Journal of Ecological Anthropology

Volume 9
Issue 1 *Volume 9, Issue 1 (2005)*

Article 4

2005

Weaving Traditional Ecological Knowledge into the Restoration of Basketry Plants

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Abstract

This paper focuses on the benefits of incorporating traditional ecological knowledge into the field of ecological restoration. Case studies on indigenous use of sweetgrass in New York State, U.S.A (Haudenosaunee Nation), and beargrass in Washington State, U.S.A (Quinault and Skokomish Nations), are presented. Both studies focus on the restoration of basketry plants by incorporating indigenous knowledge of changes in abundance of culturally significant plants; knowledge of sites appropriate for restoration of culturally significant plants; and knowledge of land management methods to restore species and/or habitats. Open-ended, semi-formal, and informal interviews were conducted with indigenous consultants familiar with the plant and/or habitat of interest. Traditional knowledge of appropriate restoration sites was used in a field experiment to re-establish sweetgrass in an area from which it is believed to have been extirpated. Traditional knowledge of anthropogenic burning was used to reintroduce fire in low-elevation beargrass habitats to manage both the resource and its environment. By incorporating traditional knowledge with published information on sweetgrass biology, it was found that two potential factors influencing its population in cultural gathering sites are unsustainable harvesting and the absence of controlled burns.

Introduction

Knowledge developed over generations of interactions between indigenous people and the land can make valuable contributions to contemporary sciences such as conservation and restoration, the study of ecological processes, and sustainable resource use (Berkes et al. 2000). This paper discusses ecological restoration as a field that can benefit considerably from incorporating traditional ecological knowledge. While restoration is the primary focus, topics covered may also assist in developing methods to incorporate traditional knowledge into land management and ecological, anthropological, social science and geographical studies addressing both cultural and environmental issues. The studies presented use traditional knowledge in different stages of restoration projects, such as: recognizing population trends through exploratory research, choosing a re-establishment site, and using traditional knowledge as a tool in implementing restoration experiments.

Ecological restoration as defined by Dave Egan is: "[t]he practice of reestablishing the historic plant and animal communities of a given area or region and the renewal of the ecosystem and cultural functions necessary to maintain these communities now and into the future" (Egan 2001, cited in Anderson 2002:60). Traditional ecological knowledge is "a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, concerning the relationship of living beings (including humans) with one another and with their environment" (Berkes et al. 2000:1252). These two concepts are complimentary. Indeed, academics, agency scientists and policy makers have been increasingly seeking traditional knowledge as a source of ideas for ecosystem management, restoration and conservation biology (Huntington 2000; Kimmerer 2002).

Figure 1. Sweetgrass growing in a Mohawk gathering site in New York State.

Once resources essential for traditions cannot be acquired, traditions themselves may be significantly changed. Restoring the land and plants that were a part of the pre-European settlement North America may assist in strengthening or supporting the cultural practices of people that lived off of that land (Martinez 1993; Shebitz and Kimmerer 2005).

Species or ecosystems that historically were anthropogenically managed offer unique opportunities to incorporate both traditional and Western scientific worldviews into restoration (Anderson 1996a; Lewis 1993:58; Peacock and Turner 2000:170). Ecological research that tests the effects of integrating traditional knowledge in restoration of plants and ecosystems is limited and the implementation of such projects based on collaborative research with tribal members is not well documented. This paper examines methods to integrate traditional knowledge into restoration. The non-Western knowledge involved in the research is referred to as 'traditional' since it involves knowledge of the local environment and management practices transmitted orally through generations from before European contact.

Ways to Weave Traditional Ecological Knowledge Into Restoration of Basketry Plants

Berkes et al. (2000:1259) state that traditional knowledge can be viewed as a "library of information" on how to cope with changes in ecosystems. For each of the two case studies presented, indigenous consultants have noticed changes in both the species and ecosystem of focus. The objective of comparing both studies is to illustrate ways that traditional knowledge can be used to understand these changes and to assist restoration work so that the plants will be more readily available to traditional

Figure 2. Beargrass in flower under an open canopy at the Quinault restoration site.

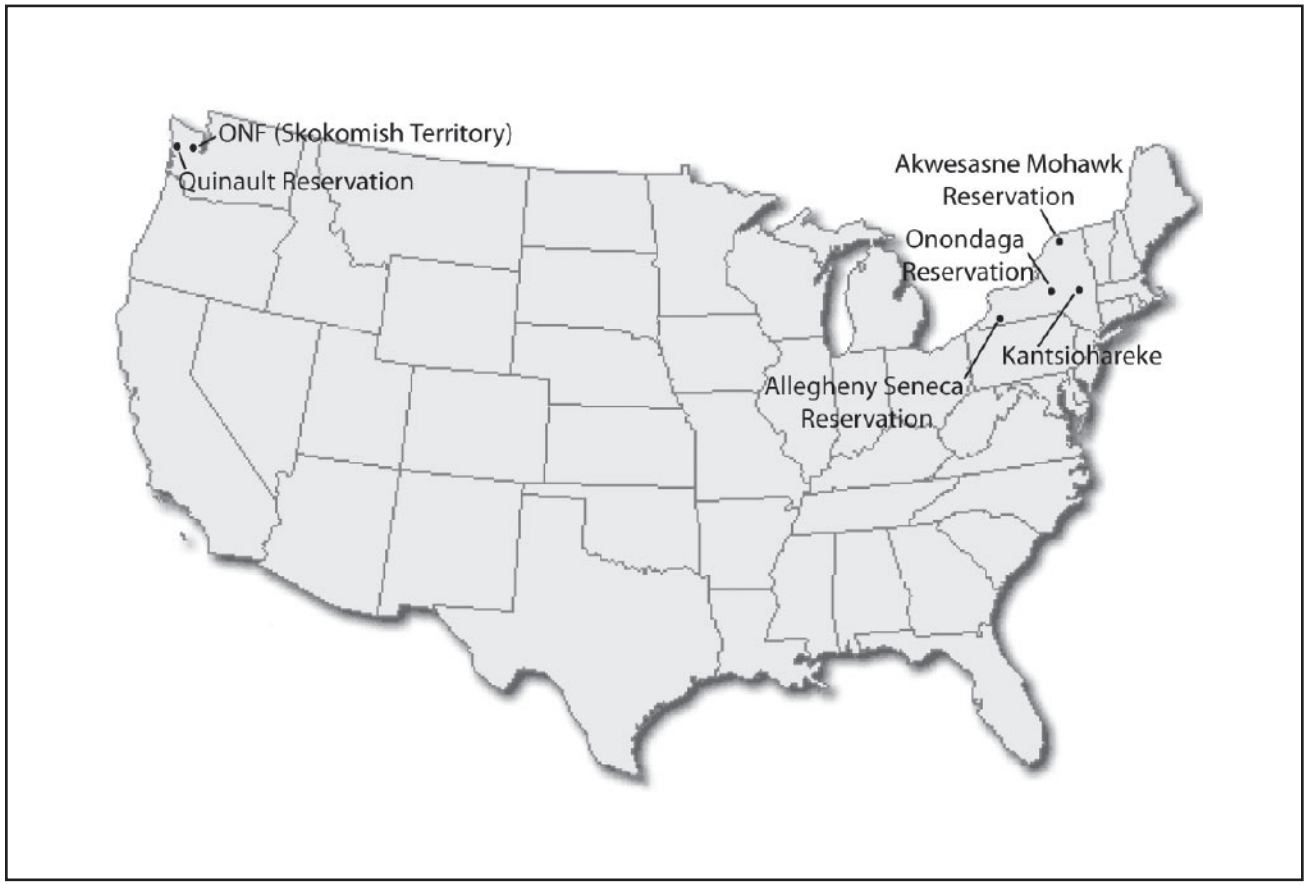

Figure 3. A map of the United States illustrating the locations of study sites mentioned.

users. Both projects apply anthropological and ecological methods to elucidate historic and current relationships between cultures and their environment. Knowledge of changes in abundance of culturally significant plants and of appropriate sites for restoration will be discussed. In addition, knowledge of land management methods to restore species and/or habitats will be considered.

The first case study was conducted on sweetgrass (*Anthoxanthum nitens* (Weber) Y. Schouten & Veldkamp [= *Hierochloe odorata* (L.) P. Beauv], Poaceae) (Figure 1) with the Haudenosaunee (Iroquois Confederacy), specifically with members of the Mohawk, Onondaga and Seneca Nations of New York State, U.S.A. The second case study is being conducted on beargrass (*Xerophyllum tenax* (Pursh) Nutt, Melanthiaceae) (Figure 2) with members of the Quinault and Skokomish Nations on the Olympic Peninsula in Washington State, U.S.A (hereafter referred to as "the Peninsula"). The locations of these study sites are illustrated in Figure 3.

The impetus for both projects was reports from tribal members that the plant of interest was declining in traditional gathering areas. The first case study involving sweetgrass takes a species-based approach to analyzing potential causes for these population trends and methods to re-establish it, while the second case study on beargrass takes a species and ecosystem-based approach to restore the plant's habitat by reintroducing traditional land management practices. Table 1 summarizes the characteristics, methods and results of both studies.

Table 1. A summary of characteristics, methods, and results for both case studies.

	Case Study #1	Case Study #2
Species of interest	Sweetgrass, *Anthoxanthum nitens*	Beargrass, *Xerophyllum tenax*
Ethnobotanical uses of the species in study area (based on interviews)	Basketry, ceremonial smudge, incense, perfume, medicine	Basketry, burial ceremonies
Tribes involved	Haudenosaunee: Mohawk, Onondaga, and Seneca	Quinault and Skokomish
Region of interest	Northeastern U.S., New York	Olympic Peninsula, Washington
Known pre-European settlement management associated with the species habitat	Burning, harvesting (some believe without roots and rhizomes)	Burning, harvesting by taking the longest blades
Aspects of traditional knowledge incorporated	Knowledge of population trends and appropriate sites for re-establishment	Knowledge of past landscape structure and burning practices
Ethnographic methods	Semi-formal interviews (8), informal conversations (9), and participant observation in harvesting	Semi-formal interviews (7), informal conversations (3)
Key interview questions common to both studies	• Have you noticed any changes in the plant's abundance? • If so, why do you think there have been changes? • How was this plant managed before European settlement?	
Interview questions particular to each study	• What type of habitats do you harvest sweetgrass from? • How has this habitat changed since you started harvesting? • How do you harvest sweetgrass? • How do others harvest it?	• What was the Olympic Peninsula lowland landscape like prior to European settlement? • Where were prairies and savannas? • How and why were they maintained? • Where was beargrass in relation to these open areas?
Location of project efforts	Northeastern United States. Akwesasne, Seneca, and Onondaga Reservations, and Kanatsiohareke in NY	Olympic Peninsula, WA. Quinault Reservation and ONF (near Skokomish Reservation)
Ecological habitats	• Sweetgrass habitat: fens, roadsides, salt marshes, meadows. • Re-establishment site: Mohawk River floodplain	• Beargrass savanna restoration sites: low-elevation coniferous forests (ONF, SE Peninsula), and low-elevation bog (Quinault, Western Peninsula)
Indigenous community participation	Site selection and preparation, plant installation and data collection	Site selection and preparation, treatment installation (fire and clearing vegetation) and data collection
Results thus far	• Sweetgrass was declining in areas where it was present throughout the past century due to development and succession • Re-establishment efforts successful with cover crop of hairy vetch and weeding • One acre of sweetgrass successfully established and is being used for harvesting	• Most beargrass recovering nicely after high temperature burn (some mortality) • Seedling establishment higher in plots burned than in control • No results yet from experiment testing low temperature burns

Figure 4. A Mohawk basketmaking class in which students of all ages make traditional baskets with black ash (*Fraxinus nigra*) and sweetgrass.

Why Focus on Basketry Plants?

Both plants discussed are primarily used in basketry by tribes in the study areas. While the beauty of traditional baskets is physically apparent, their importance is deeper than aesthetics. Each traditional basket represents not only the artist's perspective, but also incorporates elements of the artist's culture and family. Basketmakers' traditional knowledge is passed on to younger generations via oral traditions and through physical representation in baskets themselves (Figures 4 and 5).

A basket's cultural context consists of elements such as its design, the technology of gathering, preparing and weaving the materials, and the use, function and ritual associated with it. Baskets provide a culture's expressions of the "…conceptualization of the universe" and therefore "…are intended as portraits of the society that inspired them" (Guss 1989:91).

Michael Pavel (hereafter referred to by his Skokomish name: CHiXapkaid) is a Traditional Bearer of Southern Puget Salish Culture and Professor at Washington State University. He recognizes the importance of basketry to the Skokomish people:

> There is a great deal that goes into…being able to walk into a domain and ask for the portions of a body of a living entity so that it can carry on the way of life of a people. A basket is a sacred item that stores many of the belongings of the native people and gives them an avenue to record the history of their people. You see, they say that we don't have any written language, but they're wrong. Our written language may not be in words, on paper or in books, but they are in symbols that are embroidered and applied to baskets. (Interview transcript, November 4, 2004)

Native American baskets offer an opportunity to study changes over time in the baskets' function, form and manufacture. They are products of culturally distinct tribes at specific times and places (Porter 1990:3). Plants used to create a basket can inform an ecologist or archaeologist about what species were readily available at the time of its construction. The

Figure 5. Leta Shale, a Quinault basketmaker, displays a beargrass and western red cedar (*Thuja plicata*) basket she made with her family's design of a whale and bird.

use of particular species may therefore provide an understanding of the past ecology of the area, or potential trade routes between tribes.

Previously, each basket was made for a particular use (Interview, Theresa Burns, February 12, 2001). Currently, baskets, including those made by consultants in this paper, are created primarily for their aesthetic appeal and are sold commercially, given as gifts to friends and family, or traded for other artwork. For the past few decades, however, as Michele Dean Stock, one of the few remaining basketmakers of the Seneca Nation stated: "…[basketry isn't] being passed on in families like it was before…[S]ome of the baskeweavers died, and…no one had been taught by them…" She continued to explain that basketry is "…almost lost to our people" (Interview transcript, July 10, 2001).

Ethnographic Methods Used for Both Case Studies

Consultants for the projects were chosen based on their familiarity with the species or habitat of interest. Open-ended, semi-formal and informal interviews were conducted with basketmakers, herbalists, ceremonial leaders, cultural resource representatives, and a Traditional Bearer of Southern Puget Salish Culture. All consultants are fluent in English.

Semi-formal interviews were tape recorded or, if the consultant preferred, hand-written notes taken. Each consultant signed a letter of consent that included an option to remain anonymous. Consultants stated if they wanted to be referred to by their Native name. Individuals named in the manuscript have been consulted about appearing with their quotes and actual names are used. All of the names appearing in this document are the consultants' real names. No quotes were used from those who wished to remain anonymous. Semi-formal interviewees were offered financial compensation for their time and cooperation. Interviews were usually conducted at the consultants' homes. The interviews will be discussed in further detail with each study below.

Case Study I: Knowledge of Changes in Abundance of Culturally Significant Plants and of Appropriate Sites for Restoration

Individuals who rely on a particular plant for their traditions and livelihoods are likely to be among the first to notice if that resource is no longer readily available (Berkes et al. 2000). An impetus for this research was concern of Haudenosaunee herbalists and basketmakers that sweetgrass populations have diminished in many traditional gathering areas on or near their reservations (Shebitz 2001). These observations are supported in literature that states, "[w]hile sweetgrass grows naturally at Akwesasne and in surrounding areas, it is becoming more difficult to locate..." (Lauersons 1996:31).

In this study, knowledge of past and current land management practices plus observations of sweetgrass' decline played an essential role in understanding its population trends in the northeastern

United States and causes for these trends. Ecological methods and results regarding sweetgrass' habitat characteristics are available in Shebitz and Kimmerer (2004).

Preliminary Ecological Study

In order to understand sweetgrass' historic distribution and habitat preference in the Northeast, I visited 27 sweetgrass 'sites of record.' Sites of record are areas from which sweetgrass had been previously harvested, pressed and preserved as herbarium specimens with the precise locations described. Specimens from four major herbaria (New York Botanical Garden, New York State Museum, Harvard University and Cornell University) were studied. In addition, five Haudenosaunee current and past sweetgrass gathering sites identified through participant observation and interviews were also visited and studied. Vegetation was sampled where the site was still intact through a stratified random sampling technique (Shebitz and Kimmerer 2004). Trends in sweetgrass populations throughout the Northeast were studied by its presence or absence in areas that were previously sweetgrass habitat.

Sweetgrass was found in only 48 percent of the 32 sites of record. This finding indicates that Northeastern sweetgrass populations are indeed declining in locations where they were present during the past century according to herbarium records. The earliest site of record in which sweetgrass was still present in 2000 was from 1904. Original collection dates for the 15 sites of record that no longer had sweetgrass in 2000 ranged from 1913 to 1982. In those sites that no longer had sweetgrass, the most important causes of sweetgrass' absence were development and succession (Shebitz and Kimmerer 2004).

While development and succession are clearly threats to sweetgrass throughout the Northeast, the role of these factors on traditional gathering areas was unclear. The absence of sweetgrass in 15 sites of record prompted me to ask why sweetgrass is declining in gathering areas on and near reservations, and provided me an opportunity to frame interview questions using a background of Western scientific knowledge from both previous ecological studies and published literature. The findings helped me raise the following questions in interviews: What additional factors can be limiting sweetgrass in gathering areas that are not in non-gathering sites? Was fire historically used to limit succession in sweetgrass habitat?

Summary of Relevant Past Sweetgrass Research

In addition to being used in baskets, sweetgrass is widely gathered, braided and sold commercially for its use as a ceremonial smudge and incense. The demand for sweetgrass in the Northeast is thus not limited to the Haudenosaunee basketmakers (Shebitz 2001).

Sweetgrass reproduces primarily by rhizomes (Greene 2000:2; Winslow 2000). Therefore, some tribal members are concerned about the removal of its rhizomes through unsustainable harvesting practices. Educational efforts are being made by the Haudenosaunee Environmental Task Force to inform people about the importance of harvesting sweetgrass sustainably. They distribute information pamphlets and books to the public and at tribal basketmaking conferences asking people to not overharvest and to replant roots from sweetgrass that are picked (Arquette 2000:57). Whether removing roots and rhizomes negatively affects the overall sweetgrass population is arguable. There are cases where digging subterranean organs of wild plants benefited the overall population of the plant (Anderson 1997; Peacock and Turner 2000:134).

Due in part to its ability to vegetatively reproduce, current literature indicates that sweetgrass abundance can increase following fire. The fact that its rhizomes are not consumed by surface fires enables sweetgrass to recover from burning, while benefiting from increased sun and nutrient availability (Lynch and Lupfer 1995:4). Prior to European settlement**,** anthropogenic burning was often used by indigenous people to increase yields and promote growth of desired plants in the midst of reduced competition (Anderson 1996a; Lewis 1993:69; Stewart 2002:68). Since some basketry plants require burning, the absence of controlled burning and fire suppression policies have created difficulties for contemporary weavers (Anderson 1996b; Ortiz 1993:209).

Ethnographic Methods

Consultants were primarily women members of the Onondaga, Mohawk, and Seneca Nations of the Haudenosaunee in New York who were familiar with sweetgrass. Eight semi-formal interviews were conducted with Haudenosaunee basketmakers, herbalists and ceremonial leaders in 2001: two with elder female herbalists from the Onondaga Nation, five with people from the Mohawk Nation (four female basketmakers and an elder male ceremonial leader), and one with a female Seneca basketmaker. In addition to the eight semi-formal interviews, nine informal conversations were conducted with Haudenosaunee basketmakers: five female and one male from the Akwesasne Mohawk Territory who were all elders, and three younger female Seneca basketmakers.

Interviews were semi-directive with topics focused on observed changes in the distribution of sweetgrass and causes of these changes. Past and current harvesting practices and land management (primarily controlled burning) were also discussed. Additionally, I inquired as to where they currently gather sweetgrass, and/or traditional gathering sites where it is no longer found.

Participant observation was used in visits to sweetgrass gathering areas near the Akwesasne Mohawk Territory. It involved harvesting plants with three generations of gatherers in July 2000 and 2001. Site visits at Kanatsiohareke were conducted with individuals familiar with sweetgrass to determine an appropriate re-establishment site. Community members also took part in the site preparation, plant installation, and data collection.

Ethnographic Results

According to Seneca consultants, although sweetgrass was abundant in western New York in past centuries, it is now rare in the area. Michele Dean Stock stated, "[t]o my understanding, there was a time when you can gather sweetgrass on the…Allegheny [Reservation] but it's been at least 100 years that people haven't been able to find it there" (Interview transcript, July 10, 2001). Five of the eight participants in the semi-formal interviews felt that sweetgrass is threatened by non-native plants. As Onondaga Herbalist Otatdodah Homer stated, "I blame… [f]oreign plants from other areas" (Interview transcript, February 15, 2001). In particular, four participants referred to purple loosestrife (*Lythrum salicaria),* which was present at two sweetgrass harvesting sites, one of which no longer had sweetgrass (Shebitz and Kimmerer 2004).

Based on findings from the interviews, I recognized two possible causes of its decline in gathering sites, both pertaining to changes in land management: unsustainable harvesting practices and the absence of prescribed burning over the past century. These two topics were the basis for further interview questions.

First, it is possible that sweetgrass is no longer found in traditional gathering sites due to a shift in harvesting practices. To many consultants, sweetgrass is traditionally harvested by grasping the shoots at the base of the stem and pinching them until they break loose from the rhizomes and roots. In an interview, Theresa Burns explained that, "[t]he way I pick sweetgrass is the same way that my grandmother picks sweetgrass. She never takes the root, so that it can come back next year…" (February 15, 2001) (Shebitz and Kimmerer 2004:106)

Not all sweetgrass gatherers, however, practice this harvesting method. All 17 consultants in semi-formal and informal interviews reported that some Native gatherers and many non-Native gatherers take roots when they harvest sweetgrass. Eight do not believe that this method affects the sweetgrass population. Thomas Porter, a Mohawk Leader stated that, "…we take the whole plant, just pull it up, and some root comes off too, but that's not a problem, it doesn't hurt the grass" (May 30, 2001) (Shebitz and Kimmerer 2004:106).

Five consultants cut sweetgrass at the stem's base to not disturb the underground portion. These participants are angered when they see people harvesting sweetgrass with its root. They believe that people have only recently begun in their haste to carelessly pull its roots. Otatdodah Homer stated, "I think people…didn't know how to pick it. They would just pull it up from the root…Obviously they're not properly picking" (February 15, 2001) (Shebitz and Kimmerer 2004:107). Over-harvesting

sweetgrass, in conjunction with the removal of the roots and rhizomes, was mentioned by collaborators in half of the formal interviews as a threat.

In addition to unsustainable harvesting, the absence of controlled burning might be responsible for the decline in sweetgrass populations. All consultants recalled land being burned by their grandparents. In fact, two interviewees remember that fields from which they harvested sweetgrass were burned until approximately 50 years ago. Theresa Burns stated that, "[m]ost of the time what they burned for was hay…because…burning puts all the nutrients back in the soil" (Interview transcript, February 15, 2001). According to the interviewees, burning was low intensity, small in area, and conducted in the early spring, but the frequency of burns was not known by the consultants. Maintaining sweetgrass in these areas was likely not the aim of the burning, but a result nonetheless. Two elder consultants from the Akwesasne Territory recalled burning specifically to encourage sweetgrass growth. Most consultants explained that although some controlled burning is still practiced, it is uncommon today.

Ecological Study: A Sweetgrass Re-establishment Experiment

Based on findings from the interviews and ecological fieldwork, it was evident that sweetgrass is declining in the Northeast and that restoration would be beneficial to Haudenosaunee gatherers who rely on the species for traditions such as basketry. On the Onondaga and Akwesasne Reservations, reintroducing burning and sustainable harvesting may be the primary means to ensure that sweetgrass persists. Reintroducing prescribed burning was not feasible in the study areas, unfortunately, due to the high density of residential areas. However, a sweetgrass re-establishment and management experiment was conducted in an area from which it is believed to have been extirpated. The field experiment is described in detail in Shebitz and Kimmerer (2005), and discussed briefly below. It takes a species management-based approach, as opposed to an ecosystem restoration approach. However, the importance of traditional knowledge in recognizing population trends and threats to sweetgrass are fundamental in understanding its population dynamics and can be used to assist in future sweetgrass ecosystem restoration work.

Kanatsiohareke (Ga no jo ha lay:gay) is a Mohawk community that was established in 1993 to reoccupy land in the Mohawk River Valley that belonged to their ancestors. It consists of 130 ha of land in Fonda, New York, and is predominately mixed hardwood forest and agricultural fields. The community's efforts are dedicated to revitalizing its culture and economy. One factor upon which this goal depends is the presence of culturally significant plants (Interview, Thomas Porter, February 20, 2001).

The Haudenosaunee believe that sweetgrass once grew on what is currently Kanatsiohareke. Today, the closest area from which sweetgrass is harvested in large quantities is near the Akwesasne Mohawk Territory, approximately 325 km north. Growing sweetgrass at Kanatsiohareke reintroduces beauty and heritage to the Mohawk Valley and strengthens traditional practices associated with the plant by providing a supply of basketry grass and the opportunity for local harvesting.

A sweetgrass re-establishment site on Kanatsiohareke was identified based on traditional knowledge of sweetgrass. Interview questions focused on descriptions of gathering sites and plants associated with sweetgrass. All consultants described its habitat as 'moist' or 'damp' including riverbanks with grasses and shrubs (three consultants), meadows with willow and grasses (three consultants), ponds with burdock, horsetail, cattails and sweetflag (one consultant), and swamps (one consultant). After potential sites were surveyed on Kanatsiohareke, four community members selected an old agricultural field on a Mohawk River floodplain, bordered by a forested riparian area, for the restoration.

A field experiment was established at the selected site in summer 2000 to facilitate sweetgrass re-establishment. Effects of competition reduction and cover crops on sweetgrass growth and reproduction were examined in 20 garden-sized ($2.25m^2$) plots (five replicates of four treatments) randomly located in the study area. It was found that there is great restoration potential for sweetgrass since

it is easily transplanted and reproduces vigorously. Sweetgrass biomass, height, reproduction rate, and survivorship were greatest in plots that were weeded to eliminate competition and in plots with hairy vetch (*Vicia villosa*), a nitrogen-fixing cover crop. Vetch allowed for a relatively non-labor intensive method of cultivation and resulted in desirable sweetgrass characteristics, such as abundance and tall blades (Shebitz and Kimmerer 2005).

Based on findings from the garden-size plot experiment, 0.4 ha of sweetgrass was planted on Kanatsiohareke with hairy vetch during the summer of 2001. Members of Kanatsiohareke assisted in choosing the re-establishment site, tilling the land, planting sweetgrass, and sowing hairy vetch seed. Presentations of sustainable harvesting were given to potential harvesters. Four years later, sweetgrass continues to grow and is harvested at the site. A free information sheet on sustainable sweetgrass harvesting is available to harvesters at the Kanatsiohareke gift shop.

Prior to the re-establishment of sweetgrass, basketmaking classes at Kanatsiohareke were conducted with material from the Akwesasne Reservation, and students were disconnected from the process of gathering the resources. Today, classes incorporate harvesting sweetgrass as an aspect of basketmaking itself. Many of the baskets are displayed and sold at Kanatsiohareke's gift shop (Figure 6). With the re-establishment of sweetgrass on Kanatsiohareke, there is potential for basketry to continue as a means to pass traditions on to younger generations.

Case Study II: Knowledge of Land Management Methods to Restore Species and/or Habitats

The second case study takes both an ecosystem process-based and a species approach to restoration, and covers two initiatives. It does this by incorporating ethnographic information to assist current restoration efforts of both the Olympic National Forest and the Quinault Indian Nation in reintroducing anthropogenically managed open-canopied beargrass habitats to the Olympic Peninsula of Washington State. The objective of this study was to determine if traditional knowledge of the historic fire regime of lowland beargrass habitat of the Peninsula is maintained and, if so, to incorporate this knowledge into restoring the managed ecosystems.

Figure 6. Mohawk sweetgrass and black ash baskets for sale at Kanatsiohareke.

Much of the pre-European settlement Peninsula lowlands were characterized by a mosaic of prairies, savannas, and woodlands in a forest matrix (Kruckeberg 1991:284; Peter 2001). There is evidence dating to 3,500 years ago indicating that Native Americans burned the land repeatedly to maintain the diverse landscape and ensure the presence of culturally important resources (Wray and Anderson 2003).

Treaties of 1855 ceded tribal land and established reservations on the Peninsula (James and Chubby 2002:109; Skokomish Culture and Art Committee 2002:68). In 1887, much of the land occupied by the Quinault was allotted to individuals. Once private ownership prevailed, traditional burning practices were inhibited (James and Chubby 2002). These cultural changes are reflected in markedly increased tree establishment into previously open-canopied areas on the Peninsula during the late 1800s (Peter 2001). Through interviews with tribal members, it was learned that the movement onto reservations and land allotment limited the ability to burn and therefore resulted in both changes in the landscape and of knowledge associated with traditional burning practices.

In the absence of burning, fire-adapted communities change dramatically (Copeland et al. 2002; Peterson and Reich 2001; Stewart 2002:69). Due to fire suppression in the Northwest throughout the past century, historically abrupt borders between herbaceous-dominated areas and forests have become less distinct. The past extent of prairies and savannas therefore is not well understood in many areas, particularly in those that have undergone complete succession (Franklin and Dyrness 1988:89; Kruckeberg 1991:286).

Summary of Relevant Past Beargrass Research

Vegetative communities historically maintained by native people include beargrass habitats of the Peninsula. For centuries, beargrass has been an essential element of baskets made by local tribes (James, Quinault Indian Nation 2003, personal communication). To personalize baskets, beargrass blades are often dyed and interwoven with cedar to add ornamentation (Storm 1985). In interviews, basketmakers reported a decline in beargrass quantity and quality in traditional gathering sites on the Peninsula.

The basketmaking quality (specifically leaf pliability) of beargrass improves with exposure to fire (Rentz 2003) and tribes have used prescribed burning to stimulate the new growth of fibrous leaves (Hunter 1988; LaLande and Pullen 1999:263). Quinault and Skokomish Tribal Members interviewed for this study believe that the best basketry-quality beargrass is gathered under some shade. Many have also stated, as supported by published literature, that it is intolerant of deep shade and cannot flower under a canopy (Duncan 2003; Kruckeberg 2003:149; Vance et al. 2001:127). Therefore, one cause of the decline in beargrass quantity is likely the suppression of natural and anthropogenic fires and subsequent increase in forest canopy cover over the past century. While beargrass generally thrives under an open canopy (Kruckeberg 2003:149; Vance et al. 2001:128), it is somewhat sensitive to soil compaction and competition from shrubs, causing growth to frequently decline after logging (Dyrness 1973; Halpern and Spies 1995; Nelson and Halpern 2005).

In the following study, knowledge of the landscape history of two types of lowland beargrass habitats was investigated: a past beargrass savanna on Olympic National Forest, which was historically Skokomish territory (southeastern Peninsula), and a wetland ecosystem on the Quinault Reservation (western Peninsula). The site on the southeastern Peninsula is in an area where the previous occurrence of savannas is supported by fire scars, tree establishment dates, present fire-adapted species, and historical documents, maps, and ethnographic accounts (Peter 2001). The western Peninsula site occurs in the temperate rainforest zone, yet Kulzer and others (2001:8) suggest that, "[f]ire may be an important factor in the formation and persistence of this variant." The site has hundreds of camas (*Camassia quamash* var. *azurea*) plants, traditionally a fundamental food crop for western Washington tribes including the Quinault (Gunther 1974:24). Maintaining an open habitat for camas was a primary reason for burning in the Pacific Northwest (Boyd 1999:2). Camas therefore is an indicator that the area was historically open-canopied (Antieau and Gaynor 1990).

In order to restore beargrass habitat on the Peninsula, the past burning practices of local people can be reintroduced to open the canopy. Restoration efforts of Olympic National Forest and the Quinault Indian Nation are notable in that they unite the Federal Government, tribes, and the University of Washington to acquire knowledge about the historic landscape and to reintroduce traditional management practices that helped define the land's structure.

Olympic National Forest/Skokomish Territory Ethnographic Methods

In 2004, semi-formal interviews were conducted with two Skokomish men: Bruce Miller (hereafter referred to by his Skokomish name: Subiyay) who is a Skokomish elder, master basketmaker and keeper of plant knowledge; and CHiXapkaid. In addition, three informal interviews were conducted with Skokomish employees familiar with the past landscape and land management of their region. Semi-structured, open-ended interview questions focused on current threats to beargrass, historic prairie and savanna distribution in the region, burning practices associated with land management, and current and past beargrass habitat characteristics.

Olympic National Forest/Skokomish Territory Ethnographic Results

While some beargrass persists in the southeastern Peninsula lowlands under a canopy, it is not as prolific as it was historically (Interviews, Subiyay and CHiXapkaid, November 4, 2004). In this section, I refer to the mosaic of habitat types with beargrass as savannas due to the presence of some trees, but the term 'prairie' appears in instances where it was used by a consultant to describe the habitat. Despite the loss of beargrass savannas in the southeastern Peninsula over the past century, knowledge of the historic landscape structure and burning practices is still widely shared among Skokomish who collaborated with the project. Although burning stopped in the late 1800s, information regarding its purpose and extent has been passed orally through generations.

Subiyay reported that the Skokomish maintained a network of 'prairies' and rotated the burning so that each burned every two to three years. Burning was conducted in autumn and varied in size from a few meters to hectares. He described that beargrass occurred in the savanna-like border between prairie and forests and stated, "[t]he periphery of the prairie was equally as important as the prairie itself" (Interview transcript, November 4, 2004).

In an interview conducted at the savanna restoration site in Olympic National Forest, CHiXapkaid explained:

> This prairie area was extremely important to the well-being of…Skokomish people. This particular area in fact was the domain of my own family… I've been told by elders who have already passed away…the practice of caring for this land was something that we maintained for several thousand years… it was manicured like a park. And it was that way until the late 1800s. People stopped doing that around that time when they were forcibly moved to the reservation… (November 4, 2004)

Flora and fauna of the savannas were integral components of diets, medicines, baskets, and belief systems of local indigenous groups. Bracken fern (*Pteridium aquilinum*), Columbia lily (*Lilium columbianum*) bulbs, berries (*Vaccinium spp.*), and beargrass could all be procured from these areas. Another primary reason for maintaining savannas was to provide habitat for game. Numerous local plant species that benefit from fire, such as beargrass and huckleberries, provide forage for mammals. The presence of these plants therefore facilitated hunting (Interviews, Subiyay and CHiXapkaid, November 4, 2004). Subiyay explained that burning was conducted after the first frost of the autumn. Regarding the purpose of maintaining the open areas, he stated:

> [they] were part of our commitment to our ancestors to maintain grazing grounds…[I]t wasn't only for human usage that the prairies were burned and maintained, it provided a very expansive grazing area for the elk and deer. And as the burning…ceased, the forest gradually choked up the areas that were prairie land and greatly reduced the foraging land that we aborigine provided for the grazing animals. (Interview transcript, November 4, 2004)

Although Peninsula tribes have experienced an enormous change in lifestyle over the past century,

beargrass continues to be an integral part of their traditions. As CHiXapkaid explains, "We can clearly say that [beargrass] contributed to the maintenance and preservation of our traditional culture… [Beargrass basketry] is a sacred practice that is important to maintaining the role of certain entities in our lives and recording our history…" (Interview transcript, November 4, 2004).

Olympic National Forest/Skokomish Territory Ecological Study

Olympic National Forest initiated a savanna restoration in 1995 in an area maintained by the Skokomish prior to the mid-1800s. Over 13 ha of Douglas-fir (*Pseudotsuga menziesii*) forest was thinned, burned and revegetated as the first steps in restoring its historic savanna structure. The extent of the thinning was determined based on 1929 aerial photographs. On September 30, 2003 the Forest Service led a prescribed burn in the unit. Plots were installed prior to the burn to monitor the regrowth of beargrass and associated species. Due to the dry summer and relatively large area burned, the fire was high in intensity, yet the vegetation is recovering well. This burn is the first of many consecutive burns planned for three to five year intervals, a frequency believed to enable the maintenance of the savanna community. Olympic National Forest hopes to restore beargrass and other shade-intolerant species that have declined in abundance over the past century to the site. A follow-up low-intensity fire restoration experiment was initiated during the summer of 2004 to investigate the response of beargrass and associated vegetation to two treatments: low-intensity fire and limited competition through vegetation removal. Plots were established adjacent to the 2003 burn unit on the southeastern Peninsula. Results are not available at this time but measurements of changes in beargrass phenology, morphology, and abundance are being taken annually to determine the vegetation's response. Leaf samples will be brought to basketmakers so that they can assess beargrass quality after regeneration.

Restoring beargrass savannas to the southeastern Peninsula has significant ecological and cultural implications. In addition to reintroducing a species-rich ecosystem lost to succession, restoration will provide local tribes with culturally significant plants, such as beargrass, that have become difficult to obtain. With the savanna re-establishment, plants will be readily available to the tribes since harvesting rights of tribes are recognized by Olympic National Forest and the site is within ten miles of the Skokomish reservation and along a road.

The Quinault Site

The Quinault historically conducted controlled burns to maintain open areas, particularly for resources such as camas, berries and ferns (James and Chubby 2002:106). The "boundary of ecological areas" (James 2002) between these open areas and the forest had a savanna-like structure and was likely beargrass habitat. Controlled burning was likely frequent, low-intensity burns by virtue of the high precipitation, averaging 355 cm/year, (Capoeman 1990:21), and probably stopped in the late 1800s during the allotment period.

Quinault Ethnographic Methods

Five semi-formal interviews were conducted with Quinault Tribal Members in the summer of 2003 with three female basketmakers (two are elders), a male cultural resource representative of the Tribe, and an elder husband of a basketmaker. Questions addressed to the Quinault were the same as those for the Skokomish.

In addition to being consultants in the interviewing process, Quinault Tribal Members assisted with restoration site selection and preparation, treatment installation, and data collection. Biannual updates of research progress are being given at Olympic Peninsula Intertribal Cultural Advisory Committee meetings.

Quinault Ethnographic Results

The Quinault consultants interviewed were unfamiliar with historic burning practices, and did not recall witnessing controlled burning by tribal members. All Quinault consultants were aware that areas that used to be more open are being encroached by trees. Two elder female basketmakers recalled harvesting beargrass near Moses Prairie, which has subsequently undergone succession and has now been clear-cut. They report that beargrass no longer grows there.

All Quinault consultants reported a decline in beargrass populations, which they attributed to immigrant harvesters removing beargrass from the Reservation in mass quantities. For example, when asked why beargrass is declining, Leta Shale, a Quinault elder and basketmaker, stated: "There isn't hardly any because now they pick up anything! Everything! They don't select the best. They go to floral shops. They dye them and put them in floral displays" (Interview transcript, June 18, 2003). Indeed, beargrass leaves are sold throughout the U.S., Europe, and Asia for dried floral crafts and are touted by some floral greens wholesalers as the highest volume European export of all special forest products (Thomas and Schumann 1993:73).

Another factor mentioned as potentially affecting beargrass abundance was clear-cutting. Charlotte Kalama, a Quinault elder and renowned basketmaker, has experienced difficulty getting basket-quality beargrass for a number of years. She stated: "My husband used to get it for me, but it's hard to find now. Where he used to go, they have cut the trees. Now, beargrass grows short there, it stays small. I need it to be at least 2 feet long" (Interview transcript, June 17, 2003).

Quinault Ecological Study

The low-intensity fire restoration experiment described above for Olympic National Forest was replicated on the Quinault Reservation during the summer of 2004. The Quinault Fire Crew applied the fire and vegetation clearing treatments to the plots. While the plot design and measurements were the same, the habitat is remarkably different from the Olympic National Forest site's dry, Douglas-fir forest. Results for the experiment are not yet available.

On the Quinault Reservation, the experiment was established on a wetland site that was clear-cut five years prior to the initiation of the experiment. The site is a dry variant of a *Sphagnum* bog, which experiences seasonal flooding and drought. In addition to beargrass, Labrador tea (*Ledum groenlandicum*), and western swamp laurel (*Kalmia occidentalis)*, a unique feature of the site is the presence of camas *(Camassia quamash* var. *azurea*). It is believed that this location was part of the Quinault annual migration route (James, Quinault Indian Nation 2003, Interview transcript) and it was likely burned after harvesting crops.

Comparisons of the Case Studies

The impetus for both case studies was concern of local tribes that an essential basketry plant was declining in traditional gathering sites. At the start of both projects, tribal members were asked what culturally significant plants are declining in areas where they used to be readily available. For both case studies, the answer was a basketry plant that was increasingly being gathered by non-tribal members and sold commercially. I believe that shifts in gathering practices and changes in land management (particularly the absence of controlled burning) associated with both sweetgrass and beargrass have contributed to the decline reported by the consultants.

The perseverance of basketry is dependent in part upon the availability of culturally significant resources. The two restoration projects presented were designed to not only restore basketry plants to their native habitat, but to also enable cultural traditions associated with those plants to continue by creating suitable conditions for their restoration and management. In both studies, basketmakers observed a decline in a necessary resource, and ethnographic information learned through interviews assisted in developing ecological studies. Both studies incorporated traditional knowledge to gain an understanding of the ecology and management of the plants of interest and each study focused on particular steps that are fundamental to restoration projects. The first step in many restoration studies is to determine the population status of a species of interest. Through the first case study presented, the claims of some Haudenosaunee that sweetgrass was declining was supported by an ecological field study. Following the recognition of this population trend, traditional knowledge was effectively used to understand potential reasons for its decline and to assist in choosing a site for a re-establishment experiment. For the second study, knowledge shared concerning traditional burning practices (including season, frequency and intensity of burn) assisted in reintroducing past burning practices to restore beargrass and its habitat.

The studies presented took place on opposite coasts of North America and differed in regards to the indigenous consultants, plant species, and site characteristics involved. While restoration projects inevitably vary based on the species or ecosystem of interest, methods used in the case studies illustrate that some projects should not rely solely on ecological data. Traditional knowledge can be an essential tool to understanding population trends and ecological processes, and to designing restoration projects.

There are challenges associated with integrating Western scientific and traditional knowledge systems. In both studies, my interest in interviewing tribal members and working on their land was met with hesitancy. At Kanatsiohareke and on the Peninsula, I addressed concerns at meetings with community members and conversations on the importance of both Western science and traditional knowledge as elements to understanding population trends and ecological relationships. In reference to my research with beargrass, Justine James, a Quinault Indian Nation cultural resource specialist stated that elders were at first suspicious about the project: "In the past, so much information was taken from them, often for the profit of others, and they didn't get anything back. This time, they will get something back—a way to perpetuate bear grass" (Preston 2005:8). Both projects aimed to enhance the opportunity for basketry to continue by suggesting ways to manage the plant resources.

Conclusion

The scope of this work is neither limited to basketry plants nor to the methods described. It is hoped that the case studies provide restoration ecologists and public land managers with ideas of how to incorporate traditional ecological knowledge into their work, and encourage the exploration of different methods of uniting knowledge bases. In addition, methodology presented may also assist social scientists by illustrating the applicability of ethnographic methods to understand the links between plant availability and the cultural traditions, as well as threats to particular species and ways of managing plants and their habitats.

Acknowledgments

This paper is in memory of Bruce Miller, Subiyay, who passed away soon after the first draft of this manuscript was written. This work would not have been possible without the cooperation and support of the members of the Haudenosaunee and the Quinault and Skokomish Nations who shared their knowledge with me. In particular, I am grateful to Thomas Porter, Theresa Burns, Otatdodah Homer, Justine James and Michael Pavel for their friendship and assistance. I am indebted to my mentor, Dr. Robin Kimmerer, for her continued guidance and for reviewing this paper. Dr. Kern Ewing, Dr. Eugene Hunn, Dr. Michael Pavel, Justine James, and Linda Storm reviewed this paper. Dr. Sarah Reichard supported the continuance of this work with the University of Washington. Kanatsiohareke, the Olympic National Forest and Quinault Indian Nation are thanked for cooperating with the restoration projects presented. Funding was provided by the U.S.D.A. Fund for Rural America, Sussman Foundation, A.R.C.S. Foundation, Olympic National Forest, and the University of Washington. Views expressed in this paper are those of the author and not of the reviewers or sponsors.

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