial dances were conducted along with the accompaniment of appropriate sacred songs, then the Euro-American people would leave the Indian’s homeland for good, the buffalo would come back in their former numbers, the earth would regenerate herself, and the *Lakota* people would thrive once again (Mooney 1991). The Euro-Americans in the West misinterpreted the meaning of this spiritual revival, or renewal ceremony, and understood it to be a prelude to open rebellion (Mooney 1991; Sansom-Flood 1997).

Tragically, the peaceful spiritual movement ended with the U.S. Army's Seventh Cavalry killing and wounding several hundred unarmed men, women, and children of the Bigfoot Band of *Ho Hwoju Lakota* at Wounded Knee Creek on the Pine Ridge Reservation on December 29, 1890 (Mooney 1991; Sansom-Flood 1997).

The Ghost Dances of the 1880's anticipated the reappearance of the buffalo in full measure (Yorks and Capels 1998; Mooney 1991). However impossible this may seem to some people, there are some that believe the prayers of the spirit dancers of the 1890's are being answered and are actually coming true in our time. Contemporary research illustrates that several basic tenants of this religious movement may be coming to fruition, however coincidental it may appear to the western scientific community (Valandra 1993; Yorks and Capels 1998, Garrett 2000b). Recent demographic studies of the Great Plains region reveal a steady long term decline in non-Indian populations (Popper and Popper 1987; Valandra 1994). According to Danz (1997), the overall buffalo population is steadily on the rise once again, and Valandra (1994) confirms in his demographic research that there is an increase in the *Lakota* population in South Dakota. Recent grassland research is beginning to demonstrate that the bison, with their unique grazing habits and patterns and also their propensity for mobility, serve as an important agent in grassland restoration (Knapp and others 1999; Hartnett and others 1996; Garrett 2000b; Valandra 1993). This may appear to be a remarkable coincidence and a stretch of the imagination, however in the introduction of the 1991 Bison Books re-publication of James Mooney's 1896 Bureau of Ethnography Report, noted anthropologist Raymond J. DeMallie remarks that, "the situation among the *Lakota* people of 1991 is in many ways remarkably parallel to that of 1891" (Mooney 1991). Indeed, contemporary *Lakota* have

not come to terms with western land management methods, ownership of land, western education, nor existing business methods very much as it was one hundred years ago.

Some contemporary *Lakota* still struggle to identify how they fit in the world in which they live. The reservation era, from beginning to the present day, has brought with it the diminishment of culture, and the loss of language, a healthy diet, economy, and the steady erosion of much of their land base (Nabhan 1997). And in recent times, Native People are beginning to exhibit, to a certain degree, the erosion of their traditional ecological knowledge base (Nabhan 1997). In recent times, reservation agency towns have grown by leaps and bounds because this is usually where the only jobs are on the entire reservation and this clustering of the reservation population has caused many of the youth to congregate in groups abandoning their culture. Another major impact on Indian youth is the television and especially the depiction of urban life in big cities where it is ‘cool’ to be in a gang (Mander 1991). These reasons have combined to alter the youth of reservation children to a life that is more global and therefore, it is felt by many youngsters that cultural knowledge is irrelevant in today’s world (Mander 1991).

According to Manning (1995), “Culture, in its broadest sense, encompasses all aspects of our lives: economics, ecology, science, community, and spirit.” The Bureau of Indian Affairs contributed to this cultural loss through their complete authority over Indian affairs and their maintenance of a slow and gradual but continual erosion of tribal sovereignty. They have completed this through absolute control of the Indian’s natural resources, e.g., grasslands, etc. The *Lakota* Nation, as well as many other Native American Tribes, have been attempting recovery ever since and currently, many people see the restoration of the buffalo to Indian lands as being one of cultural-ecological

restoration that includes important spiritual and identity restoration too. Many of these same people also see the buffalo as being the last great hope of many Indian tribes (Goodstein 1995). They observe that this restoration process of returning the buffalo to the people will once again enable both the *Lakota Oyate* and the *Pte Oyate* to recover much that has been lost (Cournoyer 1996).

### Indigenous Ecological Knowledge

Indigenous ecological knowledge as a distinct body of knowledge remains an evolving process that undergoes sweeping change with advancement of newer concepts and ideas just as does western ecological science. A fundamental difference between western thought and native thought is that indigenous knowledge is usually expressed as spatial while western knowledge, with a few exceptions such as landscape ecology, has a more temporal orientation (Pierotti and Wildcat 2000). Interest in indigenous ecological knowledge as a valued body of knowledge has been constantly growing. Although it is gaining credibility, a large amount of cultural-ecological information, knowledge, and experience has been previously ignored or treated as mysticism by much of the western world (Pierotti and Wildcat 2000; Deloria 1995).

Among vocal critics of anthropological theory was the renowned late author, professor of law and history, and Native American activist Vine Deloria, Jr. (*Hunkpapa Lakota*). Deloria (1995) strongly criticized the scientific community for their acceptance of what he refers to as the unsubstantiated 'Bering Strait' and the 'Great Overkill' hypothesis mostly because in his opinion, there really is very little substantive evidence to prove the so-called theory. Deloria challenges the notion of and points out the dangers

of 'consensus-based science' where there is straightforward acceptance of an unproven hypothesis simply because it is easy and it fits the existing paradigm. His criticisms were that modern science is not exactly objective as it claims to be and that it will never be so. Deloria's book, Red Earth: White Lies, uses tongue-in-cheek humor in an attempt to discredit the notion that Native Americans came to this continent solely via the treacherous route of having to negotiate several mountain ranges between Siberia and Alaska to get to North America. Many of the theories put forth by modern anthropology are fervently debated by critics such as Deloria because many Native People's sacred narratives include origin stories that conflict with current anthropological theory. The oral histories, mythological tales, and sacred narratives of Native People usually depict them originating on this continent. The term sacred narrative is used in the context that depicts an ancient tale that happened so long ago that it is not remembered how long ago it actually happened but nevertheless remains a true story (Talamnatez 2006; Deloria 1995). There are becoming more instances where modern researchers use cross-discipline methods to establish that sacred narratives have standing (Orlove and others 2002; Biser 1998).

Many indigenous nations have contributed their knowledge of the world to the collective knowledge base of mankind. However, many have never been given due credit for their contributions and often these very same contributions have been expropriated by the academic or corporate world for profit. Much can be debated about current first-world patent laws and how these laws have been cleverly written to enable the privatization of knowledge and property that has been collectively-invented by indigenous groups or nations (McGowen 1991; Brush and Stabinsky 1996; Garrett 1996). In the case of

ethnobotany, many pharmaceutical companies are reaping benefits from field representatives in the Amazon Jungle who acquire knowledge of medicinal plants from unsuspecting natives without sharing profits or providing compensation (Tuxill 1996; Whitt 1995; Garrett 1996). Many indigenous people throughout the world classify first-world patent laws to be neo-colonization in action (Garrett 1996). Native knowledge is almost always communal-based knowledge, meaning that it is for the benefit of the group not an individual. Contemporary western patent laws are written to protect private knowledge and so, native knowledge has to be expropriated in order for it to be privatized so that it can be patented. This is done either by an individual person or by a corporation which can be classified under western law as an individual. Fortunately, indigenous people throughout the world have been experiencing some recent advances made in the international arena regarding the expropriation of such knowledge.

Despite the expression of studying the buffalo in its natural state within the title of his book, The North American buffalo: A critical study of the species in its wild state, zoologist Frank G. Roe (1951) could not have studied the bison in its wild state because the animal was nearly killed off long before he undertook his study. The animal could not be taxonomically described in the traditional western scientific methodology because its ecology was altered by major population reduction. Roe did not live during the times of free-roaming buffalo on the Great Plains and so he could not have studied them in their naturally wild state. Although this book has been held up as the seminal study of bison for a long time, he could not hold back his personal biases. His writings express racism towards Indian people and this attitude can be traced directly back to the earlier writings

of William T. Hornaday who also expressed the exact same sentiments towards the Indian people (Roe 1951; Hornaday 2002).

There are very few studies of bison/plant interactions and most focus only on bison and almost all have compared bison with European domesticated cattle (Stueter and Hidinger 1999; Truett 2001, 2003; Plumb and Dodd 1999). In essence, many of these studies are clear attempts at proving that bison are nothing but shaggy cattle. This seemingly is an effort to mitigate the near extirpation of the bison by Euro-American hide hunters. Arguments are made that cattle and bison are analogous to each other, however, almost all of the research only covers foraging ecology. There are very few, if any, that discuss long-term environmental impacts of the two species on their foraging grounds (Plumb and Dodd 1999). Truett (2003) meanwhile, makes a serious attempt at saying that there may not really be anything called over-grazing at all and it can all be chalked up to structural change in motion or seral-stage change. Certainly though, research studies have concluded that cattle consume more forbs and browse than do bison (Plumb and Dodd 1999; Knapp and others 1999), thus creating a major difference in how each species affects diversity, aboveground biomass, and soils within the grassland ecosystem. By virtue of 100-plus years of use of the Northern Great Plains grasslands by cattle, then they have more than likely created dramatic change in the ecological structure of the grassland plant community. This may be true simply by the fact that although the bison grazed the grasslands very intensively, they did not return to these areas for long lengths of time but in direct contrast, cattle have been intensively grazing every section of the grasslands non-stop for over a century and have given the grasslands very few chances to recover.

Most research has not taken into account that prairie plant species and their habitat may have been dramatically altered since the late-nineteenth century when bison were replaced by European cattle and when Native People's land management practices were replaced by Euro-American land management methods (Kimmerer 2000; Kimmerer and Lake 2001). It is obvious that plowing the land is the most radical of changes made by the Euro-American, however, there are significant amounts of surviving grassland areas where its structure and composition have been altered as well. Research conducted by most westerners has totally ignored the significance of Native People acting as ecosystem managers and their active promotion of biodiversity within the ecosystem (Shay 1986; Peacock and Turner 2000; Salmon 2000). If buffalo do not consume as many forbs and browse than do domestic cattle as some research indicates, then one might extrapolate that the grasslands would be a very different place than it is today if the buffalo had not been taken off the prairie in the first place (Knapp and others 1999). One can also extrapolate that with a high natural population of beavers that existed on the Great Plains before being trapped-out, the expanse of riparian areas within the entire grassland ecosystem would be much greater than exists today. There certainly would have been a much larger representation of underground natural springs that would have surfaced and created meandering waters. There also would have been many small ponds that held up the water flow long enough for it to infiltrate. With recent evidence indicating that Native People were actively managing plant species within their traditional territories and when the potential impacts of an abundant population of beaver on the ecosystem are considered, the prairie would almost surely have been a very different place than it is today (Shay 1986; Salmon 2000; Peacock and Turner 2000).



There is ample evidence that it was a fairly common occurrence for Native People to extend the range of plants (Peacock and Turner 2000; Salmon 2000; Nabhan 2000a; Posey 1983, 1985b), just as it was common for plant seeds to stick to the fur of the buffalo to be transported and deposited elsewhere as they wallowed and rubbed in the soil. Seeds were also transported via their feces as well (Shay 1986).

Ethnobotany itself focuses upon the ways in which human societies relate to the plant life that surrounds them. A society's attitudes toward the natural world around them affects how they exploit their environment; exploitation of their environment in turn alters that society's culture and environment (Shay 1986). According to Kimmerer and Lake (2001), the worldview and legacy of a society is often written more truthfully in the condition of their land than in its documents. If there is truth to this axiom, then many of the Native Tribes left a very light footprint and most certainly, a more positive influence on the land. However, probably the most under-rated contribution of Native Peoples is their legacy of extensive development of their habitat. Provenza (2003) has stated, "Management that makes use of all plant species can, and will, enhance the biodiversity of any given area." When the Euro-Americans came to North America, they labeled the environment a "wilderness" and did not realize that what they were seeing was centuries, if not millennia, of ecosystem management by the Native Peoples. In fact, many of the so-called wilderness areas were actually occupied by food-producing plant and tree species that were consistently used by Native Peoples of the same area (Kimmerer 2000; Kimmerer and Lake 2001). Posey (1985b) says that the exact scenario takes place in the land of the *Kayapó* in the South American tropical forest where the people are always planting, moving, cultivating, or harvesting plant species as they traverse the forest.

Of the few westerners that have conducted research on the botanical knowledge of Native People such as Melvin R. Gilmore and Father Eugene Buechel, they found about 1500 flowering plants in the Northern Great Plains region with about 300 of them being eaten by various tribal people with several hundred more plant species that were used for purposes such as medicines, religious symbols, ornaments, construction materials, and fuel (Rodgers 1980; Gilmore 1919; Shay 1986). The roots, shoots, leaves, berries, and/or wood from these plant species were utilized as food, medicines, or materials (Shay 1986; Peacock and Turner 2000). Management techniques were at the population, community, and landscape levels and their harvesting was not random but selective. Harvesting was oftentimes governed by several considerations of which included the physical, the spiritual, and/or social sanctions (Salmon 2000; Swezey and Heizer 1982). The physical considerations were such things as the species yearly growth cycles, reproductive status, and maturity and size (Peacock and Turner 2000). Spiritual and social considerations consisted of deferring harvest until the species had a chance to perpetuate itself; a classic example is the ritual regulation and management of fish resources in California where the people allowed the first salmon to continue on upstream for a few days before any harvest was allowed (Swezey and Heizer 1982).

In the Northern Great Plains, Tribal People made their living with a variety of methods. There were long-established sedentary river-bottom agriculturalists, there were semi-nomadic Tribes that combined hunting on the open prairie with a life of river-bottom agriculture, and then there were the hunter/gatherer types that did not practice any agriculture *per say*, but did still manipulate the ecosystem to their advantage. Among the sedentary river-bottom agriculturalists of the Northern Great Plains were the *Mandan*,

*Hidatsa*, and *Arikara* Tribes. These horticulturalists constructed large dome-shaped earthen homes on river terraces that overlooked their river-bottom farms and oftentimes traded with hunting Tribes for additional meat, hides, roots, medicines, and other material needs (Hanson 1984; Wilson 1987). They would trade although they certainly knew how to hunt and gather for themselves and would organize large annual fall season buffalo hunts. Their agricultural crops consisted of corn (*Zea mays*), beans (*Phaseolis vulgaris*), several varieties of squash and pumpkins (*Cucurbita pepo*; *C. pepo pepo*; *C. pepo maxima*; *C. lagenaria*), sunflower (*Helianthus annuus annus*), Jerusalem artichoke (*Helianthus tuberosus*), and a tobacco plant (*Nicotiana quadrivalvis*) (Gilmore 1919; Wilson 1987). Besides their agricultural cropping, the *Hidatsa* Tribe's economy was one of strength because they also controlled a significant flint quarry located at mouth of the Knife River where it joins with the Missouri River. Flint from the Knife River quarries has been found in many areas of Western North America (Hanson 1987).

According to Ceci (1978), many of the Tribes used the springtime appearance of the Pleiades star group as a method of predicting when to plant crops much like the Incan potato farmers do to predict the coming of rain and consequently when to plant their crops (Orlove and others 2002).

There were other groups that combined river-bottom agricultural and hunting. The *Pawnee* would plant crops along the rivers, leave for the open prairie to hunt buffalo during late spring and summer, return to their crops in midsummer to cultivate their crops, return in the fall to harvest, and then spend their winters in the sheltered riparian areas along the rivers (Deloria 1990). Tribes such as the *Lakota*, *Cheyenne*, *Arapaho*, etc., were hunters and gatherers that firmly established territories and hunted within these

territories year round (Berger and Cunningham 1994). Some greatly expanded their territory with the adoption of the horse and these territorial boundaries tended to be in constant flux due to climatic conditions and/or the aggressive nature of surrounding groups.

### Lakota Epistemology

The worldview of the *Lakota* people has always been one of attempting to blend into and live within their environment without disrupting or changing any system components. This philosophy has lead them to a position of wanting to leave the world a better place for the future generations and consequently, they placed high value on not degrading their environment.

The most important aspect of *Lakota* thought and belief is that there are a number of spirits that make the world work the way it does. This belief comes from direct observation of the world. It is believed that an energy force makes up an all-powerful spiritual entity they call *Wakan Tanka* (Great Mystery) and this all powerful energy force has a number of helpers that makes the world move the way it does each day. *Wakan Tanka* and helpers are called *Tunkasila*, or the grandfathers, and they consist of the spiritual entities known as the winds, water, lightening and thunder, clouds, etc. In reality, the people recognized the sun as the primary energy force within the universe. They honor and cherish that force. This force is referred to as *Taku Skan Skan* (the energy force that makes the world move). It is believed that without *Taku Skan Skan*, our lungs would not take in air and allow us to live, our heart would not beat, the rivers would not flow, and the birds could not fly, etc. It is also recognition that without the energy of the

Sun, the plants would not grow and then we, and the other animals, would have nothing to eat.

*Lakota* philosophy includes an acknowledgement that the Creator provided the people with a bountiful place to live. Thanks are constantly given for the beauty that surrounds us, the bountiful food sources that are available, and the clear and pure water that we drink. It is believed that everything we have been given belongs not to us but to the Creator and therefore, the only thing we have to offer the Creator in return is our body. Consequently, the *Lakota* people offer their flesh to *Wakan Tanka* in the Sundance ceremony as a sincere offering of thanks for the bounty given to us and also to prove their worthiness of having special knowledge bestowed upon them.

The *Lakota* worldview comes directly from direct daily interaction with the ecosystem. Their understanding and comprehension of the world includes knowledge of astronomy, climatology, animal husbandry, botany, natural resource management and can generally be referred to as ethnoscience. They also possess a highly developed spiritual understanding of all life that surrounds them in their community because they have developed an avenue of expression and communication with the spirits that reside in another dimension or in the “metaphysical world.” When the White Buffalo Calf Woman brought the Seven Sacred Rites to the people, she gave them the necessary instructions for each spiritual ceremony. Some of these ceremonies such as the *hanblecheyapi* (the vision quest ceremony) and the *wiwanyank olowan wacipi* (the sundance ceremony) are specific times when one seeks the assistance of the spirits.

*Lakota* astronomical knowledge speaks to the fact that the stars in the heavens are a mirrored reflection of a geographical place-map of sacred locations that lie within their

territory. Great importance is placed upon following the spiritual instructions that are given to for renewal ceremonies that are to be held at certain locations at specific times throughout the astronomical year.

Their botanical knowledge comes from individual participation in the spiritual ceremonies where the spirits will actually give someone knowledge of what plant to use for which illness. They were given the necessary instructions of preparation and application of the herb as well. This knowledge is given to those who understand explicitly that the knowledge given is to be used for the good of the community and is never to be used for the good of the individual who possesses the knowledge. In-depth knowledge of the ecosystem comes from direct experience that was passed from one generation to the next via experience-based stories that incorporate cultural-ecological knowledge.

*Lakota* spirituality incorporates a philosophy that includes all life as their sacred relative acknowledged and known as “*mitakuye oyasin*,” with the literal translation being “all my relatives.” This phrase is a prayer and refers to the fact that all life is connected and that all life is considered to be a relative. Consequently all life is considered “sacred” as one would consider their mother, father, or grandparents to be sacred. This epistemology comes directly from daily contact with the physical and spiritual worlds through their ceremonial connection to the spirits that inhabit the ecosystem.

Native scholar Elizabeth Cook-Lynn refers to the learned ecological knowledge, or insights, of Indigenous People as “credible-observation” because it is given as lessons that the people did not forget. This knowledge is then passed along to the next generation and so on and now represents many generations of knowledge about the particular

ecosystem. However it is described, this close observation of the natural world allows them to develop a rather remarkable understanding of the inner-workings of the ecosystem of which they are an integral and essential component. Their knowledge extends into the range of understanding of how different species interact with each other, for example, how the coyote and badger will sometimes hunt together in a manner that mutually benefit each species. Many times knowledge of the past is expressed in stories, for example it is still told of how the *Lakota* and the wolf hunted together and how the wolf taught the people to hunt. Mythological stories tell us of past knowledge and many times it seems almost impossible. Because we live in a much different ecological context today, these stories many times appear difficult to understand and believe. Native scholar Inés Talamantez refers to these stories as “sacred narratives” that keep Indian Tribes alive (Talamantez 2006).

The *Lakota* people were predators of many species, but primarily were hunters of the buffalo. This activity placed the hunters in the unique position of learning the ways of the buffalo in order to effectively hunt them. Over hundreds of years, Native People perfected their hunting skills which progressed from hunting individuals to jumping groups of them over embankments, and then after the adoption of the horse, to chasing and killing the buffalo from the back of a horse at full speed. Thus, it has been said of the *Lakota Oyate* by the late *Sicangu pejuta wakan*, John Lane Deer... one has a difficult time determining where the bison end and the people begin (Erdoes and Lane Deer 1994).

## METHODS

### Research Study and Description

The research study is focused upon the native cultural-ecology of the Northern Great Plains, more specifically the *Lakota* Indian people. The study was originally designed to take place throughout different states within the Northern Great Plains that have significant native populations. However, because of some logistical difficulties, it became entirely focused on the *Lakota* Indian people of modern-day western South Dakota.

I wanted to find out if the bison, native plants, and Native People contributed to environmentally-shaping each other over time. If this was so, then exactly how did one component contribute to the other component's physical, ecological, spiritual lifestyles? I understood from conversations with many older Indian people exactly how much Indians knew of the grassland ecosystem and decided early on to capture this ecological knowledge while it was still possible. My love of and compassion for all three grassland ecosystem components, the buffalo, the native plants, and the Native People, drove this research.

I set out to investigate exactly how much and what types of ecological knowledge remained among the *Lakota* Indians after 100+ years of being subjected to the colonizing effects of the Euro-American culture. I designed a study where selected Indigenous People that I felt or knew possessed just such knowledge were selected for an interview. Their knowledge would become the focal point of understanding the grassland ecosystem and how the components interacted over time to assist in the environmental shaping of the other components.



After conducting a thorough literary research on the subjects of indigenous ecological knowledge among the *Lakota*, I interviewed Native People whom I believed were in possession of in-depth knowledge of this particular subject area. Undoubtedly there were additional or more appropriate people, but I had immediate access to these eighteen. I asked each to answer a set of about eighteen questions, with six each on each component (Appendix B). The data was collected through tape recording the interviews with a small hand-held micro-recorder. The data was then transcribed and very closely scrutinized and analyzed. Qualitative methodology was applied to the transformation of the data into useful information through the means of coding the data.

#### Data Collection

Prior to fieldwork, a set of initial data codes were established for each of the ecosystem components that I wanted to gather information on (Appendix C). As an example, I wanted to collect information on the relationship between *B. bison* and Native People so I coded the collected data as REL-B/NP (interpreted as: the Relationship between Bison and Native People) to denote an occasion within the transcribed interview when a participant discusses or mentions this specific topic.

Each interview consisted of conducting a formal face-to-face interview that was taped along with making hand-written notes. The interview was then transcribed word-for-word. All transcriptions were scrutinized for material relating to each of the code categories and each comment was then pulled from the interview and put into a bulleted format. A list consisting of each comment specific to each coded category was made. The lists were scrutinized for themes or concepts that became a “main topics” list. The

selected themes or main topics were then placed as paragraph topic sentences with supporting data from the bulleted list underneath them in exactly the same way that a topic sentence begins a paragraph. This second process is called the axial code and each was then converted into a narrative that describes the relationship topic.

### Interview Participants

It is recognized by some Native People that throughout the latter part of the nineteenth and the beginning of the twentieth centuries the United States Government forcibly took Indian children from their parents and placed them in mission schools. The chain of knowledge that was traditionally handed down from one generation to the next was broken (Standing Bear 1933). This chain of knowledge contained knowledge that I, and others, call the cultural coding of how the *Lakota* people had lived and survived for centuries and millennia. As a result, when the children returned home after being in mission schools for most of their formative years, most were incompetent in both the Euro-American culture and their native culture. Many of them eventually became crippled or lost individuals, while many became alcoholic. This displacement caused many to become dysfunctional people with no parenting skills because they had received no model of parenting as they grew up. However, there were some who either themselves resisted or their families resisted this assimilation process and some youngsters reintegrated back into the society and reverted back to their cultural ways. It was described in my younger years on the reservation as a person having gone back to the blanket. This cultural phrase refers to the fact that the old-time Indians always wrapped themselves in blankets as a form of dress and so it was inferred that someone “returning

to the blanket” went backwards in their progress and resisted being assimilated into mainstream American.

The people that returned to the traditional ways usually resisted this assimilation process with great strength and raised their children to understand their cultural ways and knowledge through a variety of ways, but primarily through stories told by the elders of the community as had happened for hundreds of years. This is the oldest method of transferring cultural knowledge among the generations. In some extreme cases, parents would hide their children from the authorities to resist having to send their children away to schools. Most parents did not get away with this type of trickery for long because the authorities had special truant officers that would sneak around and find out who was not sending their children to the government schools. Many grandparents would raise their grandchildren not because the parents were busy gathering food as was a traditional practice, but because increasingly the parents would be off raising cane in town instead of being at home raising their children. There was a late-nineteenth century prophecy that foretold of a time coming when the young will have to teach the older generations how to be traditional *Lakota* people once again. Consequently, there are some among the age-group of 50- and 60-years old that possess a great amount of cultural-ecological knowledge among the people today. Most of this is directly from being raised by grandparents which is exactly the data that I wanted to collect.

It is from this group of people who held fast to their traditional ways of living their lives that I tried to select for participation in my research study. In the context of today’s world, these are very special people and in many cases, they appear to be wise beyond their years. Most of these individuals are very spiritual people and many have

dedicated their lives to the servitude of the bigger community in one form or another. They feel that they have a special responsibility to the perpetuation of the *Lakota* Nation. There is a *Lakota* term that is used for people that are like this and it is *ikce wicasa* and it is a designation for a person that is a common ordinary person and displays much humility. An individual that is said to be *ikce wicasa* is one that does not put on airs that he/she are important, they do not allow themselves to be put up on a pedestal because of possessing knowledge that others do not, they do not expect to be treated any differently than are others, they believe strongly that all are equal but possess different powers to move the earth and to give assistance to our brothers and sisters. Although *Lakota* people do not make any type of fuss over an *ikce wicasa*, most fully recognize that these people are so special that they deserve a high amount of respect and do command the deepest of respect from the people. Sometimes one does not even have to know that a person is a *ikce wicasa* but it will be known because of the way they carry themselves. In today's world, an *ikce wicasa* is often a leader of the people in one form or another and outsiders usually do not recognize their role of leadership at all because their actions are not like what American society defines as leadership behavior.

The interview participant's insight into philosophy, thought, and belief has established them as true leaders in guiding the future of the nation. Many of the participants possess an ability that allows them to travel back in time to visit and communicate with the spirits of our ancestors in a ceremonial context. Most of the interview participants are people who have been given special wisdom that enables them to provide leadership to the people. Most of these folks will never be recognized formally

for their contributions but will, nonetheless, be credited with bringing the nation forward during a difficult time in history.

Of course, there are many among us today who believe, or more importantly want others to believe, that they are truly *ikce wicasa* but they actually are not and so, one has to be careful because they will, and do, try to fool people. Sometimes, they will even refer to themselves in public as being *ikce wicasa*. This type of person was not asked to participate. A true *ikce wicasa* will never broach the subject anywhere or anytime because even to think about it makes them not that way. So, it is a special role they have amongst the people.

Eighteen people were interviewed in all and confidentiality was promised to all interview participants. Not all participants completed the entire interview protocol because some talked at great length on specific topics and made it necessary to conclude the interview before completion (Table 2).

I also used data that was transcribed from three different conference presentations that were given on the specific subject being investigated and these were followed up with informal conversations where notes were taken. The presentations were given by Native People at two different buffalo conferences that were held in Wisconsin and Colorado. The presenter's brought up some interesting aspects that were specific to my investigative research and so I decided to follow-up on these. One participant discussed the idea that certain insects showed the Native People where to find the buffalo and another discussed how corn and buffalo were married. I felt that these two subjects were appropriately connected to my study and it was necessary to pursue them further.

**Table 2.** Interview Participation Information

	<b>Participant</b>	<b>Location</b>	<b>Formal</b>	<b>Presentation</b>	<b>Follow-up</b>
1	WM	Red Shirt Table, SD	X		
2	BCE	Red Scaffold, SD	X		
3	RTC	Batesland, SD	X		
4	LL	Denver, CO	X		
5	RAF	Cherry Creek, SD	X		
6	FD	La Crosse, WI		X	
7	VD	Mission, SD	X		
8	AWH	Mission, SD	X		X
9	FM	Kyle, SD	X		X
10	GHA	Bear Butte, SD	X		
11	VHE	Eagle Butte, SD	X		
12	BKS	Kyle, SD	X		
13	JM	Dupree, SD	X		
14	MBB	Deadwood, SD	X		
15	ECL	Denver, CO		X	X
16	BM	Bismarck, ND		X	X
17	VD	Denver, CO		X	X
18	JAH	Kyle, SD	X		X

I encountered difficulties during the data gathering process. During some of the interviews, the hand-held tape recorder malfunctioned and the interview was then reconstructed from notes taken during the interview. Due to difficulties getting people to agree to an interview and to actually be there for me after having traveled great distances to remote locations in surrounding states, the study took place primarily in South Dakota. I also had a very difficult time finding a person who would transcribe my interview tapes word-for-word as I would specify.

The interview participants represent a broad range of types and backgrounds. Among the people interviewed are five tribal college instructors, four Doctors of Philosophy, and six who are considered to be healers within their respective communities. All have distinguished themselves through significant contributions to the Indian community in some manner such as their research and work in journalism.

education, wildlife and cultural-ecological restoration, ethnobotany, ethnoastronomy, or anthropology. Several have distinguished themselves in more than one of the aforementioned fields. For example, one person with a Ph.D. held degrees in theology, law, and history. Five of the interviewees have passed on to the spirit world since granting me an interview. My thoughts regarding this are that this research project should have been conducted years ago.

A set of eighteen questions were asked each participant regarding the major components of the grassland ecosystem was asked of each participant. The questions were roughly broken down into six each about bison, native plants, and Native People. The questions sought to illicit specific knowledge about the native plants that are used by the people, about the buffalo, and knowledge about the people and their use of natural resources. All interview participants were asked similar questions from the interview protocol.

#### Qualitative Methods/Grounded Theory

Typically it is the deductive/hypothetical model that is associated with theory building, however within the qualitative paradigm the grounded theory approach can also build theory (Glaser and Strauss 1967). In grounded theory, the “grounded” refers to being grounded in the empirical world, theory is induced from the details of this “grounded experience” in the real world. The theories that will develop will be grounded in the real-world patterns of experiences. Theory follows data rather than preceding it. The patterns or “theory” embedded within the data are discovered through a data analysis process called “constant comparison” or constant comparative analysis (Glaser and

Strauss 1967). The concept of “constant comparison” refers to the process that data are ordered into preliminary categories of codes (open- or first-level codes) according to their conceptual context, and then constantly compared with each other to establish categories (axial- or second-level codes). These second-level codes are more abstract and organize the first-level codes. Glaser and Strauss (1967) indicate that categories must be readily, not forcibly, applicable to the data. This is an inductive process... it is the discovery of patterns and theory from data.

#### Qualitative Methods /Constant Comparative Analysis

This method begins by open-coding the data where the data is closely observed line-by-line for the purpose of finding and locating the data into one of the codes that were previously established. These open-codes are examined through the process of constant comparative analysis to produce a more analytic or abstract category that holds a group of the open-codes together. This second grouping is called axial-coding that forms major categories that induce a theory or conceptual framework that denotes the relationships between and among categories. This final- or summary-coding is referred to as the “selective-code” or “core-category.”

The following is a description of the step by step process that I followed in developing the conceptual framework or theory that the data produced.

Step One: Each taped interview was transcribed and the interviews varied in length from 1-hour to three-hours.



Step Two: Each transcription was Level-I coded using “open-coding.” method (Glaser 1987; Strauss 1987; Strauss and Corbin 1990). The open coding process produced concepts (codes) that fit the data (Hutchinson 1988; Strauss 1987). Particular attention was paid to data that could generate concepts that relate to interactions among subject actors, strategies and tactics, and consequences of interest to the research questions (Strauss 1987).

Step Three: Each of the concepts generated by open codes were examined to find relationships and to elevate (inductively) the open-codes to more abstract levels or to Level-II codes (Hutchinson 1988).

Step Four: The concepts and relationships produced by the Level-II coding was then analyzed across all participants and important classification variables for the purpose of finding the major constructs/themes of Level-III that will allow the data to speak to the major research questions of the study (Hutchinson 1988).

These steps are guided by the constant comparison of the data (Hutchinson 1988). The purpose of this method is to constantly compare concepts and themes to produce the similarities and differences that can lead to an understanding of the data. This model is designed to produce a conceptualization among all three levels of coding that weaves all data together (Glaser 1987). In Level-I, the data are listed in bulleted points. In Level-II, the data points are then categorized and the subcategories, or the concepts, are subsumed as properties, conditions, consequences, and strategies. It is a set of procedures where data are put back together in new ways after the initial open-coding by making connections between categories. Level-III is the process of selecting the core category.

systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development. Core-categories are developed that become the central phenomenon around which all the other categories are integrated. A descriptive narrative is developed about central phenomena of the research study. The conceptualization of the story is the core category. The process goes from open-coding (words, etc.) to axial-coding (categories and relations among categories) to core-condition (comprehensive pattern) to grounded theory. This third-level is thus a story line made from all of the core categories. Featured highlights of the data are all rolled into a story regarding each initial category or code. The data on each category is made into a story that reads as descriptive narrative of the relationship between the two entities of the categories.

#### The Researcher's Role

The researcher is a *Ho Hwoju Lakota* Indian person that grew up along the Cheyenne River in South Dakota about thirty or so miles upstream from where that river joins the Missouri River. As kids, my brother, two sisters, and I rode our horses, along with several of our cousins to a small country school. We did this everyday of the school year regardless of whether the temperature was above or below freezing. We lived on the Cheyenne River *Lakota* Reservation until I was about 10-years old and then we ended up having to sell our ranch to my Uncle Lee because my father was seriously hurt by a horse. We moved to Los Angeles, CA where my father had the radical surgery that was necessary to heal his broken back. I ended up living away from the reservation from 10-years of age until I was drafted into the military at the age of 19. The US Army

discharged me after a 14-month tour of duty in Viet Nam and I returned to the reservation mainly because I needed some peace and quiet. Because of my experience in a war zone I was a little older than my peers, so I actively sought out the older people around my home and I became friends with many of them. I needed to hear the stories of times past and also needed to catch up on exactly who my community was. I eventually befriended a whole generation of my relatives that were my parent's age very well and I got to know our family and *tiospaye* through each of them. I got to know many like Chauncey, Millard, and Percy Dupris, Bevins Circle Eagle, Sr., Stanley Looking Horse, Marcella Red Bull, Moses Bad Male, Ruth Garrett, Sullivan Larrabee, Stanley Red Bird, Silas High Elk, Sarah and Henry Red Horse, and Alma Pearman, etc. Most were my aunts and uncles and many had such great names: the kind of names that are not used anymore. Even today, I still mourn the passing of this generation of Indians mostly because they were near and dear to me personally, but sincerely wish that I could have done this research study with that bunch because they knew so much more than do the Indians of today.

I do not assume, nor do I pretend, to speak on behalf of my nation nor even the people of my home reservation. However, it should be noted that on several occasions the Tribal Chairman and/or the Tribal Council has asked me to speak on behalf of our Tribe on at certain meetings or special occasions. I've also been selected at different times to speak on behalf of several organizations, the *Lakota* Treaty Council, the *Maka Luta Tiospaye*, the *Sitanka Okolakiciye Wokiksuye*, and the Cheyenne River Community College. I say this not to be a braggart, but because some of my academic colleagues appear to have a difficult time understanding that a Native scholar can also be a respected

traditional leader as well. There probably always will be non-Indian people who automatically make the assumption that they have the right to decide who is or is not legitimate within the Indian community. The days when any Indian community blindly accepts this kind of treatment by outsiders are long gone. The point of this discussion is that my community collectively decides who speaks for them.

The path that has led me to conduct this research involves how strongly I believe that contemporary grassland ecological restoration projects are not really true restoration efforts because very few if any include Native People either as inhabitants, long-time users/consumers, or advisors/consultants. Native People have always been an integral component of many ecosystems and to not include them in an ecological restoration effort constitutes a false restoration. This is especially so with the *Lakota* in the grasslands. It is believed by some (Fischer and Roll 1998; Deloria 1992, 1995) that Native People have played vital roles within their respective ecosystem. Fischer and Roll (1998) believe that Native People played a much more significant role in the shaping of the grassland ecosystem than we currently understand. They believe that the people contributed by burning, harvesting, manipulating the ecosystem over hundreds of years so that the system was very different because of the various types and degrees of manipulations (Fischer and Roll 1998). In my opinion, many scientists and/or natural resource managers have not given Native People enough credit for maintaining the integrity of the ecological systems they've resided within and cared for over the centuries. Nor do these same scientists seem to care about the tremendous amount of ecological knowledge the people have accumulated.

My biases are self-evident. I am, and always will be, closely aligned with Native American society. However, I make a serious attempt at being as truthful as is feasibly possible within the context of my research. Although I am a part of the *Lakota* community, my perspective is valuable because I walk in two worlds. I am a bridge between the *Lakota* and the American cultures. It is precisely this bridge aspect that enables me to interpret the data gathered in the manner of this study. Ever since first contact between the two cultures, there have always been people that were referred to as *iyeskas*. In the old days, this meant an interpreter but in later times, as it does today, this term means someone who is of mixed-blood descent. Sometimes it is used in a derogatory manner but the truth is that I am a mixed-blood that is extremely knowledgeable of both cultures. The perspective of the “insider” is oftentimes more valuable than are the perspectives of those of an outsider because the insider can interpret by adding meaning and context to data. Even with outsiders that have spent long periods of time embedded within a community we still see the community from the perspective of an observer and not a participant.

I’ve received access to the interview participants precisely because of my participation in the cultural affairs of the grassroots people. I’ve been an active participant in the spiritual, cultural, and ecological affairs of the Cheyenne River Reservation, and the *Lakota* Nation as a whole, ever since my return from Viet Nam. I’ve contributed to the revival of a sacred *Lakota* ceremony that was nearly lost to our people. This ceremony called the “*wacigala*” was nearly lost during the time period of 1884-1978 when the U.S. Government forbade Indian people to participate in traditional spiritual ceremonies (Mooney 1896). The *Sitanka Okolakiciye Wokiksuye* revived the *wacigala*

ceremony in 1990 after many years of its absence from *Lakota* life. Consequently, many Native People have a large amount of respect for the Bigfoot Riders because of this revival. We, the Chief Bigfoot Memorial Rider's, made tremendous personal sacrifices to pay tribute to the *Sitanka Tiospaye* that were killed at the Wounded Knee Massacre of 1890 by riding horseback for five consecutive years in temperatures that were sometimes as low as 50° below zero Fahrenheit with the wind chill factor. We rode our horses the distance of several hundred miles from the Standing Rock and Cheyenne River Reservations to the Wounded Knee Creek Massacre Site on the Pine Ridge Reservation. This occurred during December of each year and we were retracing the footsteps of Chief Bigfoot's Band who was fleeing the US Army at the time. We hold a ceremony at their gravesite each year and usually the temperatures are bone-numbing freezing cold. I remember one year when even my horse was shivering so bad I had to get him to shelter behind a building.

It was oftentimes difficult for me to get a person to participate in an actual interview. Several times I traveled long distance to reservations in other states to interview someone only to find they would not be there as was previously promised. Many nearby people found every excuse in the world to get out of sitting still for an interview. It took me over a year to actually nail down an interview with my very own brother.

In the end though, I prevailed by presenting evidence that convinced them to cooperate. Most often this evidence had to do with the fact that this research study will contribute to the knowledge of future generations of our Nation by writing much of our cultural-ecological knowledge down before it quietly fades. We all wish that our youth

would learn this knowledge before it is lost altogether but this is becoming increasingly difficult with each passing generation because the youth of today seem intent on adopting other people's culture. For reasons only they can relate to, they see more value in the American inner-city culture that is depicted on television and the movies. When I presented my arguments for preserving our cultural knowledge through participation in my research study, it did not take too much convincing to get my contemporaries to participate. After all, something that has even a slight chance of turning the attitudes of young people around in order to get them to see the long-term value in our culture has to be better than not trying at all.

## RESULTS

The following section represents a collection of data that was collated into narratives. It is presented in a collective narrative form that is taken from all the participants and combined into one story. As stated in the methods section above, the data is developed into a running narrative that allows the story to be told. These narratives are not the researcher's, they are statements of all the participants that are combined into a story. I classify the knowledge contributed here as "sacred ecology."

### Ecological Practices - Philosophy and/or Beliefs

To the *Lakota* people, it is of no consequence what the western historian or anthropologist says because the people know they originated in the sacred Black Hills. The *Inila Oyate* (Plant Nation) was chosen to lay down a beautiful carpet of grass for the buffalo to come to earth and tell the *Lakota Oyate* how to live their lives. The buffalo has

taught them to protect their families and each other through strong spiritual thoughts and belief. In turn, the buffalo is looked upon as a sacred brother and a role model.

During difficult times, the *Pte Oyate* sent a woman called *Pte Skanwin* and she appeared to give the people instructions. Some of her instructions were to not waste resources or they may be lost forever. Live by the philosophy of taking only what is needed. If something is taken, give back twice as much. We are only a small part of the circle of life no better nor any worse than other part of the circle. She taught the people the Seven Sacred Rites and how to pray and to sing certain songs in reverence.

Consequently, the people always lived in a harmonious way with the other species. This philosophy is called “*mitakuye oyasin*.” The people had a very small footprint in the environment. Many spirits reside within our bodies and need to be balanced. Knowledge needs to be passed on to the next generation. When the Euro-Americans took our children away to boarding schools, this broke the chain of knowledge that had been passed down through the generations for millennia. The Creator meant for the people to practice their way of life forever. Patience is probably the most important virtue among the Native People and the contemporary situation is surely testing their ability to be patient.

#### Relationship between *Tatanka* and Native Plants

*Tatanka* and native plants communicate with each other about which plants can be used as medicinals for healing and can pass this knowledge on to human beings. The buffalo has also been assigned a specific role within the grassland ecosystem by the Creator and will eventually show this power to some humans that are worthy of the



knowledge. *Tatanka* has been given or assigned certain plants to eat. He wakes up the plants in the spring time w/ the vibrations of his hooves so they will begin their annual growth cycle.

*Tatanka* likes to graze burned areas for the tender new shoots of grass that are come up in the springtime. A participant said that it appears that *Tatanka* does not cause the same type of damage to the ecosystem as do the European cattle because *Tatanka* is very picky (selective forager) about what they eat. If given enough choice of forage, he will only consume the grasses and will leave the forbs, thus assisting in the development of a biologically diverse ecosystem. His role is to create disturbance on the prairie and he does so through his constant movement. This movement assists in disturbing plant life by mowing, trampling, hoofing, horning, rubbing, and fertilizing. His constant rubbing and trampling of plants invigorates their growth nodules and they become healthier because of being disturbed. He also has been assigned the great task of extending the range of plants by transporting their seeds in his fur or by excreting the seeds in different geographical locations.

*Tatanka* is a very strong spiritual creature and has certain powers given to him by the Creator that invigorates the plant life around him. He has the ability to use the plants as medicinals and can use them for his own health or show them to others. He can heal himself by consuming certain plants that grow in certain locations at certain times of the year. He communicates with plants through his keen sense of smell. He makes sacred things happen on the prairie just through his presence and this power can rub off on those that come near him.

### Relationship between *Tatanka* & Native People

The Native People followed the bison around and tried to hunt only the larger herds. However, neither the bison nor the Native People can roam around wherever they choose anymore like they are meant to do. *Tatanka* managed themselves well and chose their favorite places to graze such as along the Good (Cheyenne) River in modern day west-central South Dakota. The people kept a vigilant eye on the bison because they were absolutely necessary to the survival of the people.

The buffalo and Native People share a special spiritual relationship because the buffalo were human and the *Lakota* people were buffalo at one time in ancient times. The *Lakota* people were the spirits of the buffalo and a sacred brotherhood has developed over time that some refer to as a “sacred symbiosis”. The sacred pipe is what completes the connection between them and the buffalo. This pipe was brought by the representative of the buffalo and it represents a way for the people to stay on the “red road” or the good path that the Creator intended for the people to walk. The bowl of the pipe is made of a specific red stone (*Catlinite*) that is taken from the Earth in only one place and the stem is made from the white ash tree that is native to the Great Plains. The red stone is a metaphor for the blood of the people and the ash stem is extremely durable and represents the backbone of the people.

The buffalo as a role model is considered to be a teacher. Among things that the buffalo has taught the people are the familial traits that were adopted by human beings. Although the buffalo is entirely capable of managing themselves, they prefer to be near the *Lakota* and allow the people to manipulate the ecosystem to benefit all the species and especially the buffalo. The buffalo show the people major lessons about how to live

and they also illustrate that if one lives a good life, then a good healthy life will follow. They teach the people that if they are patient, their prayers will be answered at some point in the future. An example of this would be the prayers that were given by the ghost dancers at the end of the nineteenth century are now being answered... the buffalo is coming back.

*Tatanka* also show that buffalo have craziness amongst them as well and that this behavior is a natural part of life. There are examples of crazy buffalo exhibiting weird behavior towards people and this is understood as a lesson that illustrates that there always has to be positive and negative forces in the world, there will be bad with the good, and black with white. One has to know positive in order to understand negative. This is very much like the ancient Chinese belief of circle with the yin and yang.

According to one collaborator, the buffalo resemble a sundial to the *Lakota* because they show the people where they are to be for their obligatory spiritual ceremonies at specific times of the astronomical year.

#### Relationship between *Tatanka* and Other Animals

A special relationship exists between the prairie dog and the buffalo. This relationship consists of the prairie dog continually trimming the plants in their village and keeping them in a vegetative state. Consequently, the plants inside the village complex are more nutritious than plants outside because they are continually in a growth stage. Buffalo contribute to the trimming of these plants on the outer edges of the prairie dog village and thus help keep the prairie dog safe from predators. The pronghorn also have a similar relationship with the prairie dog and they also contribute to keeping the prairie

dog safe by foraging in the very center of the village complex. The buffalo will wallow and roll in the dirt in the prairie dog village because there are medicinal effects from getting the dirt from the village on his hide. The contributions that buffalo and pronghorn make to the village should not be underestimated because there are species whose survival depends on a healthy prairie dog village complex. This contribution to the biodiversity of the ecosystem should be honored.

Some native species of the prairie, such as the prairie dog, the bear, the buffalo, etc., show by their behavior and character which plants can be used for medicinals and food sources. Their willingness to show this is interpreted as to their wish to share the bounty of the grassland ecosystem with the *Lakota*. Each species has a certain job to do within the system and some have larger more visible roles than others such as the buffalo as he is looked upon as the master of his environment.

#### Relationship between Native People and Native Plants

The *Lakota* have always felt that they have a spiritual obligation to create disturbance within the ecosystem. Among many types of disturbance that are created, they have always set the prairie on fire for various reasons. The Native People used several management methods that used fire for different purposes; 1) to restore the integrity and vitality of the grasslands, and 2) to bring the buffalo to them because they knew they loved to eat the tender young grass shoots that would spring to life after the grasslands burned. The people understood the concept of over-use and subsequent depletion of their resources because they always used a lot of natural resources. An example is that the horse herds ate much grass and so camp had to be moved frequently.

Many people today do not understand that this type of intensive natural resource management was occurring a long time ago before the Euro-Americans arrived. Natural resource management is not something that exclusively belonged to the Euro-American

The Native People had a special relationship with the plants as a nation too. They were able call upon the plants to come to them so they can be used for healing sickness that occurred among the human beings. Some people with special powers can locate plants by their aroma in a similar fashion as do the animals. The *pejuta wakan* among the Native People sometimes can call the plants to them and some can even make the medicinal plant grow right before them. These people with special powers can even use special plants to rub on their hands so they will not get burned by the hot rocks in a *inipi* ceremony.

The *Lakota* had a very special knowledge of the plant life that surrounded them. They employed about 300 different types of plants for a wide variety of uses. Many different plants were used as foods at different times throughout the entire year. Some such as the *timpsila* were dried and can be used year round, while others such as the mouse bean were considered delicacies because they could only be found at great expense of time and consequently were always in short supply. The mouse bean is small and difficult for humans to harvest. They observed and learned from the mouse and were able to obtain them through a special relationship with the mouse.

Some plant species were special spiritual partners to the Native People. The Cottonwood Tree is one of their special species and in fact, the *Lakota* consider it to be the equivalent of a “keystone species”. This particular tree provides shelters and

subsistence for a wide variety of species all year round but especially during the harsh winter months.

The people knew that not all plants were good and that some were harmful if eaten or otherwise messed with and so they had great respect for the power that resided within each type of plant. The people witnessed that certain plants made their horses sick or abort and would avoid these plants. There used to be an old man that lived around Cherry Creek that went deaf and he told people that he ate a certain kind of wild plant that made him lose his hearing. Many plants are special medicinals that are to be used only by experienced people that possess the power and knowledge of the *pejuta wakan*.

#### Relationship - Interactions among Species

The animals of the grasslands know their individual roles within the ecosystem and respect each other and the roles they provide. The animals provide knowledge to the Native People for their survival and they also provided medicines through allowing the humans to eat their healthy flesh. Many different types of grazing and browsing animals utilize the same areas of grassland because they all have specific food plants that they are assigned to consume by the Creator. The Native People residing upon the grassland ecosystem made use of all the different species.

The animals throughout the prairie ecosystem taught the people the virtues of life and life lessons. The *Lakota* and all other species developed a deep respect for each other as a result the other species helped the people survive. The animals would offer themselves as food because they knew that the people would become very healthy if they ate a wide variety of foods. The very fact that the other animals ate healthy native plants

from the prairie made them a healthy food for the people. This is the way that animal species provided medicines for the *Lakota* people. In this way, all the different species provided themselves as medicines for the others and they worked together to help each other.

The different species would observe the others and learn what their food sources were. They would also observe how each other hunted and learn their techniques. The badger and coyote have had a long established collaboration of hunting together. In ancient times, the *Lakota* and the wolf hunted together and that is how the people learned their hunting techniques. However, it is recognized by the *Lakota* that there are certain relationships amongst other species that we will never understand until the proper time has come about.

The Native People and all the four-legged animals lived together and all got along well with each other. The grazing and browsing animals that share the grasslands each have their own specific food plants. This was assigned by the Creator and none violated this assignment except under extremely hard times. The *Lakota* hunted all animal species and they ate whatever they hunted and killed. The people always left some behind for the others such as the wolf, eagles, coyotes, or bears.

Some foods were recognized by different species as medicines for certain ailments and so were left for when they were needed. The different species of animals relied on each other for a variety of things such as security. Many times the elk and buffalo would graze near each other simply for the reason of having extra eyes watching for predators.

### Ecological Knowledge – *Tatanka*

The bison is a special animal because he can find the medicines that he needs to heal himself and he will show the Native People these plants. He will go to areas where these certain plants grow so he will have them at his disposal. The bison recognizes that he has a certain role both within his society and within the ecosystem. His role in the ecosystem is to continually trim the plants and to fertilize them. The bison understands that he has a spiritual role to play in the grasslands and today he also recognizes that he has a crucial role in the restoration of these very same grasslands.

The Native People knew that after a fire, *Tatanka* would be there the following spring and so, they burned portions of the grasslands regularly. They would burn also because they knew that the fire would restore the vitality of the plants. *Tatanka* taught this to the people. The people knew that when they saw an imbalance of males and females among the bison that they must hunt them so that they were in balance once again.

The Native People were keen observers of the bison and they cataloged many character traits. They knew that the bison was a social animal much like themselves. They witnessed what looked like to them the bison expressing certain emotions like grief for the loss of a loved one, care for their relatives that were ill, and that they will protect the weaker ones and their young. If there were a white buffalo among the herd, the other buffalo would always keep the white one in the middle of them so that no harm would come to the rare one. The people witnessed the bison swim easily across deep bodies of water and that they would assist their young to stay afloat while the herd was swimming.



The people also knew that the bison recognized each other through their keen sense of smell.

The bison exhibit behavior that is akin to human familial traits and they have a strong sense of spirituality. The people would tell their children to watch the bison when they play and to learn from them. The people also witnessed that during the very season that humans performed their annual Sundance Ceremony, the bison too exhibited what looked like a deep spirituality during that same astronomical time of the year. During these spiritual times of the astronomical calendar year, the bison seemed drawn to the huge fields of sunflowers and would remain among the sunflowers for quite awhile. The bison would move in a giant circle following the annual circular route of the stars. In the *Lakota* territory of what is now present day South Dakota, the people knew that the bison loved the Good River (Cheyenne River) area and would travel up and down the length of it over the grazing season. The bison would take care of themselves by living in a good way. The Native People always observed and learned from *Tatanka*. The people honor the buffalo because he voluntarily gives his life so that the *Lakota* will have enough to eat.

Unfortunately, both the *Pte Oyate* (Buffalo Nation) and the *Lakota Oyate* are stuck on reservations today where their lives are no longer as rich as they once were. They have both been forced to become sedentary animals and struggle to live in a good way.

#### Ecological Knowledge - Plants

Native People understood that the prairie plants need disturbance. They need this disturbance in order to produce viable fruit. The many types of berries, etc., that the

people ate were directly tied to whether they had undergone disturbance. The people feel that if a plant lacks disturbance, then it will lose its spiritual powers and the fruit that it bears will no longer be good to eat. Quite naturally, the people managed their plants by subjecting them to constant disturbance whether it be harvesting their fruit, burning them, or having the animals use the plants to rub on. The people always harvested what they could, but they were always very careful to leave some for whatever other species may come along and need something to eat as well.

The people understood that when the plants were subjected to fire, then the plants would bear better fruit and the subsequently the plants would be much healthier. The fire will enhance plant succession by stimulating the nutrient cycle. The burning will bring integrity to the ecosystem.

The Native People fully understand that plants have to be pollinated and they recognize today that with fewer and fewer native bees about, the plants are getting weaker and even become sterile. They also recognized that some fruit was much too small for humans to effectively harvest and so they would enlist the help of other species, for example the mouse would help harvest a certain small bean that the people knew to be both delicious and nutritious.

There have always been many *Lakota* people that use plants, animals, insects, or natural powers such as lightening to heal with. The medicinals have come about because the people were shown how to use them while beseeching the Creator in a spiritual ceremony for a method to help their relatives. The *Lakota* call it *hanblecheyapi* where a person sits on a hill and asks the spirits for a way to heal a sick relative or a way to help the people in general. This has resulted in some very powerful people among the *Lakota*.

These people are sometimes called a *pejuta wakan wicasa* (a healer that uses plants). In order for a person to receive this type of knowledge, they must be willing to only use the knowledge to help others and not for personal gain. They have to think a lot of the health and welfare of the Native People and of all the other species. There are many different types of healers that have special powers. For example, certain Native People can sing or pray the wild game or plants to come to them. (Special Note: This author has personally participated in a ceremony, while conducting this research, where a young man sang a special song to ask the buffalo to come to him and they did!). Another participant in this research study uses 180 plants to heal with. I was told by a participant that his uncle was able to perform laser surgery with by using a certain plant and lightening together and not unsurprisingly; this man was looked on as a very powerful leader among the people.

The buffalo understand that sometimes they have to eat the grass down to nothing but they know that when this happens, there will be a certain mossy-type plant that will come into that area and its power will replenish the grass once again. The buffalo gives assistance in keeping the prairie healthy this way. They located certain medicinal plants by their specific smell and would travel a long ways to find the medicinals.

#### Ecological Knowledge - Other Animals

The *Lakota* people knew their territory on an intimate basis and they also knew exactly what the inventory of their resources looked like. Each band within the *Lakota* Nation had a distinct geographical areas that they resided in and therefore had jurisdiction over. They would use certain areas during specific times of the calendar year. Usually they would use their territory that led them in a circular route that would lead them to

where the next *Oceti Sakowin* (Seven Council Fires of the *Lakota* Nation) annual gathering would be held. They would hold certain areas within their territory in reserve in case of severe drought or other critical need. However, everyone shared and sometimes other bands would experience drought in their territory so would be in need of a hunting area and so the bands would share with each other in this way.

Native People knew they were not supposed to change their physical environment, but they also felt that they were spiritually obliged to disturb it on a limited basis. This meant that they burned certain areas that were important for them. The burning was used a method to invigorate the plants and to bring the buffalo to that area. The buffalo was also an agent of change because they would create an extreme amount of disturbance to an area. They would not only consume most of the forage in an area but would create wallows, rub on bushes and shrubs, knock down small trees, etc. In short, they would wreak temporary havoc and then they would move on to another area.

The environment was always very important to the *Lakota* and they were always trying to conserve. They would try to hunt only the large buffalo herds and would try to allow the smaller herds to replenish themselves. Sometimes, the people would see that things were out of balance and need to be put back into balance. One thing they saw on occasion was that the buffalo herds would consist of more of one gender than the other. The people understood that this had to be fixed and so they would hunt only that gender that had higher numbers. The *Lakota* felt that they had an obligation to maintain this fragile balance within the ecosystem. However, the people were like most people in the world and valued a variety of foods and so the hunters would focus on a wide variety of species for food. This also conserved and preserved specific species from being over

harvested. There was a very wide variety of plant and animal species that were harvested and consumed by the *Lakota* people. They also knew that it was their responsibility to help the other species too. They would leave some of their harvest for the other predators and scavengers so they would have enough to eat.

The people relied heavily upon their star knowledge. The stars would illuminate the seven sacred spots around the Black Hills territory at different times of the year.

The people know that there are lots of plants on the prairie that have medicinal properties and have either shown themselves already or will show themselves in the future. In fact, the *Lakota* continually are given plant knowledge by the Creator as the years go by. As an example of knowledge given, one participant discussed how his uncle was able to heal by using a certain plant in conjunction with lightening to cut out cancer from a patient. However, the some of the *Lakota* people are becoming worried because they feel that with the forced introduction of the western farming and ranching methods of managing the land into the *Lakota* territory, the prairie is becoming a monoculture. They feel that without the necessary disturbance within the ecosystem, it is suffering and many native species, both animal and plant, are dying back to the point that they are becoming peripheral and no longer usable.

#### Ecological Practices - Governance

Decisions were made by a group of experienced older men in council with each other. This was on both a band-level and a national-level. Many short-range and more immediate decisions were made at the band-level. The larger long term decisions were made at the *Oceti Sakowin* annual gathering of all the bands. They followed the natural

laws that the Creator had given them to live by when the White Buffalo Calf Woman was sent to talk with the *Lakota*. These councils were charged with planning environmental and resource-use. They established territories for each band and annual and seasonal time schedules for camp movement both for resource-use planning and to know where each band was at certain times of the year. Decision-making for the entire nation occurred at this great encampment.

There were men's societies that kept strict order in both the camps and during communal events such as communal hunts and ceremonies. These societal duties were rotated through several societies and they were essentially the policemen of the old camps. Rule violations were severely punished, especially if a violation occurred during a communal hunt where the band was attempting to secure essential food to carry them through the winter months. If someone caused a failure of the hunt, they were severely punished where their camps were either destroyed or given to others.

Practicality oftentimes combined with the spiritual. There was a certain amount of governance through the spiritual ceremonies. One was population control. The ceremonies were sometimes used to control when women could get pregnant.

#### Ecological Practices - Spirituality

The Cottonwood Tree is recognized by the *Lakota* as being key to the survival of many species on the prairie landscape. This is where most species' lives revolve around the gallery forests along the riparian areas and this certainly did not go unnoticed by the *Lakota* people. This concept is very similar to western scientific explanation of what a keystone species is to the ecosystem. It is the Cottonwood Tree that ensures that other

species have shelter from the harsh weather on the prairie and food for their subsistence. The cottonwood forest also provides the human component of the ecosystem with a much needed energy source as well. The forest provides equally for all species. Because of this deep recognition of the Cottonwood Trees' importance within the system, it is invited to participate and become an honored guest in the Sundance Ceremony.

The medicine men among the *Lakota* are herbalists and botanists. They are the ones that will establish and maintain the connection between humans and the spirit world. They do this by praying with the sacred pipe, by heating stones in a fire and throwing water on the stones, and also by ensuring the proper protocol is maintained during the ceremonies, especially during the annual Sundance Ceremony.

Animals convey knowledge to humans by sharing their understandings of the plant world that surrounds us. They show which plants can be used for medicinals, where to find them, when to find them, how to pick them, how to fix them, type of potion, and how to administer them to the ill. Offerings are made to the spirits for the bounty the earth has given the *Lakota*. This is the teaching of the sacred White Buffalo Calf Woman.

The people would always give thanks for what the Creator has given and this is what made the *Lakota* the healthiest and strongest people in the world. It is felt that the Creator provided whatever the people needed.

The *Lakota* have developed an understanding of the world that some call a philosophy. This understanding is called "*Mitakuye Oyasin*" in the *Lakota* language. This saying literally means "all my relatives." What is behind this saying or prayer is the fact that the *Lakota* people are really saying that all life is my relative and that they pray for the welfare of all life.

The whole idea of using animals for food came as a sacred covenant from the Creator. It provides that animals may be used for food if they are properly thanked for their contributing to the health and well-being of the people. It is felt that some species, both plant and animal, have lots of spiritual power while others do not. The people in turn do not like to eat anything whose spirit may be weak or do not have a strong spiritual power because they believe that by eating something that is weak, then the people become weak as well.

Although all species are sacred to the *Lakota* in the exact same way as are the deer, elk, bear, etc., the buffalo was high on the list of honored and loved species. The buffalo is considered to be especially sacred because it was the *Pte Oyate* that sent a delegate to the people and told them that the buffalo would always be there for the people to eat as long as they lived a good life. Since that time, the buffalo and the *Lakota* call themselves brothers. The people believe that if you give your trust to *Tatanka*, then they will give trust back. The people believe that when the spring comes and the buffalo begins to move about more, their hooves wake up the plants root systems for their annual growth cycles. The buffalo sings special songs to the people and this means that he has something that he wants to share with the people. This special sharing is quite often some type of knowledge about using plants as medicinals. It is the buffalo that has taught the *Lakota* all their spiritual ceremonies that are called "The seven sacred rites of the *Lakota*." The *Lakota* have a special dance they dedicate to the buffalo.



## Ecological Practices - Utilization of Natural Resources

The *Lakota* leadership planned for how much resources would be necessary to take care of all the people. An extreme amount of planning was necessary so that resources available would be enough to take care of them during a long harsh winter. Shelter during the winter was paramount however, putting aside enough food resources was almost equal. They would plan in advance to the best of their ability in predicting where the game would geographically be best during each season. They people knew that the buffalo would follow where certain plants grew best during which time of year and the people would follow the buffalo in the exact same way. The buffalo provided everything that the *Lakota* needed and thanks was given all the time. Almost every part of the buffalo was used and it has been documented that Native People had over 100 uses for the buffalo. The people did not waste their resources and they used them wisely. Part of that wisdom was that other species had to eat too and so, the *Lakota* would leave behind enough for the others such as the eagle, bear, wolf, etc., to have something to eat. There was great concern among the *Lakota* when the Euro-American began killing buffalo and leaving them to rot and that is why the *Lakota* fought back so hard.

Each band had traditional territories that they called their homes and each family had distinctive markings on their hunting implements. The annual *Oceti Sakowin* encampments were held in different locations each year because of the recognition of the great environmental cost each encampment had on a particular piece of land. There were many conflicts with other tribes, such as the *Crow* and *Pawnee*, over natural resources and territory.

Among today's concern, people believe that great care needs to be taken on how we use the buffalo and also in how we treat them. The people believe that if we do not use them wisely, then they may go away for good this time around. They also believe that we need to begin setting aside more land for communal usage such as building adequate buffalo reserves. They also want to give the grasslands a break from being constantly grazed by livestock.

### Ecological Practices - Post-Contact with Europeans

The coming of the Euro-American into the territory of the *Lakota* Nation brought about many changes to the ecosystem. The very first change was that the intrusion of the white man and his livestock disrupted the natural grazing cycles of the buffalo. The Native People knew that the white men were killing off their valuable game and that the wild game began fleeing at the approach of humans. That is when the trouble began and it has been a constant struggle between the two cultures ever since.

The colonization of the Northern Great Plains ecosystem has brought severe change. This dramatic change has come in terms of land management methods that are in direct conflict with the Native People's methods. The Euro-American did a lot of things to the land that were in direct opposition to how the *Lakota* had always managed their land and resources. First, there is attitude that all fire is bad and has to be stamped out before it can do damage. Secondly, the immigrants began turning the prairie upside down and growing grain crops. This essentially converted the prairie from production of perennial plants to annual production. This has completely annihilated the biodiversity of the prairie. The prairie ecosystem has literally become a monoculture. It has become a

monoculture now because many of the native species are missing completely with their niche being filled by invasive species from another part of the world and the balance is thrown out of whack.

The fencing of the grasslands has done more to kill the grassland ecosystem than just about anything. The fencing has elevated humans to the role of the Creator because now they are the gatekeepers and the grazing animals cannot move about unless humans open the gate. The imported livestock eat down everything in its path year after year. It is literally like burning the entire prairie every year for over one hundred years. This has drastically reduced the number of forbs that naturally grow in the grasslands and contributed greatly to the monoculture. European cattle have contributed to the drastic amount of soil erosion in the Northern Great Plains as well as introducing diseases that are not native to North America.

The European people have only been here a short while and look at the damage they have done to the ecosystems throughout North America. They have greatly contributed to the ruination of the grasslands by plowing them under. We are in a period of a great killing off of native species right now. What has happened to the buffalo and the *Lakota* people has subsequently happened to the black-footed ferret, elk, grizzly bear, wolf, etc. The federal government planned for the *Lakota* to be a landless people and even though they did not complete the job one hundred years ago, they are now making us landless. Even though we hold title to lots of land, we are powerless to do with it what we want. This has displaced and dislocated the Indian people so drastically that they are almost completely removed from the circle or web of life. Many Native People no longer

think native anymore and they also think of themselves as better than any mere animal. Essentially, they have placed themselves outside and above of the web of life.

If there is one thing that has completely displaced the Indian today though, it is the reliance on preserved and hormone-injected foods. The diet of the Native People was once a very healthy one and it was reflected in the health of the people as a whole. Today, new diseases are creeping into the Native Peoples lives from eating high fat and high sugar diets.

The colonization of Native People and the grasslands, the active extermination of native animals and plants, especially the near-extirpation of the buffalo, are leading up to the total disintegration of the grasslands, both as an ecosystem and as a community.

#### Analysis of Data

There are many aspects of the relationship that exists among the major ecosystem components of the grasslands. This investigation centers upon the historic dependence of the three major components. The situation has inexplicably been altered because of the plowing of major portions of the grasslands of the Great Plains, the near-extirpation of the bison, and the displacement of the Native People from their traditional landbase and their former lifestyles. How long this altered state remains in place is anyone's guess. Is this extreme disturbance a temporary one or will the relationship undergo permanent damage that will be forever?

Some people tend to think that as long as the individual components are still present, then the relationship can be reformed in the future. The adage "old instincts die hard!" may be truer than we dare believe. An example of this is when a friend who raises

both bison and wolves on his ranch brought them together for the very first time. they both reacted with ancient instinct. The bison immediately formed a half circle and made serious attempt at intimidating the young wolves by pawing the ground and snorting. The wolves were significantly intimidated and immediately put their tail between their legs and skulked away. All this was done without any word from the human being that was present. These two wild species had not been around each other for over a hundred years, yet their instincts reminded them to be extremely cautious. This example represents a historical relationship that did not die just because of the near-extirpation of both species one hundred years ago. The relationship appears to survive in their genetic coding. The question is, exactly how long will these ancient instincts survive within each of the animal's genetic coding? Will this instinct disappear if we feed our bison corn or if we domesticate the species? Or, what will occur if wolves become used to being around humans in national parks?

I remind the reader that Meagher and Wallace (1993) tell us that bison as an ecological force helped shape the North American Great Plains but that relationship appears to be in peril. The ecological force itself is still alive but for how long?

There appears to be several different types of relationships among the grassland ecosystem components. The triadic relationship is where each component relies upon the other two for some type of amenity. *Tatanka* wakes up the plants in the spring time through the vibration of his hooves when he once again begins his annual journey across the grasslands. The plants in turn provide the animals and humans with both food and medicinals so they can care for themselves and they also guide, through their maturation process, the annual migratory route that takes place around the sacred Black Hills area.

The people use their astronomical knowledge to regenerate or renew the grassland ecosystem and all life through their spiritual ceremonies each year.

There appears to be a celestial relationship as well. Both *Tatanka* and the *Lakota* people used the stars to guide them in their annual migratory routes across the geographically huge grasslands. There are instances of Indigenous Peoples across the Americas using astronomy, especially the Pleiades star group, to guide them either in their planting of crops or to assist them in their travels.

The bison/human relationship consists of the bison character providing a behavioral model for the humans. The bison is said to show grief for the loss of a loved one, care for ill relatives, play that is associated with leisure time, protection of vulnerable herd members, and to exhibit behavior that is associated with celestial ceremonial times.

The human/plant relationship consists of the human assisting in the creation of necessary disturbance. The humans understand that disturbance is a spiritual obligation that was given to them and the bison by the Creator. Chief among these disturbances was fire. The traditional firing of the grasslands always restored the vigor and vitality of the grasslands and it also ensured that the bison would be nearby in the immediate future. Both the harvesting and the burning of the plants invigorated plant populations. Burning also prepared some seeds for germination by scarifying them. It assists in the transport of the seeds away from their origins and it also helps extend the geographical range of the plants. Humans managed the grasslands through creation of disturbance and by initiating fire, they enhanced the nutrient cycle of the ecosystem. It caused temporary disruption of the local plant succession process. Disturbance is a critical issue within the grasslands

and the humans understood this and became key players in fulfilling their role as agents of change through disruption. Disturbance enhances the biodiversity of the grassland environment by disrupting plant succession. It is necessary for the health of the animal, plant, and human populations.

The human role in ecosystem disturbance is critical as well. The continual harvesting conducted by humans contributed significantly to the genetic structure and diversity within plant and animal populations. When an animal is hunted and removed from the local area, it creates an opportunity for a juvenile from another geographical area to move in and establish a territory for itself. This is an entirely natural method of introducing new genetic structure into a community.

There is mention by the interview participants of *Tatanka* showing Native People which plants to be used as medicinals. As mysterious as we in the modern world may think this is, it is the basis for a fairly new field of study within science called “zoopharmacognosy” (Biser 1998). This new field of study is where animals self-medicate themselves by seeking out and consuming or using plants in some manner. Zoopharmacognasy is currently being investigated and documented. Although the amount of data remains slim, there appears to be sufficient evidence to conclude that there are certain animals that know which plants or kinds of soils to use as medicinals. Another cultural practice is known as “geophagy” which is the consumption of dirt during pregnancy by indigenous women to acquire the minerals that are within the dirt (Diamond 1999). Humans having learned of the healing properties of certain plants and soils have been using them as medicines for unspecified lengths of time. The author has personally witnessed the practice of geophagy among *Lakota* women. Of course, western

science has a difficult time with any ethnoscientific explanation of how people are receiving this knowledge from the animals.

*Tatanka* contributes to the biodiversity of the grasslands through their selective grazing style and the creation of both micro- and macro-disturbance regime. The *Lakota* people contributed to the biodiversity, health, and vigor of the grassland environment through their continual harvesting of certain plant communities. Even today this disturbance is viewed by Native People as a spiritual obligation that has been placed upon them by a higher power and it is one that can not be easily dismissed nor forgotten.

These relationships have all been severely disrupted and may even be considered temporarily destroyed. However, the original components are still present, but are extremely fragmented and marginalized in modern times. The biodiversity of the grassland ecosystem continues to suffer because of the suppression of traditional disturbances. These include the exclusion of both fire and harvesting.

## DISCUSSION/CONCLUSION

There are many reasons why some people believe that western science and indigenous knowledge share common ground. Both employ methodologies that attempt to enhance our knowledge about the natural world that surrounds us. The idea that both are knowledge systems that can depict the natural world in extreme detail through their different methods of observation is true. There is no doubt that the two can compliment each other, although when one observes both closely, there are some fundamental differences.



Each system has its own unique way of reaching conclusions based on observation. Probably the biggest difference between the two is the fact that Indigenous ecological knowledge is almost always unique to a very specific local situation and any attempt to apply that knowledge outside of the original context reduces its applicability. Whereas, western science reaches its conclusions and that they become theory which can then be applied anywhere at anytime. If it cannot, then the conclusions are not valid. Deloria and Wildcat (2001) discuss the idea that western scientists are very good at identifying all the pieces, explaining how the parts work together, but in the end, do they have any true understanding of the meaning of the observed phenomenon? In the chapter entitled, “Traditional Technology” in their book Power and Place, Deloria expresses the belief that the old indigenous method of inquiry asked the questions of “How does it work?” and “What use is it?” but added another important question, “What does it mean?” (Deloria and Wildcat 2001) Although there are occasions when reductionist science has its purpose, most times in the modern world that we live in, we do not stop to ask ourselves “What does it mean?” I would add to this that when one asks this last question, it almost seems natural that they are pausing to contemplate what are the long-term effects of this going to be and how will it affect the system that we live in. especially, “How will this affect the future generations?”

Most certainly an attempt to compare western science and indigenous ecological knowledge reassures the fact of the human mind’s capacity to recall and recite historical events that occurred a very long time ago and how absolutely incredible it is. Methods employed by Indigenous People on how to sustain their oral history are rich in illuminating how long sacred stories can be remembered and recounted. Many Tribes

have sacred narratives that may indicate they may have witnessed some very important geological events that took place long ago. While other cultures, such as the participants of this study, indicate just how much knowledge of the ecosystem the humans had in times gone by.

Both knowledge systems being discussed here are valid and can compliment each other in furthering our understanding of the natural world. What needs to happen is more acceptance of Indigenous knowledge by western science and vice versa. Although I believe this is beginning to occur because of the potentially crippling environmental crisis we find ourselves facing. The fact of the matter is that probably both knowledge systems need each other to help us get through the crisis if we could get over our biases about which is better. It is my hope that a blending of these two knowledge systems will occur that will create a more understandable science that can be taught in our schools.

The dramatic changes in the disturbance regime within the grassland ecosystem have resulted in an ecosystem that is considerably more monocultural than it was in its native state. Monocultural systems appear to be extremely ripe for disastrous environmentally chaotic events because of the system's diminished biodiversity. Many contemporary ecological restoration projects leave out an essential ecological component of the system. Ecological restorationists would do well to pay more attention to the magnitude, frequency, and kinds of disturbances that have been part of the grassland history, especially human-induced disturbance. Native People had a much deeper understanding of how specific species should be harvested in order to develop their fullest potential as a much needed crop (Salmon 2000b). There is ample evidence that when the European land managers forced Native People to stop burning, the natural food

species became much smaller and almost useless as food crops (Snively and Corsiglia 2001; Nahban 1997).

Much of indigenous ecological knowledge is based upon reciprocity and respect for other species. Many indigenous cultures have mutualistic relationships with certain species that ensured that both species assist each other. The *Lakota* people had such a relationship with the field mouse where the mouse would gather a very small bean and the people would take it from the mouse's winter stash, but the people would always replace what they took with corn. This reciprocity establishes the concept of a sacred and symbiotic relationship (Garrett 2001; Zontek 2003).

Many Native People believe that if they, and their nations, are given the necessary freedoms to restore their culture, then ecological restoration will follow. However, former territories that were guaranteed in treaties between Indian Nations and the United States may have to be recognized as well in order for Indian Nations be free to practice their style of ecosystem management once again. Although present day politics may preclude the return of aboriginal territory, there are sacred narratives among the *Lakota* that explain that it will not always be so. Many Native People believe that there may be a future day when this country has no choice but to submit to a change in how natural resources are managed. This is certainly the case when one considers what changes have to occur if we are to deal effectively with global climate changes.

When contemplating the destruction of the triadic relationship which is the basis of this research study, it can be concluded that a potentially valuable environmentally sustainable system has been destroyed. The system that was in place was in a dynamic equilibrium state that was upset when Native People were over-powered by advanced

technology. Even though the Assiniboiné Tribe recognized the full potential of the gun early on, the technology outstripped the Tribe's ability to regulate its use. Early Tribal People saw change coming and it was impossible to stop it. However, it is shocking when one reads authors such as Hornaday (2002), Roe (1951) Flores (1994, 1996, 1999) and Kretch (2002) and they all exhibit such collective guilt over what their ancestors did that they feel a desperate need to condemn that Native People's behavior. It is even more shocking when Isenberg (2000) says that it was the Native American that killed off the bison and not the European hide-hunters. There are also some (neo-Nazi's, the Iranian President, etc.) that say the holocaust did not occur. There are others as well, however the more important issue is that the triadic relationship that was in place was sustainable and would have lasted for a very long time. After all, Native People hunted the bison for centuries, and even millennia, without doing any harm to population numbers, but within a very few short years after the arrival of the European, tens of millions of bison was nearly extirpated. It is all the more sad that in a time when humans in general are in such desperate need of sustainable models that these authors waste our time grinding their axe against Native People. My question is what will this nonsensical revisionist history do to future academic scholarship?

The concept behind the methodology of this research study was predicated on the principle that although this is the first research study on the relationship between the three grasslands components, there should be follow-up studies that are quantitatively-based. There are certainly issues surrounding the discussion of bison self-medicating themselves and then sharing this knowledge with the human component that can be taken further.

The new field of study called zoopharmacognasy may yield some very interesting results in the future.

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## APPENDICES

Appendix A: *Lakota* Terminology

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## APPENDIX A: Lakota Terminology

### TRANSLATION OF *LAKOTA* LANGUAGE AND TERMS

*cankgleska* = sacred hoop

*hanblecheyapi* = “crying for a vision” or “seeking a vision” ceremony

*hehaka* = elk

*hocoka* = circle

*Ho Hwoju* or *Mni Conju* = one of the Seven Council Fires/Bands of *Teton Lakota*

*iktomi* = spider or trickster

*Inila Oyate* = Plant Nation

*inipi* = sweatlodge

*itopta sapa* = black-footed ferret

*iyeska* = interpreter or a mixed-blood

*kimimila* = butterfly

*mato* = bear

*mitakuye oyasin* = all my relatives

*Lakota* = Allies or Friends

*Lakota Oyate* = *Lakota* Nation

*Leksi* = uncle

*Maka Luta Tiospaye* = Red Earth Family/Band

*Oceti Sakowin* = Seven Council Fires of the *Teton Lakota* consisting of the

*Hunkpapa*, *Ho Hwoju*, *Itazipco*, *O’ohenumpa*, *Sicangu*, *Sihasipa*, *Oglala* Bands.

*pejuta wakan wicasa* = medicine man that heals with plants

*pispiza* = prairie dog

*Pte Oyate* = Buffalo Nation

*Sitanka Okolakiciye Wokiksuye* = The Chief Bigfoot Memorial Ride, 1986-90

*sunka wakan* = horse

*sunkmanitu tanka* = wolf

*tahca* = deer

*Taku Skan Skan* = the great mysterious energy that makes the world move

*tatanka* = *B. bison* or American buffalo

*timpsila* = prairie turnip

*tiospaye* = family or band

*Titonwan Lakota Oyate* = Teton Lakota Nation

*Tunkasila* = Grandfather

*wacigila* = “wiping of the tears” ceremony

*Wakan Tanka* = The Great Mystery or Creator

*wiwanyank olowan wacipi* = “sundance” ceremony

## APPENDIX B: Interview Protocol and Questions

### INTERVIEW PROTOCOL:

The interview will begin by informing the participant what the goals of the interview process are and that the research may result in either a dissertation and/or a journal article. Points to go over before beginning:

- 1) I am here to learn from you.
- 2) I am collecting information for an ecological study about relationships among bison, plants, and Native People from the northern Plains.
- 3) May I take notes and record this interview? This interview may take approximately one to two hours.
- 4) Please assume that I know nothing about what you are able to tell me when giving a definition or description of relationships.
- 5) Please feel free to tell me if any question does not make sense to you and I will rephrase the question.
- 6) Please feel free to say that you don't know the answer to the question that is asked if that is the case.

### INTERVIEW QUESTIONS:

#### Part I. Native People:

1. Can you begin by telling me a little bit about yourself, any certain group that your family belongs with, and your present day community that you live within?
2. What types of environmental issues do you suppose were discussed and decided upon at the annual gathering of your people?
3. What types of ecological decisions were made at these gatherings?
4. Do you know if they discussed resource sharing and management and wildlife conservation?
5. Are there any stories that you can tell me about the buffalo ecology?
6. Do you know if each individual group of your people had a specific area of land within the overall land base that they used exclusively?

#### Part II. *Tatanka*:

1. Can you describe any relationship that might exist between your people and the buffalo?
2. Is this different today than it was long ago and if so, can you please describe any differences?
3. What role did the buffalo play in keeping either or both the native plants and your people healthy? Is this different today than it was long ago?
4. Do you suppose this type of management makes the native plants in the pasture healthier? Why?
5. Do you have any knowledge about how the bison, elk, deer, and pronghorn shared the grasslands at the same time?



Part III. Inila Oyate:

1. Can you describe any particular type of relationship your Nation had with the Plant Nation?
2. Do you think plants had an affect on the way the bison used the land where your people lived?
3. Do you believe the bison & plants communicated with each other? If so, how?
4. Do you think the people had an affect on which kinds of plants grew where in the old days? If so, how did they?
5. Can you recite any stories your people have about the plants? Any about plants & bison together?
6. What kind of relationship do you believe exists/existed between the bison & plants?

Part IV. Other Animals:

1. Do you have any knowledge of the elk traveling together in very large herds?

## APPENDIX C: Initial Data Codes

### ❖ Relationships among Ecosystem Inhabitants (REL)

#### Relationships amongst Ecosystem Components

- REL-B/PL bison/plants
- REL-B/NP bison/Native Peoples
- REL-B/AO bison/other animals
- REL-NP/PL Native People/plants
- REL-INT-SP interactions among species

### ❖ Indigenous Ecological Knowledge (EK)

#### Ecological Knowledge

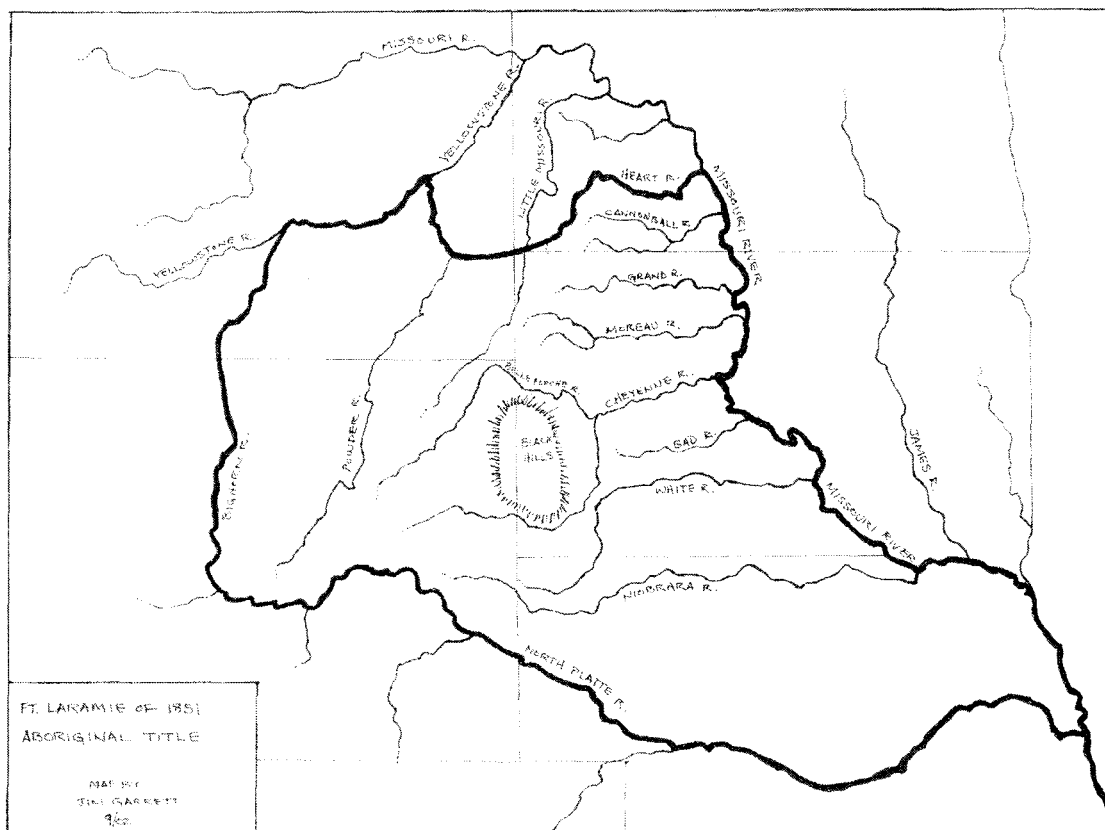
- EK-B bison
- EK-PL plants
- EK-OA other animals
- EK-NR natural resources

### ❖ Native People's Ecological Practices (EP)

#### Knowledge of Ecological/Ecosystem Practices

- EP-ACT actions
- EP-GOV governance
- EP-SP spiritual practices
- EP-UNR utilization of natural resources
- EP-PC post-contact with Europeans
- EP-PH/BE philosophy and/or beliefs

APPENDIX D: Map. Fort Laramie Treaty of 1851



APPENDIX E: Map, Contemporary *Lakota* Reservations

