Impacts of the global Echinacea market on the people and land of the Fort Peck Assiniboine and Sioux Reservation

Monique Kathleen Kolster

The University of Montana

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Impacts of the Global *Echinacea* Market on the People and Land of the Fort Peck Assiniboine and Sioux Reservation

Director: Vicki Watson

*Echinacea angustifolia* var. *angustifolia*, or narrow-leafed purple coneflower, faces threats from intense harvesting due to globalization and expansion of international herb markets. Isolated reports detail massive spot removals, but no prior studies examined the magnitude of harvesting or effects on prairie ecosystems and human communities. Level of *Echinacea* harvesting and associated ecological, sociological, and economic implications were examined on the Fort Peck Assiniboine and Sioux Reservation. Extensive, semi-structured interviews were conducted: (1) to explore the range of local perspectives on harvesting effects; (2) to gain feedback on possible solutions if a problem was perceived; and (3) to gain insight into the number of people involved and the depth to which *Echinacea* harvesting has become entrenched in the economic "stability" of the reservation. Present harvesting practices threatens the integrity of the plant, land and people. Societal tensions, ecological destruction, and yet another form of resource and cultural exploitation result from prolific harvesting and short-term monetary benefits. Conservation efforts are addressed.
ACKNOWLEDGMENTS

This Echinacea story comes from the experiences and knowledge of people throughout the prairie. I am incredibly indebted to all the individuals who shared their voices and carved some time to tell me their stories. Their communal tale provides great lessons for all of us, and I hope that the reader spends equal quality time understanding the complete story. In my most truthful effort, I attempted to weave the voices together, using the words and feelings that people expressed. I hope the stories and background research provide the beginning answers into the tribal members’ questions of where the plant are going and for what they are used. I also hope that the talks and discussions continue in order to heal the community and the landscape. Thank-you for sharing.

Deep thanks also needs to go out to: Vicki Watson, Rustem Medora and Cathy Zabinski for their patience, record turn-around time, and cross — eyes from the length of the text; Robyn Klein for her unending support, enthusiasm and advice; Peter Lesica for the suggestion; Doug Smith for the article hooks; Laura for the extended deadlines; Lisa, Mattie, Hopi, Molly, Bradley, Tara and all my other roommates who endured the dirty dishes and overflowing compost bucket; Fran for the borrowed dinosaur; John, the Greek god, for your invaluable suggestions and bootie shaking; Chris for the hugs; Kelley for your strength; Billysun for giving me back my memory; Gary for the map lesson; Rick for the brick of a song; Mic for the snacks, music and title; Beth Judy, John and Elaine for your willing ears; Sandra for sharing thunder storms in our offices; Laura for laughs and daydreams; Geoff for the stress outlet; Jennie, Dave, Dom, Leah, Lisa, and Jason for long distance encouragement; Rachie, Cole, Uncle Nick and Angel for sharing in simplicity; Jason for being my little angel through the home stretch; and Mitch, Steverino, Kristen, Boeg, Libby and ma and pa koster for your infinite support, sopping shoulders, overwhelming love and for believing in me.

Thanks Echinacea for the healing
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Chapter 1

RESEARCH FOCUS, METHODOLOGY AND THE UNFOLDING OF A STORY

"Now we might have a chance to do some medicine that might help out a little"
(Mad Bear in Boyd 1994)

INTRODUCTION

Since the late 1960's, the United States has experienced an explosive resurgence in medicinal plant and "alternative" health care. The herbal medicines that once stocked small health and natural food stores now line the shelves of mass market grocery outlets and conglomerate multi-purpose stores. In the last three years, since 1995, the medicinal herb industry grew from a two billion to a three plus billion dollar industry, from consumer purchases of herbal products (Liebmann 1997; Johnston 1997a). People are seeking more natural methods of health care, taking more responsibility for their health, and reconnecting with plants and ancient health practices. But the ultimate paradox of modern herbalism is that they also may be causing harm to the plant species and people living amongst the plant's habitat. Herbalists increasingly find themselves in precarious situations of promoting medicinal plant usage and, at the same time, encouraging medicinal plant conservation. Some small herbal businesses already voluntarily pulled goldenseal (Hydrastis canadensis) and American ginseng (Panax quinquefolius) from the retail line. These concerned business owners give as their reason massive overharvesting and reduction in wild populations. However, the majority of retail stores have not followed suit, since profits from these top selling herbs encourages sales over conservation.

Demand for medicinal herbs comes not only from domestic markets, but from similarly growing and expanding international markets. The United States exports over 150 wild harvested plants into world markets (Liebmann 1997). Increasing cultivation efforts are beginning to satisfy some of the heavy demand, but, in many cases and
particularly for the top selling wonder herbs, harvesting from the wild, or wildcrafting, is still the primary source. Although recent regulatory protection has been afforded to goldenseal and American ginseng, other medicinal plants face unknown harvesting pressures and receive little conservation concern. Little regulation and even less scientific data exists concerning the collection of wild plants (i.e., how much is being harvested, what methods are employed), definition of sustainable yields, and long term implications for population survival. While the harvesting of flowers, seeds and other aerial plant portions creates concern for the plant's regeneration ability and future reproducibility, the harvesting of roots is a greater concern since the whole plant is removed and killed. Herbalists and United Plants Savers, an organization dedicated to preserving native medicinal plants in North America, are most concerned about the root medicines, such as goldenseal, American ginseng, and Montana's local Echinacea.

Sales of Echinacea accounted for nearly ten percent of total herb sales, outranking goldenseal and American ginseng as the top selling herb in 1995, 1996 and 1997. The result is that Echinacea populations throughout the plains are in threat of overharvest (Richman and Witkowski 1997, Johnston 1997b). Intense marketing schemes, misconceptions of the plant's healing ability, improper and overuse of the plant medicine, adulteration and substitution between Echinacea species and other unrelated plant species, and difficulties in cultivation combine to produce intense pressures on wild populations. These factors not only touch ecological communities, but also have major sociological and economical repercussions within human communities throughout Echinacea's range.

Wildcrafting, in general, is a "tenuous business... [and] often practiced by poor rural inhabitants seeking to supplement their incomes during times of underemployment" (Fuller 1991). At the same time, harvesters often are underpaid, and, in areas like southern Appalachia, which experiences the brunt of medicinal plant harvesting in the United States (Liebmann 1997), a small number of wholesale distributors monopolize control over prices of wildcrafted plants (Fuller 1991). Fuller (1991) suggests that the maintenance of
artificially low, wildcrafted prices promotes overcollection as harvesters try to obtain reasonable returns on their investments. However, in the *Echinacea* industry and in areas throughout Montana and the Dakotas, the relatively low prices encourage intense harvesting due to high unemployment rates, potential for high earnings, and the large number of individuals digging. On another front, low prices undermine cultivation efforts and encourage further exploitation of wild plants since monetary values of wildcrafted *Echinacea* plants are less than that of cultivated plants. While all these factors exert additive pressure on *Echinacea* populations in the wild, only one study at the University of Kansas has systematically surveyed *Echinacea angustifolia* var. *angustifolia* populations in response to high commercial demand. Although herbalists, botanists, and local newspapers are talking about the possible perils to *Echinacea*, nobody really knows the magnitude of harvesting nor the effects it is having on local communities or the "new black gold," as Oklahoma harvesters call the plant.

**FOCUS OF STUDY**

The following research began with a passing suggestion, alluding to the possible overharvest of one of Montana’s natives, *Echinacea*. Then a series of newspaper articles were mailed to me, and the story and situation became real. The articles only revealed glimpses into the communal story and projected headlines reading "Popular *Echinacea* root starts local price war," "Root digging-gaining in popularity," and "If we don't protect our land, cultural resources, who will?" These articles were all clips from the Fort Peck Assiniboine and Sioux Reservation newspaper, *Wotanin Wowapi*. With each new article, the description of harvesting activity and people’s reactions increased and intensified. Why did only a few people outside the reservation know that *Echinacea* was harvested from the wild? Why were only a few people outside the reservation aware of the changes *Echinacea* harvesting was bringing to the tribes?
After further inquiry of federal and tribal agencies around Montana, I concluded that
the bulk of *Echinacea* harvesting was occurring in the Northeastern part of the state,
primarily the Fort Peck Reservation. Later interviews suggested that the *Echinacea*
harvesting "fever" had traversed North Dakota before reaching the Fort Peck Reservation
and since has spread to the Fort Belknap, Crow, and Northern Cheyenne Indian
Reservations. However, this "gold rush" type phenomenon did not originate in North
Dakota, nor have these newspaper stories been isolated. Throughout the Great Plains
states of Kansas, Missouri, Oklahoma, Arkansas, Nebraska, Texas, and the Dakotas,
reports indicate drastic declines in *Echinacea* populations due to root harvesting pressures
(Foster 1991).

At the same time, very little scientific information exists on the future viability and
resilience of these populations, and no analyses examine sociological or political
implications of harvest. In Montana, such information is even more scarce. Besides the
handful of articles published by the Wowanin Wowapi warning about overharvesting
impacts on root size and extinction in other states, no information exists concerning
harvesting effects on Montana plant populations or people. How many pounds of plants
have already been harvested from the wild? How many plants does this equate to? What
are the implications for population survival? What are the sociocultural effects of such
harvesting on local human communities?

Pressures from harvesting need to be addressed. This paper serves as a preliminary
study into understanding the degree to which collecting occurs in a specific region, the Fort
Peck Assiniboine and Sioux Reservation, and analyzes the ecological, sociological and
economical impacts this region faces due to globalization and expansion of the *Echinacea*
market. The site choice focuses on the area where *Echinacea* harvesting first spilled into
Montana, and explores the range of local perceptions of the effects of harvesting on the
landscape, families and culture. The local observations, experiences and stories are cradled
in background information describing the social atmosphere, economic situation, local
cultural history of *Echinacea angustifolia*, biological knowledge of the species, and the larger international market demand. This range of aspects must be considered to understand fully the nature and causes of the current *Echinacea* harvesting craze. Besides describing localized effects and providing a range of background information, this paper also addresses recommendations for conservation efforts on the reservation, on the greater prairie ecosystem, and in personal and business retail decisions.

**METHODOLOGY**

*Echinacea*’s story interweaves many contemporary issues, hence a multifaceted approach assists in understanding the current situation of *Echinacea* harvesting. Besides gathering information from literature and conference talks, I conducted over seventy interviews on the reservation with harvesters, buyers, private landowners, BIA officials, tribal traditionalists and other tribal members concerned with the issue. I used extensive, semi-structured interviews to permit key questions to be asked of all interviewees within a "group" (i.e., harvesters) while allowing the flexibility of new lines of inquiry to arise. The following key questions were asked to create some overarching theme and interconnectedness of stories:

- **How do you participate in the *Echinacea* market?** In other words, are you a buyer, harvester, cultivator, marketer? Describe your involvement and practices in detail.

- **Do you see any problems with the present day harvesting of *E. angustifolia*?** What do you think should be done to reduce those problems?

- **If there is a problem, would you be willing to change your practices to reduce pressure on *E. angustifolia*?** How would you change your practices?

- **Do you know other people involved in harvesting, cultivating or buying of *E. angustifolia*?** What are their names?

The purpose of these questions was to: (1) understand how their roles in the *Echinacea* market affects an individual's perception on harvesting, (2) to gain feedback on possible solutions if a problem was perceived, and (3) to gain insight into the number of people
involved and the depth to which *Echinacea* harvesting has become entrenched in the economic "stability" of the reservation.

Further questions were prepared for the different groups and varied according to their relationship with *Echinacea*. For instance, harvesters were asked questions pertaining to their methods of collecting, while buyers were asked about drying, shipping and other business aspects (see Appendix A: Interview Questions). However, these questions were secondary to the key questions and not meticulously followed since more emphasis was placed on interviewees freely discussing their ideas and opinions. This technique of being a listener reduces the "cultural filter." It diminishes the possibility of pointed questions and introduced preconceived notions by not limiting interviewees' answers. Instead, semi-structured interviews allow interviewees to tell their own story, in their own words, and can lead to detailed and in-depth explanations. According to Martin (1995), semi-structured or open-ended interviews provide very high information content, very broad breadth of subject covered, and require only a low number of queries to explore the subject. Since so little is known about *Echinacea* harvesting, these qualitative methods were employed rather than more formal quantitative surveys which are more specifically gauged.

Interviews were conducted with a single person at a time to allow expression of personal viewpoints, discussion of disagreements in the community, and freedom from interruption or contradiction by others (Martin 1995). Length of interview ranged from one to four hours and were recorded in a field notebook. Although a cassette recorder was at hand, it was never used due to the uneasiness it created in the interviewer. Participants were chosen primarily by the "snowball effect," in which a few initial contacts introduce other possible interviewees which led to still other contacts. So participants were not selected by unbiased, random sampling. However, there were only so many people to talk to within a certain group. For instance, out of the six known buyers of *Echinacea* root, five were interviewed. So sample size, though small, included almost the entire population
of a group. Information gathered was cross-verified, or triangulated, with the stories of other participants to verify or strengthen data collected. Additionally, I made direct observations of harvesting activities from field digging to the shipping at buyer's warehouses to complement interview data. To obtain the information, two field trips, each nearly a week long, were made to the Fort Peck Reservation in February and March 1998. Although these are typically harsh winter months for Montana, mild weather this year encouraged early February harvesting and therefore provided glimpses into the beginning of digging season and the re-awakening of the digging spirit.

Due to sensitivity of some of the material, names have been altered to conceal identity. However, even with lack of proper names, various circumstances will indicate the person's identity. Ambiguity will be used as much as possible to protect the person, without substantially altering the story. A number of elders were especially sensitive to the growing issue and chose not to participate. Without their insights, this paper is incomplete, for rich historical perspectives and experiences are missing. Additionally, the native language was not used or known by the interviewer. However, all those willing to be interviewed spoke English. In fact, given the diverse membership and dialects on the reservation, the English language actually provided some commonality and consistency between interviews.

Finally to supplement direct observation and in-person interviews and cradle the case study in a broader context, information was gathered from herbalists, herbal organizations, herb companies, nurseries and seed distributors, *Echinacea* cultivators, academic researchers and other people from various Montana reservations and public land agencies. These added interviews widened perspective and provided a deeper background for understanding why this plant is being extracted. Interviews either followed the same semi-structured format as above; some were conducted in person and some over the telephone to reduce traveling. Further review of the literature provided information on ecology, biology, recent medical research, economic demand, and political and
ethnobotanical history of *Echinacea*. I attended a number of conferences and talks to learn more about the cultivation of *Echinacea*, harvesting pressures in other states, and other medicinal plants facing populations reductions. These included the Great Northern Botanical Association meeting in Hot Springs, MT, the Ethnobiology Society conference in Reno, Nevada, and the United Plant Savers slide show in Missoula, MT. Botanical surveys were beyond the scope of this project, but would be a valuable line of future research.

Throughout this work, the stories of individuals are interwoven with traditional knowledge and scientific information. Informal indigenous knowledge of nature is often excluded from research; however, this paper attempts to include this traditional environmental knowledge. Sources are clearly identified to distinguish between the types of knowledge. My intent is to give the written story back to the tribes, the herbalists, the cultivators, and anyone who shared their knowledge and anyone who is willing to learn from these shared experiences.

Chapters are organized as discrete sections focusing on particular subject areas. Chapter Two describes site-specific characteristics, economic conditions, and historical and present life experiences on the Fort Peck Assiniboine and Sioux Reservation. This information provides a context for understanding the escalation of harvesting and the underlying communal struggle of indigenous people over the losses of a cultural plant. Chapter Three interweaves personal perceptions with scientific data on the biology and ecology of *Echinacea angustifolia* var. *angustifolia*. Given the lack of scientific information, local harvesters, traditionalist and *Echinacea* cultivators provide some information to begin assessing the ecological effects of widespread *Echinacea* harvesting. Chapter Four discusses the ethnobotanical uses of the plant from early Assiniboine and Sioux tradition to modern use on the reservation. The uses of the plant from early pioneers to modern medical research is included to display the cyclical demand of *Echinacea* through recent history and the lessons that need to be remembered. Chapter Five evaluates the
growing domestic and international demand for *Echinacea*, other issues affecting the *Echinacea* market, and the implications these have on conservation. Chapter Six delves into the case study and the localized effects of intense harvesting. Issues raised in previous chapters combine to provide deeper understanding of the socioeconomic and ecological implications on the reservation. Chapter Seven and Eight evaluate conservation recommendations aimed at developing a sustainable rural economy.
People of the Fort Peck Assiniboine and Sioux Reservation have faced many of the social injustices common to the experience of Native Americans. Their history is plagued by recurring natural resource decimation, homeland removal and new site confinement, and fighting overpowering external institutions. The Assiniboine and Sioux are the Plains tribes who witnessed the loss of the buffalo, the division of the prairie into allotment sections, and the near total destruction of traditional lifestyles, livelihoods, and community and familial structure. Confinement to reservation life forced new adaptations to acquire material necessities and survive the changing imposed visions of the government. The following chapter stresses the continued exploitation of people trying to cope in an economically depressed and isolated area (see Appendix B for a fuller historical account).

**DESCRIPTION OF SITE**

The Fort Peck Reservation is located in the extreme northeast corner of Montana, approximately 25 miles south of the Canadian border and 20 miles west of North Dakota (see Fig 2.1). The total area encompasses 2,093,318 acres (approximately 3,200 square miles) and stretches 110 miles from east to west and 40 miles from north to south. The Missouri River carves out the southern boundary, Porcupine Creek the western boundary, and Big Muddy Creek delineates the eastern boundary. From the bottomland of the Missouri Valley, the land gently rises to the north and west and transitions into the glacier-formed, rolling prairies. Elevation gain starts at river bottom (1900 feet) and reaches the pinnacle (3100 feet) on the higher bench lands. Throughout the landscape, several streams
cut broad and flat valleys en route to the Missouri River, and a few isolated badlands areas break up the mixed-grass prairie (see Fig 2.2).

Typical of grassland climates, temperature and precipitation are variable and extreme. Winters are generally severe, windy and dry, with little snow accumulation, and summers are characteristically warm, often droughty and punctuated by thunderstorms in June and July. Average annual rainfall is thirteen inches, and seasonal temperatures range from over 100 degrees Fahrenheit in summer to well below minus 20 degrees Fahrenheit in winter. Although snowfall is light, severe northwesterly or southeasterly winds (occasionally reaching 17 to 27 knots) can create thick snowdrifts along roadsides and coulees (Madison 1973). Frost-free periods range from 100 days in the higher benches to 130 days along the Missouri River bottom, which translates to an average length growing season of 125 days.

Given the extreme climate and short growing period, the land always has provided botanical resources. The rich bottomland of the Missouri and the lower reaches of its tributaries encourage cottonwood, ash, willow and box elder growth. While considered of low commercial value, the woody cover provides shelter for wild game and firewood and fence posts for the local population. Beyond the riparian areas, the floodplain supports fertile and easily irrigated land which is tilled for various agricultural grains. The upland bench areas, once home to herds of buffalo, initially attracted white settlers in search of high quality range lands. Today, much of these lands either provide forage for cattle or are under wheat cultivation.
Fig 2.1. Map of Montana Delineating the Fort Peck Reservation
Fig 2.2. Map of the Fort Peck Assiniboine and Sioux Reservation
DEMOGRAPHY

According to the 1990 Census of Population and Housing, over 10,700 people reside on the reservation, of which roughly half are non-Native American. Census data of reservations must be examined with caution, for past surveys undercounted Native American populations by as much as 7.7%. The 1970 census was amended somewhat through a joint house-to-house survey by the Bureau of Indian Affairs and HUD (Nolley 1982). However, the reliability of the present census information is unknown. The majority of the population is concentrated in the southern one-third of the reservation, along the main transportation routes of U.S. Highway 2 and the Burlington Northern railway. A handful of towns, populated with less than 4000 people, scatter alongside these byways. The largest town, Wolf Point, is the focal commerce area and seat of Roosevelt County. Poplar, twenty miles east, houses the headquarters for the Assiniboine and Sioux Tribes, Bureau of Indian Affairs and Indian Health Services. The Fort Peck Community College and Native American Education Service College also are located in the town. While the predominant population of Poplar is Native American, the majority of Wolf Point residents are non-Native American. Similarly, in the northern and upper benches areas, rural populations are largely non-Native American. The present population distribution is the product of land policy changes at the turn of the century and has defined the region of current Echinacea harvesting.

RESERVATION LIFE

Even before the formal establishment of the Fort Peck Reservation in the late 1800's, starvation and other dietary problems were prevalent among the tribes. Insufficient or complete absence of rations combined with severe winters led to the slaughter of hundreds of domestic animals. The mortality rate of young, old and physically weak
people rose significantly (Choong 1992). In 1884, over 300 Assiniboine died of starvation at the Wolf Point sub-agency (Chamber of Commerce 1995). Conditions only deteriorated with the establishment of the reservation.

Poor health facilities, continued short supply of rations, constant yearly turnover rates of agents, and introduced diseases and epidemics intensified the early traumas and transitions of reservation life (Miller 1987). Although the major epidemics of smallpox, measles and influenza had already taken their toll, their presence on the reservation was felt still. However, eventually epidemics were replaced by widespread chronic ill-health (Choong 1992). By 1890, 79% of the reservation population suffered from illnesses such as dysentery, diarrhea, influenza, tuberculosis, syphilis, gonorrhea or other illnesses (Choong 1992). Malnourished and overstressed body systems, lack of health facilities and supplies, and overcrowded and ill-ventilated houses only made the problem worse. Little relief was received from agent physicians who were culturally ignorant or nonexistent. It was common practice for the physician to discourage the Native Americans from visiting their "medicine man" (Choong 1992). As a result, today many tribal members are disconnected from traditional health practices, lack the once integral knowledge of botanical medicine, and depend on western therapies and physician diagnosis.

Conditions in boarding schools were just as bad. To promote acculturation, boarding schools opened to teach Native American children the impeding cultures' customs, manners and three R's. However, the institutions served to promote further spread of diseases through students' close contact. Chicken-pox, diphtheria, influenza and conjunctivitis were common early reservation infectious diseases (Choong 1992). While struggling to maintain their health in these new environments, children were enduring alienating teachings that discouraged the use of their native tongue and tribal customs. The government boarding school closed in the 1920's, and missionary schools run by Mormons and Presbyterians ran for the first few decades of the 1900's (Chamber of Commerce 1995). Today, Fort Peck Reservation boasts an extensive school system with
two post-secondary institutions, one of which offers classes in Assiniboine and Sioux languages.

A central issue on the government agenda to break up tribalism was the dissolution of social structure. Christian missionaries who moved into the area assisted by discrediting the spiritual people (Sung-gleska, 2 February 1998). By pushing aside traditional values, they converted people to Christian beliefs and attempted to assimilate tribal members into the "civilized" culture. As a result, the role of the native spiritual leaders diminished and the social organization of the tribe crumbled even further. Furthermore, the passing of the Dawes Severalty (or General Allotment) Act of 1887 divided communal reservation lands into allotments that were issued to individual males. The plan's impetus generated from the notion that individual ownership of a piece of property created incentive to work, which in turn, provided the backbone towards civilization. The "excess" land, not allotted to individuals or tribal use, was opened to purchase by non-Native American homesteaders in 1907. The Act also permitted tribal members to sell their allotted land. The result was "that the majority of the land on the reservation passed to non-Indian ownership, and the losses of prime agricultural land were extremely high" (Nolley 1982). Today, the amount of tribal owned and individually allotted Indian land make up 18% and 26% of the total checkerboarded reservation, respectively (Chamber of Commerce 1995; see Fig 2.3). Programs to buy back some of this land have been developed by the tribe in recent years.

ECONOMY

The major contributors to the reservation's monetary economy are wheat production and cattle ranching. Feed grains and hay are secondary crops, and sheep and hogs secondary livestock. As in the greater extractive resource economy of eastern Montana, agricultural commodities are shipped out of the state, and prices depend on fluctuating external markets. Agriculture can provide a fairly substantial income; however, most of the
SEE OVERSIZED MAPS

Fig 2.3. Land Ownership Pattern of the Fort Peck Assiniboine and Sioux Reservation
people making the money on the reservation are non-tribal members. The fifth of land owned by the tribes is essentially unproductive and was acquired only after early homesteaders returned it to the government claiming it was unprofitable. The other portion of individually allotted Indian land is more productive, but since many Native Americans do not have the funds for large overhead or equipment, the land is leased and operated by non-tribal members (Nolley 1982). As a result, agricultural income for the Native American population is minimal.

Since its discovery in 1951, oil has been another important extractive resource in the area. However, little of the money generated goes back to the tribes. Essentially, the only capital gained comes from the issuance of the operational land permit by the tribes, but oil companies basically write the terms (Nolley 1982). Very few tribal members are employed, and little stimulation of the local economy is created. Coal lignite deposits also have produced some income for the reservation; however, no mining efforts are underway at present.

The Fort Peck Tribes have actively undertaken efforts to vitalize the area's economy and stem high unemployment rates. But the relative isolation from large populations, manufacturing and marketing centers amongst other factors, has hampered tribal owned industries. The most persistent operation, A & S (Assiniboine and Sioux) Tribal Industries, was established in 1968 and has had to change with the times. Originally producing camouflage netting and military medical chests and food containers for the Department of Defense, the manufacturing company has had to convert its machinery to create commercial products after the contracts for Desert Storm tapered. The industry reduced its size and presently employs a small handful of tribal members. Other industries have come and gone, and the unemployment rate has waxed and waned in response. Small independent business and services contribute to the economy, but almost all are owned by non-tribal members. Within the last ten years, many of these stores have folded due to the
development of the shopping industry in Williston, North Dakota, which has lured residents to buy goods off the reservation.

The majority of income for tribal members comes from the public sector. Approximately half of the Native American population is employed by the Tribal Government, the Bureau of Indian Affairs, Indian Health Services, tribal industries, and the school system. According to the 1990 Census, unemployment figures on the reservation accounted for 40% of the population in 1989. The median income for family households (2,669 of the total households) was $21,019 and for nonfamily households (720 of the total households) $9,653. Recent reports suggest that unemployment rates have doubled in the last ten years and now reach 80% during certain times of the year (Sung-gleska, 2 February 1998).

CONCLUSION

The impoverished conditions on the reservation provided a ripe environment for a new economic enterprise. High unemployment rates, failed economic re-development strategies, bankruptcy closure of local small businesses, and lack of full-time permanent job positions all laid the path for the introduction of *Echinacea* harvesting. Not only could people carve out an improved monetary lifestyle, but the job allowed independence, entrepreneur creativity and a sense of freedom to work on one's own terms.
THE BIOLOGY AND ECOLOGY OF ECHINACEA

"Surely we can then estimate that mature Echinacea individuals...are at least 20 years old. Will it take 20 years for these populations to return? For that matter do we even know what pollinates Echinacea? Will these pollinators survive the lack of nectar once provided by Echinacea in these areas?" (Robyn Klein, 1998)

PLANT DESCRIPTION

*Echinacea angustifolia*, an herbaceous perennial, grows from a deep taproot that can reach five to eight feet in length (Kindscher, 17 April 1998). According to a traditionalist on the Crow Reservation, the thickness of the root varies with soil composition, with small diameter roots growing in rocky soils and thicker roots in finer substrates. Since the Fort Peck Reservation is less rocky than the Crow Reservation, the roots are thicker, and the plants bigger (Snell, 7 November 1997). Erect, single or branched stems may reach 10-50 cm high and often are sparsely to densely covered in coarse hairs. Oblong, lance-shaped leaves extend from stalks at the stem's base and become sessile (stalkless) and reduced above. Leaves are toothless, alternated, and dark green. Single flower heads emerge from individual stems and in bloom display showy white, pink or purple ray flowers. The length of the ray flowers are comparable or just less than the width of the disk (2-3.8 cm long). The raised receptacle "cone," characteristic of its name, coneflower, is comprised of fertile disc flowers which produce yellow pollen and turn into achenes after the reproductive period. Beneath this inflorescence, specialized leaves transition into sharp or blunt spines that extend beyond the flower's length (see Fig 3.1).
Fig 3.1. *Echinacea angustifolia* var. *angustifolia*, Narrow-Leafed Purple Coneflower

(a) Flowering branch. Height: 41.3 cm (16.5 in). (b) Ray flower. Length: 2.4 cm (1 in). (c) Disk flower. Length: 0.5 cm (0.2 in). (d) Floral bract. Size: 0.7 cm (0.3 in).
NOMENCLATURE AND TAXONOMY

NATIVE AMERICAN NAMES AND SPIRITUAL SIGNIFICANCE

The names bestowed on plants, animals and the landscape give spirit to place and provide the mental glue to relationships between humans and the environment (Salmon, 16 April 1998). The various Native American names for *Echinacea* conjure up physically descriptive images and permit insight into playful, cosmetic and medicinal uses. The Lakota Sioux have two names for *Echinacea* that incorporate location and purpose. When found growing in low places, it is referred to as *On'glakcap* (something with which to comb hair). When found in the hills, it is called *Ica'hpehu* (something used to knock something down) (Rogers 1980; Sung-gleska, 10 February 1998). The Dakota Sioux call the plant, *Ichahpe-he*, or "whip plant" (Gilmore 1977). Other names used on the reservation are black sampson (Long, 27 January 1998), purple coneflower, black root (Zeckner, 2 February 1998; Sung-gleska, 9 February 1998), and snake root (Sung-gleska, 9 February 1998; Dailey, 4 April 1998). These physically descriptive names were adopted from early settlers' names or translation of native names. Snake root referred not only to the snake-like appearance of the debarked root, but also to its reputed use for snakebites (described in Chapter 4). The Crow in southcentral Montana refer to the plant as Burnt Head (Snell, 7 November 1997), and other tribes throughout the Plains had their own names and descriptions (see Table 3.1).
### Table 3.1. Native American Names for *Echinacea angustifolia*

<table>
<thead>
<tr>
<th>Tribe</th>
<th>Name</th>
<th>Description of Use</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fox</td>
<td><em>wetop</em>, or &quot;widows comb&quot;</td>
<td>Stiff seed head used to comb hair</td>
<td>Gilmore (1977)</td>
</tr>
<tr>
<td></td>
<td><em>ashosikwimia’kuk</em>, &quot;smells like a muskrat scent&quot;</td>
<td>Medicinal application as an eyewash</td>
<td>Gilmore (1977)</td>
</tr>
<tr>
<td>Omaha/ Ponca</td>
<td><em>mika-hi</em>, or &quot;comb plant&quot;</td>
<td>Children’s activity in which two stalks are whirled around each other, touching only by the head</td>
<td>Gilmore (1977)</td>
</tr>
<tr>
<td></td>
<td><em>ikigahai</em>, or &quot;to comb&quot;</td>
<td>Descriptive analogy of the head compared to a mushroom</td>
<td>Gilmore (1977)</td>
</tr>
<tr>
<td></td>
<td><em>iⁿšhtogahte-hi</em>; from iⁿšhta, &quot;eye&quot;)</td>
<td></td>
<td>Gilmore (1977)</td>
</tr>
<tr>
<td>Pawnee</td>
<td><em>ksapitahako</em>; from iksesa, &quot;hand&quot; and <em>pitahako</em>, &quot;to whirl&quot;</td>
<td>Children’s activity in which two stalks are whirled around each other, touching only by the head</td>
<td>Gilmore (1977)</td>
</tr>
<tr>
<td></td>
<td><em>saparidu kahts</em>, or &quot;mushroom medicine&quot;</td>
<td></td>
<td>Gilmore (1977)</td>
</tr>
</tbody>
</table>

### Scientific Names and Taxonomy

*Echinacea angustifolia* DC. var. *angustifolia*, narrow-leaved purple coneflower, is a member of the Asteraceae (Compositae) family. Although the names and classifications of the *Echinacea* species have been debated by taxonomists since 1753, current chemical and genetic analyses support McGregor's nomenclature of nine species and two varieties (Baskin et al. 1993, Baskauß et al. 1994; see Table 3.2). Thus while Cronquist, McGregor's chief adversary, would disagree, *Echinacea angustifolia* DC var. *angustifolia* (herein referred to as *Echinacea angustifolia*) will be treated as a separate species and not a sub-species of *E. pallida* (Nutt.) Nutt. However, former names still seep into the scientific literature, and therefore it is worth recognizing other botanical synonyms (see Table 3.3).
Table 3.2. The two current views on the taxonomic status of *Echinacea angustifolia*, *E. pallida*, and *E. tennesseensis*


   *Echinacea pallida* (Nutt.) Nutt. var. *pallida*  
   *E. simulata* McGregor

   *E. pallida* (Nutt.) Nutt. var. *angustifolia* (DC.) Cronq.  
   *E. angustifolia* DC. var. *angustifolia*  
   *E. angustifolia* DC. var. *strigosa* McGregor  
   *E. tennesseensis* (Beadle) Small—"...an eastern outlier of var. *angustifolia* in the cedar barrens of Tenn..." (Cronquist 1980)

   *E. pallida* (Nutt.) Nutt. var *sanguinea* (Nutt.) Gandhi and Thomas [Varietal status of *E. sanguinea* was suggested by Cronquist (1980), and formal combination made by K. Gandhi and R.D. Thomas (1989).]

2. R.L. McGregor (1968a)

   *Echinacea pallida* (Nutt.) Nutt.  
   *Echinacea simulata* McGregor  
   *Echinacea sanguinea* Nutt.  
   *Echinacea angustifolia* DC. var. *angustifolia*  
   *Echinacea angustifolia* DC. var. *strigosa* McGregor  
   *Echinacea tennesseensis* (Beadle) Small

(Baskin et al. 1993)

Similar to Native American nomenclature, the Latin and common names of species often reflect uses and appearance. The prominent coneflower features left such impressions on early peoples and botanists that names such as red sunflower, droops (describing the reclined petals), black susans, and cock up hat where addressed to the plant (Hobbs 1995; Kindscher 1989; see Native Names and Spiritual Significance for other common names). Even the scientific name, *Echinacea*, derives from a Greek word *echinos*, describing the hedgehog or sea urchin-like appearance of the flower head. Other common names (i.e., rattlesnake weed, Kansas snakeroot, Missouri snakeroot, scurvy root) have been attributed to the plant for its healing properties (Kindscher 1989, Bergner 1997).
**Table 3.3: Taxonomic Formation of the Genus Echinacea, According to McGregor.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Echinacea angustifolia</em> DC. var. angustifolia</td>
<td>Synonyms: <em>Brauneria angustifolia</em> Heller</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea pallida</em> var. <em>angustifolia</em> (DC.) Cronq.</td>
</tr>
<tr>
<td>Echinacea angustifolia DC. var. strigosa McGregor</td>
<td></td>
</tr>
<tr>
<td>Echinacea lavigata (Boytont &amp; Beadle) Blake</td>
<td>Synonym: <em>Brauneria laevigata</em> Boynton &amp; Beadle</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea purpurea</em> (L.) Moench var. <em>laevigata</em> Cronq.</td>
</tr>
<tr>
<td>Echinacea pallida (Nutt.) Nutt.</td>
<td>Synonyms: <em>Echinacea angustifolia</em> Hooker</td>
</tr>
<tr>
<td></td>
<td><em>Rudbeckia pallida</em> Nutt.</td>
</tr>
<tr>
<td></td>
<td><em>Brauneria pallida</em> Britton</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea pallida</em> (Nutt.) Nutt. f. <em>albida</em> Steyerm.</td>
</tr>
<tr>
<td>Echinacea paradoxa (Norton) Britton var. paradoxa</td>
<td>Synonyms: <em>Brauneria paradoxa</em> Norton</td>
</tr>
<tr>
<td>Echinacea paradoxa (Norton) Britton var. neglecta McGregor</td>
<td></td>
</tr>
<tr>
<td>Echinacea purpurea (L.) Moench</td>
<td>Synonyms: <em>Rudbeckia purpurea</em> L.</td>
</tr>
<tr>
<td></td>
<td><em>Rudbeckia hispida</em> Hoffmngg.</td>
</tr>
<tr>
<td></td>
<td><em>Rudbeckia serotina</em> Sweet</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea purpurea</em> (L.) Moench var. <em>arkansana</em> Steyerm.</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea purpurea</em> (L.) Moench f. <em>ligeti</em> Steyerm.</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea speciosa</em> Paxton</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea intermedia</em> Lindley</td>
</tr>
<tr>
<td></td>
<td><em>Brauneria purpurea</em> (L.) Britton</td>
</tr>
<tr>
<td>Echinacea sanguinea Nutt.</td>
<td></td>
</tr>
<tr>
<td>Echinacea simulata McGregor</td>
<td>Synonyms: <em>Echinacea speciosa</em></td>
</tr>
<tr>
<td>Echinacea tennesseensis (Beadle) Small</td>
<td>Synonyms: <em>Brauneria tennesseensis</em> Beadle</td>
</tr>
<tr>
<td></td>
<td><em>Echinacea angustifolia</em> DC. var. <em>tennesseensis</em> (Beadle) Blake</td>
</tr>
</tbody>
</table>

(Bauer and Wagner 1991)

_Echinacea angustifolia_ is the only species native to Montana. No other relatives can be confused with it in this state. However, its eastern range blends with the western range of _E. pallida_ in Western Oklahoma and Kansas. In the Eastern end of its range, _E. angustifolia_ is taller, less pubescent, and has longer rays, making it more similar to _E. pallida_. Due to these intermediate forms, Cronquist (1945) reduced _E. angustifolia_ to a variety of _E. pallida_. However, McGregor (1968) disputed the merge and detailed several
characteristics to distinguish between *E. pallida* and the intermediate forms of *E. angustifolia*:

*E. pallida* is a tetraploid (n=22), has white pollen, resin canals in both pith and cortex, lacks sclerotic cells in the pith, and the rays are distinctly longer than width of disk.

An unrelated plant that has been confused with *E. angustifolia* is *Parthenium integrifolium*. Up until 1988, this species was the most common adulterant of *Echinacea* remedies (Hobbs 1995). However, the range of this species does not extend into Montana (Great Plains Floral Association 1977). On the Fort Peck Reservation, the harvesting of other substitutes is widespread. Novice root diggers do not always recognize *Echinacea* and return with bags of sage and other unknown roots, which buyers sort and throw away (Dailey, 4 April 1998).

**Geographical Distribution**

*E. angustifolia*’s widespread range reaches from the dry plains of Texas to southern Saskatchewan and Manitoba, and encompasses Oklahoma, Kansas, Nebraska, the Dakotas, eastern Montana, Wyoming, and Colorado, and the western edges of Minnesota and Iowa (see Fig 3.2). Although recent population studies have not been conducted in Montana, old herbarium samples reveal spot locations of the species in 15 counties: Sheridan, Roosevelt, Garfield, McCon, Richland, Dawson, Prairie, Wibaux, Rosebud, Custer, Fallon, Yellowstone, Big Horn, Powder River, and Carter (The Great Plains Floral Association 1977; see Fig 3.3). The species as a whole has suffered declines throughout its range due to habitat conversion and wild harvesting. However, effects on populations largely have not been quantitatively measured or monitored.
Fig 3.2. Entire Distribution Range of *Echinacea angustifolia* var. *angustifolia*
Fig 3.3. Distribution Range of *Echinacea angustifolia* var. *angustifolia* in Montana
Habitat Description

The range of *E. angustifolia* extends throughout the short and mixed grass prairies to the edge of the tallgrass prairie (Baskauf and Eickmeier 1994). The wide, patchy distribution covers a "considerable range of moisture and temperature regimes and gradation in the length of growing season" (Risser et al. 1981, Baskauf and Eickmeier 1994). On the Fort Peck Reservation, *E. angustifolia* has been observed to grow on hilltops and southwest-facing hillsides in rocky soils. The thinner and rockier the soil, the higher the water drainage and the more the plant thrives (Dailey, 4 April 1998; Gelker, 9 March 1998; Long, 27 January 1998; Zeckner, 2 February 1998; Sung-gleska, 2 February 1998). However, with the majority of the native habitat converted to agriculture, it is unknown whether hillsides are the preferred habitat or simply reduced islands of the original habitat. The soils on the reservation are comprised of cenozoic and mesozoic sedimentary rock (U.S. Geological Survey 1932), and plant community structure is dominated grama-, needle-, and wheat-grasses (*Bouteloua, Stipa*, and *Agropyron*) (McGregor et al. 1986).

Life History

Plant Development/ Reproduction

Little is known about the reproductive biology and ecology of the species in the wild. Most available information derives from laboratory and greenhouse experiments and focuses on improving germination rates. The impetus behind such research is to increase production of *Echinacea* for ornamental and landscape businesses, prairie preservation projects and now medicinal plant cultivation. The seed requires cold stratification to break dormancy (Baskin et al. 1992; Zajicek 1986). Twelve weeks of fluctuating temperatures
(either 15/6, 20/10, 25/15 or 30/15 C) induce 80-100% seed germination (Baskin et al. 1992). When compared to fourteen other species in the same family (Asteraceae), *E. angustifolia* displayed higher germination percentages at lower temperature regimes. Essentially, the plant can germinate earlier in the spring than other species (Baskin et al. 1992). However, warm winter temperatures may affect spring germination and population emergence for that year. Seed reproduction is not the only mechanism for propagation. Cultivators have propagated the plant vegetatively through root divisions (Sugarek, 6 February 1998). However, McGregor (1968) and Snyder et al. (1994) report that the species is nonclonal, suggesting that in the wild and without human manipulation, vegetative reproduction may not occur.

According to cultivators, after the second year of growth, single flower buds form at the end of individual stems. This duration of time may under-represent the length until bloom for wild species. The sparse information available which details the life span of composites indicates long growing stages (Klein 1997). In northeastern Montana, the bloom typically occurs in mid-July (Dailey, 4 April 1998; Gelker, 9 March 1998; Sung-gleska, 11 June 1998), at which time these obligate outcrossers are pollinated by bees, butterflies and other insects (McGregor 1968; Hemmerly 1976; Cech 1995a). The flowerheads produce a high percentage of viable achenes (Hemmerly 1976) that lack specialized mechanisms for dispersal (Baskauf and Eickmeier 1994). However, the strong winds of the prairie can blow the seeds great distances (Kindscher, 17 April 1998; Snell, 7 November 1997). Dispersal distances have not been estimated.

During summer dry periods, the plant has adapted to avoid water loss through leaf wilting (Chapman and Auge 1994). As the season progresses, all aerial portions dry up, and the plant prepares for winter dormancy. Along with other neighboring prairie species, the skeleton remains through winter months. Yet the brown, dried out stem and seedhead standout against the yellow dormant grasses, making *E. angustifolia* an easy plant for
harvesters to locate in winter. Below in the soil, the seed bank dynamics and longevity of seed viability are not well understood.

LIFE SPAN

The duration of growth stages and length of life span is poorly understood for *E. angustifolia*, and perennial herbs as a whole. While some perennials have been aged by counting root rings, the rings of *E. angustifolia* have proven unreliable (Kindscher, 21 March 1998). According to local knowledge, the size of the root, size of the seed cone, number of flower heads, and number of branched stems better indicate maturity of the plant (Kindscher, 21 March 1998; Zeckner, 2 February 1998; Lee, 21 March 1998; Dailey, 4 April 1998; Gelker, 9 March 1998). Additionally, lack of blossoms and large clumps of leaves seems to indicate an older plant (Lee, 21 March 1998; Dailey, 4 April 1998). Although anecdotal estimates of maximum age range from ten to fifteen years (S. Foster, 23 March 1998; Kindscher, 21 March 1998; Sugarek, 6 February 1998), scientific studies of other perennial's life spans reveal the possible underestimation of these guesses. The calculated ages of *Liatris cynolandra* and *Helianthella quinquenervis*, two species in the same plant family, are nineteen and forty years, respectively. Since *E. angustifolia* is more closely related to the latter (same tribe) and grows larger taproots than either of the species, it may be possible that the plant lives until a similar old age, or at least past the age of thirty years (Klein 1998).

POPULATION ECOLOGY

Information on the population ecology of *E. angustifolia* is scarce. The only research focusing on population dynamics and population density changes over time is being conducted by Dana Price Hurlburt, a graduate student at the University of Kansas.
The results of three years of data collection will be available fall of 1998. Specific species information on seedling recruitment and survival will be included (Price Hurlburt, 7 April 1998; Kindscher, 21 March 1998). Other ecological studies concentrate primarily on competitive interactions between *E. angustifolia* and other plant species. When grown with other *Echinacea* species, *E. angustifolia* displayed poor competitive ability and suppressed growth (total dry weight and leaf area) compared to *E. pallida* and *E. tennesseensis* (Snyder et al. 1994). Similarly, in situations with non-related plant species, *E. angustifolia* grew less rapidly than *Daleacandids* Michx. ex Willd. var. *candida* (Clements et al. 1929) and was reduced to near death next to *Agropyron smithii* Rydb. (Weaver 1942). At the same time, both competing species thrived and developed more quickly. Observations on the reservation note reduced growth in areas with thick grass cover, possibly due to competition (Lyn, 5 April 1998). However, many other variables could be responsible for this vegetative pattern.

The relationship between animals and plant population dynamics is even less clear, but studies and observations by cultivators fill in some of the gaps. Apparently, predation on seedlings, seeds, and roots may reduce reproductive success of wild and cultivated populations. Preliminary studies suggest that predation along with microsite characteristics are important factors in seedling recruitment (Price Hurlburt, 7 April 1998). Birds are a major predator on seeds of cultivated plants (Cech 1995a), as are moles and deer. Moles have caused major reduction in population size by burrowing underground and eating plant roots, while deer graze the aerial portions and sometimes completely uproot plants (McIlhatten, 7 March 1998). Buffalo also have been observed to eat the species (Sung-gleska, 9 February 1998).

While livestock grazing intensity affects population size of wild stands, the degree of effect is unclear. The Extension Service (1994) report *E. angustifolia* population decreases in response to increasing grazing pressure and describe the species as an indicator of good range condition. However, other people suggest that cattle do not
necessarily select the plant, and thus the species is not particularly sensitive compared to other plants. In this regard, the plant acts as a secondary indicator (Telmack, 6 March 1998; Lenz, 9 March 1998). While *E. angustifolia* is "palatable and nutritious to all livestock" (Extension Service 1994), cattle grazing intensity may decrease during the blooming season due to injury to the cattle. The blunt spines projecting from beneath the inflorescence have been observed to cause bleeding in cow's mouths, and therefore, cattle may stay away from the plants at this time. Additionally, the sharp points can work their way between the cows toes causing pain and possible infection (J. Foster, 23 March 1998). So even trampling at this time may decrease if cattle purposefully avoid the plant to prevent injury. However, according to Jim Foster, Range Scientist and Broker of Headwater Herbs, summer and spring grazing greatly reduces and impacts stands of wild *E. angustifolia* (personal communication, 23 March 1998). Spring grazing may be particularly detrimental since flowering shoots get damaged and overall seed production is lessened (Price Hurlburt, 7 April 1998). On the other hand, winter grazing still allows the plants to thrive (J. Foster, 23 March 1998).

Another, animal that affects the plant's viability is an unknown species of insect larvae which burrow into older plants and leave holes in the center of the root. One *E. angustifolia* root buyer observed cocoons on roots that had been drying for a few days (Lyn, 5 April 1998). Although the pupae does not seem to affect the plant's medicinal potency, it does affect future survival. According to the buyer, the infected plant will die the following year. He also notes that plants growing south of the Missouri River do not seem to be affected by the root borer. Since the roots are smaller in the designated location, he suggests that the root borer needs a certain size root to grow. However, many other factors may contribute to the absence of the predator.

Fire may induce *E. angustifolia* population shifts across the landscape and affect population dynamics. While observations suggest it does not kill the plant, fire can set the
plant back and kill the seed. However, time of year and intensity of fire are major
dependent factors (J. Foster, 23 March 1998).

**OTHER UNIVERSITY ECHINACEA RESEARCH**

In recent years, research efforts have increased on *Echinacea* genetics, propagation
and ecological population dynamics. Although some of the details are vague, projects are
described briefly below. This October, an informal conference will be held at the
University of Kansas to allow graduate students and faculty to their work, observations,
and concerns and to establish a committee to organize a larger event involving broader
interest groups.

- **Agriculture Canada, Edmonton, Alberta**
  Studying propagation, pollination and hybridization of *Echinacea* species.

- **Kansas Biological Survey, University of Kansas**: Dana Price Hurlburt, PhD
candidate, and Kelly Kindscher, Assistant Scientist
  Examining the effects of harvesting on *Echinacea angustifolia* population
dynamics.

- **South Dakota State University**: Richard Little, Graduate student, and Neil Reese,
  Professor
  Studying agronomic potential and basic biology of *Echinacea*.

- **University of Illinois**: Kimberly Bauer, Graduate student
  Chemical analysis of *Echinacea* after nutrient application.

- **University of Ottawa**: Shannon Binns, Graduate student
  Conducting a study on the genus *Echinacea* to complete taxonomic revisions
  concerned with native population conservation and genetic biodiversity.

- **University of Massachusetts**: Kathy McKeown, Graduate student
  Collecting germplasm and studying the genetics of all *Echinacea* species.

**CONCLUSION**

The wide range of *E. angustifolia* encompasses a prairie facing major ecological
crises. The introduction of domestic livestock and development of large-scale agriculture
has redesigned hydrology, soil structure and dynamics, grassland ecosystems and the natural contours of the Great Plains. Only a few remnant pockets of untilled native prairie remain. On the Fort Peck Reservation, the remaining natural grasslands are threatened by pesticide and fertilizer contamination. There is no buffer for soil erosion and chemical runoff between the artificial and natural landscapes (Sung-gleska, 2 February 1998). On top of these existing problems, wildharvesting of some plant species in Montana is becoming a secondary threat (Heidel, 12 November 1997). Unfortunately, with the lack of biological and ecological knowledge, threats to the species and greater ecosystem are poorly understood and difficult to evaluate. *E. angustifolia* falls into this category. Until plant life history and response to disturbance is more fully understood, local environmental knowledge and observations provide invaluable understanding for population and habitat threat assessments and conservation strategies.
Chapter 4
MEDICINAL USES OF THE PLANT

"This drug, which has slowly wedged its way into attention, is persistently forcing itself into conspicuity. The probabilities are that in time to come, it will be ardently sought and widely used, for it is not one of the multitude that have flashed into sight, been artfully pushed, then investigated, found wanting, and next dropped out of sight and out of mind. It seems proper, then, that the history of this drug should be recorded in an authoritative way, where it can be referred to in time to come...." (John Uri Lloyd, 1904)

ASSINIBOINE AND SIOUX TRADITIONAL USES

As part of the acculturation agenda of the US government and early missionaries, traditional medicine was discredited and replaced with Western doctors, philosophies and practices. As a result, today only a handful of elders and younger traditionalists presently retain the cultural knowledge and use E. angustifolia as medicine. The majority of tribal people either do not know the medicinal application of the plant (Sung-gleska, 2 February 1998) or have relearned the various uses through herb books or scientific literature. The following information is in no way complete. E. angustifolia has had a wide range of uses and applications. Some of the knowledge has been lost, and some continues to be shared secretly for protection of the plant and the culture. However, past ethnobotanical accounts and present information sharing has provided insight into age-old traditional remedies and preparations.

According to an early ethnobotanist, Melvin Gilmore (1977), Echinacea has been used by tribes of the upper Missouri River region for more ailments than any other plant. Ethnobotanists during the mid-1800's to early 1900's recorded various uses by the Assiniboine, Dakota, Lakota, and Teton Sioux. Although its not known by the author if these methods are still employed, historically the Assiniboine chewed the root and applied it to rattlesnake bites, gunshot wounds and frozen parts to alleviate pain and reduce tension and inflammation (Denig 1930). The Dakota used the fresh root to treat hydrophobia (rabies), snakebites, and septic conditions (Smith 1928). They also applied the root to
inflamed areas to lesson the sensation of burning (Gilmore 1913b). The Lakota and Teton Sioux used the root in remedies for toothaches, tonsillitis, bellyaches, and pain in the bowels (Munson 1981; Densmore 1918). During a visit to the Rosebud Reservation, South Dakota in 1987, Kindscher (1989) noted that *E. angustifolia* still is widely harvested and used by the Lakota. These identical treatments with the plant reflect the vast trading of knowledge and material between Plains tribes (Sung-gleska, 2 February 1998; see Table 4.1). One account even reports the use of *Echinacea* for snakebites in Mexico, even though no *Echinacea* species' native distribution extends that far south (Gilmore 1913b).

The present knowledge of the plant is an amalgamation of the remedies that have been tested, expanded and exchanged throughout hundreds of years. Eighty-five years after Gilmore's observation, Yantonai/Hunkpapa and Crow traditionalists describe *Echinacea* as having the "greatest medicinal value of all plants" (Snell, 7 November 1997; Sung-gleska, 2 February 1998). Sung-gleska, a Yanktonai/Hunkpapa traditionalist, explains that it's "like a bandaid on top of anything... It's used for so many problems... from toothaches to AIDS on the reservation" (personal communication, 2 February 1998 and 9 February 1998). Many of the applications are connected with immune system, which *E. angustifolia* is thought to boost. The plant is used for breathing disorders, fevers and colds, and tuberculosis (Sung-gleska, 2 February 1998; Sung-gleska, 9 February 1998; Zeckner, 2 February 1998). While it is unclear how the latter two are treated, breathing disorders are treated by burning the plant in sweat baths (Sung-gleska, 10 February 1998). A few traditionalists explain that by chewing the root, the pain of toothaches diminish. A Crow herbalist on the Crow Reservation has used the "Western" advent of *Echinacea* tincture to numb the mouth and completely remove a rotting tooth (Snell, 7 November 1997).

Scientific research has illuminated the physiological mechanisms associated with healing through immune system stimulation. Apparently, when taken orally, *Echinacea* increases the white blood cell count in the body for a few days (Bergner 1997), which
<table>
<thead>
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<th>FORM</th>
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<td>Cheyenne</td>
<td>Colorado, Kansas</td>
<td>analgesic or orthopedic aid</td>
<td>infusion of leaves or root</td>
<td>Grinnell 1962</td>
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<td></td>
<td></td>
<td>rubbed on painful necks</td>
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<td>sore mouth, gums or throat sore</td>
<td>infusion of leaves or root</td>
<td>Grinnell 1962</td>
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<td></td>
<td></td>
<td>toothache remedy</td>
<td>root juice</td>
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<td>thirst preventative</td>
<td>chewed root to stimulate</td>
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<td>saliva</td>
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<td>Choctaws</td>
<td>Mississippi, Alabama</td>
<td>rheumatism, arthritis</td>
<td>tea; salve for external use</td>
<td>Hart 1981</td>
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<td>Comanche</td>
<td>northern Texas</td>
<td>mumps, measles</td>
<td>tea; salve for external use</td>
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<td>coughs, dyspepsia</td>
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<td>decoction of root</td>
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<td>root</td>
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<td>Dakota (Sioux)</td>
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<td>colds</td>
<td>chewed roots</td>
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<td>tea of root</td>
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<td>analgesic for burns</td>
<td>juice used as a wash</td>
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<td>headache</td>
<td>smoke of plant</td>
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<td>Kiowa</td>
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<td>snake and other venomous bites and stings</td>
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<td>toothache</td>
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<tr>
<td>*Meskwaki (<em>Fox</em>)</td>
<td>eastern Nebraska</td>
<td>distemper of horses</td>
<td>smoke of plant</td>
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<td>Omaha</td>
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<td>hydrophobia (rabies)</td>
<td>freshly scaped root</td>
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<td>gonorrhea</td>
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<td>stimulates energy</td>
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<td>coughs</td>
<td>ground root chewed</td>
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<td>colds and soro throats</td>
<td>chewing the root</td>
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<td></td>
<td></td>
<td>stomach cramps; fits</td>
<td>root (possibly of <em>E. pallida</em>)</td>
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<td></td>
<td></td>
<td>anesthetic to arms and hands</td>
<td>poultice of smashed roots</td>
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<td>antitoxic for snakebites,</td>
<td>plant</td>
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<td>sore eyes</td>
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<td>eye trouble</td>
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<td>Omaha-Ponca</td>
<td>northern Nebraska</td>
<td>antidote to septic diseases</td>
<td>poultice of smashed roots</td>
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<td>Pawnee</td>
<td>central Nebraska</td>
<td>as an eyewash</td>
<td>root</td>
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<td></td>
<td>children's game</td>
<td>root</td>
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<td>Teton Sioux</td>
<td>eastern Wisconsin</td>
<td>rattlesnake bites</td>
<td>root</td>
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<td></td>
<td></td>
<td>bowel pain</td>
<td>root</td>
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<td></td>
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<td>tonsilitis</td>
<td>root</td>
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<td>Winnebago</td>
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<td>toothache</td>
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<td></td>
<td>anesthetic against heat</td>
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*Tribe outside the Great Plains
increases the body's ability to fight foreign substances. Additionally, the activity of white blood cells is raised, so "removal" of foreign substances occurs at a faster rate and over a longer enhanced period of time (Bergner 1997). Two clinical trials have been conducted to examine the use of *Echinacea* for colds and flu. One demonstrated significant reduction in length and severity of flus after 180 drops of *E. purpurea* tincture (450 mg dose) were administered during the onset of the flu-symptoms. The second study tested preventative effects in people highly susceptible to recurring colds. Although the differences were not statistically significant, people who were receiving two tablespoons per day of the *Echinacea* preparation, Echinacin® (a product made from pressed juice of the flowering *E. purpurea* tops) remained more infection-free and tended to have milder infections than people in the placebo group (Bergner 1997). Sore throats, sometimes associated with colds and flu, also are relieved by traditionalists using *E. angustifolia* (Sung-gleska, 10 February 1998). Probably the numbing effects in combination with the increased immune system activity in the lymph nodes (tonsils) provide the healing improvements.

Other immune-related ailments in which *E. angustifolia* is employed include open wounds and inflammation of bumps, bruises and cuts (Sung-gleska, 2 February 1998; Sung-gleska, 10 February 1998). Although today lard or vegetable oil forms the base of *Echinacea* salves, historically buffalo or elk fat were used in the *Echinacea* preparation which was applied topically to the wound and then covered with the hot hide of the animal. Bullet hole wounds also were treated using *Echinacea*. After the bullet was extracted, the burnt plant was placed in the wound (Sung-gleska, 2 February 1998). Reviews of the scientific literature suggest the mechanisms for action of topical preparation include stimulation of the local immune system, reduction of inflammation, and promotion of tissue generation (Foster 1991). Research has demonstrated psoriasis remission after injection of Echinacin® and rapid healing of first degree burns after topical application of an *Echinacea* preparation (Foster 1991). Additionally, a review of 4,598 clinical cases involving Echinacin® ointment revealed high effectiveness (71 to 96% improvement) in treating
wounds, burns, eczema, inflammatory skin conditions, herpes simplex and varicose ulcers of the leg (Bergner 1997).

On the reservation, *E. angustifolia* is used to relieve bellyaches, migraines and other headaches. By chewing the root, stomach upset amends, and by using the plant as a smudge, headaches are alleviated (Sung-gleska, 2 February 1998; Sung-gleska, 10 February 1998; Zeckner, 2 February 1998). A Yantonai/Hunkpapa traditionalist described smudging in sweat lodges and putting a towel over the head while breathing in the smoke. In the past, animal skin was used instead of a towel (Sung-gleska, 9 February 1998; Sung-gleska, 10 February 1998). Additionally, *E. angustifolia* reduces dry mouth which was very important to "runners" years back. As Alma Snell, a Crow herbalist, recounts from stories: "Runners, you know that'd run from village to village [bringing the news], would basically go from water hole to water hole. But if they were really thirsty, they would find *Echinacea* [Burnt Head] and pick the petals to suck on. This always made the saliva come, and it would wet the throat... enough until the next water hole" (personal communication, 7 November 1997).

While topical salves, chewing the root or petals, and inhaling smoke from smudges account for a few preparatory forms, there are other ways in which *E. angustifolia* is used. Infused leaves and flowers are drunk as teas. The root, stripped of its "bark" and pounded into a powder, is snorted into the nostrils. Medicine men used to cure certain ailments by sticking a sharp object that had been saturated with *Echinacea* into the sick person's vein (Sung-gleska, 2 February 1998; Sung-gleska, 9 February 1998). Today, people put *E. angustifolia* in blenders to make a fine powder for teas. A pinch of the powder will bring fluid and coat the throat (Sung-gleska, 6 March 1998). In order to use the medicine throughout the year, the root powder or the dried whole root can be stored (Sung-gleska, 9 February 1998).

As part of the healing process, Sung-gleska uses the plants with prayer and song, so that "it's done with all goodness and the taking is left behind." The spiritual application
recognizes that "the Creator gives potency of the medicine to heal" (personal communication, 2 February 1998), so that physical health and spirituality are mutually inclusive.

"Long ago, people were able to look at the color and understand what medicine it provided and whether it was toxic. The purple of the [E. angustifolia] represents compassion. But we don't have the understanding anymore. Plants have been tampered with. Perhaps that is why people say you can't transplant [or cultivate the species] because it would give a false reading [in color and in medicinal potency]" (Sung-gleska, 2 February 1998).

Sung-gleska further adds that:

"Traditional medicine did not fail for thousands of years, and over this time, the uses were refined. Now, doctors are salesmen, making money off pharmaceuticals to validate their practice. Who has the greatest cure?.... At times, when modern doctors gave up on patients, Echinacea has cured those people to live normal lives" (Sung-gleska, 2 February 1998).

**MEDICAL HISTORY FROM FOLK USE TO MEDICAL DISUSE**

Medicinal prairie plants have not been studied extensively in part because of antagonistic and hostile relations between Plains tribes and early settlers, but also because physicians' medicine bags were already full of exotic or American woodland botanicals. However, *E. angustifolia* was one of the few prairie plants that did seep into folk usage (Kindscher 1989). The exchange of information occurred in a number of locations throughout the Plains (Lloyd 1923). One of the earliest references, made by Ferdinand V. Hayden in his 1859 "Botany Report to the Secretary of War" on the Upper Missouri River region, depicted traders and Native Americans using the plant for rattlesnake bites (Hayden 1859). Later in a 1914 issue of *Gleaner*, Dr. J. Leachman of Sharon, Oklahoma described multi-purpose and veterinary use by early settlers and Native Americans in Oklahoma: "Old settlers all believe firmly in the virtues of *Echinacea* root, and use it as an aid in nearly every kind of sickness. If a cow or a horse does not eat well, the people administer *Echinacea*, cut up and put in the feed. I have noticed that puny stock treated in this manner soon begin to thrive" (Lloyd 1923). But it was Dr. H. C. F. Meyer of Pawnee City,
Nebraska who learned the medicinal value from Native Americans, developed his own secret remedy and then introduced the plant to the greater medical community.

In 1885, after fourteen years of experimentation, Meyer sent samples of the root and his *Echinacea* medicine to two prominent Eclectic physicians, John Uri Lloyd and John King, for plant identification and product endorsement. At the time, the Eclectic school was a notable branch of medicine in the United States that incorporated the use of herbs in clinical practice. Meyer hoped not only to expand awareness of the plant's medicinal applications, but also to increase sales of his secret remedy called "Meyer's Blood Purifier" (Lloyd 1904). However, without the whole plant for identification and lack of knowledge of the remedy's ingredients, Lloyd and King would not endorse Meyer's product. They required that the botanical name of the medicine be made public. In the following year, Meyer sent the whole plant to Lloyd, and it was identified by Curtis Gates Lloyd as *Echinacea angustifolia* (Lloyd 1923). Still John Uri Lloyd was not swayed by Meyer's claims that his medicine could cure anything from a rattlesnake bite to typhoid fever (Lloyd 1897). Meyer also asserted that the remedy had not failed once in curing over six hundred cases of rattlesnake bites (Lloyd 1904). However, since *E. purpurea* had already been used by Eclectic and herbal practitioners, King investigated the remedy further and soon developed a favorable opinion. The tincture preparation was then sent to other Eclectic physicians who became "so convinced of its value that in 1887 [King] announced it to the medical profession in... the Eclectic Medical Journal" (Lloyd 1897). Personal experience with the preparation further strengthened King's opinion and turned Lloyd into a believer. Apparently, Meyer's concoction was the only remedy that gave King's wife relief from her "virulent cancer" (Lloyd 1904).

One of the major claims that Meyer was eager to sell was the medicine's antidotal treatment for venom poisoning. Meyer wrote King and Lloyd on a number of occasions that he would come to Cincinnati and, in the presence of medical authorities, allow a rattlesnake to bite him. The only medicine he would use to counteract the venomous bite
would be *Echinacea*. Thinking that their refusal stemmed from King and Lloyd's inability to find a snake, Meyer offered to bring with him "a full-sized rattlesnake, possessed of its natural fangs" (Lloyd 1923). However, this offer also was declined.

Gradually, attention around *E. angustifolia* increased, and under the advice of King, the Lloyd Brothers Pharmacists, Inc. developed and introduced a tincture preparation to the medical profession. By 1917, *E. angustifolia* became "the most used American drug introduced since eighteen hundred and eighty five" (Lloyd 1923). However, exaggerated reports from physicians led to overpraise of the drug as a "cure all" and initiated laboratory research by the "Regulars," or allopathic physicians, to determine the plant's therapeutic value. From Couch and Giltner's report, the efficacy of Meyer's "far-reaching claims" was brought into question as a large number of ailments including tuberculosis, tetanus, and snake bites demonstrated no relief from the medicine (Lloyd 1923). Hoping to clarify the therapeutic values and prevent further discrediting of the plant, the Lloyd Brothers suspended *E. angustifolia* advertisements for a year, examined the "antagonistic statements," and surveyed practicing physicians on their clinical experiences with the plant. Despite laboratory findings, clinical evidence compiled from the questionnaires reaffirmed certain therapeutic values of the plant remedy. Concurrently, the popularity of the *E. angustifolia* preparation with medical practitioners continued to grow. In 1922, the drug was the top seller by three times in a list of 239 plant remedies (Lloyd 1923), and from 1916 to 1950, the dried roots and rhizomes of *E. angustifolia* were listed in the National Formulary (Hobbs 1995).

The Eclectics were not the only health practitioners to incorporate *E. angustifolia* into their practice. Around 1902, Homeopaths started using the plant in the United States, England and Germany. The dilute homeopathic medicine became popular for general weakness, healing and disinfecting difficult wounds, and as an energy stimulant (Bergner 1997, Hobbs 1995). It is believed that Homeopaths originally introduced the plant to Europe where it remains an important medicine to this day (Hobbs 1995).
However, the use of *E. angustifolia* in the United States drastically waned around the late 1930's. Due to the fierce competition of the Regulars branch of medicine, the Eclectic physicians finally were put out of practice. In 1939, the last Eclectic School closed, and with it, the Lloyd Brothers' famous *Echinacea* tincture formula disappeared. At the same time, synthesized antibiotics were discovered and promoted by the Regulars (or present-day doctors), and *E. angustifolia'*s immune system stimulating ability was temporarily forgotten. To this day, historians and herbalists seek to find the Lloyd Brothers Specific *Echinacea* recipe which has been lost to antiquity.

**MODERN REDISCOVERY**

As *Echinacea* use waned in the United States, the demand in Europe continued to expand. In 1937, the French bought nearly the entire export crop which created severe shortages of supply for German companies. This initiated Dr. Gerhard Madaus of the firm Madaus and Company to travel to the United States and bring back seeds for cultivation efforts in Europe (Foster 1991). The plants that sprouted turned out not to be *E. angustifolia*, but a relative, *E. purpurea*. Before this time, scanty reference to *E. purpurea* as medicine existed. But after preliminary experiments, Madaus found similar therapeutic properties in *E. purpurea* compared to *E. angustifolia*. The accident had major implications for German and worldwide medicine. Today, fifty years later, over 200 European pharmacological, clinical and chemical studies have been conducted on the applications of *E. purpurea* (Foster 1991). However, unlike the United States practice of using the root, Madaus' products were developed from the tops of the flowering plant. So constant planting was not necessary (Bergner 1997). Therefore, most *Echinacea* research is based on the efficacy of the flowering tops (product: Echinacin®). The German Commission that regulates herbal products allows the sale of the flowering tops, but due to lack of research, denies the sale of *E. purpurea* or *E. angustifolia* roots (Bergner 1997).
American rediscovery of the plant occurred during the 1970's as herbalism resurfaced and people started taking more responsibility for their health. With added awareness of pollutants in the environment and other bodily stresses, *Echinacea* again began seeping into medical practice. Ironically, information this time came from the Germans, who retaught Americans about their prairie plant. Today, there are over 300 products containing *Echinacea* (Bergner 1997). "Nearly every herb company has one or more *Echinacea* products" (Hobbs 1995), and the demand increases (see Chapter 5).

**Recent Clinical Findings**

Most information on *Echinacea*'s clinical effectiveness derives from the research of Eclectic and German physicians and herbalists who employ it in their practice. According to Bergner (1997), most of the research is not scientifically valid in the modern medical view; but the consensus of personal experience creates its own high value. Although hundreds of studies have been conducted, there exists "very little definitive information from scientific trials about how to use *Echinacea*, what species or plant parts are most effective, and what form or forms are most useful" (Bergner 1997). Much research focuses on isolated *Echinacea* constituents instead of the whole plant, incorporates injectable forms of the medicine rather than oral forms, and is conducted on animals or in petri-dishes. Bergner suggests these methods do not reflect the various ways in which the whole plant reacts in the human body (1997). Furthermore, many of the articles are not controlled trials, but practitioner reports, and the German studies that are well-designed incorporate *Echinacea* in combination with other plants. So the effects of *Echinacea* used alone remain unclear. Lastly, problems with adulteration and substitution of *Echinacea* confounded many analytical and clinical studies prior to 1987, and therefore much of the evidence is questionable (Bergner 1997). However, research using *Echinacea* in human trials suggests it is effective in treating wounds, inflammatory conditions, bacterial and
viral infections and in stimulating the immune system. For a review of the scientific research on *Echinacea*, see Bauer and Wagner (1991), Foster (1991), and Hobbs (1995).

**CONCLUSION**

The popularity of *Echinacea* medicine has waxed and waned throughout the last one hundred years. As each cycle thrust *Echinacea* back into the public eye, the renewed demand for the plant posed intense threats for the wild species (see Table 4.2). With little cultivation happening around the turn of the century, the main source of *Echinacea* stock was the wild stands. In 1902, LE Sayre of the University of Kansas Pharmacy Department reported that over 200,000 pounds of the dried root were harvested (mostly) in northwestern Kansas (Sayre 1903). Even though students found "little profit at twenty-five cents a pound" in 1897, five years later the worth of the 1902 harvest generated more than $100,000 (with the price rising to 50 cents per pound) (Sayre 1897, Kindscher 1989). If eight to ten dried roots equal one pound, then in that year alone, about two million roots were harvested (Kindscher 1989). The demand prompted Sayre to write Rodney True, director of drug and medicinal plants at the USDA's Bureau of Plant Industry, "asking that something be done by the government for the protection of this weed against extermination" (Sayre 1903). True suggested cultivation of the plant. However, interest in *Echinacea* fell before cultivation efforts commenced (Kindscher 1989).

The demand surged again in 1965 due to research interests, and orders called for "all the root that could be obtained" (McGregor 1968). During that year, 25,000 pounds of dried root were harvested. Since *E. pallida* was more desired than *E. angustifolia* at this time, harvesting efforts shifted toward this species. This sudden demand waned almost as fast as it started, for two years later, the demand for the root had already decreased. Pre-dating and extending this surge, demand from European markets created annual exportation
of 50,000-100,000 pounds of *Echinacea* from the 1930's through the 1980's (Hobbs 1995).

Today, in 1998, we are in the midst of yet another upswing in the demand cycle. How we handle the present increasing demand and harvesting pressures still unfolds. Will we learn from these historical recurrences? Or will we again be driven by the demand that fades before conservation efforts are in place, with our botanical history again lost?

**Table 4.2: Botanical history of *Echinacea angustifolia***.

<table>
<thead>
<tr>
<th>Pre-1800's</th>
<th><em>Echinacea</em> is an important medicine for many Native American tribes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1690's</td>
<td>European botanists first classify <em>Echinacea</em>.</td>
</tr>
<tr>
<td>1870</td>
<td>Meyer learns of <em>Echinacea</em> from Native Americans or early settlers in Pawnee City, Nebraska, and makes &quot;Meyer's Blood Purifier.&quot;</td>
</tr>
<tr>
<td>1885</td>
<td>Meyer contacts Eclectics Lloyd and King about his medicine</td>
</tr>
<tr>
<td>1887</td>
<td>King introduces <em>E. angustifolia</em> to the medical community</td>
</tr>
<tr>
<td>1891</td>
<td>The first article on <em>Echinacea</em> appears in an Eclectic medical journal.</td>
</tr>
<tr>
<td>1902</td>
<td><em>Echinacea</em> is adopted for use by homeopathic doctors.</td>
</tr>
<tr>
<td>1907</td>
<td><em>Echinacea</em> is the most popular herb in medical practice in the U.S., among both Eclectic and allopathic practitioners.</td>
</tr>
<tr>
<td>1910</td>
<td><em>Echinacea</em> is recognized as an immune stimulant that increases leucocytosis.</td>
</tr>
<tr>
<td>1920-1922</td>
<td><em>E. angustifolia</em> is the top plant drug sold by Lloyd Brothers Pharmacist, Inc.</td>
</tr>
<tr>
<td>1930</td>
<td><em>Echinacea</em> preparations become popular in Germany.</td>
</tr>
<tr>
<td>1930's-1980's</td>
<td>More than 400 scientific journal articles appear exploring the medicinal properties of <em>Echinacea</em>.</td>
</tr>
<tr>
<td></td>
<td>About 50,000 pounds of <em>Echinacea</em> are exported annually from the U.S. to European markets.</td>
</tr>
<tr>
<td>1970</td>
<td>U.S. herbalists &quot;rediscover&quot; <em>Echinacea</em>.</td>
</tr>
<tr>
<td>1986</td>
<td>More than 240 medicinal products in Germany have <em>Echinacea</em> as a constituent. In the U.S., <em>Echinacea</em> consumption quadruples over previous year and more than 100,000 pounds of the herb are sold.</td>
</tr>
</tbody>
</table>
| 1998       | ????

(adapted from Hobbs 1995, Lloyd 1923)
Chapter 5

THE ECHINACEA MARKET
AND CONSERVATION IMPLICATIONS

"A tremendous increase in the popularity of herbal medicines is quickly bringing to light the vast healing potential of plants. Every day another newspaper or magazine article extols the virtues of a medicinal plant whose traditional use has been confirmed by modern scientific study. Perhaps no other herb has played a larger role in bringing about this change than Echinacea, the most popular medicinal plant among herbalists, health professionals and American consumers" (Roy Upton, 1997).

NATIONAL/INTERNATIONAL MARKET DEMAND, DISTRIBUTION AND BIOLOGICAL IMPLICATIONS

Herbal medicine in the United States is a rapidly growing business. In 1995, consumers spent over two billion dollars on herbal products (Liebmann 1997). Three years later, revenue has reached over three billion dollars (Johnston 1997a). Pharmacies throughout the country presently are experiencing the fastest growth in the herbal market segment of their business. And the demand is projected to increase to a five billion dollar industry by the year 2000 (Liebmann 1997). Induced by American rediscovery of medicinal herbs, the radical growth accelerated when the herbal market shifted from a health and natural food market to chain pharmacy and mass market production in 1995 (Foster 1997). Again, Echinacea became the most popular medicinal herb, this time riding the surge of the "herbal renaissance." Grossing nearly 10% of the total herb sales in the United States, the prairie perennial ranked the top selling herb for the last three years (Richman and Witkowski 1997; Johnston 1997b). With more than 300 products on the market, the plant now is found in everything from shampoo to fruit juices to throat lozenges and immune system medicine for race horses (Mater 1997). The word Echinacea has become a marketing ploy liberally used by the media and for general commercial herbal product sales.
Although *Echinacea* has been part of European medicine continuously since the 1930's, the European and greater international markets also have expanded in *Echinacea* sales. In 1992, the herbal medication markets in Canada, France, Germany and Great Britain grew five to ten percent (Mater 1995). Over the past decade in Western Europe, medicinal plant consumption doubled (Fuller 1991). In the midst of the growing herbal demand, sales of *Echinacea* rank eighth internationally on the list of the most frequently prescribed mono-herbs (Cech, 27 March 1998). The plant medicine has become a daily recommended prescription amongst physicians in Germany (Foster 1997).

Commercialization and utilization of the plant recently expanded into Australia. With such large national and international demands, a question that direly needs to be addressed is "From where are all these plants coming to supply the global market?"

While cultivation of these species fills some of the heavy demand, most commercial supply still comes from the wild, particularly for *E. angustifolia* (Foster 1997). The nine species and two varieties of *Echinacea* occur only grow in southern Canada and throughout the central plains and southeastern sections of the United States. Two species, *E. atrorubens* and *E. paradoxa* var. *paradoxa*, are relatively rare; and two other species, *E. laevigata* and *E. tennesseensis*, are listed as endangered by the United States Fish and Wildlife Service (Bergner 1997). The other species and varieties are either relatively common and widespread (*E. purpurea*, *E. pallida*, and *E. angustifolia* var. *angustifolia*) or have narrow and spotty distribution ranges (*E. sanguinea*, *E. simulata*, *E. paradoxa* var. *neglecta*, and *E. angustifolia* var. *strigosa*) (Foster 1991). Since scientific and clinical research have been conducted to support their medicinal efficacy, *E. angustifolia* var. *angustifolia*, *E. purpurea* and *E. pallida* are the three plants in present demand.

Due to increased cultivation of *E. purpurea*, wildharvesting of this plant appears to have decreased in the last couple of years. While similar cultivation efforts have been attempted for *E. angustifolia* var. *angustifolia*, the plant's low germination rates and finicky germination requirements have discouraged large-scale cultivation. Jim Foster, a broker
with Headwater Herbs, estimates that approximately 300 to 400 acres of *E. angustifolia* have been planted throughout the United States and other cultivation endeavors are expanding into Canada and Costa Rica. Canada now exports tons of *Echinacea* to Germany, France and Italy (J. Foster, 23 March 1998). Yet the effect these supplies have on the international market remains to be seen. Reports suggest that the *Echinacea* grown in Costa Rica actually lacks potency due to the wet, inappropriate growing conditions of the environment (Cech, 27 March 1998; see Appendix D: Cultivating *Echinacea*: Specifics of growing and shared lessons for more details). Whether this venture by an Italian company will continue probably depends on reevaluating the needs and requirements for species propagation. Since the environment in Canada is more like *Echinacea*’s native habitat, Canada’s drought stressed crop may produce more biologically active constituents, and therefore, a higher quality medicine than that from Costa Rica. Expansion of this source may be very beneficial to the wild plants in the United States.

However, despite cultivation efforts, wild populations throughout the Great Plains comprise the majority of commercial supply and are in threat of overharvest (Foster 1991). Population declines due to root digging of wild stands has been observed in Oklahoma, Arkansas, Kansas, Nebraska, Texas, the Dakotas (Foster 1991) and now Montana and Wyoming (J Foster, 23 March 1998). In 1984, Dr. James H. Wilson, former Endangered Species Coordinator of the Missouri Department of Conservation, noted "seeing a substantial decrease in coneflowers along Missouri roadsides" (personal communication, 14 March 1984 in Foster 1991). A few years later, Ronald McGregor, Director of Emeritus of the Herbarium at the University of Kansas, leading authority on *Echinacea* botany, and observer of the 1965 wildharvesting wave, stated that the problem has become more acute in recent years.
Over the past 25 years, but especially within the last five, I have noted a rather drastic decline in Kansas populations of *Echinacea pallida*. Last summer I observed a crew of six persons with a one-and-a-half ton truck filled with bags of roots and was told that it was their eleventh load so far in the season, and that was around the first of June.

The digging of *Echinacea angustifolia* is much less extensive in Kansas largely because the roots are smaller and harder to dig. If the price increases, however, it is certain populations of *Echinacea angustifolia* will decline.

In my opinion we will have a real problem on our hands with native populations before we are able to develop some sort of control. Because populations are still rather frequent, it is difficult to create much interest on the part of those in a position to act. Though I carefully explain the drastic decline in populations in recent years, I receive little attention (personal communication, 24 March 1987 in Foster 1991).

Recent observations point to the central states as a hot spot of *Echinacea* harvesting, since many species naturally grow in the area. Harvey Payne, director of the Nature Conservancy's Tallgrass Prairie Preserve near Pawhuska, Oklahoma, notes an increased number of poachers on the preserve, highway and country road rights-of-way, and his own private property (Lantz 1997). Similarly, Paul Buck, botanist at the University of Tulsa and founder of Oklahoma Native Plant Society, observed a 40 acre field that had been stripped of all *Echinacea* plants from just days before (Lantz 1997). Another hot spot of activity and closer to home are the prairies of North Dakota, particularly the reservations and around Minot and Williston. Advertisements as far as Wisconsin suggest traveling to North Dakota to dig *Echinacea* (Crawford 1998a). Local notices in the widely distributed Williston Shopper encourages people to "just grab a shovel, start digging and make some money!!!" (Northern Plains *Echinacea* District Company 1997; see Fig 5.1). On the Fort Berthold Reservation, reports "indicate that it is not uncommon to see people out with shovels roaming the countryside looking for purple coneflowers, including... incidents of 'truck-fulls' of the roots being taken" (North Dakota and Minnesota Chapters of the Wildlife Society 1998).

The harvesting of *Echinacea* species in commercial demand also threatens the rare and more unusual *Echinacea* species. Declines in these populations have been noted. On the ground, collectors generally are not trained to distinguish between the species, so endemic and endangered plants often are thrown in the back of harvester's trucks (Kindscher, 11 November 1998). Populations of *E. atrorubens* have been collected
The Purple Coneflower is starting to bloom now. So just grab a shovel, start digging, and make some money!!!

Call 572-1878 for complete details

FIG 5.1. Advertisement in the Williston Shopper Promoting Echinacea angustifolia Harvesting
illegally on private land without the landowners permission. These plants are "thrown in mixed lots of material sold as 'E. angustifolia'" (Foster 1991). Other reports describe dramatic declines in E. simulata populations in south central Missouri and northern Arkansas. In the Ozarks, Foster (1991) observed truckloads of the harvested root and warns, that if the harvest continues at the current level over the next ten years, this species' fate will be extinction. Considering his observations were made seven years ago and the Echinacea market is strong and steady (Cech, 27 March 1998), serious and immediate attention must be directed toward the status of this species. E. paradoxa, known only from seventeen Missouri counties and five Arkansas counties, also faces pressure from harvesting. In the winter of 1987, seven thousand yellow coneflowers were reported stolen from a glade in Missouri's Ha Ha Tonka State Park (Foster 1991). Although no accounts of collecting E. tennesseensis and E. laevigata have been made, the demand for Echinacea and rarity of these species worries Fish and Wildlife Service regional personnel in North Carolina. Essentially, "anyone with a backhoe and a semi could take one of those populations in a single night," warns one FWS official, Nora Murdock (Lantz 1997).

As the situation progresses throughout the prairie, only the one study conducted by Dana Price Hurlburt, graduate student at the University of Kansas, systematically assesses population responses to high commercial demand. The results and information gathered will be invaluable for conservation plans throughout the plains. In the big ecological picture, no quantitative data exist concerning the total amount (pounds) of Echinacea wildharvested, total amount cultivated nationally or internationally, or overall ratio of wildharvested to cultivated raw material in present trade. Also lacking is the site specific information on harvesting locations and local impacts as well as domestic and international shipping destination and amount in commerce. This problem reflects the greater dilemma in medicinal plant trade in which the biological status of commercially exploited plants is unknown due to undermonitoring and poor regulation (Robbins 1997).
ISSUES AFFECTING THE ECHINACEA MARKET

A number of issues complicate the Echinacea market and contribute to the widespread harvesting threats confronting Echinacea species and other plant species within its range. At least since the turn of the century, Echinacea medicines have been adulterated and substituted with other plant species. The level of such past and present substitutions remain unknown, but added pressures to the plain's plant community have been felt due to these unintentional and purposeful activities. Other issues center around the confusion over which Echinacea species or which plant part is more medicinally potent. The present conceptions drive specific markets in Germany and the United States. Lastly, overuse and inappropriate use have contributed to unnecessary harvesting and removal of the wild plant species.

DECIDING WHICH PLANT SPECIES, PLANT PART AND CHEMICAL CONSTITUENT IS MORE MEDICINALLY POTENT

Although typically the flowering tops of E. purpurea are used in Germany and the roots of E. angustifolia in the United States, every part of both species has medicinal value. However, the level and ratio of chemical constituents within the plant and between species varies, so quality of medicine also varies. Surprisingly, with the hundreds of articles published on Echinacea, scientific studies still have not determined how these differing chemical "fingerprints" equate to potency, or in other words, which chemical makeup of the plant or plant part is of higher quality. But there is a strong clinical consensus in the United States from herbalist and past Eclectic history supporting the primary Native American tradition of using E. angustifolia roots, and this belief largely drives the American market for E. angustifolia.
But what are the criteria to judge the species and plant part as medicinally strong? Is it part of the belief system and training under which herbalists learn? Is it based on personal clinical experience and long term comparative analysis? Or is it related to the immediate effects of numbing and tingling taste sensations stimulated from sampling the root? While a combination of these probably factor in, immediate criteria of plant quality depends on oral sensation (Hobbs 1995, Bergner 1997). If numbing is related to effectiveness, then the stronger the numbing, the higher the potency. Under this criteria, one local cultivator claims the flower cones as the most potent, followed by the roots, stem and leaves in descending order (Sugarek, 6 February 1998). On the Fort Peck Reservation, taste measurements were employed by a Yantonai/Hunkpapa traditionalist when we dug for root. After uprooting one plant and nibbling the root, Sung-gleska noted the lack of a "tingle" and stated the root was not medicinally potent. Upon sampling a second root which did tingle, he acknowledged that this plant was "very potent" (personal communication, 2 February 1998). However, other herbalists do not stand by this oral determination and believe the numbing is not indicative of potency. Although *E. angustifolia* produces the tingling more than *E. purpurea*, herbalists believe there is either no difference or no substantial difference between the two species and incorporate either plant into their practice (Klein, 16 February 1998; Carney, 9 March 1998).

As researchers look deeper into the plant, even the isolation of chemical constituents in the plant has not unveiled the source of *Echinacea*’s medicinal action or the answer to which plant or plant part is stronger. Current opinion suggests that more than one constituent is involved (Bauer and Wagner 1991). Compounds found in the plant that show medicinal activity include the volatile oil, polysaccharides, cichoric acid, cynarine, echinacoside, isobutylamides and polyacetylenes. Isobutylamides promote the flow of saliva and produce the oral tingling sensation. After examining concentration of this constituent in the roots and leaves of *E. angustifolia*, *E. purpurea*, and *E. pallida*, evidence supports the claim that *E. angustifolia* roots contain the highest content of isobutylamides.
The second highest concentration was found in *E. purpurea* leaves (Bauer and Wagner 1991). However, again studies have not been able to prove or disprove whether this constituent (or tingling) is responsible for the medicinal activity. While isobutylamides display broad immuno-stimulating effects (Bauer and Wagner 1991), German *E. purpurea* products, demonstrating no tingling, also produce these effects in clinical trials (Bergner 1997). For scientific literature reviews on *Echinacea's* chemical constituents, see Bauer and Wagner (1991), Bone (1997), and Hobbs (1995).

Constituent concentrations vary not only within the plant and between plant species, but other factors, such as time of harvest, geographic location, and local environmental conditions and stresses probably have a role as well. Cosson et al. (1966) examined the alkaloid content of *Datura* species under varying light conditions. Long light exposure during the flowering stage induced greater alkaloid production in *Daturatulata*. Bennett et al. (1990) found that the alkaloid constituent, sanguinarine, increased with decreasing latitude, which may have been attributed to increasing pest, predator or disease pressure along the north-south gradient (Bennett et al. 1990). Other studies demonstrate biochemical adaptations due to climatic and geographical variables on the biosynthesis of glycoside, volatile oil and cannabinoid production (Vanhaelen et al. 1991). Thus far, no studies have examined such ecophysiological influences on chemical levels in *Echinacea*.

**Adulteration and Substitution**

Adulteration has been a problem in the *Echinacea* market for at least ninety years. Moser (1910) detected the first "spurious adulterant," *Parthenium intregrifoliuni*, or Missouri Snake Root, in 1909 which continued to pollute *Echinacea* medicine until 1987. The roots are easier to dig, weigh more and when cut and sifted resemble *E. angustifolia* or *E. pallida* roots. However, taste, flavor and medicinal quality are significantly different. Other plants that have been substituted include *Lespedezacapitata* (bush clover), *Eryngium*
aquaticum (rattlesnake master), Helianthus annuus (common sunflower), and Rudbeckia nitida (St. John's susan) (Lloyd 1923). Although techniques were employed to lessen the substitution, the problem continued to seep into commercial medicine lots and also into scientific laboratories. For this reason, many of the studies conducted prior to 1988 are viewed with skepticism. Researchers at the University of Munich raised the issue again in 1986 and, after further chemical analysis, determined widespread adulteration of P. intregrifolium. Since this discovery, herb manufacturers increasingly test batches of the raw Echinacea plant using visual or taste inspection, microscopic analysis, and chemical analysis by thin-layer chromatography (TLC) and high-performance liquid chromatography (HPLC) (Hobbs 1995). However, up until at least two years ago, the problem still manifested, and one large company intentionally purchased P. intregrifolium from harvesters in Missouri, with the intent to mix in Echinacea lots (Moore, 27 July 1998).

However, the tampering gets even more complex. Other species of Echinacea have been substituted for the desired species. E. pallida has long adulterated commercial lots of E. angustifolia. Although E. pallida may possess immune stimulating activities and once was listed in the National Formulary, the official book on approved botanical drugs, the comparative medicinal quality of the two is unknown, and one should not be blindly substituted for the other. The extent of present adulteration from the other rare and endemic species not in demand is unknown. Strict regulation through standardization of products is presently being examined by the Federal Drug and Administration. However, the projected cost of testing products and purchasing drug identification numbers (DIN) is enough to put many small herbal stores out of business and promote large-scale pharmaceutical industry.

OVERUSE AND INAPPROPRIATE USE

The healing integrity of E. angustifolia has been convoluted by the Echinacea craze and intense marketing schemes. With expanding product lines, the plant increasingly is
found in products in which it has no known beneficial value (Upton 1997) or diminished value. Using the plant in multivitamins, fruit juices, and various medicinal preparations compromises the plant's medicinal value and unnecessarily contributes to the exploitation of wild populations. On the present herbal supplement market, *E. angustifolia* can be bought as powdered capsules, cut and sifted teas, liquid extracts, topical salves and ointments and in whole forms. The most wasteful preparations are the powdered capsules and tablets. Not only is a portion of the raw material lost in the grinding process, but these powders quickly lose their potency. Due to greater surface area, some active constituents oxidize and lose effectiveness in as little as four months (Upton 1997). The potency of teas is questionable since they lack alcohol-soluble constituents (i.e., isobutylamides), which appear to be responsible for medicinal activity (Bergner 1997). Liquid alcoholic extracts, or tinctures, are very favorable since they have long shelf lives (3 to 5 years) and extract alcohol-soluble compounds. In drug preparation, fresh roots are preferred by herbalists since drying initiates loss of some biologically active constituents (Cech, 27 March 1998; Troutman, 27 March 1997). Herbal combination tinctures may be beneficial, but the most common mixture of *Echinacea* and Goldenseal flu and cold formula is "ill-conceived" (Bergner 1997). Goldenseal has many beneficial uses, but not in treating these ailments. More importantly, goldenseal is greatly overharvested in the Northeast and buying any non-cultivated goldenseal products only contributes to its demise.

Another issue surrounding *Echinacea*’s healing ability is its use as a short-term stimulant or a longer duration tonic. Two studies have examined the response of the immune system to *Echinacea* application over time, and both showed short term effectiveness (4-7 days) with a decline in activity as the application progressed (Upton 1997). However, the studies were short-lived, and ceased within days of the initial decline in immuno-stimulating activity. Other research since has suggested that longer, more comprehensive studies are needed. Coeugniet and Schoneberger (1986) demonstrated that between weeks two and ten immune system responses steadily increased with continued
use of *Echinacea*. Clinical experience suggests anywhere from ten days to a month to longer with cyclic rest periods between doses (Hobbs 1995, Upton 1997, Foster 1991). The opinions on the issue range considerably. The German E Commission recommends not using the plant past eight weeks, partly because the body becomes desensitized to its effects. But the range of research focuses on injectable forms of *Echinacea*, and no clinical evidence on oral preparations support this statement (Bergner 1997). At the same time, Upton (1997) comments that if *Echinacea* has not produced effects after eight weeks, then either the *Echinacea* therapy is not working or a deeper health plan, including exercise and change of diet, need to be addressed to keep the immune system strong. Understanding what affects maximum effectiveness of the plant helps shed light on whether nutritional supplements taken every day are beneficial or actually immunosuppressive. However, for the sake of plant conservation, Upton (1997) simply recommends limiting all *Echinacea* use for systemic infections or the onset of colds and flus.

Taking the plant in a variety of forms and within its normal dosage range has no known toxic effects; however, in larger doses and with longer use, minor side effects can be produced. These include headaches, joint pain, dry tongue, decreased temperature, and gastrointestinal upset. Upton (1997) suggests these actually may be the result of *Parthenium integrifolium* substitution. Contraindications of internal *Echinacea* preparations, as listed in the German monographs, warn against use for progressive systemic diseases like tuberculosis, leukemia, collagen disorders or multiple sclerosis (Bergner 1997). However, Bone (1997) warns of "premature" and "probably ill-advised" restrictions on the use of *Echinacea*. Most scientific research was based on intramuscular injection administrations, and since most practitioners do not use this form, but rather oral preparations, results on pharmacological effects may be skewed.
OTHER COMMERCIAL THREATS TO ECHINACEA

While the medicinal herb industry creates the heaviest demand and threat on wild Echinacea, the horticultural industry also places pressure on genus diversity, but to a lesser and unknown extent. Dating back to the early 1700's, E. purpurea particularly has been grown as ornamentals in North American and European gardens. The tradition continued throughout the centuries, and in the 1980's, other less well known Echinacea species were introduced into the horticultural trade. While cultivation efforts promote these plants in commerce, it is unknown how much of a hidden strain is put on the various species. Specific concerns include the source of original plants, the amount collected, and the method of collection. Before recommending propagation of E. angustifolia and purchase of a company's seeds, it is crucial to know if a company's practices placed Echinacea species in more danger.

A brief and informal survey of nurseries in the Missoula and Bitterroot Valleys reveal that most Echinacea ornamentals sold are E. purpurea germinated and grown in greenhouses. However, seed packets of E. angustifolia and other Echinacea species are retailed in the nurseries and derive from outside seed companies. Another brief and informal survey was conducted over the telephone to a variety of seed companies, known for their organic and ethical practices. The origin of seeds of the various species in commerce (E. angustifolia var. angustifolia, E. purpurea, E. pallida, E. paradoxa, and E. tennesseensis) greatly varied from cultivated to wildharvested seed sources. Also, the definition of "organic" includes seeds which naturally derive from the wild. So seed packages sold in the stores and labeled "organic" may not be straight from the farm. Additionally, no "organic" seed company that I spoke with obtains seed of E. angustifolia from organically cultivated sources. "Organic" E. angustifolia seed comes from wildharvested sources.
However, one company's spokesperson (Elixir Farm Botanicals in Brixey, MO) commented that cultivated sources are increasing due to innovative techniques that break the seed's dormancy, overcoming notorious germination difficulties. As a result of improved propagation, corporate farmers began growing hundreds of pounds of seed for commercial production, and a glut in the seed market is forecasted (personal communication, 4 May 1998). The issue then may involve contamination through herbicide application (Elixir Farm Botanicals spokesperson, 4 May 1998), and the dilemma may arise over the use of chemically contaminated medicines versus further reduction in wild plant seed stock. The best way to avoid contributing to either of these problems is to get seeds or a whole plant from a gardening neighbor OR simply appreciate the aesthetic beauty of the plant in the wild.

**Conclusion**

The *Echinacea* trade includes players ranging from individual gatherers to small local herb companies to huge multimillion dollar herbal and pharmacological industries. According to Nan Vance, researcher and special forest product expert of the USDA Forest Service Pacific Northwest Research Station in Corvallis, Oregon, independent entrepreneurs and small companies tend to be more ethical in their practices than big companies (personal communication, 9 March 1998). Part of this has to do with the more direct line of communication with harvesters. The more layers that exist between harvester and end buyer, the less knowledge of environmental repercussions and sociological injustices a company can claim. While some of the larger companies extract thousands of pounds of *E. angustifolia* from the wild, their products are marketed as sustainable or as collected under reasonable recommended practices. However, written recommendations for harvesting practices are largely skeletal gimmicks, since on-the-ground evaluation of practices is never conducted. So harvesting methods never are truly assessed, and level of
disturbance due to harvesting remains unmonitored and largely unregulated. Even if the company has good intentions, interactions between harvesters, buyers and brokers are conducted largely on the telephone or through the mail, so a full assessment of the hired "employee's" job is never conducted or known. Reputation, length of time in the harvesting business, and brief long distance interactions are used to decide the integrity of the harvester.

Large companies are responsible for the massive harvesting occurring throughout the Fort Peck Reservation. Although creating less of a demand, small companies also contribute to the reduction of wild *E. angustifolia* populations on the reservation and throughout the ranges of *Echinacea*. Even if the purchase is less than one hundred pounds of root, the demand, at this point, has left its mark on the species. Added to habitat conversion and degradation (i.e., agriculture, range land), overharvesting poses a threat to *E. angustifolia* population survival in Montana that must not be ignored.
Chapter 6

CASE STUDY: THE HARVESTING OF ECHINACEA ANGUSTIFOLIA ON THE FORT PECK RESERVATION

"If we don’t protect our land and cultural resources, then who will?"
(Nellie Youpee, 24 May 1996).

"Some people feel strongly about the plant, holy plant. But it’s made money for me" (Sousa, 3 April 1998).

THE INTRODUCTION OF COMMERCIAL HARVESTING

Echinacea digging throughout the plains has been likened to gold rush fever which begins abruptly, occurs intensely and spreads to other potential mining sites when resources become depleted. The growing global demand for Echinacea angustifolia has created impetus to "rapidly dig out" wild populations in Oklahoma, Kansas, Nebraska, Missouri and Iowa (J Foster, 23 March 1998). After sweeping the Great Plains states, the digging of the root spread northward, traversed North Dakota, and spilled into the "untouched" stands of eastern Montana and Wyoming about four years ago. At the edge of the species northern range, these two states are essentially the "last places to get hit" by industrial demand (J Foster, 23 March 1998). The large intact stands and pure strain of the species makes Montana populations a particularly "special market" (Cech, 27 March 1998). Since E. angustifolia naturally crossbreeds with other Echinacea species and creates medicinally inconsistent hybrids undesired by industry, the "isolated" populations growing in Montana guarantees the raw material to be pure and attracts much attention for commercialization (Cech, 27 March 1998).

The introduction of Echinacea harvesting on the Fort Peck Reservation occurred in the fall of 1995. According to two interviewees, two pharmaceutical companies approached the tribes and offered money for the root of a plant that was being studied for AIDS research (Sung-gleska, 9 February 1998; Gelker, 9 March 1998). Since Echinacea
is an immuno-stimulator, it was thought that the plant may boost the depressed immune system of AIDS patients. One interviewee theorizes that the pharmaceutical companies were targeting reservations, since the Fort Peck Reservation was the third reservation to be approached after Turtle Mountain and Fort Berthold Reservations (Sung-gleska, 9 March 1998). High unemployment rates on reservations make these areas attractive "targets" for resource extractive enterprises thriving on cheap labor (Sung-gleska, 9 March 1998). However, not all people on the Reservation share this attitude, and express feelings of gratitude for an industry that has stimulated individual economy in a geographically isolated, impoverished area with little industry. The following is a story told by local harvesters, buyers, traditionalists, landowners, tribal officials, and concerned reservation members. Their tales depict the various attitudes and personal experiences of the boom of *Echinacea* harvesting on their reservation. The sociological and ecological implications will be discussed in their words, but all informants will remain anonymous. Details of some of the story inadvertently will reveal some interviewees' identities, but these segments of the story are well-known to the community anyway. Details that are not so well-known will be omitted to prevent possible harm to interviewees.

**THE HARVESTING STORY: INITIATION TO PRESENT**

The initial contact encouraging the harvest and sale of wild *E. angustifolia* on the Fort Peck Assiniboine and Sioux Reservation came from an individual in Minot, ND, who started collecting the root around her area with a small crew of people. The company she contracts with agreed to take as much root as she could supply (Pipe 1996), so she expanded operation throughout the Minot area and Fort Berthold Reservation. Four years ago, she approached the Tribal Office on the Fort Peck Reservation to engage people on the reservation to start harvesting. One man at the Tribal Office became interested in the venture, started digging and then paying other people in Poplar to dig (Beeman, 3 April
1998; Dailey, 4 April 1998). At that time, very few people even knew what the plant was; diggers just searched for a plant with a "brown bulb on the top" (Sousa, 3 April 1998). Only after a man brought the plant to his grandmother for her insight was the plant's name revealed to be purple coneflower (Sousa, 3 April 1998). But the name of the plant was still largely forgotten by the community.

Initially, there was only one buyer, but he was soon joined by a second buyer, and the trade monopoly was shattered. The original buyer (buyer 1), offering $4/lb for the wet root, was forced to compete with the $6/lb the new buyer offered (buyer 2) (Beeman, 3 April 1998). The following year, in April 1996, competition and tension mounted as the original buyer could only raise his offering price by one dollar. In the local newspaper, Wotanin Wowapi (24 May 1996), the Tribal Executive Board reported a complaint by buyer 2's wife regarding the harassment her husband and she endured from buyer 1. The verbal threats, stalking and interference with business led to the issuance of a restraining order on buyer 1. Yet tension only continued to mount as three new buyers entered the market. Want advertisements for prairie coneflower roots, and letters of concern for cultural preservation started appearing in local papers (see Fig 6.1). Popularity of root digging on the reservation gained momentum. By 1997, buyer's signs littered Highway 2 announcing root prices to passing harvesters (see Photo 6.1), and further threats between buyers were reported by the Tribal Executive Board (Culbertson, 4 December 1997). Harvesting "snowballed" in 1997 (Gelker, 9 March 1998).

During this time, one of the main employers on the reservation, A & S Industry, cut back on labor and reduced their work force. Jobs were becoming even more scarce. Knowledge of a root that grows wild on the reservation and is wanted by pharmaceutical companies for money heavily circulated by word of mouth or through the local newspaper. Only a shovel was needed to get started, and the work hours were self-scheduled. Not only did digging provide some sort of potential income, but an opportunity to be self-employed and work as many hours as desired without answering to anyone.
Now Buying ROOTS (Cone Flower) for $8.00/Pound

CONTACT: Tom Cheek

Wanted: Prairie Coneflower Roots. If you have pasture land with prairie coneflowers, or if you are interested in collecting roots please call Firehill Farms at 406-895-2551. We pay cash on delivery.

Fig 6.1. Want Advertisements for Echinacea root in the Wotanin Wowapi
PHOTO 6.1. Roadside Advertisement for the Purchase of *Echinacea* Roots
Since its introduction, hundreds of people (350-400+) have grabbed shovels and searched the prairie hills for the purple flowers or skeletal stalks and cones (Dailey, 4 April 1998; Sousa, 3 April 1998). Harvesters dig anywhere from a couple of hours a week to all day seven days a week. One man reported stories of harvesters digging through the night.

Since the flower reflects the moonlight, its illumination makes it easy to spot at night (Sung-gleska, 9 March 1998). The flexibility of the work not only allows tremendous variation in self-schedules, but permits people of all ages to participate and make money. Ages of people either holding the shovel or involved in the process in some manner varies from toddler to elder. The youngest harvester is a four year old girl who helps her sixty-seven year old great-grandfather, the oldest harvester, dig (Lyn, 5 April 1998).

Typically, individuals, small groups or whole families pile into the car or truck, with shovels in back, and drive the paved or dirt roads throughout the southern portion of the reservation looking for stands of *Echinacea*. An all day trip sometimes requires packing picnics, which as one buyer notes is a "good way to get families together" (Jacobs, 5 April 1998). Four wheel drive trucks can be driven on roadless prairie hills to reach isolated stands, while cars can get stuck in mud ruts, moist vegetated soil or steep hill inclines. Often people with cars either spot plants close to the road or walk up to five miles searching for remnants of the plant (Sousa, 5 April 1998).

Once a stand has been spotted, digging begins. For individuals, the task is very labor intensive, since many different motions are involved. However, with groups, tasks can be separated into shovel handler, root collector, and plant spotter to quicken the process. Often children are given the job of plant spotter, and games are created to pick out the plants with the big roots. Number and size of flowers, number and thickness of flower stalks, and size of leaf clump are helpful criteria to read the age and size of the plant underground (Dailey, 4 April 1998; Lyn, 5 April 1998; Gelker, 9 March 1998; Sousa, 3 April 1998).
Previously, shovels were employed to uproot the deep roots of *Echinacea*. However, one ingenious entrepreneur created a specialized root digging tool which reduces time spent digging and soil disturbances (see Photo 6.2). Instead of a wide curved blade, the "Echinacea Root Tool" consists of a thin, narrow blade that enters the soil with less resistance, more directly aligns with the root, and uproots the plant without as much soil removal. The purpose of the tool is not to completely dig out the root, but to break the strong fibers and remove only the upper portion of the root. Harvesting the entire taproot takes time, especially when roots measure a couple feet deep and summer soil is dry and compact due to lack of rain. Instead harvesters trade off root poundage for time saved and break the root as deep as the tool allows (6-8 inches).

The tool also is specialized for soil conditions, body size and personal preference. Longer, narrower blades enter gravely soil easier. Taller handled tools provide more leverage in the dry, summer soils. However, a typical four to five foot steel handle bar can be created specifically for shorter or taller people. Some tools are made with the blade angling away from the harvester to reduce the distance of the pull motion when excavating root. "Everybody has their own preference" (Sousa, 3 April 1998). For mechanical support, all tools have a welded steel backing which runs from mid-handle to the top of the tapered blade. This extra bit of steel strengthens the tool body to prevent bending in dry soils (Dailey, 4 April 1998).

Thus far, approximately 200 *Echinacea* tools have been made and sold in the last three years, and in the spring of this year, inquiries for all different sizes already were coming in. Although one of the tool-makers believes his prices should be more, he keeps his prices low so people can still afford them. He even tried renting tools for five dollars a day, but this venture was short lived since either the people never paid or never returned with the tools. Unfortunately, word about renting spread fast, and every day for the next two weeks, he had to turn people away from renting and explain his frustration in reminding people of their debt. The cost to own a tool, paid up front, amounts to $35 for a
PHOTO 6.2. Specialized *Echinacea* Root Digging Tools
PHOTO 6.3. Harvesting *Echinacea angustifolia* with a Specialized Digging Tool
Рис. 6.4. Uprooting *Echinacea angustifolia* for Commercial Trade
smaller tool and $40 for a bigger tool. Or in the tool-maker's eyes, the value equals two hours of digging (6-7 pounds of root), depending on root size (Sousa, 3 April 1998).

Some harvesters take a couple of tools into the field to be prepared for the variety of weather and soil conditions (Sousa, 3 April 1998). The sites in which *Echinacea* grow and the harvesters search are dry and gravely hillsides or just along roadsides (Dailey, 4 April 1998; Gelker, 9 March 1998). After the aerial portions are spotted, the tool handler places the digging tool about three to four inches behind the root and pulls back on the horizontal bar grips until the breaking root "pops" (see Photo 6.3 and 6.4). By then, the spotter points to a new plant and the tool handler re-positions next to its root. A third person follows the procession, pulls up the plant, detaches and discards the aerial portions, and throws the root in a bag or in the back of a truck. While this method is considered the "fastest way to dig" (Dailey, 4 April 1998), groups of people establish their own system, dependent on the number of digging tools available. Buyers supposedly advocate covering up holes, however harvesters often move onto the next plant and leave holes exposed.

**Socioeconomic Implications on the Reservation**

At a time when business and tribal industries were cut back and unemployment rose even higher, *Echinacea* harvesting provided a money source for families and individuals. The income generated by this new industrial market now supplements or provides entire incomes for many families. The timing of this new economic development is considered "God-sent" by some people (Dailey, 4 April 1998), particularly the local buyers who assess their role in the community as beneficial. One buyer believes that "God used him to make the root known... It's like destiny for the roots to happen now, when people need it" (Dailey, 4 April 1998). Another buyer had left the reservation for over ten years and upon returning, wanted to make a positive change on the reservation. For him, buying *Echinacea* root and providing people with money has created a difference (Lyn, 5 April...
A third buyer does not turn any harvesters away. He will pay anyone wanting to sell him root because "it's a start" (Lyn, 21 March 1998). While not all people work full time, harvesting just a couple hours a day will supply money for various necessities. "People thank me for being able to pay for food and lightbulbs" (Dailey, 4 April 1998). One harvester replied that by digging *Echinacea* for about five hours every day, his bills get paid. "You don't need a college education. Just will power and ambition" (Sousa, 3 April 1998). Even people with full time jobs in the private sector or federal agency positions are lured to harvest *Echinacea* and take time off work to dig. Various people could not be interviewed since they were out "looking for that root."

However, these benefits are not equally weighed throughout the community, and a number of social rifts have been created between groups concerned about cultural plant conservation, damage to livestock or intrusion on their capital market. One collective voice that emerged at the onset of *Echinacea* harvesting came from the traditionalists. While the reasons for the harvest are understood, the lack of ceremony and proper traditional harvesting techniques makes some traditionalists uncomfortable.

"Money has helped some families. One family got $10 from harvesting to purchase a used model plane for their boy. He learned the value of money and working.... So there are some benefits. But overall, I don't like it. I feel uncomfortable about the use [of a cultural plant] as an economic resource. There is no ceremony involved, and some people dig under the use of alcohol or use the money for alcohol" (Azure, 27 January 1998).

"You can't judge people cause of the 80% unemployment. It's difficult to say not to pick; for it provides for children. On the other hand, people have used the plant... as a general, all-purpose medicine... for many years. It was used greatly in the past, and some traditionalists and elders still use it" (Sung-gleska, 2 February 1998).

"It's an honest way [to earn money], but it uses [the plant] up" (Sokol, 26 January 1998).

In May, 1996, one traditionalist's guest opinion in the local newspaper expressed the concerns of other traditionalists:

The root is regarded by traditional people as a medicine root because of special qualities it has. Because it is a traditional medicine, this root has to be picked in certain ways, there is more to this than covering holes, but this knowledge is best sought by approaching a traditional person.

There is a concern that tribal members who use this root as traditional medicine may not be able to find it because of large amounts being sold. Some traditionalists believe if this root is not being taken properly or misused, this could bring consequences on the families of the people involved or on our tribes as a whole (N. Youpee, 24 May 1996).
Although this paper can not substitute for proper demonstration and knowledge of traditional methods, a few concerned traditionalists shared some insights into proper and traditional harvesting techniques. Philosophy, song and prayer are all part of the process, and in order to understand harvesting, the meaning and connectiveness of the plant's role in the cultures is necessary and acknowledged. According to one Yantonai/Hunkpapa traditionalist, "Songs and talk go with the medicine. Since each tribe and individual [has] different practices, there are many ways to interact with the plant" (Sung-gleska, 9 February 1998)." The incorporation of prayer with an offering reinforces the traditional belief and the tie to the Creator and oneness of all things.

"Plants are connectors to all living,... and all forms of life. They make us understand who we are. They are nourishment: both sacred and food supplier. Plants bring life to all things. People, in return, [give back] after we go to the other life, and the body becomes fertilizer to grow more. The body goes back... to bring more life. This is why food should be free. Basic subsistence should be free.... Food is medicine to the body, and it's natural. The natural order of things" (Sung-gleska, 9 February 1998).

As part of the healing process and even before harvest, people recognized animal or plant signs to decide which plant was more appropriate for a sick person.

"Buffalo can lead you to medicine. Buffalo recognizes people who are sick and leads them to the plants. Then the person figures out which plant to use. Bear does this as well. Plants [also] have the ability to talk to people.... People get information this way: what plants to use, what part to use, how to use it" (Sung-gleska, 9 February 1998).

If *Echinacea* was chosen in the process, particular procedures were followed to ensure thankfulness and reciprocity to the plant. One Hidatsa traditionalist likens the harvesting of *Echinacea* to turnip digging.

"Like turnip digging, [you] pray, have tobacco and ask the Creator to help find turnips to feed the family. After you turn over the spade, you fill in the hole and leave the top leafy part [for regeneration]" (Azure, 27 January 1998).
Other traditionalists echo the importance of prayer and the act of leaving the flowering tops behind (Zeckner, 2 February 1998; Sung-gleska, 9 February 1998) and also stress the seasonal timing of the harvest.

"The strength of the plants are tuned with the season. Most plants are harvested in the spring, and some in the fall. Traditionally, *Echinacea* is harvested when there is a flower.... But people are harvesting without the flower" (Sung-gleska, 2 February 1998).

Even the buyers note changes in medicinal potency throughout the seasons. One buyer explained that the potency of the root during spring is "decent," decreases when the aerial portions grow and are green, and then increases again when the plant blossoms and seeds. According to the buyer, the fluctuations result from responses to changing water content within the plant and the way it flowers. Once a plant and flower form, the roots lose much water to the aerial portions. This happens at the end of June to beginning of July. In spring (March), the plant loses 68% of its weight during the drying process, but during these summer weeks, the root only loses 50% of its weight (Lyn, 5 April 1998). Perhaps the noted increase results from the loss of water and concentration of bioactive constituents. Competing buyers contradict the timing of the root water level decreases and note heavier weights during the July bloom due to an increase in water content. One buyer describes this time as the "peak season," since roots are heavier and worth more money (Dailey, 4 April 1998). And another buyer refuses to buy during the bloom because the roots are not as potent. According to this buyer, the "energy is in the aerial parts at this time, not the root. Chemical tests say this, and you can just tell by trying it [through the numbing sensation]... Also the root is limp in June, the energy is not there. It's stiff now [March] because the nutrition is still there. The leaves are more potent when the plants are about to flower" (Jacobs, 5 April 1998).

While the timing of maximum medicinal potency can be debated amongst buyers and harvesters, the monetary incentives largely overshadow concern of proper or optimum timing. Money offered throughout the year inspires people to buy and harvest nearly year round from the time the snow melts until it returns. With the warmer winter temperatures
this year, most people stopped digging only in January when the ground was too hard and the snow too deep (Sung-gleska, 2 February 1998; Jacobs, 5 April 1998). Although one buyer usually closes shop from the end of November or early December until the first of May, he was able to buy throughout the winter months this year. He personally dug about 1000 pounds of wet root this winter just to pay for business expenses (Lyn, 5 April 1998). A harvester replied that for winter digs finding the plants is half the problem. Yet if the snow is a couple inches thick, the dried coneheads still can be seen protruding through the white cover. Sun exposed, south facing hills become the harvester's habitat of choice during these months since the snow layer is thinner and the soil less frozen. As one concerned traditionalists summarizes, "It says something about Echinacea when people fight the cold to find the root. It's like a body eating its own fat" (Sung-gleska, 2 February 1998). However, as the ground eventually froze completely and only two inches of the root could be dug, the monetary return this last January was not worth the effort (Sousa, 3 April 1998).

One of the biggest complaints on the reservation by traditionalist and other private landowners are the visible holes left behind. Not only are individuals concerned with the environmental damage and aesthetic integrity of their land, but owners of livestock are concerned about animals breaking their legs (Sokol, 26 January 1998; Azure, 27 January 1998; Sung-gleska, 9 February 1998). Although the number is uncertain, an article in the local newspaper describes such incidences involving cattle (Wotanin Wowapi, 18 July 1996). Gates left open, trash left behind, and lack of consent from landowners to dig compounds the concern. Although some landowners repeatedly and openly defy harvesters on their property, the digging continues. "Lots of people don't pay attention to [the requests] and dig anywhere unless they get run off... Some people sneak onto the property at night. They park out of sight and then dig" (Sousa, 3 April 1998).

Supposedly, before a harvester begins to collect roots, they need to go to the Bureau of Indian Affairs office and pick up a map with land ownership boundaries. These maps
delineate tribal land, private land, and individually allotted land. Since tribal land is collectively owned, any member can harvest on these lands. The rest of the property can be dug only with the landowner's permission. While no permits are issued for tribal lands, the maps serve as some preventative control over harvesting on the reservation. However, only a few people have picked up maps, and most people are unaware of this procedure (Bureau of Indian Affairs, Natural Resources and Land Operations personnel, 6 April 1998). So individual landowners are left with the responsibility of protecting their property. Besides written complaints in the local newspaper (see Fig 6.2) and oral complaints to buyers (Dailey, 4 April 1998), landowners paint fences red or otherwise mark their property lines to keep people from trespassing. One person who lived just outside of Wolf Point along Highway 2 finally marked his land due to waves of harvesters trespassing and "making a mess" (Sousa, 4 April 1998). At the same time, other landowners do not mind harvesters digging up the Echinacea on their land, since they consider the plant a weed (Gelker, 9 March 1998; Sousa, 4 April 1998). "All you have to do is ask... and the farmers say go ahead as long as you don't leave a mess" (Sousa, 4 April 1998). Some ranchers off the reservation in Badlands even are making their own business out of Echinacea harvesting and charge $20 for each person collecting the roots (Sousa, 4 April 1998).

Tribal regulations permit only reservation members to collect plants on tribal land. Since the majority of the buyers are non-Native American, a few traditionalists warn of the exploitive nature of digging. Harvesting got started due to the impoverished economic situation on the reservation and by people who could not harvest on the land themselves. Employing Native Americans to dig allows people to extract resources from reservation lands. The situation "victimiz(es) people that are poor," describes one Yantonai/Hunkpapa traditionalist. "Pharmaceutical companies [directing attention to the end buyer] take the resources from people's own cultural needs" (Sung-gleska, 9 February 1998). As another traditionalists states, "People don't even know where [the plant is] going or what it's used for" (Zeckner, 2 February 1998). "How many tons leave the reservation? Do these people
ATTENTION ROOT DIGGERS

Due to the fact that root diggers went on my land without permission last year—my land has been left in a horrible state—trash everywhere—tremendous holes dug without being refilled. There wasn't any common courtesy given to me as an elder of this community. I do not want anyone on my land without my knowledge definitely no root diggers will be allowed! My land boundaries are directly North behind Gene Culbertson's residence - Myrna & Harry Gruefe's trailers - James Snell residence to Rena Comes Last's family boundaries. Thank You.

Sylvia Rising Sun

April 2, 1998

Wotanin Wowapi

Fig 6.2. Landowner's Written Complaint Concerning Harvesting in the Local Newspaper
who use [the *Echinacea*] benefit? We need tradeoffs!... Pharmaceutical companies need to come to terms" (Sung-gleska, 9 February 1998).

Thus far, the only tradeoff is the cash paid per pound of *Echinacea* root, and these prices vary greatly depending on competition between local buyers, market demand, and raw material surplus. Originally starting at four dollars for every pound of wet root, prices have fluctuated from $3.50 per pound to $8.50 per pound throughout the last few years (Sousa, 3 April 1998; Sung-gleska, 9 February 1998). Seasonal changes in root water content reflect some of this increase, since in spring less money is offered for roots with higher moisture contents (Gelker, 9 March 1998). However, the increase in price was created primarily by fierce competition between local buyers. While competition added monetary value to the plant resource and inflated harvester's earnings, the increased prices attracted more people to harvest (*Wotanin Wowapi*, 30 October 1997). The short-term monetary earnings have helped many people, but the sustainability of the business becomes extremely questionable with so many diggers extracting the limited resource.

And what exactly does this monetary value equate to in terms of time and labor invested? Depending on root size, stand abundance, harvesting experience, and number of harvesters, amounts collected may yield anywhere from two to six pounds in one hour. Based on variable prices and hours worked, harvesters report making $20- $200 per day (Sousa, 3 April 1998; Sung-gleska, 2 February 1998). Buyers note that the average harvester sells five to twenty pounds of wet root a day, which under present prices equates to a daily sum of $32- $145 (Lee, 21 March 1998; Gelker, 9 March 1998). The more experienced harvesters dig up to fifty pounds per day.

The pretentiously high prices and potential gross earnings make harvesting appear to be a high income job. In fact, gross earnings can be higher than the wages in local full-time permanent jobs, which is why employees take time off work to dig the root. However, costs such as gas expenses, travel time, weather conditions, and wear and tear on vehicles need to be taken into account. One collector, during an evening interview, described how
he spent his day driving twenty miles to a harvesting site, getting his car stuck in the mud and then expending four hours digging out his car, only to run out of time and have to travel home (Sousa, 3 April 1998).

Another issue is price differences between wages on the reservation compared to professional wildcrafters earnings ($30-50 per pound of wet root) in other areas throughout the plains (Drum, 23 November 1997; Klein, 17 June 1997). Part of the difference likely results from the layers of buyers and brokers involved in the *Echinacea* market. Most buyers on the reservation sell to intermediate distributors who resell to other buyers (see Table 6.1).

**Table 6.1:** The Progression of *Echinacea angustifolia* Sales From the Fort Peck Reservation to End Buyers.

<table>
<thead>
<tr>
<th>Harvester</th>
<th>Local Buyer</th>
<th>Location of 2nd Buyer/Broker</th>
<th>Location of 3rd Broker/Buyer</th>
<th>Location of End Buyer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tribal Members</td>
<td>Lyn</td>
<td></td>
<td></td>
<td>California</td>
</tr>
<tr>
<td>(350-400+)</td>
<td></td>
<td></td>
<td></td>
<td>New York</td>
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<td>Utah</td>
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<td></td>
<td>South Carolina (Germany)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Washington</td>
</tr>
<tr>
<td>Jacobs</td>
<td></td>
<td></td>
<td></td>
<td>Utah</td>
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<tr>
<td></td>
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<td></td>
<td>Canada</td>
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<td></td>
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<td>Oregon</td>
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<tr>
<td>North Carolina</td>
<td>Massachusetts</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Carolina</td>
<td>Massachusetts</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dailey</td>
<td></td>
<td></td>
<td></td>
<td>*South Carolina (Germany)</td>
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<td></td>
<td></td>
<td></td>
<td>*California</td>
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<tr>
<td></td>
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<td></td>
<td>*New York</td>
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<tr>
<td>North Dakota</td>
<td>Montana</td>
<td>Anonymous</td>
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<td>Anonymous</td>
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<tr>
<td>Canyon</td>
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<td>Taylor</td>
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</tr>
<tr>
<td>Yates</td>
<td></td>
<td></td>
<td></td>
<td>no longer sells</td>
</tr>
</tbody>
</table>

*Potential buyers as of March 1998.*
The chain from harvester to end buyer typically consists of at least two middle people. The longer the chain, the less money the harvester will make, since at each level, earnings will be extracted. So the amount of money the local buyer offers is largely dependent on the price earned from selling the root and whether the second buyer is a middle or end purchaser. Last year, one local buyer offered five dollars/pound for wet root and resold the root for fifteen dollars a pound after dry processing. Since nearly two-thirds of root weight is water and lost when dried, his earnings amounted to a 5% markup on the price offered to harvesters. In other words, if he bought 100 pounds of wet root from harvesters for five dollars a pound, he would spend a total of $500. After drying the raw material, root weight would decrease to approximately 35 pounds due to water loss. Since the second buyer offered fifteen dollars a pound, he would get $525 for the dried roots. Subtracting his gross earnings ($525) from his costs ($500) yields a net profit of $25. Two years ago, he was earning $18 for every pound of dried root. However, due to a glut in the Echinacea market from 1996 to 1997, prices for Echinacea root fell, and distributors could not offer as much money for the dried material. Although the market is stronger now, this buyer still only receives $15 for every pound of dried root.

Temporary floods in the market and resulting price drops make competition difficult for local buyers, especially when costs of maintaining shop, packaging and shipping goods, and running drying equipment are absorbed. Additionally, harvesting does not supply a constant work force. The number of people wax and wane from month to month, and even week to week, as prices change. A monthly cyclical pattern has developed on the reservation in which number of harvesters lessen around the first of the month, when other paychecks come in, and then increase as the month progresses and money is needed (Lyn, 5 April 1998). Due to these variables, buyers become restricted on the amount of money they can offer for root material. If Dailey, for example, offers harvesters six dollars for every pound of wet root, he would lose $75 per 100 pounds of fresh root (Dailey, 4 April 1998). However, a greater profit margin can be earned through direct sales to an end buyer.
Another buyer on the reservation resells the roots directly to a pharmaceutical company (Wotanin Wowapi, 18 July 1996), cutting out the second buyer in the chain and greatly increasing his profit by a 0.34-0.88 markup (receiving $25-35 per pound of dried root) (Gelker, 9 March 1998). In the competition wars that developed on the reservation, this buyer had an advantage since he easily could compete with the prices of other local buyers and still make a substantial profit. Dailey hopes to "eliminate the middle person" to increase his earnings. And in fact, recently he was offered more money ($20/pound) for the dried root through direct negotiations with a pharmaceutical company. The increase would raise his net profit by five dollars per pound and make him a better competitor by allowing him to offer more to harvesters. In the meantime, at least two local buyers have folded due to insufficient earnings through indirect reselling and inability to compete with competitor's prices.

Originally, when harvesting began on the reservation, prices offered were not very competitive, since there were only two main distributors purchasing *Echinacea* root. Since this time, local buyers actively search for companies or wholesale distributors to sell the raw materials. Not only are people simply looking on the back of product labels for companies' addresses, but the Internet has become a tool for finding buyers (Jacobs, 5 April 1998; Etkins, 13 April 1998). Once a contact is made, samples of the root are sent to the company for qualitative analysis and then approval or disapproval of a contract is made. Thus far, buyers from northeastern Montana have had no problem setting up deals, since the *Echinacea* is medicinally strong and of pure strain. Still the prices offered are well below that received by professional harvesters.

As mentioned earlier, the number of middle people involved contributes to the reduction in knowledge of harvested plant location, amounts extracted, sustainability of practice, and raw material destination and use. Harvesters and local buyers on the Fort Peck Reservation do not know what happens to the plant once it leaves the reservation. They only know their initial steps in the *Echinacea* industry, which consists of the removal of the
root and the cleaning and drying process. All local buyers purchase wet roots, and two offer money for dried roots. While drying the root is worth more money ($11/pound; Sousa, 3 April 1998), it requires space, more labor, more time, and actually greatly reduces total earnings. Early this spring, prices for wet root ranged, depending on buyer, from $6.50 to $7.25 per pound. If a harvester sold 100 pounds of wet root at the lowest price ($6.50), her earnings would generate at least $650. If that same harvester dried the roots before selling, the water loss would reduce root weight to 35 pounds. After sale ($11/pound for dry root), her earnings would only amount to $385. And depending on the drying method, costs may depreciate her net income further. Costs may include initial purchases of screens and sand for air drying or energy bills for heating in ovens and microwaves. These high heat methods actually reduce the medicinal quality of the roots (Jacobs, 5 April 1998).

However, most local buyers clean and dry the root themselves. "Harvesters still try to pull a fast one on you," replied one local buyer. He described harvesters bringing in bags of wet root with dirt or heavy objects like lugnuts or bolts to increase the weight on the scales. Other "tricks" include putting dirt on the bottom of sacks and covering with layers of clean root (Dailey, 4 April 1998) or soaking the root in water to add 5-10% weight (Etkins, 13 April 1998). Most local buyers have learned the tricks of the trade and now routinely dump the sacks of root onto screens and clean off the dirt before weighing and paying the harvester (Dailey, 4 April 1998; Lyn, 5 April 1998). However, as one buyer states, "As long as you treat the harvester fair, they treat you right. You give enough money, they won't pull things" (Etkins, 13 April 1998). Other buyers are more particular and prefer the roots to be washed and trimmed before sale. Some people "wash in the washer for a bit or spray [dirt] off. You can put 15-20 pounds in the washer" (Jacobs, 5 April 1998). But the detail to remember is to bring in the roots for sale right away. Not only will roots mildew and become unacceptable for purchase (Jacobs, 5 April 1998; Sousa,
3 April 1998), but over time, roots lose water so the harvester will be paid less (Dailey, 4 April 1998).

Once the purchase has been made, the buyer dries the root, packages, and ships the root to the next level. Depending on the size of the root, drying takes three to seven days. One buyer described and demonstrated his drying process through the employment of elaborate fans and slow, dry air. He emphasized the rate of air movement since fast drying contributes to loss of root potency (Lyn, 5 April 1998). He also used dehumidifiers to remove water from the air. After the roots are completely dry, most buyers package the raw material in UPS boxes and ship to out-of-state buyers. Once it leaves their home or warehouse, local buyers do not know where the plant ultimately goes or into what it is processed (i.e., tinctures, cough drops, teas) (Lyn, 5 April 1998; Dailey, 4 April 1998). None of the material is sold or processed locally, and ironically, people travel off the reservation to Williston's KMART (~80 miles east of Poplar) to buy Echinacea cough drops and other products (Sousa, 3 April 1998).

Although one buyer sells to a distributor in northeastern Montana, all the root eventually leaves the state to be processed further in other states or other countries (see Table 6.1). Some distributors sterilize and chip the root and then resell to the next buyer, earning money for their efforts (Jacobs, 5 April 1998). The Montana distributor purchases wet or dried root throughout Montana, Canada, and North Dakota. They simply dry the wet root and resell dried root for between nine and twenty eight dollars a pound. This spring, prices offered were "somewhere in the middle of $9-28" (EtkinS, 13 April 1998). When asked whether harvesting was being conducted in a sustainable way, the distributor referred the question to local buyers. For he is "removed from this part...[and has] no sense of where the root comes from in the wild" (Etkins, 13 April 1998). He also does not know what happens to the Echinacea once it leaves his place. The buyers on the reservation who sell directly to pharmaceutical companies comment that big companies do not care from where the plant comes. Their concern is for a quality product (Lee, 21 March 1998).
Essentially, the *Echinacea* market is profit driven, unilaterally extractive and lacks concern for long-term environmental and socioeconomic repercussions. "Brokers keep wanting more and more, and we have to say no" (Jacobs, 5 April 1998).

The gluts in market and price fluctuations make the business an unnerving venture, so most local buyers actually have second jobs. However, earnings generated from *E. angustifolia* generally comprise large portions of their total income. The personal dependency on the plant and the market only further contribute to competitive tensions between buyers. Last year, the competition became so fierce that an all-out root buying war escalated. Since no formal contracts exist between harvester and local buyers, buyers used attractants to induce harvesters to sell to them. Besides constant availability and insurance of immediate payback, biggest root contests were held (see Fig 6.3), gas money was given out, and free digging tools were allocated to keep competitive edge. Buyers report staying open seven days a week, from 8am until after 10pm (Dailey, 4 April 1998; Jacobs, 5 April 1998). If a harvester calls after this time, one buyer makes it a point to be at the scale waiting (Sousa, 3 April 1998). The same buyer also stations people in other towns to reduce travel for harvesters (Sousa, 3 April 1998) and expand his operation. The idea of the digging tool giveaway actually contributed to tensions, since harvesters would take the tools and then sell the root to other buyers offering more money. Frustrations led to oral and physical threats and the issuance of restraining orders to keep certain buyers away from other buyers. An eruption of negative slander was slung between buyers to cast doubt on competitor's integrity and honesty. One of the major accusations used against a competitor was the accuracy of the weighing scale. Buyers preached that they secretly sent preweighed plant material with a conspiring harvester to other buyers, and upon weighing the material, proved the inaccuracy of their scales. "...His scale was off by one pound and ten ounces" (Sousa, 3 April 1998). "By having their [another buyer] scales off, they're making up for the high prices they're paying" (Dailey, 4 April 1998). To ease confusion, some buyers have purchased newer, calibrated scales. In this way, "people can see you're
AND THE WINNING ROOT IS.... Casey Cheek (r) holds the largest root in a “root contest” won by a Poplar man who wish to remain anonymous because he does not want anyone to follow him when he goes out rooting and find his “spot.” It was 3 feet and 2 1/2 inches long, which scored him $100.00 for 1st place in the “rooting contest” held by Cliffton Cheek from Brockton, MT, who buys roots from local “rooters.” Second place went to Clayton Montclair, Sr. from Poplar. Holding the root is Thomas Montclair, age 6, who is heavy duty into rooting, scoring $50.00 for his work. “The contest came about when the people who brought their roots in were so proud of their large roots, which were really big last year in 1996. So we decided to put up money this year for the heaviest and longest root,” said Angela Cheek, Cliffton’s wife. She also said they will be buying roots until the ground freezes up and that they buy at all times of the day and night. (Photo by Fred Lowry)
honest" (Jacobs, 5 April 1998). "If you have a good scale, word gets around, and it's more honest. If you have an old scale, people complain and think they're getting cheated" (Sousa, 3 April 1998). Other verbal assaults towards competitors were directed at personal intentions of being in the buying business. "He does this as an alcohol manipulation of the people. People buy alcohol with the money. That's not why I buy" (Lyn, 5 April 1998).

Other assaults included physical actions such as distributing nails around competitor's sign advertisements along the highway (Sousa, 3 April 1998). Although not necessarily a universal goal, one local buyer hopes for monopoly control in the next two to three years (Sousa, 3 April 1998), by driving down the prices of his competitors (Lyn, 5 April 1998).

Local buyers are not the only people feeling the tensions of the *Echinacea* market. Members of the community and non-members digging off the reservation have reported various incidences of theft. One person had $2000-5000 of earned harvesting money stolen (Azure, 27 January 1998). Another individual described people breaking into his car and taking his proprietary maps that were marked with plant locations. "All the plants in the area were gone cause I marked them on the map" (J. Foster, 23 March 1998).

After merely four years of harvesting *Echinacea* for profit, the "industry" has become an instant institution in society. People now identify themselves as "Root Diggers" (Sung-gleska, 2 February 1998) and masquerade at pow wows as root harvesters (Azure, 27 January 1998). After merely four years, the culturally significant plant and age-old medicine has become the main source of income for hundreds of people. While opinions of societal effects vary, it is well-voiced that cash income benefits many individuals and families. However, people are torn between a short-term money-producing venture and a possible long-term form of exploitation. As one man states, "Once it's gone, it's gone" (Gelker, 9 March 1998).
ECOLOGICAL IMPLICATIONS OF ECHINACEA HARVESTING

The massive digging occurring on the reservation has left its mark not only on the communities, but on the landscape as well. Thousands of holes pockmark entire hillsides, and tire tracks crisscross and entrench the rolling grasslands. Not only are traditional knowledge and appropriate harvesting methods forgotten in this money-driven atmosphere, but age of the plant, future reproducibility, and ecological impacts are ignored. Since profit is determined by root weight, "experienced" harvesters calculate that they make more money, in the same amount of time, by selectively uprooting older, usually larger, roots (Lee, 21 March 1998). In this manner, one buyer claims that there "always will be plants left" (Lee, 21 March 1998). However, selective removal of viable seed producers and possible strong seed stock may contribute to a regionally weaker gene pool. The biggest root dug reported by local buyers and proud harvesters weighed 3.14 pounds wet, measured over two feet long and had about a three inch diameter at widest girth (Lyn, 5 April 1998). The age of this grandmother plant can only be speculated to be anywhere from fifteen to forty years (see Chapter 3, section Life Span). During a harvesting excursion two to three miles outside of Poplar, a buyer glanced over the landscape and commented that people "knew what they were doing at this spot;" for most of the bigger plants had been dug out (Dailey, 4 April 1998). However, upon driving over the next grassy hillside, he was amazed. "People have dug thousands of dollars at this sight... Last fall, this hill was full of plants. Now nothing" (Dailey, 4 April 1998).

With the hundreds of people now harvesting, areas are constantly revisited, and the only "large" roots left often are from young plants. But the next wave of harvesters dig these. The estimated average age of plants removed is five to six years (Lyn, 5 April 1998), and these measure one quarter to one third inch in diameter (J. Foster, 23 March 1998). "Occasionally, you run into a thick carpet of Echinacea. [But] when people leave these places, it looks like someone went through with a tiller" (Dailey, 4 April 1998). On
another excursion about fourteen miles northeast of Wolf Point, holes six inches to two feet in length imprinted the landscape. The only place *Echinacea* was found was hidden in a patch of taller vegetation. "Either the *Echinacea* was not seen or it was too difficult to dig on the rocky hillside" (Sung-gleska, 9 February 1998). Approximately twenty feet below this site, a couple large 'X' holes (1.5 x 2 feet) provided evidence for a harvesting attempt. The shovel was "probably used in four directions before the plant came up. Looks like people tried to dig the rest, but [the rocky soil] made it too hard," observed Sung-gleska (9 February 1998).

- When harvesting was originally introduced to the people of Poplar, diggers only traveled a couple miles to find big roots and intact stands. Now harvesters need to travel twenty miles to locate plants (Gelker, 9 March 1998; Sousa, 3 April 1998). "The more you go away from Poplar, the more *Echinacea* there is," replied one buyer describing the heavy harvest in the immediate vicinity (Dailey, 4 April 1998). The same is beginning to occur in other towns in the southern edge of the reservation and along the major transportation route of Highway 2. Due to the increase in local buyers, the towns of Brockton and Fort Kipp have seen increases in harvesting activity in the last couple of years (Sousa, 3 April 1998). Harvesting appears to be restricted to the eastern portion of the reservation; however, efforts have been made by buyers to entice digging in the western areas, west of Wolf Point, to dig (Beeman, 3 April 1998). Other harvesters travel to surrounding areas near Bainsville, Vida, Badlands and Williston, North Dakota (Sousa, 3 March 1998; see Fig 6.4). Since the roots are getting harder to find, some harvesters drive up to seventy-five miles to Plentywood or Reserve (Jacobs, 5 April 1998; Sousa, 3 April 1998). On these longer excursions, people go out for two to three days at a time and come back with $100-200 worth of root (Jacobs, 3 April 1998), which makes the traveling monetarily worthwhile. While some herbalists cast doubt on large-scale extinction of the species due to inaccessibility of some stands and eventual diminished cost/benefit tradeoffs (Drum, 23 November 1997; Moore, 27 July 1998), localized extinction in the Fort Peck vicinity may result if harvesting continues at the
Fig 6.4. Map of Harvesting Locations in the Fort Peck Vicinity
present rate. Areas south of the Missouri River were once deemed off-limits, since the land is primarily privately owned and off the reservation. However, harvesting now has spread to these areas (Sousa, 3 April 1998). In the privately owned wheat fields, ranchers and farmers, considering the plant a weed, spray it with herbicides (Jacobs, 5 April 1998). Collecting in these areas pose new problems for the harvester and consumer who uses the medicinal plant product.

Not only are plants of every age span taken, but the holes and tire tracks left may cause massive change to the ecology of the northeastern Montana plains. Holes can be seen from the Poplar area to the Fort Kipp vicinity (Sousa, 3 April 1998; see Photos 6.5, 6.6, and 6.7). Gaps from wide shovel blades create the most disturbance, but the specialized root digging tools also contribute heavily (see Photos 6.8 and 6.9). Thousands of exposed six to eight inch holes provides an opportunity for exotic species invasion and large-scale alteration of plant community composition and dynamics. One harvester already has noted increased soil erosion on hillsides due to exposed soil and lack of vegetative cover (Sousa, 3 April 1998). The repercussions of plant loss on pollinators and other animals can only be speculated, and disturbance intensifies with untrained harvesters digging out sage and other unrelated, misidentified plant species. With so little knowledge of *Echinacea*’s ecological interactions, reproductive biology and resiliency to mass disturbance (see Chapter 3), harvesting poses a great threat to the regional survival of the species and dynamics of the present prairie community.

One encouraging note is *Echinacea*’s apparent ability to resprout. In a number of harvested holes, green *Echinacea* leaves were seen sprouting (see Photo 6.10). According to buyers and harvesters, if a portion of the root is left in the soil, the plant will come back in three to five years (Lyn, 5 April 1998; Dailey, 4 April 1998; Jacobs, 5 April 1998; Sousa, 3 April 1998). The older, deeper root is thicker, and the newer growth thinner (Lyn, 5 April 1998), which appears like an uneven graft. Kelly Kindscher, Assistant Scientist at the Kansas Biological Survey of University of Kansas, estimates that 30% of the harvested
PHOTO 6.5. Remnant Holes from a Harvest
PHOTO 6.6. Hillside of More Exposed Holes
Photo 6.7. Remnant Holes from Another Site
PHOTO 6.8. Hole Left Exposed After a Harvest
PHOTO 6.9. Hole from Shovel Harvesting
PHOTO 6.10. Plant Resprouting (?) in an Exposed Hole
plants in Kansas resprout (personal communication, 17 April 1998). Studies on *Echinacea*’s resprouting frequency and survival in Montana are needed. On the discouraging side, professional wildcrafters note that water puddles during wet years can lead to root rot (Drum, 23 November 1997). If a plant is resprouting inside a hole, the gap serves as a collecting pool for water, which over time may lead to rot and reduce initial resiliency and survival. A simple solution to promote survival of resprouts is to cover holes, although increased soil depth may hinder vegetative regrowth.

Another potentially positive, yet questionable, undertaking is the reseeding project carried out by one of the buyers. Before becoming a buyer, he approached the Tribal Council to seek permission and approval to buy the culturally important *Echinacea* plant. By talking to *Echinacea* growers, seed banks and conducting personal experiments, he gained the sanction of the tribe to harvest and buy. Although the elders had mixed feelings, he assured his business would not be a big drain on the environment. The particular selling point was his reseeding project. Prior to his opening shop, he tried to assess where the plant was growing and how many plants the land could support and began reseeding. His idea was to create a sustainable supply and put people without an environmental conscience out of business. In his words, "You don’t need to rape and pillage the land. There is no sense in liquidating the resource. Nor is it economically viable to do this" (Lee, 21 March 1998). In the last few years, it has become his routine to examine the abundance and distribution of *Echinacea* in fall, plant seed after evaluations are complete, and then reassess plant abundance in spring to determine harvesting areas and levels. Flowering tops are collected by paid harvesters in August when the plants are dry and the seeds mature. Seventeen to twenty pounds of the tops equal one pound of seed, and $6.50-8.00 are offered per pound. Last year, he broadcast planted over 300 pounds of seeds in previously harvested areas. Yields of mature two-year-old cultivated *E. purpurea* plants produce 2.25 pounds of fresh flowering aerial portions per plant (Cech 1995a). Subtracting stem weight (45% of entire aerial portion) and water content (75% of leaf and flower) (Cech 1995a),
dried flowering tops in August would weigh approximately 0.25 pound per plant. If seventeen to twenty pounds of flowering tops are needed to provide one pound of seed, then 4.3-5 plants need to be harvested. To provide the 300 pounds of seed, approximately 1290-1500 plants were cropped of their flowering tops. Although the buyer reports increasing germination rates by breaking up the soil and planting seed in fall, the best germination percentage recorded was 30% (compared to 68% germination rate for cultivators) (Lyn, 5 April 1998; Cech 1995a). His method for determining these rates in the field was left unclear. The comparatively low germination rates and additive pressures of harvesting seed needs to be assessed in light of his vision of sustainable harvesting.

After evaluating potential harvesting and reseeding sites, the buyer encourages harvesters to dig all plants in an area, including small roots, so that he can "reseed with pure strains" (Lyn, 5 April 1998). He also examines potential growing sites, like hillsides with two or three native plants growing, and seeds these areas for future harvests. Every year seeds are broadcast in different areas, so that the age of plants and their ability to grow under different conditions is known. However, again his methods are vague. According to Kelly Slater, Conservation Program Officer for the New England Wild Flower Society, the public "may come to falsely perceive that natural populations are easily recreated and therefore expendable" (Slater 1998). In an extensive review of reintroduction projects, Slater (1998) reported that half were "total failures" and about two-thirds had "less than a 50% survival rate." Only 18% of the projects demonstrated 75% survival over the short term duration of one to two years. Over the last three years, the local buyer has broadcast planted 500-600 pounds of seeds (Lee, 21 March 1998; Lyn, 5 April 1998). His "sustainable" methods are advertised to promote sale of his Echinacea root. A local Missoula store even reported getting a call from his business advertising the root as ethically wildcrafted by Native Americans. A full evaluation and verification of his operation still are incomplete, but his ideas bring up valuable questions concerning the meaning, description, and quantitative definition of what is sustainable harvest of Echinacea.
PHOTO 6.11. *Echinacea angustifolia* Roots Drying in a Local Buyer's Warehouse
PHOTO 6.12. Racks of Drying *Echinacea angustifolia* Roots in a Local Buyer’s Warehouse
The present concentration of harvesting, removal of nearly every plant, and open scars from digging methods and negligence does not provide a good model for overall sustainability of *Echinacea* harvesting on the Fort Peck Reservation. Although individual volumes of *Echinacea* root sold cannot be revealed, conglomerate figures from harvesters and local buyers estimate that 100,000 pounds of wet root (~35,000 pound of dry root) have been removed from the northeastern part of the state. If seven average wet roots equal a pound (conservatively), then northeastern Montana already has lost 700,000 plants (see Photos 6.11 and 6.12). Figures are calculated from last years earnings and total root weights in commerce. Since harvesting has been occurring for four years, the figure under-represents total plants extracted.

**THE FUTURE OF HARVESTING**

By March, the digging season was well underway this year, and talk abounds about expanding the market. Already two local buyers have sent workers to various locations including the Northern Cheyenne and Crow Indian Reservations and Dickinson, North Dakota to stimulate harvesting in these areas (Sousa, 3 April 1998; Dailey, 4 April 1998; Lyn, 5 April 1998). Additionally, distributors and pharmaceutical companies have inquired about seeds and other aerial portions, so seeds may be brought into commercialization (Sousa, 5 April 1998; Jacobs, 5 April 1998). However, the intensive cleaning process required may deter buyers from that option (Jacobs, 5 April 1998). If these portions of the plant become part of the *Echinacea* harvest from the reservation, the species will face further risk of extinction. Individual plants may seed propagate or resprout to maturity in three to five years, but how long will it take the community to recover to its former makeup-three, thirty, one hundred years? One private landowner predicts that at present rate of harvesting *Echinacea* will be gone from the Fort Peck area in two to three years (Gelker, 9 March 1998). The Yanktonai/Hunkpapa traditionalist estimates that 80-90% of the plant already
has disappeared on the eastern section of the reservation (Sung-gleska, 2 February 1998).

Still others, particularly buyers, do not see any problem facing plant survival:

"Roots haven't decreased in size; people just keep expanding their territory. They go to virgin places that haven't been dug before" (Dailey, 4 April 1998).

"I can't foresee a problem for the plant in the future. The Indians here protect it cause it's their medicine" (Jacobs, 5 April 1998).

"Echinacea harvesting is not a problem here. Not as long as other people out there are aware and concerned, like Herbs 4 Kids [a Montana herbal tincture company], who won't buy wildcrafted goods" (Lyn, 5 April 1998).

Although none of the buyers see Echinacea harvesting as detrimental to the species, one harvester commented on the plant "being overharvested" (Sousa, 3 April 1998). Yet further added that the "benefits outweigh" the reduction to the species. "It does grow back." One buyer was not so concerned with the large-scale ecological implications, but with the negligence of covering holes. "The end of this [Echinacea harvesting] will be because of the holes... or maybe until the root is gone... Eventually all things come to an end" (Dailey, 4 April 1998). As one traditionalist rebuffs, "[Harvesters] don't give it a chance to regrow. It's a craze here" (Sokol, 26 January 1998). And unlike other wild harvesting that is occurring throughout the United States, the reservation people are not mobile. The reservation is their home, and they must live with the long-term results of the harvesting industry. Yet even if the Echinacea market crashes or if the reservation plants are exhausted, the framework for a new industry is setup. Already people are calling brokers and pharmaceutical companies to find out what other plants on the reservation they might purchase.

**CONCLUSION**

Echinacea harvesting has brought short-term economic benefits to the Fort Peck Reservation, temporarily relieving the stress of high unemployment and poverty. However, the rapid boom of industry on the reservation has left little time for multi-dimensional
discussion, long-term effect analysis, and future economic planning. Since it started with a gold rush mentality, *Echinacea* harvesting may follow the typical boom and bust cycle, so familiar in Montana, and leave communities and their environment in disarray. The physical scars on the landscape, possibly unsustainable level of resource extraction, potential loss of genetic diversity, alteration of prairie and community structure, unilateral movement of goods off the reservation, degradation of the common lands, and multitude of societal changes and tensions threatens the integrity of the prairie and the cultural landscape. And as the Yanktonai/Hunkpapa traditionalist, Sung-gleska, adds, "How many other communities have been affected?" (personal communication, 12 August 1998).

Like grasslands throughout the plains, the natural habitat of *Echinacea* and prairie of the Fort Peck Reservation have been divided into allotment pieces, converted into agricultural and range land, and reduced into "island" remnants. The heavy harvesting of the plant not only depletes an individual species and a culturally important plant, but the practice marks another assault on prairie ecosystems as a whole. Similarly, the people on the reservation have endured a long history of injustices and exploitation, and depending on how it is handled in the future, *Echinacea* harvesting may end before the people receive fair reciprocity, mutual respect, and social justice. What needs to be analyzed is whether harvesting can be conducted in a manner to sustain community livelihoods, a rich cultural heritage, population viability, and grassland ecology. With today's high demand for *Echinacea* products, it seems unlikely in this area. However, efforts are being discussed amongst tribal officials to promote responsible harvesting in conjunction with sustainable rural economic development.
Chapter 7

CURRENT REGULATORY PROTECTION
FOR ECHINACEA ANGUSTIFOLIA

"I initially thought we should put crimps on people and police them. But now I think it's a delicate matter... Policy defines things, and scares people away. We need to bring subsistence to people first" (Sung-gleska, 4 April 1998).

Most people on the reservation fear regulatory status since it impinges on their freedom to harvest wherever they want and how much they take. While regulation is not being considered seriously on the reservation, it is still worth evaluating to gain insight into how other reservations or agencies are handling the present harvesting craze. At the same time that people voice discontent with reservation regulations, the possibility to promote state, federal or international regulations is attractive since it relieves the local pressure of enforcement in a socially volatile atmosphere. Additionally, regulations such as a Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) listing affects level of trade off the reservation and hits the industry at the other end of the commercialization spectrum. Regulations will be examined from the international level of trade requirements to state and federal levels of mandating the harvesting practice.

CITES LEGAL STATUS

Generally, the medicinal plant trade is undermonitored, poorly regulated, and disassociated from the impacts it creates on wild populations and local people. The only tool available to monitor, regulate and record amounts in international trade is through a CITES listing. Created in 1975, the convention made up of 130 member nations serves to protect and conserve species based on biological status and degree affected by trade (Robbins 1997). Different categories of listing warrant varying levels of protection and
regulation. Although *Echinacea* is not presently listed, its inclusion would trigger monitoring and possibly reduce detrimental effects of the growing market demand.

Appendix I listing provides the most protection and generally prohibits the species from trade. These species such as sea turtles, snow leopards and orchids are in danger of extinction and likely to be impacted by trade (Robbins 1997). About 75% of the species in this category are animals. Appendix II species are "likely to become increasingly threatened if trade is not controlled and monitored" (Robbins 1997). Most of the plant listings fall in this category. In June 1997, *Hydrastis canadensis*, or Goldenseal, was proposed by American representatives and approved by the 130 member nations for Appendix II listing. While commercial trade for Appendix II species is allowed, "export permits from the country of origin or a re-export certificate from the county of export is required" (Robbins 1997). So instead of the typically non-specific medicinal plant category, species-specific information of Goldenseal in commerce must be recorded. The categorical listing enables detailed information on amounts of plant harvested and provides baseline data for the development of conservation strategies and promotion of sustainable harvesting practices (Robbins 1998). Appendix III is an optional listing by any country wanting to protect native species possibly threatened by trade. The listing does not require approval of the convention, but it does require member nations’ help in enforcing national wildlife laws.

While *Echinacea* listing has been discussed by herbalists in the United States, some prefer not to have the plant regulated and instead focus attention on educational efforts (Cech, 27 March 1998). To propose listing, proof of unsustainable harvesting practices must be demonstrated throughout its range either through scientific studies or an assemblage of state endangered species listings. For goldenseal, seven out of the twenty-seven states in its range listed the plant as endangered, threatened or sensitive, enough to warrant the CITES designation (Cech, 27 March 1998; Denham, 1997-8). So before even contemplating international regulation, state regulation must be the focus.
STATE LEGAL STATUS

Only state affording legal protection to *Echinacea* is Missouri. Due to overharvesting in public areas, the 1993 Missouri legislature passed a plant theft law (House Bill No. 536) prohibiting the removal of coneflower roots along highways, county roadways or rights-of-way without permission. Collection in these areas result in a class B misdemeanor, which could mean a $500 fine and/or a maximum of six months in jail. Each plant removed is considered a separate offense. If plants are collected with the intent to sell, the violation becomes a class A misdemeanor, which could result in a $1000 fine and/or maximum of one year in jail. Aerial part collections (i.e., flowers and seeds) are permissible. However, even with the statute and penalties in place, Missouri Department of Conservation reported numerous incidences of taking leading to arrests and fines. In December 1996, the Missouri Department of Transportation further defined the meaning of "permission" and proposed administrative rules (7 CSR 10-13.010) to govern the issuance of permits for roadside plant collections. Preventative and managerial effects of this new regulation are unknown.

Although no state law protects the species in North Dakota, the University of North Dakota Environmental Law Society is trying to pass legislation prohibiting the harvest of *Echinacea* on public and state land. Darla Lenz, Botanist for the North Dakota Natural Heritage Program, displays skepticism for protection on private land, but is hopeful for regulatory protection on public lands (personal communication, 9 March 1997). If legislation is introduced, the next legislative session in 1999 will decide the issue. Another group, the North Dakota Chapter of the Wildlife Society, has discussed with Governor Schafer possible protection of native species on state school lands (The North Dakota and Minnesota Chapters of the Wildlife Society 1998). Actions deriving from these talks are unknown to me.
See Oversized Maps

Fig 7.1. Land Ownership Map of the Northern Region (North Dakota, South Dakota, Montana, Wyoming)
The state of Montana provides no legal protection for *Echinacea angustifolia*, but botanists and state and federal officials throughout Montana are beginning to question the need. The species is listed as a "medicinal plant of concern" by herbalists and Montana representatives of the United Plant Savers, a national organization formed to preserve native medicinal plants (Klein 1997). This listing primarily draws attention to plants impacted by commercial harvesting and encourages organizations and individuals to watch population responses and evaluate personal practices possibly detrimental to the species. The concern for *E. angustifolia* suggests "regular evaluation" and warns of the "extreme possibility of widespread destruction to whole communities" (Klein 1997). Since Klein (1997) describes the plant's Montanan distribution largely on reservation lands, the level of harvesting on the Fort Peck Reservation and expansion of the practice into the Crow and Northern Cheyenne Reservations should warrant close watch of the species and detection of negative impacts (see Fig 7.1).

**RESERVATION RULES AND REGULATIONS**

**CROW INDIAN RESERVATION**

While harvesting has been observed in the southern corner of the Crow Indian Reservation (J. Foster, 23 March 1998), no rules or regulations exist to control the developing *Echinacea* market. Various people on the reservation personally have been contacted about the encroaching business and warned of possible plant and cultural exploitation. The issue was to be brought up at a Tribal Council meeting this summer, however, council elections overshadowed broaching of the subject.
In September 1996, the Northern Cheyenne Indian Reservation Cultural Committee adopted an ordinance prohibiting the commercial harvest of any native plant. Gathering for personal use is permissible only by members of the reservation. The ordinance developed from an incident involving the overharvest of mushrooms by Native Americans and non-Native American on the reservation for personal profit. Since the resolution was passed at a non-controversial time and before Echinacea harvesting threats, the collecting of the cultural plant may challenge the concerted intent of the law and demand heavy enforcement. "People on the reservation aren't necessarily aware of the ordinance," replied Jason Whiteman, Director of Natural Resources of the Tribal Office (personal communication, 13 April 1998). If a person is harvesting unaware of the ordinance, he may initially issue an oral warning and collect personal information. If the person continues harvesting, law enforcement will be called in to handle the repeated violation. As of this April, no violations had been issued. However, with harvesting developments directed towards the reservation this summer, violations may have precipitated, and other illegal harvesting gone undetected. The Cultural Committee retains the power to alter the ordinance.

In 1996, the Fort Berthold Indian Reservation Tribal Council passed a resolution prohibiting the taking of Echinacea. The penalty for harvesters is a $500 fine. However, reports suggest that the resolution does not deter harvesting. Instead "black market behavior" has developed (Crawford, 22 April 1998) and resulted in areas "dug worse than prairie dog towns" (Crawford 1998c). Lack of enforcement and the wide open layout of the land make harvesting hard to control. Although at least three people have been arrested, the harvesting is still going on all over the reservation (Wilson 1998).
BUREAU OF LAND MANAGEMENT (BLM) RULES AND REGULATION

Recent reports suggest that this summer the concentration of *Echinacea* harvesting on the Fort Peck Reservation has spread to public and private lands just south of the reservation and as far as the Ashland Division of the Custer National Forest (Klessens, 3 August 1998; Ott, 3 August 1998; Studiner, 3 August 1998; see Fig 7.1). The quickness and abruptness of its introduction has allowed little time or planning for agency response. Presently, there is no policy specifically created for handling the removal of *Echinacea* plants. The primary means of regulation is through the BLM's general permitting process for collecting plants and other resources. Previously, the only plant parts requested for harvest on the BLM's Miles City Resource District were trees and various seeds (Wittenhagen, 3 August 1998). The large-scale removal of a plant root for commercial purposes is completely new to this district and surrounding districts in Montana and the Dakotas. Hence agency employees across districts are discussing and sharing tactics to handle the increasing and potentially detrimental pressure. Amongst other ideas, a statewide or multi-state policy to regulate harvesting of a high demand plant resource is being discussed (Klessens, 3 August 1998; Vosen, 3 August 1998).

The present permitting system requires harvester's information on collecting location, method of harvest, quantity of resource and reasons for use (i.e., commercial or personal) (see Appendix C). If the location request is in an area where harvesting has not previously occurred, an Environmental Assessment needs to be conducted to analyze the status of the plant, site particulars, and potential impacts on the ecological and cultural environment. If the impacts are considered significant, an Environmental Impact Statement is required. If the impacts are not significant, the permit may be issued with special requirement stipulations unique to the area and situation (i.e., stay on established roads, backfill holes, collect only after plant seeds). Permitting decisions are made at the district
level, and fees based on a minimum fair market value which in this new market is assessed by prices in North Dakota (Hensley, 3 August 1998). Requests may be denied for a variety of reasons including site specific designations (i.e., Wilderness Study Area, Culturally Significant Area), road closures and soil types and moisture (i.e., getting stuck in the mud). Typically, removal for personal use and/or of quick recovering resources such as seeds or flowers is allowed. However, with the high commercial demand of *Echinacea*'s slow-to-recover roots, the practice cannot be categorically excluded, and initial environmental analyses most likely will have to be conducted before issuance of a permit (Hensley, 3 August 1998).

In April 1998, there were no signs of people harvesting on the Glasgow District. By August 1998, Steve Klessens, Rangeland Management Specialist of the BLM Glasgow Resource District, reported two to three permit requests a week. Most of the harvesters live in the neighboring reservation towns of Poplar, Brockton, and Wolf Point. Ironically, the permit requests are not for harvesting on the Glasgow District, but the Miles City District, south of the reservation. Harvesters pick up maps and information on collecting and get referred to the Miles City District Office for permits. However, whether collectors gain permission at this district is unknown (Klessons, 3 August 1998). Keith Wittenhagen, Rangeland Management Specialist of the Miles City District Office, reports that people are not asking permission to dig on public or private lands. While no harvesting has been observed, patrolling of public lands is difficult due to the spacious landscape and lack of resources to monitor and enforce (personal communication, 3 August 1998). Additionally, "people are quick," and harvest on weekends when no personnel are working (Wittenhagen, 3 August 1998). At this time, no permits have been granted on the Miles City District for the commercial harvest of *Echinacea* roots (Vosen, 3 August 1998). But this does not mean that the harvesting is not occurring.
FOREST SERVICE RULES AND REGULATIONS

Forest Service offices throughout Montana, North Dakota, South Dakota and Wyoming report higher numbers of permit requests, illegal harvesting, and signs of holes (Ott, 3 August 1998; Rinehart, 27 October 1997; Reyher, 27 March 1998). Similar to BLM policies, the only mechanism to monitor harvesting activity is through permits and fees (see Appendix C). However, it is unknown how many harvesters neglect this step. Federally managed lands facing heavy harvests include the Big Horn National Forest, Wyoming, Grand River National Grasslands, South Dakota, and Little Missouri National Grasslands, North Dakota (Ott, 3 August 1998; see Fig 7.1). Harvesting demands on the Little Missouri National Grasslands (Rinehart, 27 October 1997) and the Black Hills National Forest (Reyher, 27 March 1998) began last fall, and on the Grand River National Grasslands this spring (Telmack, 6 March 1998). During March interviews, agency employees at the latter two sites hoped the diffuse concentrations of plant populations would deter digging, and at that time, reported either no harvesting (Grand River National Grasslands) (Telmack, 6 March 1998) or few small, permitted root collections (Black Hills National Forest) (Reyher, 27 March 1998). Similarly, Susan Rinehart, District Botanist of the Little Missouri National Grasslands, reported only three applications for *Echinacea* collections, and the denial of one of the three due to requested root removal and lack of plant status knowledge (personal communication, 27 October 1997). However, by April 1988, the number of requests on Rinehart's district had increased, with most coming from out of state and particularly Montana (Crawford 1998c). In May, the District Ranger of the Little Missouri National Grasslands, publicly stated:

"Given that [the commercial collectors generally like to come in and take all the plants they can find], and given that we have limited populations of the plant, and given the extreme interest in the coneflower right now, we are not going to allow collecting on public lands" (Wilson 1998).
Furthermore, field crews were informed to watch for poachers and "potholed areas" (Wilson 1998).

The denial of permits to collect has become standard practice for Forest Service agencies throughout North Dakota and eastern Montana. Until quantity of personal use and impacts on environmental and cultural resources are established, commercial permits will not be issued on the Custer National Forest (Ott, 3 August 1998). By talking to various Crow traditionalist and harvesters, Bill Ott, District Ranger of the Ashland Division of the Custer National Forest, sought to determine how much Echinacea root one person uses. The findings help him establish quantitative distinctions between personal and commercial use. Accordingly, one to one and a half pounds of Echinacea root may be used by an individual per year, so he figures that amounts for personal use constitute less than two pounds. Requests for over two pounds may be considered for commercial use (Ott, 3 August 1998). While the permitting process is on hold, an interdisciplinary meeting within the Custer National Forest is being called this September/October to decide further regulatory actions (Ott, 3 August 1998; LaPoint, 3 August 1998). In the meantime, the first arrest for illegal Echinacea harvesting was made on the Forest this summer. Eighty-five pounds of Echinacea root (six gunnysacs full) were confiscated from five Texas diggers, claiming they were digging for personal use (Studiner, 3 August 1998). The story made news in the Missoulian (Associated Press, 2 August 1998), the Billings Gazette (McKee, 1 August 1998) and a number of local newspapers across Montana. The Echinacea threat facing public lands is turning federal agencies into watchdogs and law enforcers.

The challenges that the issue presents echoes throughout the nation's land agencies. As the demand and attention for non-timber forest products increases, the gap between the permit system and public awareness or willingness to comply enlarges, and the regulatory framework of resource extraction more noticeably lacks thorough assessment of the growing market. "The monetary value [of special forest products like beargrass leaves,
huckleberries and mushrooms] is exceeding the value of timber even on Montana public lands" (Shelley, 20 October 1997). However, in this time of governmental streamlining, the agencies lack personnel and resources to monitor harvesting practices, conduct environmental impact analyses, or rapidly produce scientific/traditional guidelines regulating the harvest of understory plants.

**PRIVATE LAND RIGHTS**

The harvesting pressures on private land are only speculative and primarily governed by the granting of personal permission. However, as on the Fort Peck Reservation, trespassing onto private lands is increasingly observed (Studiner, 3 August 1998; Wittenhagen, 3 August 1998). Since most of the Great Plains is privately owned (Rinehart, 27 October 1998), some people question the seriousness of the overall threat to the species. In areas like Kansas, landowners "have been known to prohibit digging" and warrant trespassing arrests (Price Hurlburt, 24 March 1998). However, other landowners allow digging on their land and even charge people by the pound collected. One rancher, east of Billings, permitted people from New Mexico to dig on her land, charging fifty cents per root pound (Studiner, 3 August 1998). Demand and effects on private land are largely unknown.

**CONCLUSION**

*Echinacea* harvesting has spread south from the Fort Peck and Fort Berthold Reservations into privately and publicly owned lands as far as 200 miles away. While regulatory attempts may curb the practice somewhat, various regulatory methods employed by state and federal agencies have not stopped wildcrafting. Harvesting simply goes underground and becomes nighttime or weekend activities, when agency employees are not
working. The growing pressures, which most likely will continue for some time, has alerted Bureau of Land Management, Forest Service, state agency and tribal personnel into developing new and specific policies to manage the resource and prevent overharvesting. Since the issue encompasses a wider prairie concern, I am working to organize an inter-agency meeting this fall, to evaluate the extent of harvesting impacts and share strategies to reduce or stop detrimental practices.

Since regulatory processes display limited protection for the plant, introduction of regulation on the Fort Peck Reservation at this point may only add to the volatile social situation and cut deeper rifts between families and a community torn between patrolling the resource and temporarily prospering from resource income. Additionally, if a permitting system were to be employed, even some of the main voices for conservation (i.e., traditionalists) feel uneasy about reporting where they gather or how much they gather, for fear of attracting more attention. With hundreds of people already harvesting, including tribal officials, regulations probably would not be accepted and would be extremely hard to enforce. Other means must be examined quickly.
Chapter 8

CONSERVATION IDEAS AND ACTIONS

"To not seek to protect this precious plant and place is to violate Echinacea, prairie, and who we are. Each flower dug is an almost imperceptible loss, just as one by one tiny fragments of unprotected topsoil leave on wind. Perhaps Echinacea's greatest gift is to encourage us to heal our split with this precious place, to at long last come to know who we are to call out our voices and energies and respect the roots of our home" (Glinda Crawford, 1998c).

Originally, I intended to address only conservation ideas for the Fort Peck Reservation. However, the problem with Echinacea harvesting not only threatens the integrity of localized people and place, but it also threatens the larger Great Plains biome and all the people living on the land. Therefore, larger scale prairie conservation needs to be addressed in the midst of smaller, region-specific solutions. Most ideas appropriate to the Fort Peck Reservation can be extrapolated to other areas in the plains, and can, in fact, be used for different ecosystem types facing similar crises with other highly demanded plants. Additional ideas and present actions for larger Echinacea conservation will be discussed as well as mechanisms for taking individual responsibility.

CONSERVATION ON THE FORT PECK RESERVATION

While commercialization and exploitation of Echinacea arrived from external, detached, and distant sources, the conservation ideas below derive from people living on the reservation. It may seem easier to develop and apply conservation strategies from outside the reservation, but it wrongfully neglects the opinions, insights, experience and knowledge of the people that harvesting most affects and further supports exploitive disrespect for Native Americans and their culture. Globalization of the Echinacea market has degraded the ecological and cultural biodiversity of the place. Shiva (1997) describes "two conflicting paradigms of biodiversity:"
"The first paradigm is held by local communities, whose survival and sustenance is linked to the utilization and conservation of biodiversity. The second is held by commercial interests, whose profits are linked to utilizing global biodiversity as inputs for large-scale, homogenous, centralized, and global production systems. For local indigenous communities, conserving biodiversity means conserving their rights to their resources, knowledge, and production systems. For commercial interests, such as pharmaceutical and agricultural biotechnology companies, biodiversity itself has no value; it is merely raw material. Production is based on biodiversity destruction, as local production systems based on diversity are displaced by production based on uniformity."

Commercial interests on the Fort Peck Reservation have stimulated the local economy, but only for a short duration. The connection between the current level of harvesting and long-term ecological degradation and sociological disintegration must be made. However, the issue must be discussed and decided upon by the Native American community and evolve according to their own needs and priorities.

"The biodiversity issue is an opportunity to recover diversity at the ethical, ecological, epistemological, and economic levels.... The conservation of biodiversity, at the most fundamental level, is the ethical recognition that other species and cultures have rights, that they do not merely derive value from economic exploitation by a few privileged humans.... Conservation of biodiversity, therefore, involves the conservation of cultural diversity and a plurality of knowledge traditions. This plurality, in turn, is ecologically necessary for survival in times of rapid change and accelerated breakdown" (Shiva, 1998).

The suggested actions of the Fort Peck Reservation community also provide conservation insights on non-reservation lands and are welcomed by the non-Native American community.

The Fort Peck Reservation tribal members have offered the following ideas to respond to the impending cultural, ecological and economic crisis of harvesting. These suggestions provide a beginning template for communal and multifaceted programs. This fall, Curley Youpee, the Director of Cultural Resources of the Fort Peck Assiniboine and Sioux Tribal Office, hopes to gather elders, harvesters, buyers, tribal officials and other involved people together to discuss the issue and start formulating strategies (personal communication, 3 April 1998). This inclusive process will attempt to involve affected individuals and communities in the planning and decision-making process, to provide an
avenue for individual concerns to be heard, and to allow societal mending over the removal of a natural resource and cultural plant.

Amongst a range of possibilities, the most widely encouraged methods to control harvesting are education and re-evaluation of the reservation's position in the Echinacea business. Educational objectives focus on reteaching the community about culture, cultural plants and the ways that people and plants previously and presently interact. With the reservations' extensive school system, elders could be brought into the elementary and high school classrooms to share their traditional knowledge, philosophies, and methods of harvesting and using the plants (Sung-gleska, 4 April 1998). Through elders' teachings, people and their local environment may be reconnected, the importance of cultural knowledge may be reestablished, and greater connections between youth and older generations may rebuild the community. Along the same lines, the tribal community college instructors and students can develop projects through science or other courses to study the surrounding cultural resources and long-term impacts of plant collection on wild populations and their habitat (Sung-gleska, 4 April 1998). Students can investigate and determine a practical definition for sustainable harvest levels, evaluate ecological community response to disturbance (i.e., holes), and/or inventory and monitor the Echinacea resource. Many more ideas can stem from these or other suggestions, and there is much room for creativity.

An idea that would bring education outside the classroom is the creation of a pre-harvest ceremony. To describe the necessity, Azure, a Hidatsa traditionalist, gives an example of another issue:

"The rice conflicts and near war in Wisconsin. The medicine man told them [his tribal folk] not to fight over rice, and because [they had], it [wouldn't] grow for four years. And it didn't. Lots of traditional people feel the same [about Echinacea], but some harvest the root because of money... [A ceremony] is a compromise between the traditionalists and the root diggers. [You] still acknowledge the root in the traditional way" (personal communication, 27 January 1998).

A fourth suggestion is already in the making. Curley Youpee, noticing the lack of Native American input in contemporary herb books, is writing a book to educate people on
the traditional identification and value of plants and the various tribal uses and experiences (personal communication, 3 April 1998). Whether the book will be available to the greater public is undecided.

The various business ventures discussed focus on sustainable economic development and promotion of responsible harvesting. The central tactic would involve the tribes taking more control of the regional *Echinacea* industry, as a direct market player and possibly producer of processed and value-added *Echinacea* products. By acting as a wholesale distributor to small businesses and large pharmaceutical companies, the tribes cut out the middle buyers and brokers, possibly increase individual income, and generate money for the reservation (Sung-gleska, 9 February 1998). However, even this activity will have to be monitored in some fashion to prevent overharvesting. The idea of processing *Echinacea* roots into teas, tinctures or other marketable product reduces the reservation's role as a resource extractive area and promotes local business development. The floral green and wild mushroom industries of the Pacific Northwest are following such strategies; however, it is too soon to analyze effectiveness, efficiency and success of those ventures (Love and Jones 1997).

The key to developing a new business in an isolated area with few successful businesses is to start small, be creative, think sustainable and talk to people who have been successful. Some of the questions that need to be asked are: How far away will the product be marketed? How far away and at what time of the year will harvesting occur? What other business could be pursued during other times of the year? (Clow, 22 April 1998). Another major concern is the market fickleness and future demand for *Echinacea* products. By the time the business is organized and setup, will *Echinacea* still be in demand? Or will the herbal fad fade? Moreover, with the herbal industry's rapid growth, Food and Drug Administration's desire for increased regulation of herbal medicine products, and possible passage of the United Nations/ World Health Organization Codes Alimentarius Commission (CODEX), the atmosphere to promote small scale business is
unstable and unpredictable. CODEX’s proposed rules and regulations, which the FDA still is examining, would require a Drug Identification Number (DIN) for the *Echinacea* product, possibly costing up to $7,000 to $15,000 per DIN. Without DIN approval, the product could not be sold, and retailers "would be subject to arrest" (Fleisher 1997). Additionally, manufacturers would have to pay a "site licensing fee," which when combined with DIN expenses would put the small reservation retailers out of business. While creating an industrial niche on the reservation may greatly benefit the tribe, the business venture needs in-depth, multi-faceted and long-term evaluation.

Other types of business may include direct selling of the raw material from wild harvested, cultivated, wild cultivated, or a combination of sources. The obvious problem with collecting solely from the wild is large-scale disturbance, population depletion and interpersonal conflicts already created by hundreds of people harvesting. However, if the tribe was interested in expanding the raw product line, then harvesting standards or guidelines should be created to prevent the overharvest of *Echinacea* and other plants. Guidelines can be developed from traditional knowledge, long-term systematic studies conducted by researchers, including students, published guides to wildcrafting (Pilarski 1998, Tilford 1993, Thie 1997, Rocky Mountain Herbalist Coalition 1995), or ethical wildcrafting workshops throughout the Northwest (teachers: Robyn Klein, Howie Bronstein, Michael Pilarski). If a plant comes to be in high demand, like *Echinacea*, then ethical harvesting, or harvesting that does not threaten the viability of the plant population, is extremely doubtful.

Another approach to preventing overharvest involves wild-cultivating, or harvesting wild species on a rotation system and disseminating seed in the holes. To be a sustainable venture, some areas would need to be protected from harvesting as "old growth prairies." These areas can serve as references and allow more meaningful assessment of impacts to harvested areas. The level and rate of sustainable harvest and duration of rotation need to be determined for designated harvest areas. Harvest of plants would be based on an
established percentage or number of plants in the area, and rotations would be based on the number of years required to rebuild population density to preharvested levels. This system of digging allows previously harvested areas to regenerate, reduces intense harvesting at particular sites, and requires little extra work for the harvester since the only "cultivating" being done is the planting of the seed (Snell, 7 November 1998). Again the problems with this system include the large numbers of people already digging, the overlapping of their harvesting areas, and the lack of regulatory enforcement. An allotment system of the communal tribal lands may have to be developed to ensure location and amount of harvest and prevent areas from being re-dug. At the same time, this concept is contradictory to the reservation and tribal definition of communal land and may promote tensions between people claiming overlapping harvesting sites. The major problem facing the reservation and members concerned with reducing overharvesting is the free-for-all nature in which harvesting began and presently continues. Any idea proposed to curb present practices will be unpopular with a portion of the population, and without enforcement, the lack of voluntary compliance could be enough to endanger the plant.

A third conservation approach, cultivation, probably is the most protective and plausible approach for *Echinacea* at this time. Yet it does not attract as much interest as the other two, and reasonably so. Not only has *E. angustifolia* proven difficult to germinate, but it takes three years for the plants to mature and display medicinal quality. Even though the natural landscape and climate most likely will promote germination and growth, the monetary return will take at least a few years (Lee, 21 March 1998; Lyn, 5 April 1998). Who knows what will happen to the *Echinacea* market during that time. On top of these concerns, there is prevalent belief amongst harvesters, buyers, and the larger herbal medicine community that wild *E. angustifolia* is more medicinally potent and better than cultivated *E. angustifolia* (Sousa, 3 April 1998; Dailey, 4 April 1998; Sugarek, 2 February 1998; Hobbs 1995). A number of herbal product companies support the observation and base their claims on smell and taste quality standards. Although present cultivators would
not welcome the news, recent evidence may support the claim. Richo Cech, Organic Cultivator at Horizon Herb Farms in Williams, Oregon, reported that chemical analysis by the Horizon Herb Farm analytical laboratory revealed degradation of caffeic acid derivatives in tinctures made from cultivated fresh roots. At the same time, extracts from wild *E. angustifolia*, demonstrating high medicinal quality, contained high levels of caffeic acids (personal communication, 27 March 1998). However, no reason for the difference could be provided. On the other hand, dried roots show no differences between wild and cultivated roots. Perhaps processing methods which convert wet roots into macerated extracts specifically affect the chemistry of the final product. These findings may have great implications for all *E. angustifolia* cultivation efforts, especially since fresh roots comprise the majority of the tincture business. However, caffeic acids are only one group of plant constituents displaying medicinal activity, and their effect on the body is minimal compared to other compounds (Berner 1997; Medora, 28 August 1998). To understand observed potency differences, more studies need to be conducted.

Ironically, while wild harvested *E. angustifolia* roots may be more medicinally potent, more money is paid for cultivated *E. angustifolia* roots (see Table 8.1). The price difference increases pressure on wild species and should encourage widespread cultivation. Despite the high price paid for cultivated roots, people are hesitant to begin a process with a three-year payback using a plant of questionable quality medicinally. On the other hand, cultivators have noted that *E. purpurea* is relatively easy to grow and cultivated *E. purpurea* plants produce more of the tingling sensation thought to be associated with medicinal potency than do wild *E. angustifolia* (Smith 1998). Although the monetary value of cultivated *E. purpurea* is less than that of cultivated *E. angustifolia* (see Table 8.1), these tradeoffs may be worth the risk. If cultivation is considered seriously as a business venture on the reservation, then the propagation of *E. purpurea* may be the best choice. However, introducing an exotic species which may crossbreed with the pure *E. angustifolia* may put the local native populations at risk. Sung-gleska recommends that cultivation should be
done incorporating "traditional practices." He further jests that "Indian names like 'Dakota Echinacea'" should be put on the raw herb material and sold as such to increase profit (personal communication, 2 February 1998, 9 February 1998).

**Table 8.1: Comparative Raw Material Price List for Cultivated Echinacea purpurea and Wildharvested and Cultivated Echinacea angustifolia.**

<table>
<thead>
<tr>
<th>Source</th>
<th>Plant part</th>
<th>Company/Place</th>
<th>Price/Pound (Year)</th>
<th>Company/Place</th>
<th>Price/Pound (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wildharvested</strong></td>
<td>Dried Roots</td>
<td>Kansas**</td>
<td>$22/lb. (Spring 1998)</td>
<td>Kansas**</td>
<td>$27/lb. (Spring 1998)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Plains Echinacea</td>
<td>$8/lb. (Summer 1997)</td>
<td>Northern Plains Echinacea</td>
<td>$8/lb. (Spring 1998)</td>
</tr>
</tbody>
</table>

* Seeds actually from wildharvested source.
** Source: (Price Hurlburt 1998)

The plight of *Echinacea* and vastness of *Echinacea* digging has induced information sharing and coalition building between other affected reservations and land agencies. Connecting the Fort Peck Tribal Office personnel with concerned individuals and employees on the Crow and Northern Cheyenne Indian Reservations may encourage the exchange of harvesting stories, permit insights into the origin and nature of the *Echinacea* market, provide deeper understanding of regional harvesting effects, and promote sharing of conservation strategies on other reservations. Similarly, connections to other land agencies (i.e., Forest Service, Bureau of Land Management) presently are being formulated to discuss the issue on a greater ecosystem level.
Another issue which needs to be evaluated and implemented by pharmaceutical companies and herbal businesses is the granting of intellectual property rights. While agreements are developing in the tropical rain forest and other places around the world, efforts are lacking in the United States. The tribes should receive fair compensation for the sharing of their knowledge and plant culture. Thus far, only payments for the root are exchanged, but funds for the tribes and/or conservation measures should be installed into trade agreements to balance the unilateral flow of benefits.

**CONSERVATION ACTIONS FOR THE GREATER PLAINS COMMUNITY AND GENERAL PUBLIC**

_Echinacea_ conservation for the wider plains community has focused on consumer education and promotion of widespread organic cultivation. Glinda Crawford, Sociology Professor at the University of North Dakota in Grand Forks, Curley Youpee and I have written a number of articles informing the public about the detrimental regional effects of the _Echinacea_ demand on western North Dakota and northeastern Montana wild populations (Crawford 1998a, Crawford 1998b, Crawford 1998c, Kolster and Youpee 1998a, Kolster and Youpee 1998b, and Kolster and Youpee 1998c). The primary purpose was to increase awareness of where _Echinacea_ medicines come from and the effects individual and industrial demands place on wild resources. Other media and general public outreach projects are in the works. Additionally in May 1998, I presented an educational table display, "Echinacea harvesting in eastern Montana," at an United Plant Savers event in Missoula, MT called "Where Have All the Flowers Gone? The Decline of Wild Medicinal Herbs in America." The display may be converted to an exhibit for the Fort Peck Assiniboine and Sioux Reservation Museum. Furthermore, a verbal presentation was delivered at the first annual Montana Herb Gathering (28 June 1998), and a radio interview may be broadcast on KUFM's "In Other Words." In addition, I am discussing a letter
writing campaign to herb companies and distributors with Robyn Klein. The letter would explain and visually display what their practices are doing to the landscape and encourage purchase of organically, cultivated sources only.

While organic farms increasingly are going into *Echinacea* production, the high demand still leaves room for further cultivation efforts. Many leading herbalists recommend cultivation for conservation (Hobbs 1995, Tilford 1993, Upton 1997, Klein, 16 February 1998). "Cultivating *Echinacea*: Specifics of growing and shared lessons" provides introductory information for interested gardeners, cultivators, and agricultural extensions services, specifically in Montana (see Appendix D). For further information, a list of sources and resources has been included (see Appendix E).

Another suggestion to reduce pressure on wild *Echinacea* throughout the plains is the advent of wildcraft cooperatives. These organized groups allow wildcrafters to combine individual collections into larger communal quantities and gain greater control over fluctuating prices (Fuller 1991). The hope is that increased wildcrafting profits would reduce the level of harvesting. Bannerman suggested this proposal for harvesters in the southern Appalachian region, another area facing heavy overharvesting of medicinal plants (Fuller 1991). However, it is unknown whether his proposal was adopted or successful.

Replacing *Echinacea* with other medicinal plants of similar activity also may promote species conservation. Although not as potent, one suggested local plant is Arrowleaf Balsamroot, or *Balsamorhiza sagittata* (Pursh) Nutt. (Williard 1992, Tilford 1993). However, the danger with this recommendation is the possible overharvest of this species. In the early 1800's and before goldenseal (*Hydrastis canadensis*) became one of the present top selling medicinal herbs, another plant called American goldthread, or *Coptis trifolia*, was overharvested to the point of extinction around the Appalachian mountains. As a substitute, goldenseal was recommended (Bergner 1997). Today, goldenseal is endangered and extinct in some Eastern regions and categorically listed under CITES. As a
goldenseal substitute, some people now are recommending going back to American
goldthread (Bergner 1997).

Bruce McCallum, Director of the Great Northern Botanical Association, is "making
sure [all the *Echinacea*] species stay in existence" (personal communication, 9 March
1998). McCallum collects and grows nearly all the species for seed saving and
revegetation projects. He hopes to conserve the plant and make seedlings and residual seed
available to people at no cost. The only species he has been unable to acquire are *E.
atorubens* and *E. simulata*. The other species, including *E. angustifolia*, are being grown
and seed saved.

**WHAT INDIVIDUALS CAN DO TO REDUCE THEIR IMPACT ON WILD *ECHINACEA***

✓ Only buy organically cultivated *Echinacea* products. Stop purchasing wildcrafted, or
wild-harvested, products. If the label does not say it is cultivated, chances are it is gathered
from wild stands.

✓ Limit use of *Echinacea* products. Ryan Drum, herbalist and ethical wildcrafter on the
San Juan Islands, Washington, estimates that up to 90% of *Echinacea* is wasted due to
improper use and misconceptions of its healing ability (personal communication, 23
November 1997).

✓ Research whether *Echinacea* products are, in fact, beneficial OR if the use of the plant in
the product is a marketing ploy (see Chapter Five). One of *Echinacea*’s main values is as
an immune system stimulator, and it is best used in tinctures. Be scrupulous of its use for
other purposes and in other preparations.
Request stores to provide organically cultivated *Echinacea* products and stop carrying products that use *Echinacea* frivolously.

Write companies which produce and sell wildcrafted *Echinacea* products. Request they use plants that are organically cultivated and stop producing products from wildcrafted sources.

Encourage local commercial growing and processing of *Echinacea*.

Grow your own using seeds from a neighbor’s plant, seeds from an organic cultivator, or starts from an organic and ethical nursery.

**CONCLUSION**

Effective conservation measures depend on a good understanding of the plant’s reproductive biology and population ecology. Some critical research questions are: What are the long-term effects of wildharvesting on the plant and its community? How does the plant and its ecological community respond to massive disturbance over time? What percentage of the harvested plants resprout, and is this proportion enough to ensure future viability of the population? How many viable seeds does one plant produce, how long can seeds live in the soil, and what is the reproductive success? How many years will it take the plant to regrow to pre-harvested numbers and size? How many years will it take the ecological community to heal from the scars?

Conservation efforts are in their infancy, still focusing on visionary conceptualization and coalition building. How the *Echinacea* situation is handled may lay the groundwork for future medicinal or cultural plant extraction throughout the northern region of Montana, North Dakota and South Dakota. We are entering a new era of
resource extraction and expanding nontimber products. Strategies need to be well considered and developed to effectively and sensitively curb present and future "Echinacea" crazes. As part of the process, it is fundamental to understand the larger political, economic, cultural, social and historical context in which harvesting occurs. Bringing in the voices, concerns and thoughts of local people provides much understanding into the complexity of the issue and the extent to which harvesting effects are felt. Multiple insights provide the diversity of ideas needed to tackle these complex situations. As Sung-gleska, the Yanktonai/Hunkpapa traditionalist, states:

"Cultural interest and conservation interests need to be on the same line for protection. We need to preserve and harvest in a way that doesn't hurt the environment or culture. Overharvesting overshadows the traditional ways. It's harmful to people and the surroundings..... By understanding the circle of life, of giving and sharing and understanding how that is and why that is, you can help the environment and people. The necessity of plant life toward animal life-- ecology; it has to be together" (personal communication, 9 February 1998).

With the rapid growth of the Echinacea and herbal industry as a whole, conservation efforts must quickly be developed. Already on the Fort Peck Reservation, conversational proactive tactics are now turning into defensive tactics. Recent reports suggest that, during the 1998 summer of harvesting, the Echinacea craze further expanded in the area and placed wild species at still greater risk (Metz, 25 August 1998). Herbalists, botanists, and tribal ethnobotanists throughout Montana are beginning to discuss harvesting pressures facing other native medicinal plant species (i.e., Lomatium dissectum) (Klein, 14 July 1998), so that protective frameworks can be established before another Echinacea-like craze develops. Even if the Echinacea market crashes, the tide of non-timber forest product extraction is upon us. We must remain proactive in our solutions.

This last March, as I filled my car with gas for the drive home, I was surrounded by trucks and talk of digging. One man, on the other side of the pump, tapped the last drops of gas into his trunk's tank and hollered to another driver that he was heading out to
dig. I could not help wonder if the *Echinacea* helped pay for his gas. And then I realized my own symbolic mobility and the representation of leaving a culturally and ecological dynamic community that was not my home and that I could never known completely. Those of us who live outside *Echinacea*'s native range are not blameless in the destruction occurring throughout the plains. Every time we reach for a "wildcrafted" *Echinacea* tincture, powdered *Echinacea* pills, or the latest juice with *Echinacea* extracts, we support and encourage the *Echinacea* market and the exploitation of the plant, land and people. But we can take steps to change our individual practices and support community conservation strategies such as on the Fort Peck Reservation. Becoming aware of where your medicines come from creates deeper connection to the plant medicine, promotes further active personal healing, exposes the hidden scars of communities and their landscape from industrial exploitation, and begins the healing of those scars.
BRIEF SYNOPSIS

ECHINACEA MARKET DEMAND

Domestic Demand:
- The demand for herbal products has jumped from a $2 billion industry (1995) to a $3.24* billion industry.
- *Echinacea* sales at the forefront of the “Herbal Renaissance,” grossing nearly 10% of total herb sales.

International Demand:
- Herbal medicine market expands in Canada, Australia, France, Germany, and other Western European countries.
- *Echinacea* ranks eighth in international sales of most frequently prescribed mono-herbs.
- More than 300 *Echinacea* products on the market.

THE HARVESTING STORY ON THE FORT PECK ASSINIBOINE AND SIOUX RESERVATION

Fall 1995:
- Two pharmaceutical companies approach members of the Fort Peck Assiniboine and Sioux Reservation to harvest *Echinacea angustifolia* root needed for AIDS research.
- The Fort Peck Reservation is the third reservation to get “hit” by corporate *Echinacea* interests.
- High unemployment rates (up to 80% during certain times of the year) and geographical isolation with little industry makes the area prime for new business ventures.

Spring 1998:
- 350-400 people harvesting.
- Individuals to whole families harvest.
- People harvest anywhere from a couple hours a week to every day seven days a week, providing supplemental or entire incomes.
- Prices for wet root fluctuated between $4-8/lb in the last three years.
- Individuals can harvest 2-6 lbs./hr, depending on harvester’s experience, root size, and stand abundance.
- Gross earnings range from $20-200/day. However, costs (i.e., cost of travel, wear and tear on vehicles) are not taken into account, so net earnings are actually lower.

SOCIO-ECONOMIC AND CULTURAL IMPACTS

Strains in the community:
- Frustration between traditionalists and harvesters due to the lack for respect of a cultural plant, absence of proper harvesting techniques and disappearance of an important medicine.
- Tensions between rancher and harvesters over holes, trash and trespassing.
- Reception towards harvesting by ranchers wanting to remove a misnomer “weed” or generate some income.
- Intense competition between buyers leading to root wars and cut throat business practices.
- Theft of propriety maps and monetary income from *Echinacea* harvesting.
- Unilateral movement of material off the reservation and lack of fair reciprocity.

Cultural and economic changes:
- Creation of new cultural identity as people masquerade as “Root Diggers” at pow wows.
- Short-term source of income for the community.
ECOLOGICAL IMPACTS

- Loss of plants
- Removal of all age classes since waves of people harvest the same site.
- Exposure of holes creating mass disturbance, possibly changing interactions between plants and animals, and providing potential conditions for exotic plant species invasion and alteration of plant community composition.
- Unknown consequences due to lack of biological and ecological knowledge.
- Resprouting of harvested roots may regenerate Echinacea communities. But the potential, percentage and survival of resprouts is unknown, especially since holes may collect pools of rain leading to root rot.
- Collection of misidentified plants by untrained harvesters.

AMOUNTS EXTRACTED, BUSINESS EXPANSION, AND FUTURE PROSPECTS

- Figures from harvesters and buyers estimate that 100,000 lbs. of wet E. angustifolia root (~35,000 lbs dry root) have been removed from northeastern Montana.
- If 7 average wet roots equal one pound, then northeastern Montana has already lost 700,000 plants! (1997).
- Echinacea extraction on the reservation may expand to include seeds.
- Harvesting is spreading south off of the reservation into surrounding lands and areas as far as 200 miles away.
- One local predicts that E. angustifolia will be gone from the Fort Peck vicinity in 2-3 years.

CONSERVATION IDEAS: FORT PECK RESERVATION

- No serious consideration for developing regulatory measures.
- Promotion of education through ceremony, elder’s teachings in schools, student projects and creation of cultural plant references.
- Development of sustainable business through direct marketing of value-added products and/or raw materials from wild harvested, wild cultivated and cultivated sources.

CONSERVATION IDEAS: WHAT INDIVIDUALS CAN DO

- See pages 128-129.
LITERATURE AND INTERVIEW SOURCES

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CHAPTER 4


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CHAPTER 7


Crawford, Glinda. Sociology Professor, Department of Sociology, University of North Dakota, Grand Forks, ND. Personal communication, 22 April 1998.


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Youpee, Curley. Director of Cultural Resources, Fort Peck Tribes, Poplar, MT. Personal communication, 3 April 1998.
APPENDICES
Appendix A

INTERVIEW QUESTIONS

**KEY QUESTIONS CONSISTENTLY ASKED OF ALL INFORMANTS:**

in the *Echinacea* market? In other words, are you a buyer, seller, etc.? Describe your involvement and practices in detail.

Do you see any problems with the present day harvesting of *E. angustifolia*? What do you think should be done to reduce those problems?

If there is a problem, would you be willing to change your practices to reduce pressure on *E. angustifolia*? How would you change your practices?

Do you know other people involved in harvesting, cultivating or buying of *E. angustifolia*? What are their names?

**PARTICULAR QUESTIONS ASKED OF SPECIFIED INDIVIDUALS/ INTEREST GROUPS:**

(These questions are important, but were approached secondarily to prevent the informant from becoming too overwhelmed with set questions and allow flexibility in conversation.)

1) *ECHINACEA PHARMACEUTICAL COMPANIES AND OTHER INTEREST GROUPS:*

How many people do you purchase *E. angustifolia* from in the United States? In Montana? What are their names?

How important is the *Echinacea* market to you? What percentage of your profits? What are your total sales or profits in this area? Do you plan to expand your sales? Do you plan to expand your product lines? Are you aware that there are products containing *Echinacea* in which it has no known value? Do you sell any of these products?

2) *ECHINACEA BUYERS/BROKERS:*

Are you an individual buyer or do you work for a company? Which company? How many people do you have "contracted" to harvest *Echinacea*? How many companies/buyers do you sell *Echinacea* to? What are their names, and where are they located?

What parts of *Echinacea* do you purchase (i.e., roots, flowering tops)? Do you provide protocol to wildcrafters on how to harvest, areas to avoid or any other types of guidelines? Explain. Do you encourage proper harvesting to insure sustainability of your product, the plant? How do you do this? Have roots that harvesters bring you decreased in size over the past months/years?

How do you package and market? What is the proper way to clean and dry roots to insure top quality?

Do you also buy from cultivators? What are their names and where are they located? How much (pounds) *Echinacea* do you buy from them? How much does it cost (price/pound)?

How important is *Echinacea* to you economically? What percentage of your business?

What is your relationship with other buyers? Does buying get competitive?

3) *ECHINACEA* HARVESTERS:

Do you wish to remain anonymous in my paper?

What do you call *Echinacea*? How long have you been an *Echinacea* (or their name for the plant) harvester? How many times a week and how many hours a day do you usually harvest? How many people do you harvest with?

Would you be interested in getting involved in cultivation? Or "wild cultivation?"

How do you harvest? Explain your technique. What equipment do you use? What part of the plant do you collect (i.e., root, flowering head...)? What happens to the rest of the plant? If digging for roots, do you collect the whole root or is some left in the ground? Do you try to collect roots of a particular size? How do you determine root size- by above ground growth, partially exposing the root or some other means? Are holes covered up after roots are dug? What time of the year do you collect roots, seeds, flowers or leaves? Does time of day, weather or any other factors affect whether you collect that day or not?

What percentage of plants do you collect at a site? Do you follow any guidelines on how to harvest, areas to avoid or any other types of guidelines? Do you leave mature and seed producing plants within the stand? Do you scatter seeds, replant root crowns or encourage future growth in any way? How often do you come back to the same site? On these sites, do previously harvested plants resprout? Or is it harder to find plants the second time around?

In the time that you have been a harvester, have you seen a difference in abundance (increasing or decreasing) from year to year? How big a difference (percent or amount)? Have you noticed a decrease in the sizes of roots over the past months/years? In your opinion, what kind of effect is harvesting having on the local environment and plant populations?

What locations (specific sites or general descriptions such as public, private or tribal lands) have you harvested from? Note: Specific locations will not be reported in my paper since this may encourage more harvest. Instead it will only be provided to the Montana Natural Heritage program which keeps information on location of rare plants. Generally, how large are these sites and how do you determine where to collect? If harvesting on Tribal or public land, do you obtain permits? What does this entail? If on private land, do you obtain permission from the landowner? Have you had any trouble with ranchers or any
other landowner? Do you harvest on or near farms, power lines, roads or railroad right-of-ways? Have these areas ever been sprayed with pesticides or exposed to chemical contamination?

Do other plants grow in the area that look similar to Echinacea? Are these ever harvested?

How do you clean, dry and ship Echinacea?

How much (i.e., pounds, truckloads...) Echinacea did you harvest in 1995, 1996, 1997? Do you expect to harvest in 1998? How many roots equal a pound, truckload, bushel...? How many buyers/companies do you sell to? What are their names and where are they located? How much money (price/pound) do they pay for wet/dry roots? What is the weight and price difference between fresh and dried root? How much money do you generally make a day? Does the amount you are paid cover the expense (gas money, wear and tear on car) of harvesting?

How important is Echinacea to you financially? Do you harvest mainly for the money? Or other reasons (e.g. self use, family outing, religious significance)?

What is your relationship like with other harvesters? Does harvesting get competitive? Has the number of harvesters increased from 1995 to 1996 to 1997? In addition to the number of harvesters in 1997, do you think or know more people that will harvest in 1998?

4) FORT PECK TRIBES LAND COMMITTEE:

Is there a permitting system (or other system) to regulate harvesting of Echinacea? How does it work? Is there a maximum limit to the amount that can be harvested? Or to the amount that must be left to proliferate? How are these amounts decided? Is the harvest by an individual/group monitored to ensure this level is not exceeded? How is this conducted? Do restricted harvesting areas or any other methods exist to ensure sustainable harvesting? Where can a permit be obtained? How much do they cost? Where does this money go? How many people have obtained permits? Do you suspect people are collecting without permits?

Do you have an education program? Would you be interested in developing one?

Is the root used for religious purposes? If so, are there special regulations for harvesting?

5) PRIVATE LANDOWNERS:

Have people harvested Echinacea on your property? How many people have you seen? Do you suspect more people are harvesting that you are unaware of? Estimate how much of Echinacea was taken (i.e., pounds, truckloads). What percentage of the total plant stand was removed? How was harvesting conducted and what parts were taken? Have you noticed a decrease in Echinacea abundance over the past months/years? If roots were collected, were holes covered? Has your livestock been affected by the holes? Have there been any other inconveniences (i.e., gates left open, litter) due to harvesters?
6) TRADITIONALISTS

Has there been any tribal policies or procedures (i.e., permits, contracts, ceremonies) regarding the protection of *Echinacea*? What is the proper way of collecting the plant? How many people harvest the plant?

7) *ECHINACEA CULTIVATORS:*

What species of *Echinacea* do you grow? Is one species easier to grow than another species? Explain. How long have you been cultivating the various species? What are your techniques for growing *Echinacea* from seed/root propagation to full maturity. Explain in detail including information on soil types, nutrients added, stratification techniques and any other factor contributing to successful and unsuccessful plant propagation. How long does it take *Echinacea* to reach full maturity or the stage at which the active constituents within the plant are strong enough for medicinal use? And at what point do you harvest the plant? Explain your harvesting method. What parts of the plant are collected? How much did you grow/sell in 1995, 1996, and 1997? How much do you plan to cultivate in 1998?

Who (people/ companies) do you sell *Echinacea* to? How much money do you sell the various plant parts for? Do you make a profit? How much? Is it a beneficial venture? How important is *Echinacea* to you financially? What percentage of your profits?
THE ASSINIBOINES

The Assiniboines, or As'see nee poi-tuc (translated from Cree to mean, "those who cook with stone), are believed to have originated after a split with the Yanktonai Sioux band during the sixteenth century. Although the language spoken is a Siouan dialect and the people still refer to themselves as Nakota, they are not part of the Sioux Nation. Historically, they allied themselves with Crees, Chippewas, and Monsoni against the Sioux and other nations. The Assiniboine make up a separate nation, with an indeterminate number of bands. An early fur trader, Edwin Denig, who was married to an Assiniboine woman, recognized seven bands; however, other authors have listed 33 bands (Anonymous 1974; Fort Peck Redevelopment Area Organization 1969). Presently, on the Fort Peck reservation, the Canoe Paddler and Red Bottom bands are represented (Chamber of Commerce 1995).

By 1640, the Assiniboine migrated north to Lake of the Woods and Lake Nipigon area in Canada and began trading fur with the French. This practice later expanded when the Hudson Bay Company established a trading post, and the Assiniboine, along with the Cree, became one of the first groups to trade with the English. As fur trading moved westward and southward, the Assiniboine extended their territory from Lake Winnipeg to the headwaters of the North Saskatchewan River to south of the Missouri River (Miller 1987). This area essentially encompasses present-day Saskatchewan and Eastern Montana. By the early 1800's, large numbers of Assiniboine had moved into the Fort Peck area. With this territorial shift, bands adjusted from woodlands to plains lifestyle and, like other plains tribes, became dependent on the buffalo for food and warmth (Choong 1992).
The Sioux

The Sioux (officially named by the U.S. Government and derived from a French corruption of a Chippewa word meaning "snakes") previously inhabited the woodlands just west of the Great Lakes (Anonymous 1974; Fort Peck Redevelopment Area Organization 1969). Increased pressures from early settlers and armed Chippewa drove them west, and like the Assiniboine, adjustments to Plains life were made. Prior to their westward move, the Sioux Nations were divided into seven tribes or fireplaces:

1) Mde wak' ant' unwan, "Spirit Lake Village" (Mdewakantons)
2) Wah pek' ute, "Leaf Shooters" (Wahpekutes)
3) Sisit' unwan, unknown meaning (Sissetons)
4) Wah pei' unwan, "Leaf Village" (Wahpetons)
5) Ihank'i unwan, "End Village" (Yanktons)
6) Ihank'i unwanna, "Little End Village" (Yanktonais)
7) T' inial' unwan, "Prairie Village" (Tetons)

(Markoe et al. 1989)

However, as groups moved south and west, differences in culture and speech developed so that the tribes coalesced into three divisions. The Mdewakantons, Wahpekutes, Sissetons and Wahpetons formed the Santee Sioux (*Isan' at' i, "Knife Dwellers"); the Yanktons and Yanktonais became the Yankton, or Middle Division; and the Tetons developed into their own division, also known as the Western Sioux. According to dialect, the divisions are referred to as Dakota, Nakota and Lakota, respectively. The Teton Sioux further are divided into seven tribes or fireplaces: *Oglala, "Scatters Their Own;" *Siic' angu, "Burned Thighs," or Brule; *Mnik' owoju, "Planters by Water," or Minneconjou; *O'ohenunpa, "Two Kettles," (literally "Two Boilings"); *Itazipo, "Without Bows," or Sans Arcs; *Sihasapa, "Blackfeet" (different than the Blackfeet Nation); and *Hunkpap'a, "Campers at the Opening of the Circle" (Markoe et al. 1989). The divisions, tribes and dialects are as follows:
### Division and Tribes

<table>
<thead>
<tr>
<th>Division or Eastern Division</th>
<th>Dialect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santee Sioux or Eastern Division</td>
<td>Dakota</td>
</tr>
<tr>
<td>Mdewankantons</td>
<td></td>
</tr>
<tr>
<td>Wahpekutes</td>
<td></td>
</tr>
<tr>
<td>Sissetons</td>
<td></td>
</tr>
<tr>
<td>Wahpetons</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yankton or Middle Division</th>
<th>Dialect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yankton</td>
<td>Nakota</td>
</tr>
<tr>
<td>Yanktonais</td>
<td></td>
</tr>
<tr>
<td>Lower Yantonais</td>
<td></td>
</tr>
<tr>
<td>Upper Yantonais</td>
<td></td>
</tr>
<tr>
<td>Cutheads - amalgamation of Yanktonai and Sisseton families</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teton or Western Division</th>
<th>Dialect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teton</td>
<td>Lakota</td>
</tr>
<tr>
<td>Oglala</td>
<td></td>
</tr>
<tr>
<td>Brule</td>
<td></td>
</tr>
<tr>
<td>Minneconjou</td>
<td></td>
</tr>
<tr>
<td>Two Kettles</td>
<td></td>
</tr>
<tr>
<td>Sans Arcs</td>
<td></td>
</tr>
<tr>
<td>Blackfeet</td>
<td></td>
</tr>
<tr>
<td>Hunkpapa</td>
<td></td>
</tr>
</tbody>
</table>

The Sioux living on the reservation represent all three divisions of the nation. Although the details of their ancestor's stories are different, themes of settler's encroachment, greed and inevitable clashes weave through the tales of how they came to be in the area. The Santee Sioux, after ceding most of their hunting grounds in the Mendota Treaty of 1851 and receiving little in return, retaliated in the Minnesota Uprising of 1862. Refugees fleeing prosecution scattered west into the Dakotas and the present Fort Peck area (Anonymous 1974; Fort Peck Redevelopment Area Organization 1969). The Teton Sioux additionally moved into the region as game was being depleted in the Dakotas (Chamber of Commerce 1995).

The growing intrusion of the steamboat, railroad surveyors and eventually the streams of gold diggers resulted in more clashes and warfare. Peace treaties delineating land boundaries were drawn, signed, broken and redrawn. The Fort Laramie Treaty of 1851 designated land for the Assiniboine, Teton Sioux and Yankton Sioux, which included present day lands of the Fort Peck Reservation. Four years later, parts of this area were designated "Blackfeet Hunting Ground" for the Blackfeet and other tribes. This overlap of jurisdictions remained unresolved for many years (Chamber of Commerce 1995). In 1968,
the second Fort Laramie Treaty, considered a Sioux victory, delineated "the boundary of the Great Sioux Reservation, established agencies, and guaranteed annuities to all Teton and Yanktons" (Chamber of Commerce 1995). The number of agencies, however, was not enough for the overflow of Sioux tribes trying to receive rations. As a result, Congress established the Fort Peck Indian Agency in 1871 to serve Sioux and Assiniboine. Eight thousand four hundred and twelve individuals were relocated to the Fort Peck vicinity (Chamber of Commerce 1995).

Also as part of the 1868 agreement, the government agreed to close the Bozeman Trail and abandon all forts along the trail to keep the hunting grounds of Red Cloud and the Teton Sioux intact. However, the lure of gold was too much for early settlers, Northern Pacific Railroad surveyors and military personnel, and in 1874 General George Custer broke the 1868 treaty and entered the Black Hills on the pretext of military duty. His proclamation of gold in the sacred hills brought a flood of miners into the area. Unable to keep eager prospectors out, the government attempted to purchase the Black Hills; but the price the tribes wanted was more than the government was willing to pay. In the following months, large portions of the tribe fled into the wilderness. This event in Sioux history marked a huge transition in governmental policy towards the tribes. With "peaceful" treaties failing to suppress Sioux retaliations, militant delegations in Washington finally convinced government officials that force was needed to bring the tribes under control.

The order came out late in 1875: All Indians must come into the reservation by January 1, 1876. When the date came and went and the Sioux still were not present, the army pursued. What the military did not take into account was the heavy winter and thick snow. While some factions of the tribe simply refused to comply, others just could not make the treacherous journey in time to meet the deadline. In spite of reason, the army followed, attacked and rounded up people to dispose on reservations. The pursuit culminated late in June when Custer and his 7th Calvary found a large encampment of Sioux and Cheyenne by the Little Bighorn River. The attack that followed was to be the
end of Custer, a decisive victory for the Sioux and Cheyenne, and the beginning of the end for the traditional Sioux life. The battle left the tribes with little food and ammunition, so the encampment broke into smaller groups to find food and hunt. With the defeat behind them and a new desire for vengeance, the Army sent more troops after the Sioux. The camp of Sitting Bull was pursued to the Fort Peck area, where they stayed with Yanktonai Sioux before fleeing to Canada. The military focused on defeating Sitting Bull, and a post at Poplar Creek, next to the Indian Agency, was setup to base operations. The Fort Peck Reservation area was noted as an "unsettled and often violent place" during these campaigns (Anonymous 1974). Finally, in 1881, Gall and Sitting Bull, two of the most notorious "hostiles," surrendered. Some of Sitting Bull's followers intermarried with people on the Fort Peck Reservation, and his legacy continues through their descendants presently living in the area.

On the other front, the government sought further concessions from the Sioux confined to reservations. The annihilation of the buffalo increased tribes' dependence on the government for food. In order to receive rations for starving people, the reservation Sioux ceded the Black Hills, their hunting grounds in Nebraska, and lands east of the Powder River in Wyoming and Montana (Anonymous 1974). Later with railroad tracks being laid towards Montana, the government presented the tribes with yet another agreement concerning the further reduction of lands. By signing, the tribes ceded all but the three delineated reservations of Blackfeet, Fort Belknap, and Fort Peck.
REFERENCES


Appendix C

REGULATORY PERMIT SAMPLES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VEGETATIVE OR MINERAL MATERIAL
NEGOTIATED CASH SALE CONTRACT
($2,499 or less for vegetative material)
($999 or less for mineral material)

State
District
Date of Sale
Name of Purchaser (first, middle, last)
Address (include zip code)

<table>
<thead>
<tr>
<th>KIND OF PRODUCT</th>
<th>EST. QTY. (Units)</th>
<th>RATE/UNIT</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

TOTAL $  

Purchaser is liable for total purchase price shown above. There will be no refunds. Additional payment, if any, will be made in accordance with Sec. 1(c). This contract is made under terms of Sec. 1(c) and the stipulations indicated.

Contract expires (date) ALL MATERIALS MUST BE REMOVED PRIOR TO THIS DATE

Location of sale:

RECEIVED AS PAYMENT IN FULL

ACCOUNT  COUNTY  PRICE
P. D. (5881)  $ 
O & C (5882)  
CBWR (5897)  
Road Maintenance Fee (9110) or (9120)  
Material Site Reclamation (5310) or (5320)  

Purchaser certifies that he is twenty-one years of age or older and if purchasing timber is a citizen of the United States.

Signature of Purchaser

Signature of Authorized Officer

SEC. 1 CONTRACT TERMS
(check appropriate block)

☐ (a) All materials in contract area in excess of estimated quantity are reserved by the Government. ☐ Severence ☐ removal in excess of that quantity will subject Purchaser to trespass action.

☐ (b) The quantity of material is a predetermined amount and may be more or less than the actual amount.

☐ (c) If total number of units ☐ severed ☐ removed exceeds estimated units additional units shall be paid for at unit rate at time and place designated by the Authorized Officer.

SEC. 2 GENERAL STIPULATIONS
(check appropriate block)

All materials are to be removed in strict accordance with instructions of Authorized Officer and the following stipulations and requirements:

☐ Title to material sold under this contract shall remain in Government and shall not pass to Purchaser until such material has been removed from contract area. If this contract involves severance of vegetative material, risk of loss shall be borne by Purchaser after material is cut. Nothing herein shall be construed to relieve Purchaser from liability for any breach of contract or any wrongful or negligent act, or for any violation of any applicable regulation of the Department of the Interior.

☐ Purchaser shall take such measures for prevention and suppression of fire on the contract area and other Government lands as are required by applicable laws and regulations. Purchaser shall dispose of refuse in accordance with instructions from Authorized Officer.

☐ If Purchaser violates any of the provisions of this contract, the Authorized Officer may, by written notice, suspend any further operations of Purchaser under this contract, except such operations as may be necessary to remedy any violations. If Purchaser fails to remedy all violations within thirty (30) days after receipt of the suspension notice, the Authorized Officer may, by written notice, cancel this contract and take appropriate action to recover all damages suffered by Government by reason of such violation.

SEC. 3 SPECIAL STIPULATIONS

Form 5450-5a (July 1990)
(See instructions on reverse of District copy)
USDA - FOREST SERVICE

COMMERCIAL MISC. PRODUCTS - CRAFT, LANDSCAPE, AND MEDICINAL
(Reference: FSH 2409.18 R-1)

FOREST: ____________________________
DISTRICT: __________________________
PERMIT NO.: _________________________

PERMIT IS VALID FOR THE DATES LISTED:
FROM: ________ TO: ________

PERMITTEE NAME AND COMPLETE ADDRESS:
(Please Print)
_________ (Name)
_________ (Street)
_________ (City, State, Zip Code)

PHONE NO.: _________________________
DRIVER'S LICENSE NO.: ______________
DATE OF BIRTH: _____________________

VEHICLE DESCRIPTION:
YEAR: _______ MAKE: __________
COLOR: _______ MODEL: __________
LICENSE NO.: ______________________
STATE OF REGISTRATION: ____________
LOCATION/LEGAL DESCRIPTION: ______

PERMIT IS ISSUED FOR: COMM. MISC. PRODUCTS - CRAFT, LANDSCAPE AND MEDICINAL.

CONES (Seed & decorative) ______ Bushels @ $ 0.20/Bushel = $_____
BARK (Decorative except yew) ______ Pounds @ $ 0.05/Pound = $_____
LANDSCAPE WOOD (stumps etc.) ______ Each @ $ 1.00/Each = $_____
MOSS (Decorative - tree) ______ Bushel @ $ 1.00/Bushel = $_____
ROOTS & HERBS (Medicinal) ______ Pounds @ $ 0.10/Pound = $_____

Note: (Delete product lines that are not permitted)
($ 20.00 minimum permit)

Permit is valid only for the dates listed; no time adjustments or refunds will be made; conditions are final. Permit will be considered closed at midnight of the expiration date.

THE PERMIT MUST BE WITH THOSE OPERATING UNDER THE PERMIT AT ALL TIMES WHILE ON THE NATIONAL FOREST REMOVING OR TRANSPORTING PERMITTED PRODUCT.

PERFORMANCE BOND - As a further guarantee of the faithful performance of the provisions of this permit, Permittee delivers herewith and agrees to maintain a cash bond in the amount of $________. (Optional)

OTHER CONDITIONS OF THE PERMIT ARE SHOWN ON THE REVERSE SIDE.

PERMITTEE ACCEPTANCE: ____________________________
FOREST OFFICER APPROVAL: ____________________________

Signature Date Title: Approving Official
OTHER CONDITIONS FOR REMOVING MISCELLANEOUS PRODUCTS

1. Permit Area Map: Removal of permitted product is allowed only on the areas designated on the attached map. Other areas are prohibited.

2. Specific product removal requirements: ________________________________

3. Machinery Use: Permittee shall obtain prior written permission from the Forest Officer charged with administering this permit if any motorized equipment is to be used in the removal of permitted product off established roads.

4. Load Tags: All permitted product being transported from the permit area must be accompanied by a completed load tag. Failure to do so will be treated as a trespass with confiscation of the permitted product and prosecution for unlawful removal.

5. Permittee Responsibility: The Permittee and those accompanying him or her shall indemnify and hold the USDA Forest Service harmless from any claims, loss, cost, injury, expenses, attorney's fees, damages or liability caused by or arising out of the exercise of this permit.

6. Roads: All vehicles must remain on established roads. Use caution when driving on forest roads. Do not block roadways when parking.

7. Camping: Commercial permit holders cannot camp in developed campgrounds, at trailheads or trailhead parking areas, or in other high-use recreation or special use areas. Camping areas will be agreed to in writing with the Forest Service under a commercial camping permit. Not abiding by the conditions of the camping permit will be considered a violation and is covered under condition 12.

8. Public Law 96-95: No person may excavate, remove, damage, or otherwise alter or deface any archeological resources including but not limited to such items as old bottles and tin cans (43 CFR Part 7).

9. Fires: Permittees will do all in their power to prevent and suppress forest fires. Fire Precautionary Periods normally are from May 1 through September 30. Refer to State Forest Fire Regulations for additional information and requirements.

10. Garbage: All garbage must be removed from National Forest lands for proper disposal.

11. Human Waste: Human waste must be disposed of at least 200 feet from any stream, lake, other water body, or any recreational site, facility, or special permit use area and must be buried at least eight (8) inches deep.

12. Violations: Permittee is responsible for following all requirements of this permit. Violation of any of these requirements may result in the forfeiture of all permitted product, issuance of Notice of Violation, termination of the permit, and/or criminal prosecution with a fine of not more than $5,000 or imprisonment for not more than six (6) months or both.
84 - Miscellaneous Convertible and Non-Convertible Products. Establishes minimum rates, instructions for standard rate development, and units of measurement to be used for the sale of Miscellaneous Forest Products for personal or commercial use. For preparation information refer to FSH 2409.18, Chapter 80.

84.1 - Minimum Rates for Personal and Commercial Use for Convertible Products. Minimum rates or stumpage prices for convertible products from small diameter trees or tops (below sawlog standards) will be $8.00 per CCF for live and $3.00 per CCF for dead.

The minimum rate for utility poles from sawtimber size material will equate to the minimum rates established for sawtimber by MBF. Refer to section 83 in this handbook. The conversion from poles to MBF by length class for given species are as follows:

Poles (board foot per pole class) board foot/cubic foot per pole class.

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>Lodgepole</th>
<th>Larch</th>
<th>Douglas-fir</th>
<th>Cedar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BF CF</td>
<td>BF CF</td>
<td>BF CF</td>
<td></td>
</tr>
<tr>
<td>20 to 25</td>
<td>25 8</td>
<td>26 9</td>
<td>27 10</td>
<td></td>
</tr>
<tr>
<td>30 to 35</td>
<td>57 11</td>
<td>63 12</td>
<td>80 17</td>
<td>Special</td>
</tr>
<tr>
<td>40 to 45</td>
<td>99 23</td>
<td>120 25</td>
<td>114 24</td>
<td>Provision</td>
</tr>
<tr>
<td>50 to 55</td>
<td>234 32</td>
<td>240 38</td>
<td>216 32</td>
<td>C/CT6.83</td>
</tr>
<tr>
<td>60 to 65</td>
<td>340 65</td>
<td>343 65</td>
<td>359 69</td>
<td></td>
</tr>
<tr>
<td>70 to 75</td>
<td>440 90</td>
<td>441 90</td>
<td>364 120</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td>540 120</td>
<td>544 120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

84.2 - Minimum Rates for Non-convertible Products. The minimum rates established by the Region can be used for the sale of products up to $2,000.00. The minimum rates or unit prices at which non-convertible products may be offered for personal or commercial use are as follows:

<table>
<thead>
<tr>
<th>Seed Cones (all species)</th>
<th>Minimum Rate</th>
<th>Unit of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Use</td>
<td>No Charge</td>
<td>Incidental Quantity</td>
</tr>
<tr>
<td>Commercial Use</td>
<td>$ 0.20</td>
<td>Bushel</td>
</tr>
</tbody>
</table>

Seed Cone Conversions:

- Douglas-fir: 1,000 cones per bushel
- Engelmann spruce: 3,000 cones per bushel
- Grand fir: 250 cones per bushel
- Lodgepole pine: 1,000 cones per bushel
- Mountain hemlock: 1,500 cones per bushel
- Ponderosa pine: 250 cones per bushel
- Subalpine fir: 300 cones per bushel
- Western hemlock: 30,000 cones per bushel
- Western larch: 4,000 cones per bushel
| Western redcedar | 40,000 cones per bushel |
| Western white pine | 200 cones per bushel |

**Dry Cones (decorative)**

| Personal use | Commercial Use |
| No Charge | $0.20 |

**Incidental Quantity**

**Christmas Trees (cut trees)**

| Minimum Rate | Unit of Measure |
| Commercial | |

- **Alpine Fir**
  - $2.00 Bale
- **Other species**
  - $1.00 Bale

**Bale Sizes**

| 2-foot tree (24-35 inches) | 8 trees per bale |
| 4-foot tree (36-59 inches) | 6 trees per bale |
| 6-foot tree (60-83 inches) | 4 trees per bale |
| 8-foot tree (84-107 inches) | 3 trees per bale |
| 10-foot tree (108-143 inches) | 2 trees per bale |
| 12-foot tree (144-167 inches) | 1 tree per bale |

**Commercial Bale Sizes**

| 14-foot tree (168-191 inches) | 1 tree per bale |
| 16-foot tree (192-215 inches) | 1.5 bales per tree |
| 18-foot tree (216-239 inches) | 2 bales per tree |

**Personal Use**

| All species | $3.00 Each |

**Transplants**

| Personal Use | Commercial Use |
| No Charge | |

**Cuttings (Willows for nursery)**

| Cuttings (Willows for nursery) | $0.40 Bundle (20) |
| Shrubs | $1.00 Each |
| Herbaceous and Moss | $5.00 Square Yard |

**Trees**

<p>| All species (under two feet) | $1.00 Each |
| All species (2 - 4') | $2.00 Each |
| All species (4 - 8') | $4.00 Each |</p>
<table>
<thead>
<tr>
<th>All species (8 - 12')</th>
<th>$6.00</th>
<th>Each</th>
</tr>
</thead>
<tbody>
<tr>
<td>All species (12 - 20')</td>
<td>$10.00</td>
<td>Each</td>
</tr>
</tbody>
</table>

### Boughs

<table>
<thead>
<tr>
<th>Minimum Rate</th>
<th>Unit of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Use</td>
<td>No Charge</td>
</tr>
<tr>
<td>Commercial Use (excluding yew)</td>
<td>$0.02</td>
</tr>
<tr>
<td>(cedar, white pine)</td>
<td>$0.01</td>
</tr>
<tr>
<td>(other species)</td>
<td></td>
</tr>
</tbody>
</table>

### Bough Conversions

<table>
<thead>
<tr>
<th>Dry Weight</th>
<th>Wet Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pines</td>
<td>6 lbs./cu. ft.</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>6 lbs./cu. ft.</td>
</tr>
<tr>
<td>Hemlock</td>
<td>10 lbs./cu. ft.</td>
</tr>
<tr>
<td>Cedars</td>
<td>12 lbs./cu. ft.</td>
</tr>
</tbody>
</table>

### Transport Vehicles

<table>
<thead>
<tr>
<th>Avg. cu. ft</th>
<th>Load Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-Pickup</td>
<td>64 cu. ft.</td>
</tr>
<tr>
<td>Lg Mini/Compact Pickup</td>
<td>76 cu. ft.</td>
</tr>
<tr>
<td>Mid-size/Short Box Pickup</td>
<td>91 cu. ft.</td>
</tr>
<tr>
<td>Full-size Pickup</td>
<td>111 cu. ft.</td>
</tr>
</tbody>
</table>

#### Van - full sized
- 4 feet of length: 88 cu. ft.
- 7 feet of length: 154 cu. ft.
- 9 feet of length: 198 cu. ft.

#### Van - mini
- 3 1/2 feet of storage: 67 cu. ft.
- 6 1/2 feet of storage: 125 cu. ft.

For measurement of pickup loads, a full load is considered to be measured to an even height of 1 foot above the top of the truck sides.

### Beargrass

<table>
<thead>
<tr>
<th>Personal Use</th>
<th>No Charge</th>
<th>Incidental Use</th>
</tr>
</thead>
</table>

### Commercial Use

- $6.00 | Day |

### Mushrooms

#### Personal Use

<table>
<thead>
<tr>
<th>Non-designated collection site</th>
<th>No Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designated collection site</td>
<td>$10.00</td>
</tr>
<tr>
<td></td>
<td>$20.00</td>
</tr>
<tr>
<td></td>
<td>$75.00</td>
</tr>
<tr>
<td><strong>Mushrooms - continued</strong></td>
<td><strong>Minimum Rate</strong></td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Commercial</strong></td>
<td></td>
</tr>
<tr>
<td>Designated commercial site $ 20.00</td>
<td>7 Day</td>
</tr>
<tr>
<td>$ 40.00</td>
<td>14 day</td>
</tr>
<tr>
<td>$ 60.00</td>
<td>21 day</td>
</tr>
<tr>
<td>$ 75.00</td>
<td>30 day</td>
</tr>
<tr>
<td>$100.00</td>
<td>Season</td>
</tr>
<tr>
<td>Non-designated collection site $ 20.00</td>
<td>20 day</td>
</tr>
<tr>
<td>$ 30.00</td>
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<tr>
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<td>Quantity</td>
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<tr>
<td><strong>Bark, (decorative) All except yew</strong></td>
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<tr>
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<tr>
<td>Commercial Use</td>
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### Medicinal Herbs and Roots

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#### Seed (shrubs & grasses)

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85 - **Minimum Charge.** The minimum charge for all small sales for convertible and non-convertible products are set in sections 85.1 and 85.2.

85.1 - **Personal Use.** The minimum charge for personal use for convertible and non-convertible products (including stumpage and associated deposits) is fixed at $10.00 on all Forests. Personal use permits may be offered non-competitively but shall not exceed $50.00 in value. Permits issued for forest products with a value below the minimum shall not show a rate. For example, on a Personal Use permit for trees to be used as post and poles show: 0.5 CCF (45 trees) - minimum charge $10.00

85.2 - **Commercial Use.** The minimum charge for these products for resale shall not be less than $50.00 on all Forests for convertible products and not less than $20.00 for non-convertible products.
Appendix D

CULTIVATING ECHINACEA
Specifics of Growing & Shared Lessons

"Certain popular native American herbs which have been traditionally wildharvested are becoming quite rare as a result of current market demand, over-harvest and loss of natural habitat. Goldenseal, Ginseng and Echinacea are the big three..." (Cech 1995b).

"From an ecological perspective, it is obvious that organic cultivation of these herbs is a crucial factor in their survival, providing a needed pressure-relief valve on wild harvest..." (Cech 1995b).

Depending on the species, growing Echinacea may be a tricky endeavor. Six of the nine species have been brought into cultivation for horticultural or prairie restoration projects, but only the two species more extensively used in the present herbal medicine market, E. angustifolia and E. purpurea, will be discussed. E. purpurea cultivation dates back to the early 1700's when both North Americans and Europeans enjoyed the perennial in their gardens (Foster 1991). Its beauty, easy germination, drought tolerance and ability to grow in many environments make it a welcomed addition to any garden. However, its relative, E. angustifolia, proves to be more finicky and has caused some cultivators to think twice about growing the species.

This reprint of a pamphlet discusses various growing techniques from germination to maturity, explains harvesting and drying methods, and briefly discusses marketing methods for both species. The paper attempts to combine scientific research with information published by Echinacea experts, and then intertwines the stories and experiences of Montana growers. Hopefully, lessons can be learned from the stories of successes and problems, so that Echinacea propagation, particularly of E. angustifolia, becomes more practical. Not all of the topics will be of interest to everyone since it is written for anyone from a home gardener to a large-scale cultivator. But information ranging from the seed source to sales has been included to encourage all levels of organic cultivation. Harvesting of the wild plant has become the major source of supply during the current period of high Echinacea medicinal demand (Foster 1997). As a result, Echinacea populations have decreased throughout the Plains; however, the extent of impact on population ecology is unknown. At the same time, cultivated sources provide only a small portion of the supply. The promotion of organic cultivation either for personal use or commercial production has become essential for the survival of the species. Hopefully, this paper will provide insight into tackling the notorious propagation difficulties.

GROWING PHILOSOPHY

The key to growing Echinacea is to understand the ecosystem in which the plant naturally thrives. How do temperature, climate, and precipitation fluctuate throughout the year? In what type of soils and habitats are the plants naturally found? Echinacea angustifolia, the only species native to Montana, thrives in the dry, open prairie of the Great Plains (eastern MT to MI, and south to TX). Grassland climates generally have distinct wet and dry seasons and are noted for temperature and precipitation extremes, which need to be considered when attempting to grow this "difficult" species. Additionally due to scarce water, grassland soils tend not to leach, and therefore are usually more basic than other soils such as forest soils (Barbour and Billings 1988). E. purpurea, on the other hand, has a more eastern range, extending from eastern Oklahoma to North Carolina and from
Michigan to Georgia and Louisiana. The perennial grows in the prairie, but also in open woods and thickets. Its more widespread distribution may explain its high adaptability to grow in many different ecosystems and why it is the easier of the two to cultivate.

**PROPAGATION**

Both species propagate from seed, root divisions and by planting 4 to 5 inch sections of the roots (Foster 1991). Since starting from seed can be tricky, root divisions may be an effective method to multiply plants. If roots are harvested in the fall, the crown can be divided into two to seven buds, depending on the age of the plant (Foster 1991). Each bud can either be grown in flats placed in greenhouses (Herb Research Foundation) or stored in moist sand in a root cellar (Foster 1991) during the winter months. The following spring they should be replanted in the field. If the roots are harvested in spring while the plant is still dormant, divide the crowns and simply replant. However, Foster (1991) notes that the success rate for spring dug crown re-growth is less than that of fall dug crowns.

Propagation from seed takes a bit more effort, and most studies conducted on the cultivation of *Echinacea* concentrate on this aspect. Differences in the species' natural range may contribute to variances in germination responses. *E. angustifolia* requires a long cold treatment to germinate. Given the oscillating temperatures of the plains, this germination delay mechanism increases the survival chances of wild populations. Otherwise, *E. angustifolia* plants may sprout out of season or all at the same time (Cech 1995a). Research varies on the length of cold treatment needed. Baskin et al. (1992) report that 80-100% of seeds germinate after twelve weeks under alternating temperature regimes of 15/6, 20/10, 25/15 or 30/15°C. Cech, however, claims that under oscillating temperatures, germination only takes 30 days (Cech, 27 March 1998). By mimicking the wild conditions, better germination results may be achieved.

On the other hand, *E. purpurea* seed will germinate without stratification; however, with stratification, germination rates can improve by 20% and increase to as much as 50-80% (Foster 1987). Again, length of required stratification time varies considerably in the scientific literature. Hemmerly (1976) reports highest germination percentages after 10 weeks of 5°C stratification. However, Bratcher et al. (1993) document highest germination percentages after just four weeks of 5°C stratification, with a decrease with longer conditioning. Smith-Jochum and Albrecht (1987) similarly found highest rates after one month, exposed to 0°C temperatures. These contrasting studies simply may indicate differences in seed lot quality. Varying germination responses between seed lots have been attributed to storage conditions, stage of seed maturity and dormancy at harvest, and environmental conditions during seed development (Wartiningsih and Geneve 1994).

Light also affects cold conditioning of seeds. Again, views vary. Baskin et al. (1992) demonstrate that *E. angustifolia* seeds, stratified and incubated in light, had significantly higher germination than those stratified and incubated in darkness. Cech (1995a), on the other hand, suggests that the seed does not need any light or sun to germinate. However, the success rate of germination in the absence of light was not compared to the success rate with light. In other words, seeds can germinate in a dark refrigerator, but how many will sprout compared to seeds exposed to sunlight? Evidence for *E. purpurea*, on the other hand, support Cech's observations. In laboratory studies, commercial seeds from four sources were evaluated for germination in either light or darkness in combination with two temperature regimes. For all seed lots, light had no effect on germination (Wartiningsih and Geneve 1994).
So what is the best way to jump start those potentially problematic *Echinacea* seeds? There are a few different ways to stratify the seed, and growers may want to experiment to see which process works best in their environment. Seeds can be wrapped in wet peat moss or placed in damp sand in a plastic bag and left in the refrigerator (Foster 1991, Herb Research Foundation 1998). Cech (1995a) recommends switching between the refrigeration and freezer to mimic oscillating temperatures in the natural environment. A twelve week period of this stratification method is suggested for *E. angustifolia* (Cech 1995), and anywhere from two to four months for *E. purpurea* (Herb Research Foundation 1998). Then the seed may be directly sown in the garden or planted in flats. A second method allows the seed to undergo natural temperature fluxes, by placing the seed in a sand/peat mix and leaving it outside over the winter in screen covered flats (Foster 1991). In the spring, the flat can be brought into a greenhouse to enhance rapid and complete germination. A third technique involves direct-seeding. Generally, shallow planting by gently tapping the seed into the soil results in quicker germination than deeper planting, below the surface (Foster 1991). However, Smith-Jochum and Albrecht (1988) report that direct-seeding of *E. angustifolia* and *E. purpurea* in spring results in no emergence. Even autumn direct-seeding generally results in substantially lower germination rates than obtained with greenhouse or cold frame-sown seeds (Foster 1991).

In Montana, growers are experimenting with all three methods and adding variation to each. The amount of time needed for refrigerator stratification, sizes of flats and individual pots, transplanting into bigger containers, and growing plants in greenhouses compared to cold frames are all being explored (Sugarek, 6 February 1998; McIlhatten, 7 March 1998). However, the process is still new in this area, so trial and error has become the forte. But a few tips have been shared: Despite Smith-Jochum and Albrecht's failure with direct seeding, *E. purpurea* has been direct sown with good germination rates in Livingston (McIlhatten, 7 March 1998). Weeds can be a hindrance, especially for *E. angustifolia* since it is slower growing than *E. purpurea* (Sugarek, 6 February 1998). Seedling trays seem to work the best when first sprouting the plant (Sugarek, 6 February 1998).

Recently, scientists have developed another method to increase the germination potential. Osmoconditioning, or seed priming, has created "breakthroughs" in disturbing seed dormancy, which has led to more commercial production of *E. angustifolia* (Elixir Farm Botanicals, 4 May 1998). This process permits partial hydration of the seed so that pregerminative metabolic activities proceed while germination is prevented. Solutions of polyethylene glycol primed *E. purpurea* seeds increase the rate, synchrony and percentage of germination compared to non-primed seeds (Pill et al. 1994). Evidently, storing techniques of the seed also play a factor in this process. Seeds that are primed and open-stored in vapor-permeable cloth bags germinate more quickly and achieve higher germination percentages than primed and vacuum stored seeds (Samfield et al. 1990). So it may definitely be worth knowing where seeds come from and how they are stored. For a further review of the scientific literature concerning seed preparation methods, see Foster (1991).

**TRANSPLANTING/ PLANTING**

The seedlings of both *E. angustifolia* and *E. purpurea* should develop their second set of true leaves before transplanting to the garden. Typically, transplanting *E. angustifolia* occurs in spring and *E. purpurea* in late spring or early summer. Although both species can undergo shock, *E. angustifolia* tends to experience it more (Sugarek, 6 February 1998). Early transplant of this species helps prevent shock by avoiding summer heat and reducing leaf damage. Additionally, *E. angustifolia* can display stunted growth in the field if flats or pots were originally too shallow. By initially planting *E. angustifolia* in deep
flats or larger pots, the potential of overmaturing the root and possible encouragement of bent root growth is reduced. Given *E. angustifolia*’s deep taproot, it would seem advisable to transplant *E. angustifolia* in raised beds. However, the type of bed preparation does not influence growth. In contrast, *E. purpurea*, with its fibrous roots, benefits from raised beds and shows enhanced seedling establishment (Smith-Jochum and Albrecht 1988).

Due to morphological root differences, *E. angustifolia* can be planted closer together than *E. purpurea*. Since the deep taproot does not spread much, *E. angustifolia* can be placed six to twelve inch apart (Cech 1995a). The fibrous roots of *E. purpurea*, on the other hand, need more room to grow, so one and a half foot intervals are recommended (Foster 1991). Local growers, however, are examining this further to understand the optimal spacing. Rod Daniel and Jim Sugarek of Montana Arnica are in the process of testing a variety of consistent space intervals (6, 8, 12 and 16 inches) and combinations of these. Additionally last spring, Montana State University Western Agricultural Research Center in Corvallis planted *E. purpurea* as part of a study to examine plant spacing and maximum productivity over time. The research also involves analyzing the medicinal quality of the plants over the years to understand compensation between quality and time spent growing. A spoke wheel design was implemented in which *E. purpurea* seedlings are spaced 8 inches apart in the center and spaced further apart as the spokes extend outward, with the maximum space being two feet at the outer circumference. At the end of the second and third years, plants will be pulled, the roots weighed and root extract will be tested (Callan, 2 February 1998; Callan, 5 February 1998; Miller, 5 February 1998). In a preliminary study based on first year flowering heads, the more spacing between plants produced a linear increase in yield (dry weight). However, Callan questions whether this is a good indicator for root yield. Or whether plants growing with more space and more sun will be of higher medicinal quality (Callan, 5 February 1998). Only the next two years of root harvesting will tell.

**Growing Conditions: Soil and Watering Needs**

In its native habitat, *E. angustifolia* grows in dry upland, and often rocky, grassland areas, whereas *E. purpurea* tends to thrive along moister creek beds or seepages in open woods and prairies. However, even in these "moister" habitats, dry conditions frequently prevail. For busy growers, this is the good news. *Echinacea’s* are exceptionally drought tolerant. Although *E. purpurea* shows some degree of dehydration tolerance, its main mechanism to deal with drought is through avoidance and leaf wilting (Chapman and Auge 1994). So occasional watering during dry spells will reduce stress. Two years ago, a couple of Montana growers planted *E. angustifolia* on a dry hillside and watered two or three times that season. Even with late planting in mid-June, the plants thrived and produced "alot of flowers and seed" (Polly Green, 4 March 1998). More water should be given to *E. purpurea* though, and one grower even recommends keeping it well-watered (Cech 1995a). Attention must be made, however, to overwatering. *E. angustifolia* root crowns may rot with too much water. This is not so much the case for *E. purpurea*, for this species can withstand "torrential rains [that] turn the field into a mudbath" (Cech 1995a).

The proper soil mixture should provide nutrition and hold water, yet drain readily and stay loose (Cech 1995a). Cultivators in Montana and Oregon all recommend alkaline soils for both species, although *E. angustifolia* tends to like more alkaline soils. At Montana Arnica, Sugarek and Daniels add dolomite to the soil to raise the pH of their acidic soil (Sugarek, 6 February 1998). Interestingly, the *E. purpurea* plants at MSU Western Agricultural Research Center originate from Montana Arnica, yet grow better at the new location and flowered more the first year possibly due to more sun and the more naturally alkaline soils (Miller, 5 February 1998; Sugarek, 6 February 1998). Even though both places are located...
in the Bitterroot valley, subtle differences in microclimate produced different growth responses.

Not surprisingly, the growth of the plant is aided when competitive "weeds" are pulled. Cech (1995a) suggests applying a thin layer of organic compost, usually in mid-spring, to assist *E. angustifolia*, a slow-growing perennial, outpace competitive weeds. Sugarek and Daniel make their compost out of leaves from city trees and apply this to their plants. But they do not recommend mulching, since in the second year, plants are big enough to cover little weeds (Sugarek, 6 February 1998). If a little compost enhances plant growth, what would a lot of compost or fertilizer do? It may increase root size, but would bigger mean better? In other words, would medicinal potency of the plant be reduced? Thus far, no studies have been conducted to address this issue. On the other hand, if the natural environment is closely imitated, it may take many years to grow *E. angustifolia* (Sugarek, 6 February 1998).

While it is not yet known if fertilizing affects potency, seeds from various ecotypes may display greater concentrations of medicinal compounds. Bridger Plant Materials Center in Bridger presently is examining seeds from four areas in Montana to see how well each grow and level of medicinal potency produced (Majerus, 9 March 1998). As a side note, *Echinacea* presently is being commercially grown in Costa Rica. With a climate so different from its original habitat, the success of the venture is still questionable. Reports suggest that the medicinal potency is weak, and the tingling sensation often associated with quality is nonexistent. The plants need to grow in appropriate environments. Cold northern climates provide the required growing conditions, but also stress the plant, which apparently increases production of the chemicals that provide medicinal potency (Cech, 27 March 1998).

**CROSSBREEDING**

Special consideration needs to be given to plant locality and possibility of hybridization. All species of *Echinacea*, except *E. tennesseensis* (information on this species is lacking), cross-pollinate with varying degrees of success. Interestingly, the more geographically separated and morphologically dissimilar taxa are consistently easier to cross. Thus, "the cross between the short, [straight and upright, with coarse hairy projections] *E. angustifolia* var. *angustifolia* of western Kansas was always easy and successful with the tall, much branched, glabrous-stemmed *E. purpurea* of the eastern United States, and the *F₁* [hybrids] regularly produced over 90% viable seeds" (McGregor 1968). Depending on the reasons for cultivating the different species, this needs to be kept in mind. For ornamental gardens, hybridization may not be a worry, so planting two different species close together is not a problem. However, when growing more than one species for medicinal plant sales, the different species must be grown in two separate areas.

Crossbreeding has been a problem for major cultivators throughout the United States, but separating the species by distance or by physical barriers has alleviated the problem somewhat. But how much space is enough? How far can the pollinators travel? Physical barriers have been employed by one man in Montana who is attempting to grow all nine species for seed bank purposes. Bruce McCallum, president of the Great Northern Botanical Association, covers the various species with remay to keep pollen and bees out. However, his operation is small-scale and contains plants in 4x10 foot beds. But it's possible to apply this technique on a larger scale. The difficulty Bruce McCallum counters is obtaining pure *Echinacea* seed or plants because many that have been sent to him are hybridized (McCallum, 9 March 1998).
Although Montana Arnica grows *E. angustifolia* and *E. purpurea* next to each other, Sugarek does not believe the two crossbred last year. *E. angustifolia* flowered before *E. purpurea*, and by the time crossbreeding could have occurred, they already had cut the flowering heads off the early bloomer (Sugarek, 6 February 1998). If crossbreeding does happen, Sugarek claims the hybrids can be identified by their mix of taproot and fibrous root features. When they first started cultivating *Echinacea*, Sugarek and Daniels used plants from another grower and noticed these differences and that the two species had crossed. So they had to put a seed order out to obtain pure strains (Sugarek, 6 February 1998).

While some small companies will buy hybridized plants, bigger companies will not due to the need to be consistent in their products. Sugarek has noticed more tingling in some hybrids as compared to *E. purpurea*. If the tingling is an indication of medicinal potency, then some hybrids may be quite potent. However, there are also big variations within the mixes (Sugarek, 6 February 1998).

**ANIMAL DAMAGE**

Although *Echinacea* does not appear to be a preferred food, deer will feed on it when other food is scarce. Moles are more of a problem. They destroyed one third of McIlhattan's *E. angustifolia* plants, but ignored the *E. purpurea* plants. On top of this, the bad winter enticed deer to browse the seed heads. By the time spring arrived, there were hardly any tops left. However, nearly half of these hardy perennials considered dead came back. McIlhattan built a fence which kept the deer out, and he used a wind driven vibrator to drive out almost all of the moles (McIlhattan, 7 March 1998).

**DISEASES AND INSECTS**

Commercial producers in South Dakota documented the infection of *E. angustifolia* by the pathogen, *Fusarium oxysporum*. Nearly, 5% of plants growing in the wetter section of the field developed necrosis along the leaf margins, followed by wilting and eventual death. Upon closer examination, the roots and stems revealed darkening of the vascular and ground tissues. Isolation of the pathogen and inoculation of healthy plants induced symptoms observed in diseased plants and confirmed *F. oxysporum* infection. Noninoculated plants remained symptom free. Interestingly, in the well-drained portions of the field, no plants were infected (Peichowski et al. 1996).

*E. purpurea* may become infested with Japanese beetles that can be picked off (Herb Research Foundation). Additionally, the plant can serve as a host for the aster yellows phytoplasma (phytoplasma 16S rRNA group I, subgroup A). Infected plants exhibit thickened and brittle stems, slightly twisted and droopy leaves, and normal pigmented flower parts. Severe cases display "clusters of short, thin stems bearing sterile, dwarfed, distorted, green heads... from the receptacles of [the] flower heads" (Stanosz and Heimann, 1997).

These diseases and insects have been recorded for only small percentages of cultivated plants. Given the small incidence of pest and diseases, it is best to use organic methods to cultivate. Chemical sprays may kill off predaceous insects that control insect pests, worsening the problem.
**Harvesting**

Depending on the equipment, harvesting may be the most intensive and time consuming aspect to cultivating *Echinacea*. The aerial portions of either species can be harvested the second year of growth by cutting the stems above the first discolored leaves. Although the flowering top is not used much as a medicinal in the United States, the aerial portions of *E. purpurea* are used extensively in Germany for a plethora of herbal remedies and have been shown by many German studies to be very effective medicine. The benefits for cultivators involve harvesting two cuttings in one season and not having to replant *Echinacea* later that year. However, in areas with short growing seasons like Montana, only one cutting may be possible.

The part more used in the United States is the root. Generally, *E. angustifolia* roots are harvested after the third year, and *E. purpurea* after the second year. If *E. purpurea* matures past two years, the root becomes woody and less desirable by the herb industry. At which point, it is better to use the plant as seed stock or flowering head crop (McIlhatten, 7 March 1998). Harvesting should occur in spring or autumn after the plants have gone to seed and the leaves have shriveled and gone brown (Cech 1995). The size of the field determines the type of harvesting equipment. For gardens and small-scale farms, potato diggers and shovels are used. Since no commercial tool digs deep enough to uproot *E. angustifolia*’s long root, McIlhatten digs with a potato digger which only cuts off 6-8 inches of the root (McIlhatten, 7 March 1998). This method is incredibly time consuming since each plant must be dug (Glen Green, 4 March 1998). However, the only other options are expensive mechanical devices, appropriate for large scale farms like Trout Lake Farms (~200+ acres in cultivation). Essentially, tools involve a tradeoff between acreage and machinery investment (Rust, 9 March 1998).

Seeds may be harvested the fall of the second year when the plant is dry and the seeds begin to shatter (Cech 1995). According to Cech (1995), the aerial portions should not be harvested earlier that year. Instead let them fully mature through the season for good seed crops.

**Yields**

Cech (1995b) estimates that one half to three pounds of *E. angustifolia* seed are needed to sow one acre, depending on germination rate, field spacing and care given the plants. This amount can produce ~20,000 to 40,000 plants. If yields of fresh root per plant equal 1/8 to 1/4 pound, then every acre of *E. angustifolia* yields approximately 5,000 to 10,000 pounds of fresh root.

*E. purpurea* seed, on the other hand, is slightly heavier and should be spaced further apart. Hence, only 1/3 to two pounds is needed to plant an acre. This amount produces approximately 10,000 to 18,000 plants. The yield of fresh root per plant generally is 1/2 pound, so an acre of *E. purpurea* could produce ~9,000 pounds of fresh root (Cech, 1995b).

Yield information on the aerial portions is scarce. However, Cech (1995a) estimates that a two-year old *E. purpurea* plant may produce 2.25 pounds of fresh flowering aerial portions.

Montana cultivators still question how much root a plant grown in this northern environment will yield. After the second year, wet *E. angustifolia* roots grown on a farm
in Deerlodge weighed two to three ounces. However, they were not planted until mid-June
the first year, which may have affected second year growth (Glen Green, 4 March 1998).
A host of other factors may influence the growth as well, such as soil type, amount of
water applied, or climatic conditions throughout the year. Domesticated *E. angustifolia*
tends to grow four times larger than wild species (Cech 1995a). Whether this rapid growth
affects medicinal potency is unclear.

**CROP ROTATION**

Although little is written concerning *Echinacea* and crop rotation, Skip McIlhattan plans to
experiment rotating *E. angustifolia* root crop with other herb crops to maintain soil health (7
March 1998). Foster (1991) also suggests a rotation, replacing *E. purpurea* every three
years with nitrogen-fixing legumes. Although the plant can produce flowering tops for up
to ten years, he believes three year rotations are better. Unfortunately, the reason is still
unclear.

**CLEANING SEEDS**

Most of the seed cleaning facilities in Montana clean only a few species on a large scale.
They are not setup to experiment with small amounts of new seed crops. The only place
known to clean *Echinacea* seed commercially is Circle S in Three Forks (Glen Green, 4
March 1998; McIlhattan, 7 March 1998). However, presently one of their machines is
down, contributing to quite a backlog (Majerus, 8 May 1998).

A second facility, Bridger Plant Materials Center, cleans many species of seed on a small
basis, including *Echinacea* seed. However, the center is not profit-driven or commercially
based. The setup is educational and focuses on demonstrating how to clean seeds and what
equipment is needed for the process. Most of their work involves native grasses, forbs and
shrubs, but with the rising market of alternative crops, the center expanded to test other
types of seed. Thus far, they have assisted three people with cleaning *Echinacea* seed.
Their cleaning process involves grinding the dried seedheads in a hammermill to thresh out
the seeds. Hammermills generally are used for wheat, but if the machine is slowed down,
the coneheads can be broken up without injuring the seed. The second part involves
separating chaff from seed, so the material is run over a small two-screen fanning mill a
number of time (Clipper M2B). The first run involves using a 9/64" round holed screen
and setting the wind “high enough to blow out the very lightest of the seeds.” In the
second and subsequent runs, a 3/64" x 5/16" slotted screen separates the remaining bracts.
This procedure renders 96-99% clean seed. Out of the seed head's original weight, 15-
20% is seed (Majerus, 12 March 1998).

While the machinery at these facilities makes separating easier, they are not necessary and
simple tools can be used at home. Cech (1995) shares a couple of techniques using screens
and the wind or a flannel sheet. Please refer to his pamphlet, *Echinacea: Native American
Tonic Roots* for descriptions of these techniques.

**WASHING, DRYING AND SHIPPING**

Since *E. angustifolia*’s root system is not as extensive as *E. purpurea*, it can be left whole
and washed. *E. purpurea* roots, however, need to be pulled apart to clean the dirt trapped
between the more fibrous roots. If packaging and sending off fresh roots, allow them to
drip overnight and then send them the next day in clean, moist burlap sacks. If sending the
roots dry, again allow them to drip overnight, but then "place in a warm, shady, breezy area." Or use a forced air dryer with temperatures not exceeding 110°F (Cech 1995).

Most big companies want the plant in dry form, unless the company makes tinctures, in which case fresh roots and flowering tops are preferable. However, shipping fresh material costs more since it's heavier (moister). Additionally, fresh to dry root weight is more than a three to one ratio, with 62-70% of water content lost when dried. Hence, a grower receives two times the money for fresh roots (Sugarek, 6 February 1998). So not only is drying more time consuming and more work, the payback is actually less for dry root.

Montana companies mainly use dry material, which may be problematic for a grower without drying facilities. Currently, there are no facilities in Montana that dry on a large scale (McIlhatten, 7 March 1998). For Trout Lake Farms, a large scale operation, washing and drying is a huge task, and economy of scale definitely plays a role in determining amounts that can be processed (Rust, 9 March 1998).

**STORING**

If preserving for personal use, cut the roots and aerial portions into big segments. The more whole the plant, the longer the shelf life. Very processed forms or powders become less potent quicker. Additionally, store the roots and aerial portions in a cool, dark area. Do not expose to heat or sunlight, for it will decompose and break down the medicinal constituents faster. Also use canning jars or cleaned reused jars. Plastic bags are alright, but paper bags should not be used. They allow in too much air. Under proper conditions, aerial portions can last a year or two, and roots can stay potent for years.

**MARKETING**

Cultivating *Echinacea* is still a budding business in Montana, and most growers are stumbling through the Catch 22 of the marketing world. As McIlhatten puts it, "You can't market until you have crop, but if you have crop you need to have the market" (Personal communication, 7 March 1998). So if planning to cultivate as part of a business, how big do you start? How much land do you plant? To whom do you sell? The rule of thumb is start small, make contacts and then enlarge if possible and desired (McIlhatten, 7 March 1998; Cech 1995b). Most Montana growers have contacted other *Echinacea* growers to learn the in's and out's of marketing. However, when it comes to "who do you sell to," people are pretty tight-lipped (Glen Green, 4 March 1998). Looking for a buyer may become an active endeavor, and it may come down to calling companies to see if they want your product and then sending small samples. To learn more about the herb market, starting the cultivation process, developing a business plan and assessing the value of the plant, read "Finding Your Niche: Making a living with medicinal plants" by Richo Cech.

**WHICH SPECIES TO GROW?**

The best way to answer this question is to know the ecosystem in which you live—understand the microclimates on your land, the soil differences, slight slopes of the land, and amount of sun throughout the season. Know the growing needs of each species and contemplate how your land can provide for the species survival. The amount of water in your area may decide which species to grow. Since *E. purpurea* needs more water, a dry environment is more suited for *E. angustifolia*. Keep in mind, however, microhabitats
differ. Even though growing in the same valley, *E. purpurea* grew taller and produced more flowers at MSU Western Agricultural Research Center than at Montana Arnica, approximately ten miles away.

On the regional scale, Cech suggests that people living at high elevations with cold winters and limey soil are in a good area for *E. angustifolia* cultivation. Whereas, people living at low elevation with mild winters should probably grow *E. purpurea*. But essentially, "either species can be successfully grown anywhere in the United States where there is a good freeze in the winter" (Cech 1995a). And Montana definitely provides that requirement.

Another deciding factor may be the amount of money each species can generate compared to the amount of time and potential problems projected. Presently *E. angustifolia* sells for higher price per pound than *E. purpurea* root. However, "yields per plant is substantially less for *E. angustifolia*, and *E. purpurea* is generally more robust and easier to cultivate" (Cech 1995b). Essentially, it becomes a trade-off, and the most logical thing may be to grow both. (But watch out for crossbreeding!). However, the decision should be based on preliminary cultivation tests of both species on your land. And once this has been established, take each step as a learning process, learn from others, spend time with the plant and understand its needs, and don't forget to enjoy. good luck!
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Appendix E

CULTIVATING ECHINACEA:
A List of Sources and Resources

COMMERCIAL ORGANIC GROWERS IN MONTANA

Glen and Polly Green. 
Sell *E. angustifolia* roots and seed. Cultivates organically and hopes to be officially certified this spring.
900 Larkspur Road
Deerlodge, MT 59722
phone: (406) 846-3652

Hidden Meadow Herb Farm. Skip McIlhatten.
Sell *E. angustifolia* and *E. purpurea* roots and flowering tops. Also has *E. angustifolia* seeds; they just need to be cleaned. Cultivates organically and hopes to be officially certified this spring.
2859 East River Road
Livingston, MT 59047
phone: (406) 222-3295

Montana Arnica. Rod Daniel and Jim Sugarek.
Sell fresh/dried *E. angustifolia* and *E. purpurea* roots, leaves and flowers. May expand to include seeds.
P.O. Box 350057
Grantsdale, MT 59835
phone: (406) 363-3716

Wild Plum Farm. Tara Ream, Mike Meyer, and Brownyn Troutman.
Sell *E. angustifolia* and *E. purpurea* roots and flowering tops.
P.O. Box 9166
Missoula, MT 59807
phone: (406) 549-7933

AGRICULTURAL EXPERIMENT/ MATERIAL CENTERS

Bridger Plant Material Center
Demonstrate how to clean *Echinacea* seeds and what equipment is needed.
United States Department of Agriculture
Natural Resources Conservation Service
Rte. 2, P. O. Box 1189
Bridger, MT 59014
phone: (406) 662-3579

Montana State University Western Agricultural Research Center
Just started planting herbs and medicinal plants last spring to see which grow in Western Montana and which are worthy of pursuing, for small acre grower's production and production probability.
580 Quast Lane
Corvallis, MT 59828
phone: (406) 961-3025 fax: (406) 961-3026
SOURCES OF ORGANICALLY "GROWN" SEEDS**
(other than the above cultivators in Montana)

Abundant Life Seed Foundation
Sell *E. angustifolia*, *E. purpurea*, *E. pallida*, and *E. tennesseensis* seed. *E. angustifolia* and *E. purpurea* from organic growers whom are not certified organic.
  P.O. Box 772
  Port Townsend, WA 98369
  (360) 385-5660

Elixir Farm Botanicals
Sell organically cultivated *E. angustifolia* and *E. purpurea* from organic growers whom are not certified organic.

*Garden City Seeds
Sell wildharvested *E. angustifolia* seeds.
  778 US Hwy 93 N.
  Hamilton, MT 59840
  phone: (406) 961-4807

Horizon Herbs
Sell organically cultivated *E. purpurea* and wildharvested *E. angustifolia* seeds.
  P.O. Box 69
  Williams, OR 97544
  phone: (541) 846-6704
  fax: (541) 846-6233
  email: herbseed@chatlink.com

Seeds of Change
Sell organically cultivated *E. angustifolia*, *E. pallida*, *E. purpurea*, and *E. paradoxa* seeds.
  P.O. Box 15700
  Santa Fe, NM 87506-5700
  phone: (888) 762-7333
  internet: www.seedsofchange.com

*Local source.

**Organically grown includes cultivated and wildharvested seeds. The distinctions between the two are made for the various seeds.
Fig 2.3. Land Ownership Pattern of the Fort Peck Assiniboine and Sioux Reservation
FIG 7.1. Land Ownership Map of the Northern Region (North Dakota, South Dakota, Montana, Wyoming)