HOW CAN ARCHAEOBOTANY BE PUT INTO SERVICE OF KATZIE FOOD SOVEREIGNTY?

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Archaeobotany is a branch of archaeology, also referred to as palaeoethnobotany, that studies the deep time relationships between people and plant communities through the recovery, identification, and interpretation of ancient plant remains. In favourable circumstances, a wide array of plant parts – such as wood, seeds, bulbs, fibres, needles, and cones – can be preserved for thousands of years in charred, desiccated, and/or waterlogged form. These archaeobotanical assemblages, or datasets, gathered from sites of different ages and places, and interpreted through the lens of Indigenous knowledges, provide direct, concrete evidence of the enduring ties that communities have to their ancient landscapes.

Such evidence is critical to addressing the various sovereignty questions imposed on First Nations communities of British Columbia, where ancestral lands and waterways were never ceded to colonists and land claims remain largely unresolved. A primary goal of sovereignty initiatives is to procure the land base necessary to re-establish food sovereignty, defined as the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods and food systems of their own choosing (Nyéléni Declaration 2007; also Coté 2016; Grey and Patel 2015; Hoover 2022; Smith et al. 2022/23). Indigenous communities historically have deployed a number of strategies to reclaim portions of their lands and waterways, including treaty negotiations, legal cases for claims based on constitutionally embedded Aboriginal Rights and Title, and direct actions such as blockades, protests, and territorial reoccupations (Armstrong and Brown 2019, 15; Feltes and Coulthard 2022; Simpson 2017; Welch 2022).

As Martindale and Armstrong (2019, 60) observe, part of the rationale for this multi-pronged approach is that: "In Canada, like many settler-colonial countries, Indigenous peoples have found greater traction to confront colonial disenfranchisement in courts than in legislation. Canadian court rulings have led to the recognition of Aboriginal Rights, Including Title, often in the face of government policy that does not" (Coulthard 2014; Harris 2003).

Despite hard won battles by Indigenous communities to have their oral histories admitted as accepted evidence in Canadian courts in order to prove the sustained use and occupation of their territories (Borrows 2001; Feltes and Coulthard 2022; Hogg and Welch 2020, 2021), the courts continue to rely on Western scientific forms of evidence to corroborate (and in some cases challenge) the veracity of oral narratives as historical evidence (Martindale and Armstrong 2019; Lavoie 2020; Miller 2011). While frustrating to community sovereignty claims, this circumstance has inspired a new generation of Indigenous researchers and associated scholars to locate ways to situate the strengths of Western science in service of Indigenous priorities and ways of knowing (Reid et al. 2021). As First Nations in what is now British Columbia use the cultural, political, legal, and economic tools at their disposal to regain access to their lands, waters, and resources, they simultaneously work to decolonize political and legal systems that are highly skewed in favour of settler institutions (e.g., Hoffmann et al. 2023; Lyons et al. 2022; Wilson-Raybould 2022). In this context, archaeobotanical data have significant potential to document the nature, scope, and continuity of ancient and historical plant resource-use and management practices, bridging the pre/post-contact divide currently required in legal claims, and, in this way, to aid in re-establishing and reclaiming plant management regimes that were interrupted – but, importantly, *not eradicated* – by two hundred years of colonial interference.

To date, however, comprehensive archaeobotanical datasets have never been used as evidence in land-use planning or territorial claims. In this article, we develop a method for compiling and analyzing archaeobotanical data at a landscape level that documents what plants were used; where they were gathered, processed, and consumed; and their relative frequency and intensity of use. We demonstrate how this baseline data can be employed in land-use planning and food sovereignty initiatives that seek to envision, adapt, and reinstate ancient land management practices. Food sovereignty frequently involves the restoration of cultural keystone places, which are those that exhibit particularly high biodiversity, cultural importance, and intensive use for a cultural group (Cuerrier et al. 2015; Garibaldi and Turner 2004; Lepofsky et al. 2017; Rick et al. 2022). In areas where they have regained jurisdiction, Indigenous communities of the Pacific Northwest are working to rehabilitate traditional foodways, ritual, and governance structures through the restoration of clam gardens, food gardens, forest gardens, camas prairies, and other culturally arbitered ecosystems (Armstrong et al. 2023; Groesbeck et al. 2014; Hoffmann et al. 2023; Lepofsky and Armstrong 2018; Reynolds and Dupres 2018; Turner 2020). As Syilx scholar Jeanette Armstrong (2020, 37) notes, "focusing on Indigenous food sovereignty is one way to protect the environment by bringing into balance the skewed view that commercial interests are the only value that must be protected for the people by those in governance."

For the q̓ə́yc̓əy (Katzie), hən̓q̓əmin̓əm̓-speaking peoples of the lower Fraser River, Widgeon Slough is considered a cultural keystone place. Katzie territory encompasses a significant portion of Metro Vancouver, including a remnant of the Pitt Polder wetlands, which remains one of the largest wetland systems in the Lower Mainland and includes Widgeon Slough. Prior to forced removal from their lands, and subsequent dyking and draining of their territory to facilitate settler agriculture, infrastructure, and settlement, Katzie managed the gifts provided by this diverse landscape, working to ensure they upheld the reciprocal relationships established by countless generations of their ancestors (Hoffmann et al. 2021). It is Katzie's goal to restore and reimagine traditional management practices within the Widgeon watershed, drawing on principles of Katzie customary law to help return Katzie people to their wetlands and assert a sustainable future. The stakes are incredibly high as rapid urban expansion threatens to encroach on the few remaining cultural landscapes and their critical resources; Widgeon Slough remains the single place within Katzie territory with relatively easy access to traditional foods, medicines, basketry, and other technological resources (Hoffmann et al. 2023). In 2019, the province adopted the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP 2007) into provincial legislation (DRIPA 2019), a move that is actively shifting the political landscape and providing a strengthened basis upon which a wide range of Indigenous sovereignty initiatives are being pursued (Lavoie 2020; Reimer et al. 2022). It is within this milieu that Katzie is negotiating with federal, provincial, and municipal governments to regain control and management rights over portions of the Widgeon Creek watershed.

In this article, we present a case study demonstrating how archaeobotanical evidence – gathered across asserted Katzie territory from sites spanning the last six thousand years – is being used by Katzie to address food sovereignty within Widgeon Slough. Using archaeobotanical measures of richness, ubiquity, and abundance, we present a landscape-level analysis of archaeobotanical data that identifies the scope and depth of ancient plant use and illustrates the ties between Katzie use of their lands and waters in the deep past and asserted futures. We begin our meta-analysis of seven previously analyzed archaeobotanical assemblages by situating the data in place and time, and then examining them at increasingly finer scales of analysis, gleaning their respective values for restoration efforts. In the discussion, we look at how knowledge generated by archaeobotany, and informed by enduring Katzie knowledge, is being used in service of Katzie's desire to re-establish ancient foodways. Focusing on four species emphasized in the archaeobotanical analyses, we show how ancestral plant evidence sheds light on land-use planning in the Widgeon Creek watershed and discuss what these outcomes mean for Katzie and Indigenous food sovereignty practices in the Pacific Northwest.

KATZIE PLANT USE ACROSS SPACE AND TIME

Katzie oral histories tell how Swaneset, a powerful ancestral being, created and shaped the Pitt Polder wetlands and its expansive system of streams and sloughs so as to provide an abundance of foods, medicines, and technologies for the people in perpetuity (Jenness 1955, 13). The asserted Katzie homeland was once comprised of a mosaic of graded wetlands – sloughs, marshes, bogs, and fens – that were managed to sustain optimal biodiversity (Hoffmann et al. 2021, 2023). We know this from Katzie knowledge (KLUOS n.d.; Suttles 1955), the partial fragments of documentation from colonial agents and administrators, ethnographic accounts, and historical and reconstructed maps. One such map is a compilation of some thirty plant communities of the Fraser Lowland floodplains between 1859 and 1890 created by North, Dunn, and Teversham in the late 1970s (North et al. 1979; North and Teversham 1984). Until recently, the prolific plant diversity exhibited on this map would have been considered a natural characteristic produced solely by rich deltaic soils. Today, based on the combined work of Indigenous scholars and practitioners, along with historical ecologists, archaeologists, and ethnobiologists, we can establish that this landscape represents a set of interconnected aquatic and terrestrial ecosystems that were carefully brought into being through reciprocal relationships between people and place.

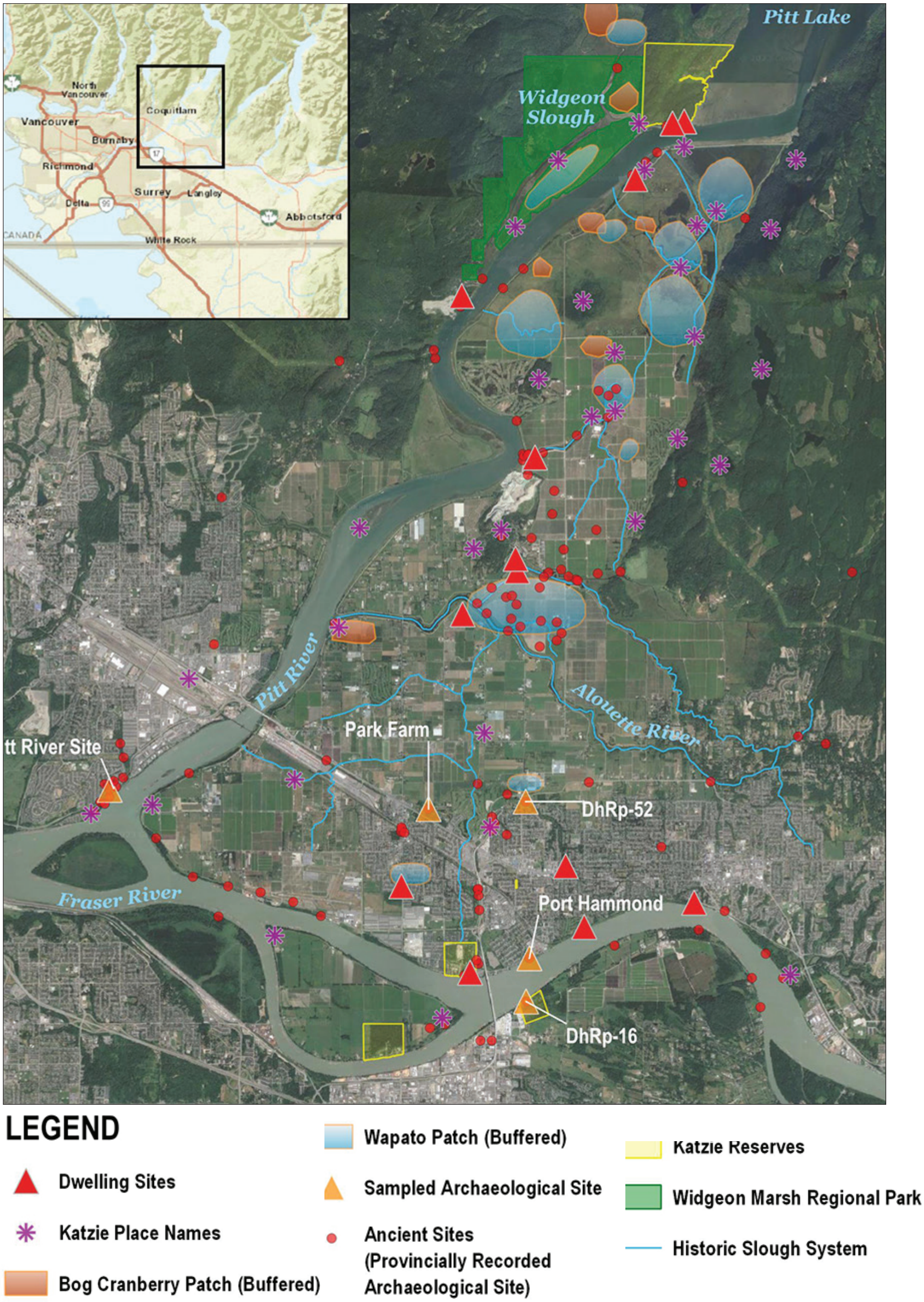

Figure 1. Sites of plant use and management in asserted Katzie territory drawn from archaeology, oral history, and Katzie knowledge and practice.

As noted elsewhere in the region, these relationships manifest as management practices aimed at creating and maintaining habitats at specific stages of succession for peak productivity (Hoffmann et al. 2016; Lyons et al. 2021; and see cf. Armstrong et al. 2021; Deur and Turner 2005; Lepofsky and Armstrong 2018; Toniello et al. 2019; Turner and Peacock 2005; Turner et al. 2021). The archaeobotanical indices explored below give us a view into the earlier antecedents of some of these practices.

In Figure 1, we present a palimpsest of data showing elements of ancient and historical land use over thousands of years by generations of Katzie people and their ancestors focused on plant resources. Katzie reserve lands assigned in the late nineteenth century, and still in use today, are represented (Hoffmann 2017; Hoffmann et al. 2021; Mohun 1880), as are historically and currently documented wapato patches (*Sagittaria latifolia*) and bog cranberry (*Vaccinium oxycoccus)* marshes. Widgeon Slough, located on the east side of the Pitt River near the south end of Pitt Lake, is the subject of the later stages of this article. Five major archaeological sites with previously analyzed archaeobotanical assemblages from asserted Katzie territory are shown in Figure 1, including DhRp-52, DhRp-16, Port Hammond, Park Farm, and the Pitt River site.

The distribution of ancient Katzie sites shows that earlier occupations (ca. six thousand years) were established in the southwest corner of the Pitt River Delta, while sites inhabited in later times (ca. fifteen hundred years) are situated in the deltaic wetlands to the northeast (Figure 1). Geomorphological evidence confirms that the delta prograded from southwest to northeast, eventually infilling the whole of the fjord-like gap that once existed at the foot of the adjacent steep mountain ranges (Clague et al. 1991). Katzie ancestors understood that many slough-edge resources, such as wapato, were best managed along the leading edge of the prograding delta, and their villages followed this edge for millennia. This understanding implies that Katzie practitioners knew that the riverine environment was ever-evolving and that their own farming and subsistence practices and policies must follow suit (KLUOS n.d.; and see Anderson 1996; Berkes 1999; Lyons et al. 2021; Turner 2014). Even from this imperfect and time-collapsed representation of Katzie plant use, the deep time continuity and scope of land-use practices are evident.

As shown in Table 1, Katzie plant use within the Pitt Polder wetlands, the primary low-lying core of the territory, spans thousands of years. Archaeobotanical assemblages are presented for seven components (individual occupations) from five archaeological sites across asserted Katzie territory. These are all substantial sites inhabited as multi-season

TABLE 1

Overview of archaeobotanical assemblages analyses in asserted Katzie territory

Site and component	Site type	Site dates	Sampled component dates	No. samples (total volume [litres])	No. seeds[a,b] (density)	Source
DhRp-52 Wet site	Winter/ multi-season village site	5800–2700 BP	All	60(30.5)	10,206 (334.6)	Lyons et al. 2010 (Hoffmann 2010)
DhRp-52 Dry site		5800–2700 BP	All	41(41)	153(3.73)	Lyons and Leon 2010 (Hoffmann 2010)
DhRp-16	Winter/ multi-season village at IR-2	ca. 2400–contact	800 BP	7(7)	117(16.7)	Lyons et al. n.d.
Pitt River (DhRq-21)[c]	Multi-component warm season occupation/ summer village	4500 BP–contact	Kroeker deposit (1400 BP), earth ovens dated ca. 800 BP	Unknown	Unknown	Patenaude 1985
Pitt River (DhRq-21)		4500 BP–contact		15(29)	250(8.62)	Lyons 2020
Port Hammond (DhRp-17)	Winter/ multi-season village	Marpole phase: 2400–1500 BP		7(approx. 6)	67(11.16)	Antiquus 2001
Park Farm (DhRq-22)	Winter/ multi-season village	4850–3900 BP (flood event in 3900)		Unknown	Unknown	Spurgeon 2001

a. Note that site formation processes are distinct in wet versus dry archaeological sites. Uncharred and charred plant macroremains are considered ancient in wet-site deposits, whereas in these specific contexts, only charred macroremains are considered ancient in the dry sites.

b. Density is calculated as seeds per litre for the whole assemblage.

c. The Pitt River site is within the asserted and claimed territories of both Katzie and Kwikwetlem First Nations.

villages over long durations. DhRp-52 is the earliest of these sites, first occupied some fifty-eight hundred years ago, while both DhRp-16 and the Pitt River site were still inhabited when the first Europeans arrived. The respective archaeobotanical assemblages were collected and analyzed between 1985 and 2020 by a variety of analysts and vary greatly in size, sampling strategies, and analysis techniques. Combined, these data represent well over 115 litres of analyzed sediment, one of the larger archaeobotanical datasets in the Pacific Northwest. Below, we explore elements of these assemblages, using richness, ubiquity, and abundance measures, and the inferences these analyses provide about plant management practices.

MEASURING PLANT RICHNESS

Richness is a measure used in archaeobotany to look at the variety of plants deposited on a site by natural and cultural means, and it has a close relationship to diversity. While proxies of ecosystem health, like biological diversity, help us understand the ways in which people lived and thrived within anthropogenically shaped environments, measures of archaeobotanical richness help us determine the extent of past cultural uses of them (Armstrong 2017; Armstrong et al. 2023; Lepofsky and Lertzman 2008; Lepofsky and Lertzman 2005; Turner and Peacock 2005; Turner et al. 2021). Here, we measure richness as number of identified taxa (NIT),[1] and we use it as a simple index to think about both the nature and scope of plant resource use by Katzie ancestors across time and space.[2] The range of plant use activities – such as harvesting, processing, consumption, storage, crafting, feasting – inferred from richness measures has a direct relation to an ancient community's access to and use of the lived landscape (Lepofsky and Lyons 2003).

At the landscape scale, more than 52 plant taxa, representing 31 plant families, have been identified archaeobotanically in 7 archaeological components across asserted Katzie territory. This inventory encompasses

[1] The term "taxon" (plural "taxa") is used to refer to all levels of botanical identification, from species, the most specific, to genus and family level. The terms "taxa" and "taxon" are used because archaeobotanists identify specimens at different levels of specificity. This is because some plant remains are more difficult to recognize because of distortion due to charring, waterlogging, and other impacts before, during, or after their deposition in archaeological sites.

[2] In order to show the full scope of plant use, the richness and ubiquity analyses in this article are generalized by archaeobotanical assemblage (Table 1). For a closer look at temporal change in plant use between archaeological site components, see the referenced reports and publications (e.g., Hoffmann et al. 2016).

6 coniferous and 46 deciduous taxa identified from plant macroremains, including seeds, needles, nutshell, cones, leaves, buds, stems, wood, and plant fibres derived primarily from dry sites and one significant wet-site component, DhRp-52. The plant assemblages include a range of wetland and emergent taxa (growing out of the water) such as various sedges (*Cyperaceae*), water-plantain (*Alisma triviale*), water-nymph (*Najas flexilis*), and horsetails (*Equisetum* spp.); riparian plants such as red alder (*Alnus rubra*), black cottonwood (*Populus trichocarpa)*, thimbleberry (*Rubus parviflorus*), and salmonberry (*Rubus spectabilis*); and plants that thrive in mixed deciduous regeneration forests, like cascara (*Rhamnus purshiana*), beaked hazelnut (*Corylus cornuta*), and Pacific crabapple (*Malus fusca*).

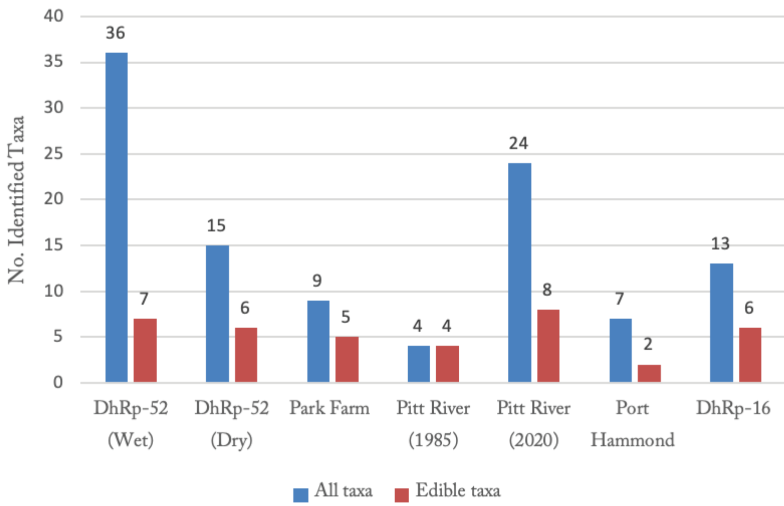

Figure 2. Richness of archaeobotanical assemblages from seven ancient components in asserted Katzie territory.

In Figure 2, we present richness measures for all taxa and edible taxa for each site component (volumes and counts for each dataset are provided in Table 1). The components are organized along the x-axis by their antiquity, left being oldest, and spanning fifty-eight hundred years ago to contact. Because of variability in sample sizes, the relative differences between richness measures are suggestive rather than absolute (Lepofsky and Lertzman 2005). Nevertheless, the extremely well-sampled wet site at DhRp-52 has one of the highest overall archaeobotanical richness of any site analyzed in the Pacific Northwest (n=36). The most recently analyzed component of the very long-lived Pitt River site has a richness tally in the mid-upper range for the region (n=24), and both the DhRp-52 dry site and DhRp-16 are in the mid-range (cf. Lyons 2017). Richness measures for edible taxa alone, which reflect food-related activities such as the processing, storage, and consumption of plant foods, are discussed in greater detail in subsequent sections.

MEASURING PLANT UBIQUITY

While richness shows us the range of plants being used, a measure called ubiquity tabulates the presence or absence of specific plant resources within or between contexts. This is useful in archaeobotany because some plant parts, such as wild cherry stones and elderberry seeds, are larger and more robust than more delicate seeds or fleshy tubers (i.e., and other "root foods"), and, therefore, both preserve better and tend to be overrepresented in our datasets. Ubiquity is a simple measure that helps to level the preservational playing field (for more on archaeobotanical indices, site formation, and interpretive practices, see Lyons 2017; Pearsall 2015).

In Table 2, we present a ubiquity chart for edible plants (n = 16 identified to genus or species) compiled by site component. All of the plant food resources found in Table 2 have greater or lesser ethnobotanically known uses by Katzie and other Coast Salish communities in the past and present (KLUOS n.d.; Suttles 1955, 2005; Turner 2014). Based on his work with Katzie knowledge keeper Simon Pierre in the mid-twentieth century, Suttles (1955, 26) noted both the wealth and desirability of wetland plant resources in Katzie territory:

> The unusual extent of low, seasonally flooded lands in Katzie territory gave them an unusual abundance of several bog and marsh plants. The two most important of these were the [bog] cranberry and the wapato (*Sagittaria latifolia,* commonly called "Indian potato"). Katzie territory was famous for these, and in the fall outsiders came from a number of other tribes to gather them.

In Figure 3, we show an overall ubiquity distribution of the plant resources presented in Table 2. The most ubiquitous taxa – salal, red elderberry, and raspberry genus – are ecological "generalists," that is, shrubs that grow in a wide variety of habitats. All three taxa were utilized and processed en masse by historical Coast Salish communities and are some of the most common plant foods found archaeobotanically on the Northwest Coast (Lepofsky and Lyons 2013; Lyons 2017). Most of the resources represented from ancient contexts in the figure have multiple known uses to coastal First Nations (Turner 2014), including detailed knowledge in the Katzie community (KLUOS n.d.).

TABLE 2
Ubiquity of edible plant taxa at sites across asserted Katzie territory

		Presence by site component							
Plant taxon	Common name	DhRp-52 Wet site	DhRp-52 Dry site	DhRl-16	Park Farm	Port Hammond	Pitt River 1985	Pitt River 2020	**Ubiquity (%)**
	Volume (litres) Sampled	30	41	7	?	~6	?	29	
Arctostaphylos uva-ursi	Kinnikinnick		x					x	**28.6**
Corylus cornuta	Beaked hazelnut	x							**14.3**
Crataegus douglasii	Black hawthorn	x		x					**28.6**
Fragaria spp.	Strawberry					x		x	**28.6**
Gaultheria shallon	Salal	x	x	x	x			x	**66.7**
Oemleria cerasiformis	Wild plum						x		**14.3**
Oxycoccus oxycoccus	Bog cranberry			x				x	**28.6**
Mahonia spp.	Oregon grape		x	x	x				**42.9**
Maianthemum dilatatum	False lily-of-the-valley						x	x	**28.6**
Pyrus fusca	Pacific crabapple	x					x	x	**42.9**
Prunus spp.	Wild cherry				x		x		**28.6**
Rosa spp.	Wild rose		x						**14.3**
Rubus spp.	Raspberry genus	x	x	x				x	**57.1**
Sagittaria latifolia	Wapato	x							**14.3**
Sambucus racemosa	Red elderberry	x	x	x		x		x	**71.4**

Some of the relatively common uses of plants in Table 2 include the use of black hawthorn (*Craetagus douglasii*) and strawberry (*Fragaria* spp.) as both food and heart medicine, kinnikinnick (*Arctostaphylos uva-ursi*) as food and smoke leaf, and wild cherry (*Prunus* spp.) and Oregon grape (*Mahonia nervosa*) as food and dye (MacKinnon et al. 2009; Turner 2014). Plants that grow in more specialized environments, like wapato along slough edges and bog cranberry in freshwater bogs, have considerably lower ubiquity but often incredible densities where they are archaeobotanically present (see below).

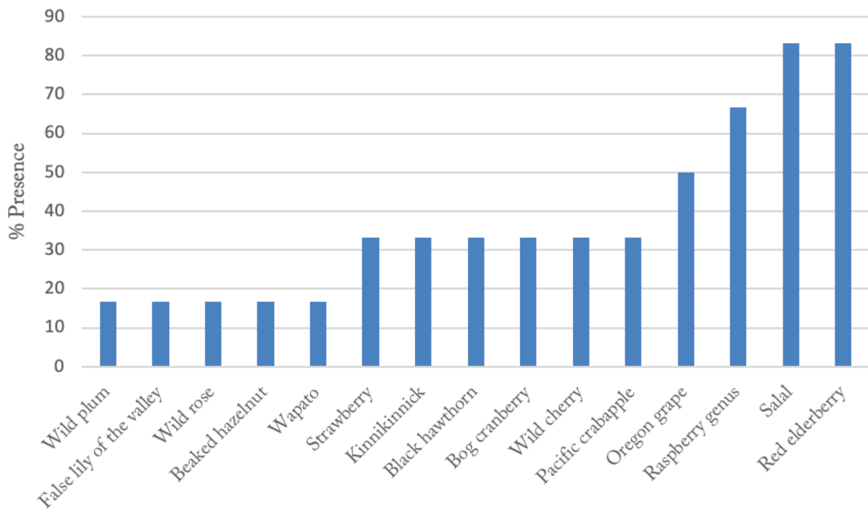

Figure 3. Ubiquity distribution of edible taxa from seven site components in asserted Katzie territory.

MEASURING PLANT ABUNDANCE

At a still closer scale of analysis, we look here at some site-specific archaeobotanical patterns that speak to the abundance of plant resources across asserted Katzie territory. Abundance of plant macroremains generally reflects the nature and intensity of plant use, for example, at a specific archaeological site (Lepofsky and Lyons 2003), while relative abundance can indicate the differences between plant use activities between contexts within a site or between sites in a region. From an archaeobotanical perspective, abundance can be measured in a number of ways, such as densities, proportions, and frequencies, all used below (Marston 2014).

In Coast Salish territories, families and communities often overwintered in large villages and spent the warm seasons moving and visiting between different kinds of resource camps. This lifestyle entailed highly sophisticated ecological knowledge and multi-layered scheduling (Turner 2014). Plant resources were harvested and variously processed throughout the growing season at known and named locations, such as t'éqeʔəm (salalberry-place), located on the eastern shore of Pitt Lake (Suttles 1955, 15–16). Salal berries usually ripen late in the summer or early fall and may have been harvested and mass processed at this place during the fishing season. Soft-stemmed bulrush, known locally as tule (*Scirpus lacustris*), was (and is) harvested from marshlands during this same general period at the peak of their growth cycle and dried and bundled for winter matting and basketry projects (R. Leon pers. comm. 2022; Turner 1998, 109).

Our first site-level look is at the relative abundance of bog cranberries at DhRp-16, a large multi-season village located on the banks of the Fraser River (Figure 1). The sampled context, dated to about eight hundred years ago, is small but significant, representing seven litres of sediment from seven different locales, five of which are cooking features used for food processing. From a ubiquity perspective, all five of the feature samples contained bog cranberries whereas the two non-feature samples did not. Overall, bog cranberries comprise a full 58 percent of this assemblage (n = 68 of 117 charred seeds). Due to historical dredging, the location and pathways of ancient slough channels in the Pitt Polder are today largely lost, but prior to this disruption, Langley Bog (and several others) would have been a short canoe trip to DhRp-16. Along with sphagnum moss, mountain goat wool (*Oreamnos americanus*), wapato, and sturgeon (*Acipenser transmontanus*), bog cranberries were an important item of exchange following the salmon fishery on the Fraser River (Duff 1952, 74). Katzie people traditionally owned many of the cranberry bogs in the Pitt Polder, and visiting harvesters had to obtain permission from the bog owners, likely a means of ensuring that berries were picked at the proper time (Suttles 1955, 24–26; Suttles 2005). Berries were generally harvested green and steam-cooked until red and soft and could also be stored raw in wet moss (Turner 1995, 86). Called qʷəmca´·l 's in hən̓q̓əmin̓əm̓, cranberries were enjoyed with eulachon grease (*Thaleichthys pacificus;* Katzie knowledge).

Pitt River (DhRq-21) is a complex and multi-component site at the confluence of the Pitt and Fraser Rivers that saw near-continuous occupation of proto-Coast Salish peoples for some forty-five hundred years (Figure 1). In the 1980s, a concerted foray into the nascent field of archaeobotany was conducted by archaeologists on deposits at this site (Patenaude 1985). This analysis yielded wildly surprising results: the berries of false lily-of-the-valley (*Maianthemum dilatatum*, also known as deerberry) were estimated to be processed in vast quantities within large intensively used earth oven features dating to ca. 800 BP. Charred false lily-of-the-valley seeds were present in eighty-one earth oven features that were either tested or excavated, with a total estimate of 450,000 seeds. The seeds were consistently found in association with the knots of hemlock wood (*Tsuga heterophylla*) and, at times, with wild plum, another edible fruit, leading the excavators to posit: "It is possible that the earth-oven features used to steam deerberries were also being used to steam wood pieces to make them more pliable for bending" (Patenaude 1985, chap. 6). False lily-of-the-valley is a common perennial herb in the region that grows in shaded and moist settings, and while not known as a preferred food among historical or contemporary Coast Salish communities, they were more commonly consumed by some North Coast communities (Ham and Broderick 1985; Turner 1995, 50–51). This resource, however, was clearly turned into a food staple during the late pre-contact occupations at the Pitt River site. Experiments by the site's investigators determined that the berries are highly palatable cooked into a jam or paste (Broderick and Blake pers. comm. 2021).

DhRp-52 is a site that has received a great deal of attention for its similarly long time span – some twenty-five hundred years of continuous occupation – the ecological engineering of its slough edge to produce a massive wetland wapato garden, and the very rare preservation and abundance of such root foods in archaeobotanical contexts (Hoffmann et al. 2016). The garden was built on a human-made rock pavement and maintained at an appropriate aqueous state through hydrological manipulation for some six hundred years beginning at 3800 BP, in a fashion clearly constituting wetland farming (Hoffmann et al. 2016; Lyons et al. 2018, 2021). Using these strategies, the garden's managers amplified the production of wapato over time – the density of tubers above the rock pavement was calculated at 55 per cubic metre compared to 4.4 per cubic metre on the adjacent bank and midden. Wapato, a staple food resource, was likely being processed and exchanged en masse in the mid-Holocene (Hoffmann et al. 2022a). The broken tips of seventy-four wooden implements and a fragment of a tumpline were found in direct association with the rock pavement. A massive pit feature (242 square metres) filled with tons of fire-altered rock (FAR), and situated on one side of the adjacent residential site, was used most intensively during the tenure of the wapato garden. The pit feature and nearby pithouse produced more than ninety thousand manufactured stone disc beads that are often interpreted as markers of wealth-based inequality among ancestral peoples of the Pacific Northwest region (Coupland et al. 2016; Hoffmann et al. 2016). Wapato is x̌ʷəq̓ʷə́wlʼs in hən̓q̓əmin̓əm̓ and itself derives from wáptu in Chinook jargon (Spurgeon 2001, 38), a term with very cosmopolitan distribution, reflecting its role in both the subsistence and prestige economies of the Northwest (Hoffmann et al. 2022a). For many Katzie members, learning about the wealth of their ancestors and the richness of their territory helped support the current interest in wapato farming in the community. The Katzie eco-cultural restoration plan identifies Widgeon Slough as the last remnant of the territory that approximates what the ancestrally managed wetland environment would have looked like (Katzie First Nation 2017).

Spectacular as the wapato evidence is, a relatively unexplored botanical element of the DhRp-52 archaeobotanical assemblage is the incredible abundance of discarded hazelnut shell. Whereas 3,768 specimens of wapato were recovered from the DhRp-52 wet site, so were 3,213 shell fragments of beaked hazelnut (stʼᶿícəm), preserved uncharred in anaerobic water-saturated conditions (Hoffmann 2010, 169). The greatest relative abundance of nutshell is on the slightly sloping bank above the wapato garden, where densities were measured at forty-five shell fragments per cubic metre and associated with deposits dating to 4600 to 4800 BP (Hoffmann 2016, Supp Materials). Hazelnuts were likely traded long distances (Turner et al. 2021) and cultivated in tandem with Pacific crabapple (qʷəʔáp) and other edible species by many First Nations of the Pacific Northwest in "forest garden" settings (Armstrong 2017; Armstrong et al. 2023).[3]Hazelnuts were pruned differently according to intended use – either for their straight and pliable shoots for weaving and arrow shafts or to develop the mast for their nuts and oil used for food and medicine (Armstrong et al. 2018; R. Leon pers. comm. 2022; Marks-Block et al. 2019, 2021; McDonald 2005, 250). Hazelnuts continue to be valued and harvested by Katzie today.

In this analysis of seven archaeobotanical assemblages, we employed a series of measures to quantify the scope and duration of use of multiple culturally important plant species over the course of the last six millennia

3 Forest gardens are a type of traditionally managed ecosystem created and maintained by Indigenous Peoples in the Pacific Northwest and elsewhere. They are biodiverse locales composed of concentrations of perennial fruit and nut trees and shrubs and herbaceous root-bearing foods and medicines, often located close to village sites (Armstrong et al. 2023).

from across asserted Katzie territory. These data show the richness, presence, and abundance of plants used within different wetland habitats and, in the case of DhRp-52 in particular, how they were managed over vast time spans (Hoffmann et al. 2016; Lyons et al. 2018, 2021). As we turn to questions of restoration in present-day Widgeon Slough, the archaeobotanical data can help to identify culturally important plants of the past and, with Katzie knowledge, inform about their potential restoration and management.

DISCUSSION

Envisioning Widgeon Slough as a Cultural Keystone Place

Over the past twenty years, Katzie researchers and plant practitioners have engaged in a number of studies aimed at understanding how ancient principles of reciprocal land and resource management remain embedded in their cultural landscape. The accrued findings from archaeobotanical studies throughout asserted Katzie territory are being used to understand and document the legacies of ancient and historical practices within extant wetland systems and provide analogies with which to move forward with land-use planning. Intact remnants of the once enormous Pitt Polder mosaic wetland system are currently managed by municipal and provincial regulatory bodies, many of which seek to restrict human access to ecologically sensitive areas based on an outdated conservation ethos. Our work, and that of others, shows that human participation is a fundamental component of creating and maintaining the reciprocal relationships with the land – participation that, in many cases, leads to sustained and increased local biodiversity and functional diversity (Armstrong et al. 2021, 2022; Casas et al. 2007; Ens et al. 2016). Based on these principles, Katzie are working to reinstitute their sovereignty using customary law and contemporary adaptations to traditional plant management regimes throughout their territory, including in heavily regulated conservation areas like Widgeon Slough (Hoffmann et al. 2021).

From a policy perspective, the Widgeon case is intensely complicated, involving regulatory agencies representing all levels of government, along with several conservation charities (Hoffmann et al. 2021, 2023). In 2020, after some fifteen years of co-management negotiations with many of the vested regulatory agencies, Katzie proposed a plan wherein the Widgeon Creek Watershed would be managed as a cultural keystone place that emphasizes Katzie values and priorities. In Western researchers' parlance, cultural keystone places are of high cultural salience and ecological importance for a specific group of people. For Widgeon, this translates into its densely layered and interconnected wetland resources, including cultural keystone species such as sandhill cranes (*Grus canadensis*), wapato, bog cranberries, and salmon (*Oncorhynchus* spp.) spawning habitat (Hoffmann et al. 2023; and see Carney 2023; Cuerrier et al. 2015; Garibaldi and Turner 2004; Lepofsky et al. 2017; Rick et al. 2022). Assembling this plan called on the accumulated place-based knowledge cited above – understandings of the sophisticated systems of Katzie use, occupancy, and management of their lands and waters across space and time; gauging the biodiversity and abundance inherent in past and present resource management practices; documenting seasonal rhythms of knowledge and movement to care for respective habitats, named places, and patterns of harvest; and imposing Katzie eco-cultural categories onto Western or Cartesian styles of mapping.

The challenges of reimagining Katzie management practices within the present-day conditions of Widgeon Slough are substantial. Climate change is shifting traditional Indigenous knowledge everywhere away from known baselines and requiring concerted and creative adaptations to land-based subsistence and travel (e.g., Ford et al. 2020; Pearce et al. 2015; Gauer et al. 2021). Katzie waterways flow far less than they once did due to extensive historical dyking by settlers, which has in turn affected tidal influences; in places there are substantive amounts of toxins in the water; and water levels, temperatures, and weather events are drastically shifting. Despite the challenges, there has never been a greater need for, and examples of, local and sustainable land-use practices and systems across the globe (IPCC 2022). Katzie leadership, stewards, and land-based practitioners are committed to accumulating the baseline knowledge required for the management of key species and their associated habitats within the Katzie wetlands, forming the foundation for both restoration practices and an equally important set of socially and educationally oriented community goals. Katzie members are seeking increased engagement with the Widgeon Slough system, which may take the form of intergenerational learning and knowledge transmission via culture camps and community-led workshops, the creation of accessible harvest areas, and the potential for reinvigorating aspects of the ceremonial calendar related to plant harvesting (Katzie First Nation 2022).

The restoration and management pieces themselves will require a lot of on-the-ground experimentation. As examples, we look here at the cases of four species discussed in detail above. Bog cranberries, for their part, flourish in highly specialized, low-energy freshwater environments that take a long time to form and are extremely sensitive to change. The berries grow on sphagnum hummocks in the hugely productive Widgeon system with bog blueberries, Labrador tea, bog laurel, and a variety of peat mosses. These resources are usually harvested alongside the hunting of migratory waterbirds (maʔaq^{w}, e.g., Anatidae) during the fall. A present threat is the overgrowth of Labrador tea in these ecosystems at Widgeon, which is inhibiting the growth of the berry plants. The surge in Labrador tea may be related to the relative moisture in and/or overheating of the bog matrix, and a Katzie-led research study is under way to learn more.

False lily-of-the-valley, the surprising food staple from the Pitt River site, is found in association with Pacific crabapple swamps throughout Widgeon Slough, growing densely with few-flowered sedge (*Carex pauciflora*) in open spaces (MetroVan 2016, 11). The Metro Vancouver ecologists who produced a biophysical report of Widgeon ecosystems had rarely seen this plant association, yet it is likely a common one throughout Katzie territory, including Mary Hill, near the Pitt River site (Ham and Broderick 1985), and other slough-edge locales. False lily-of-the-valley absolutely carpets the forest floor beneath crabapple and hazelnut in an extant forest garden at Ed Leon Slough in contemporary Sts'ailes territory, on the Harrison River. Solomon's plume (*Maianthemum racemosum*), a closely related species, is considered a forest garden indicator species, alongside crabapple, hazelnut, and a variety of other edible resources (Armstrong et al. 2021). It seems as though there is harvest potential for this association of resources in Katzie land-use planning.

Beaked hazelnut grows along sections of the benches that ring Widgeon Slough, slightly above the marshlands, in better drained soils. This pattern is seen in several forest garden settings (Armstrong et al. 2022; Vanier 2022). Hazelnuts respond favourably to numerous management practices, such as transplanting, broadcast, and point burning, and, in British Columbia, the species has a clear anthropogenic distribution created by Indigenous Peoples who extended their range across vast distances (Armstrong et al. 2018; Turner et al. 2021). At Widgeon, there are several prospects for hazelnut management and use from a community perspective. Of note, the Eastern Filbert Blight has heavily affected *Corylus avellana*, the commercial and introduced species of hazelnut cultivated widely in the Pacific Northwest for its nut crop, but the blight causes little significant damage to species native to North America. Thus, there may be commercial prospects for the native species, *Corylus cornuta*.

Last but certainly not least, wapato is a cultural keystone species within the remarkably productive Widgeon Slough system. It is a fully to semi-aquatic species that grows in still to slow-moving water, often with other emergents such as sedges (*Carex* spp.), tule, and cattails (*Typha* spp.) (Cooke 1997, 183–84). The relatively small populations of wapato are stable and growing throughout the wetlands, but like many of these other aquatic taxa with similarly significant cultural uses, they flourish with cultural care and stewardship. The highly edible wapato tuber requires little cooking, is easy to store, and is also food to many kinds of waterbirds and rodents. Because the tuber absorbs toxic pesticides, heavy metals, and other foreign substances leached into the soil and water system, it is often used in restoring toxic habitats but cannot be consumed in these contexts (Garibaldi 2003; Hoffmann 2017). The wapato populations in Widgeon, however, grow in clean water, generally protected from agricultural and industrial pollutants, and are safe to eat. These populations thus constitute a critical resource to the Katzie that needs to be protected and enhanced (Katzie First Nation 2017).

CONCLUSIONS

Takeaways for Katzie and Indigenous Food Sovereignty Initiatives

Documenting Indigenous resource management, from the deep past through to the present day, contributes valuable support for both land-use planning and food sovereignty initiatives. This knowledge is being increasingly employed by Indigenous Nations as they reassert and reimagine land-use practices in the present and implement sustainable resource-use strategies for future generations (Hogg and Welch 2020, 2021; Lyons et al. 2021; Smith et al. 2022/23; Turner 2020; Turner et al. 2013). While archaeobotany is an underutilized data source in the Pacific Northwest, the ongoing work by Katzie demonstrates the continuity with landscape-wide practices known from oral history, ethnography, and ethnohistory. In this regard, we note that the compiled archaeobotanical data for asserted Katzie territory as a whole is relatively substantive but still wanting, reflecting the youthful state of the subdiscipline of archaeobotany in the region and the nature and focus of provincial legislation, policy, and archaelogical collection practices (Lepofsky et al. 2001, 2020; Lepofsky and Lyons 2013). Our intention with this article is to demonstrate a methodology for analysis at the landscape level as well as to advocate for the development of more robust archaeobotanical datasets that can be put to various community uses, including sovereign pursuits.

Specifically, we articulate how archaeobotanical knowledge is being used to effectively support Katzie's land-use planning process in the course of their bid to regain management jurisdiction over Widgeon Slough. Katzie has utilized archaeobotany as a valuable research methodology to help establish ancient baselines of plant use, scope, and management practices in order to envision and create principles for the restoration of a cultural keystone place and its attendant resources. Profound continuities between pre- and post-contact Indigenous management practices allow us to use the tools of archaeology and archaeobotany in order to speak in a language that Western-schooled decision-makers understand and appreciate. The Canadian legal system, which rests on foundational colonial assumptions about land use and the concept of *terra nullius*, puts the burden of proof for Aboriginal Rights and Title directly on Indigenous communities, who must provide evidence for the exclusivity, sufficiency, and continuity of their land use before and after "contact" (Hogg and Welch 2020; Martindale and Armstrong 2019; Reimer et al. 2022). Archaeobotanical data frequently show profound continuities with historically known plant-use practices documented by ethnographers, ethnohistorians, and oral historians, therefore bridging the pre/post-contact divide required in evidentiary claims. The results of this work thus have great import for First Nations seeking to acquire another evidentiary tool to use in multi-pronged efforts to regain Title and access to their lands and resources. Such tools serve the dual purpose of meeting the stringent legal criteria required by the state to advance claims while at the same time contributing to ongoing decolonization efforts aimed at recalibrating the broader politico-legal system from the inside out (e.g., Hoffmann et al. 2023; Lyons et al. 2022; Reid et al. 2021; Wilson-Raybould 2022).

While using archaeobotanical knowledge to achieve nation-to-nation goals, these data hold a significantly different place within a Katzie worldview. For Katzie leaders, researchers, Elders, and practitioners, learning about archaeobotany is just one way of bringing ancestral plant knowledge back into focus. It provides a gateway for reconnecting to Katzie lands and waters; to rebuilding relationships to plants, place, each other, and the language; and to re-establishing food security and regaining sovereignty over a homeland displaced and disrupted by colonial rule (Hoffmann et al. 2022b, 2023).

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