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Ethnobotany and the linkage between cultural and biological diversity

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Abstract
Legends, songs, traditions, and material culture vanish as indigenous people throughout the world confront modernity. This loss of diverse cultural aspects is exacerbated by loss of native languages. The loss of biodiversity can also accelerate diminishment of traditional folkways. Three examples of the linkage between biological diversity and cultural diversity are here considered and emphasized. Not only can loss of biodiversity diminish the richness of indigenous cultures, but conversely the extirpation of traditional cultural knowledge can endanger the maintenance of biological diversity. One global NGO which recognizes the need to protect both cultural and biological diversity is Seacology, which has over 320 projects in 64 island nations saving 1.5 million acres of island forests, mangroves, and coral reefs. This paper is written in honor of an eminent ethnobotanist Dr. S.K. Jain, who succumbed to COVID-19 in India on 20th April 2021.

Key Words: Conservation; Biological Diversity; Cultural Diversity; Gosiute weaving; Samoan fish traps; Fijian *camakau*; S.K. Jain

Introduction

Ethnobotany, the study of how people use plants, has focused on preserving indigenous knowledge that is vanishing from much of the world (Cox 2000). As even remote villages are increasingly impacted by modernity, traditional practices involving plants have become endangered. The loss of native languages, which serve as the cultural container for traditional ethnobotanical knowledge, has accelerated cultural erosion. Knowledge held in common by large groups of people do not face the same immediate threat as does knowledge in specialized realms of knowledge such as weaving, navigation, the construction of sailing craft. Because of linguistic inabilities, as well as profound differences in the cosmologies between native peoples and outside investigators, these specialist forms of traditional knowledge are often the most difficult to save.

Gosiutes and Winnowing Baskets in North America

The cultural erosion and the extraordinary fragility of indigenous traditions in the modern world impacted my personal efforts as an ethnobotanist while I attempted to study plant lore of the Gosiute people, a Native American group long resident in the Great Basin, now confined to small reservations in the United States: one group in Skull Valley, Utah, and a second group on the extreme western border of Utah, with headquarters in Ibapah, Utah. The Gosiute, who call themselves the *Newenee* or "the people", are Numic speakers with their language most closely related to Western Shoshone (Brewster 2003). I sought to understand their concept of natural resources, since some of the elders are the last remaining people in the United States to have been raised as hunter gatherers. I used as a basis for my study an excellent ethnobotanical review of the Gosiute published over a century ago by Ralph Chamberlin (1911).

One of the first steps in conducting any ethnobotanical study is to establish rapport and trust with the indigenous people. Economic or technological asymmetries between the investigator and the indigenous peoples can represent a hurdle to overcome. I seek prior informed consent from the indigenous people for any technology I bring into an ethnobotanical study. If I have a camera, I show it to the indigenous people and ask them to take my photograph before I ask permission to take their photographs. I first obtain prior informed consent to use a notebook and pencil before introducing it in an interview. In the case of the Gosiute people, there is a political asymmetry that must be overcome because their ancestors were moved from some of their traditional lands to allow establishment of the Dugway Proving Ground and the Tooele Army Depot.
My strategy to meet elderly Gosiutes focused on driving the 4-5 hours from my university to Ibapah where I arranged to

take my lunch at the senior center. I would sit quietly at a table near senior Gosiutes, and slowly eat my lunch, after which I would drive 4-5 hours back. My repeated lunch visits to the senior center eventually aroused the attention of several elderly Gosiute women who one day asked me *"Why do you keep coming here?"* I responded that I wanted to learn Gosiute plant lore. The second question followed, *"Why do you want to learn our plant lore?"* I responded that I wanted to preserve it for their grandchildren. The matriarch who spoke to me said, "Our grandchildren don't want to learn our plant lore. They just want to watch TV."

As I returned that day through the reservation, I noted the veracity of what I had been told: most of the dwellings had satellite dishes on their roofs. Fortunately, my postdoctoral student Dr. Todd Capson learning of this began to compile a Gosiute language illustrative flora and recently a children's book on Gosiute legends has appeared (Ibapah Elementary School 2000). I realized the imminent peril the Gosiute culture faced.

Linguist Michael Krauss had compared television in indigenous societies to "cultural nerve gas" (Hale *et. al.* 1992, Lewan1999).Fortunately, the Gosiute elders accepted me and consented for me to conduct research. What I found was astonishing. Instead of facing episodes of nutritional deprivation as hunter gatherers, they had an immense palette of edible plants they could easily access (Halmo *et. al.* 1993) and never wanted for sustenance. An important part of their culture was the annual gathering of pine nuts, the seeds of *Pinus edulis* Engelm. [Pinaceae], called by the Gosiute *ti'bawara*. As noted by Chamberlin (1911, p.343) "the method of obtaining the nuts is to gather the cones and partially char them in a fire: in this process the nuts are roasted." The seeds of all these and the other plants were collected in approximately the same way. They were first gathered in large baskets, commonly about two and a half feet wide by three feet deep, and designated by the name *nu'piosu* or sometimes as *wu'tsianûmp*. These baskets were closely woven (Chamberlin 1911, p.341).

To thresh the seeds of different species including pine nuts one requires a winnowing basket. As the seeds are gently tossed, the outer seed coat is blown away. After the seed coats of cracked pine nuts were winnowed, coals were added back to the winnowing basket to continue cooking. Although I had acquired several antique winnowing baskets manufactured by Native Americans in the Great Basin (Fig. 1), the only weaver of winnowing baskets I could find was Evelyn Pete (Fulkerson & Curtis 1995).

Mrs. Pete grew up in the Shoshone tribe but married a Gosiute man and became conversant in both languages. She allowed my graduate students and me to film her weaving a winnowing basket, a task which she conducted effortlessly while engaging in conversation. Noticing my students' attention lagging, I asked them if they could split the dried willow shoots of *Salix* spp. [Salicaceae] into three equal pieces the same way Mrs. Pete did to prepare them for weaving. The students failed miserably, as did I, in this effort. Further investigation revealed that Mrs. Pete had to travel several hundred miles to find "the right types" of willow for weaving as none of the correct forms survived on the Ibapah reservation. Thus, the Gosiute practice of collecting and winnowing pine nuts and other wild gathered seeds, which they identified as a major cultural event, complete with traditional songs and legends-some involving Steller's jay (*Cyanocittastelleri* [Corvidae]) called by the Gosiute*yu'rogots*-depends on maintaining the knowledge of weaving winnowing baskets. Should Evelyn Pete's knowledge ever disappear, a key part of Gosiute knowledge could be imperiled. Yet Evelyn Pete's ability to weave these baskets depends on access to special types of willows which apparently are not easy to obtain.

Fishing Baskets in the Samoan Islands

Similar linkage between conservation of cultural diversity and biodiversity can also be seen in the weaving of *'enu*in Samoa. The*'enu* baskets are immersed in the sea during the seasonal migration of a small sardine type fish called *i'asina*by the Samoans (Hiroa1930). I interviewed one of the last weavers of *'enu* on the island of Olosega in the Manu'a group of this South Pacific archipelago. Suspended from posts in the small huts of Olosega village are *'enu* that are decades old. LeatiotiTauluavaa lives near the white sand beach (Fig.2). "It is not possible to weave them anymore," Leatioti explained. "The *'ie' ie* vine *Freycinetia reineckei* Warb. (=*Freycinetia marginata* Blume) [Pandanaceae] no longer flourishes on the island. It seems to be disappearing for some reason or the other."

Only the aerial roots of the *'ie'ie* vine can withstand prolonged immersion in seawater without rotting. And yet in Olosega, the *'ie'ie* vine has largely disappeared as flying foxes that pollinate it have become rare due to commercial hunting, as well as by the aftermath of two intense typhoons (Cox 1984, Balick & Cox 2020, p.123, Cox &Elmqvist2000, Pierson*et. al.*1996). Leatioti was able to restart *'enu* weaving and teach a young apprentice his techniques once my students and I had brought him 20 kg of *'ie'ie* aerial roots brought to Olesega from the distant island of Savai'i, 300 km away.

As in the case of Evelyn Pete and Gosiute winnowing baskets, continuation of the knowledge of *'enu* weaving in Samoa was imperiled by the rarity of the *'ie'ie* plant used for weaving. Had Leatioti died prior to training an apprentice, this entire art form may have vanished from Samoa. If *'enu* weaving vanished, the capture of the migratory *i'asina* fish,

Figure 1. Century-old winnowing baskets woven from willow by indigenous tribes in the Great Basin of North America have decorative flourishes, combined with the patina of use. They were used to remove the shells from pine nuts and other seeds after roasting. These include: (top and middle row) historical winnowing baskets; (bottom row left) a contemporary winnowing basket woven by Evelyn Pete from the Gosiute Reservation, Ibapah, Utah; (bottom row right) basket details: (top) details from historical winnowing baskets; (bottom) details from contemporary winnowing basket by Evelyn Pete.

together with the songs, legends, and celebrations associated with their harvests would also have vanished.

Biodiversity and Polynesian Voyaging

Chad Kalepa Baybayan who died on April 8, 2021, was an apprentice to Mau Piailug, a traditional navigator from the island of Satawal in Micronesia. I met Mr. Piailug in Pago Pago, American Samoa, in the early 1980s when he arrived on the *Hokule'a*, using only stars and traditional techniques for navigation from Hawaii. Mr. Baybayan and another Piailug acolyte, Naninoa Thompson continued to use the traditional navigational techniques taught them by Mr. Piailug prior to his death in 2010. When I met Mr. PiailugI gently asked him about the *Hokule'a* which resembles a traditional double-hulled Polynesian sailing vessel, but is largely constructed from modern materials. He explained that no one alive in the Caroline islands where he is from remembered how to make such ocean-going craft.

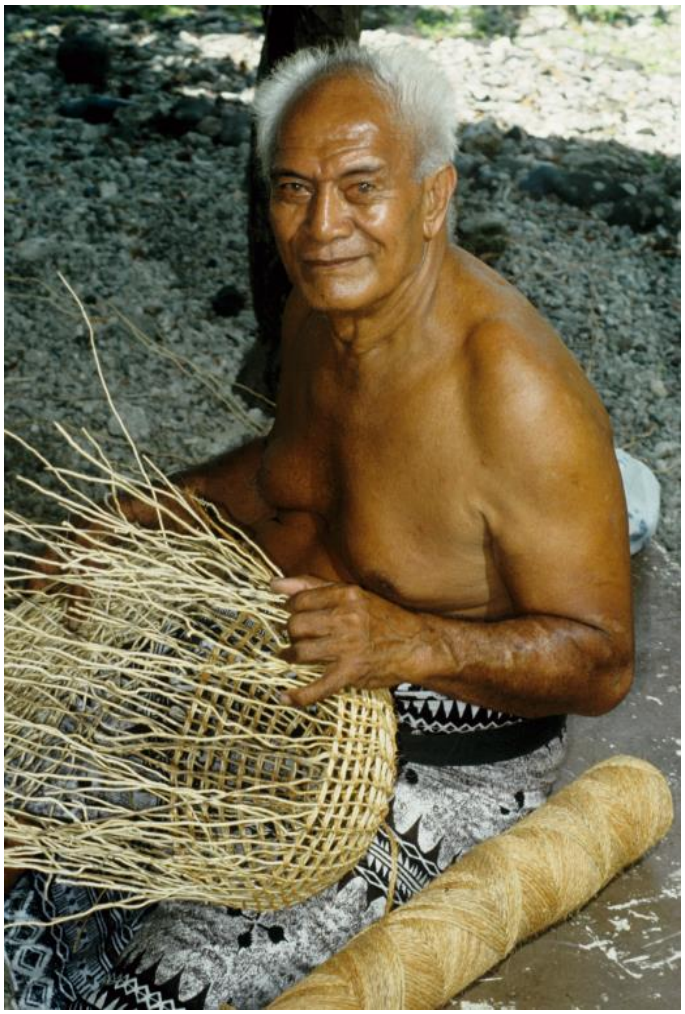

Figure 2. *Enu* fishing traps in Samoa are constructed from the dried aerial roots of the vine *Freycinetia reineckei.*

Unknown to him, a gifted shipwright by the name of Ilaijia Ledua in the remote island of Kabara in the Lau group of Fiji did remember how to make ocean-going craft. With support from the Institute for Polynesian Studies, we were able to contact Mr. Ledua and other members of the *mataisau* or shipwright guild on the island to commission construction of a *camakau*, a single-hulled ocean-going craft capable of transporting 10 or more voyagers. Ethnobotanist Sandra Banackwent to Kabarato document the plants used to construct this vessel (Balick & Cox 2020, pp.107-113, Banack & Cox 1987). Anciently, the tiny island of Kabara functioned like the oceanic equivalent of Boeing. Monarchs and chiefs throughout Polynesia commissioned '*camakau'* and double-hulled '*drua'* to transport warriors across the expanse of Oceania (Clunie 2015). Why would this tiny island hold such political saliency throughout the islands?

This small, raised limestone island has a stand of the largest *vesi* (*Intsia bijuga* (Colebr.) Kuntze [Fabaceae]) trees in the entire Pacific. These large trees produce a wood that is so dense that it sinks when placed in water. To survive the rigors of oceanic storms, boat hulls needed to be carved from a single *vesi* trunk (Fig.3). Through time, shipwrights, many of Tongan ancestry, colonized tiny Kabara, and produced sailing craft of exceptional strength and beauty.

The village women learned how to adapt the weaving of the leaves of *Pandanus tectorius* Parkinson ex Du Roi [Pandanaceae] which they used for house mats for the construction of large sails. Given the density of the *vesi* hull, much lighter timbers were used to construct the other parts of the vessel, with special attention given to the manufacture of seawater resistant cordage and adhesives (Banak & Cox 1987). At different construction milestones, the shipwrights celebrated through elaborate feasts and presentation of *tabua*, the teeth of whales, all provided by the commissioning party. Legends linking to ancient times are recalled. In this case, the existence of unique plant biodiversity, e.g., the large *vesi* trees, allowed a unique culture of shipbuilding to occur for centuries on Kabara.

Conservation of both Cultural and Biological Diversity

Many oceanic cultures, given the spatial constraints of their island ecosystems, developed unique land tenure systems and cultural prohibitions that prioritized biological conservation (Monson & Cox 2007). In such situations, meaningful conservation requires protection of both indigenous cultures and biological diversity, with best conservation practices being implemented by the indigenous people themselves (Cox & Elmqvist 1991). Seacology, a conservation NGO founded in 1992, has implemented this principle of conservation control in building over 320 schools, medical clinics, and solar electrification schemes in return for village covenants to protect adjacent rain forests, coral reefs, and other marine resources. Over 1.5 million acres of terrestrial and marine ecosystems in islands of 64 countries have been created in this manner by Seacology. Although Seacology focuses on

Figure 3. The maiden voyage of a fully rigged *camakau* in Kabara, Fiji documented by ethnobotanist Sandra Banack.

the conservation of island cultures and habitats, there is no reason why these same techniques cannot be used for continental ecosystems. Ethnobotanists trained in the approach pioneered by the late S.K. Jain who perished from the COVID-19 pandemic on April 20, 2021, are needed to help catalyze this process. The passing of this great scholar in India is mourned by his colleagues throughout the world.

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