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Synthesis

Incorporating place-based values into ecological restoration

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ABSTRACT. Knowledge of how ecocultural landscapes co-evolved, how they were shaped and maintained by local people, and what processes disturbed the landscape should inform the planning, execution, and significance of restoration projects. Indigenous stewardship has resulted in legacies of diverse and productive ecocultural environments. Often, this stewardship has been guided by place-based values, which are informed by Indigenous knowledge, beliefs of equal respect for all ecosystem components, and conduct that sustains resource productivity. We propose that cultivating place-based values in restoration initiatives will provide reciprocal benefits by conserving biodiversity and promoting human connections to land. Drawing on lessons from Indigenous knowledge systems in what is now called British Columbia, Canada, we demonstrate how place-based values directed the stewardship of historical oak-meadow and clam gardens, which created diverse and productive ecosystems that sustained for millennia. Drawing on examples of contemporary restoration projects (crabapple orchards and clam gardens) that utilize place-based values to inform the recovery of ecocultural landscapes, we propose a framework to help initiate a place-based values approach in contemporary restoration design congruent with ethics of inclusion.

Key Words: *biodiversity; ecocultural; First Nations; Indigenous; placed-based; restoration; stewardship; values*

INTRODUCTION

Land and seascapes of cultivated and domesticated species have been tended to and utilized by people for centuries, resulting in the co-evolution of unique ecological and cultural (ecocultural) ecosystems (Pfeiffer and Voeks 2008). However, many Indigenous practices that have created, modified, and/or sustained ecocultural systems for millennia have been disrupted by colonialism (Senos et al. 2006, Heckenberger et al. 2007, Trauernicht et al. 2015, Armstrong et al. 2021), and the intrinsic value of biodiversity that is crucial to the cultural fabric of many societies is threatened (Ghilarov 2000, Kelbessa 2013). Place-based communities that depend on the biodiversity, productivity, and integrity of their immediate environment are directly and adversely affected by contemporary environmental degradation (Liu et al. 2007, Pfeiffer and Voeks 2008) and in colonial contexts, this disproportionally affects Indigenous peoples. Furthermore, ecosystems have become distressed in the absence of cultural practices and management that once sustained them (Senos et al. 2006, Hoffman et al. 2019, 2021).

Indigenous oral histories and multiple Western research disciplines (e.g., archaeology, anthropology, ecology, ethnobiology) have demonstrated how historical Indigenous stewardship has contributed to patterns of productivity and biodiversity at the landscape level (Trant et al. 2016, Schuster et al. 2019, Cox et al. 2020, Armstrong et al. 2021, Hoffman et al. 2021). For example, in South America landscape burning, crop diversification, and the creation of terra preta anthropogenic soils has shaped Amazonian biodiversity (Heckenberger et al. 2007, Pivello 2011, Levis et al. 2017). In Australia, Aboriginal peoples increased plant production and biodiversity through seed dispersal, soil turnover, burning, and hunting (Bowman 1998, Zeanah et al. 2017, Bird and Nimmo 2018). In the absence of Aboriginal practices both plant and mammal species richness has decreased in the Australian outback (Bowman 1998). In these and many cases, Indigenous stewardship has contributed to complex and resilient ecosystems that sustained human beings for millennia.

Indigenous groups have considerably different cultures; however, many of them share a notable commonality: place-based value systems. Values are defined as being potential determinants of preferences and attitudes (Lyver et al. 2016), which guide the practices and customs of a social group (Berkes and Turner 2006). Place-based values are reflective of a peoples' intimate connection to their local environment (Berkes and Turner 2006, United Nations Permanent Forum on Indigenous Issues 2006). These values are formed from a deep knowledge of local ecological processes developed through generations of learning by observation and by trial and error experimentation (Artelle et al. 2018). Place-based values that guide interactions with the environment can emerge from any community with a long-term relationship to place. However, in this paper, we have chosen to focus on place-based values as they are enacted in examples of Indigenous land and seascape management. Indigenous management can provide us with unique examples of how to create and sustain biodiverse, productive landscapes and seascapes that have co-evolved alongside people for very long-time scales (millennia).

Ecological restoration is another means of shaping, protecting, and conserving biodiversity. The practice of restoration is a process, aimed at supporting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Gann et al. 2019) often by industrialized cultures (Senos et al. 2006). Ecological restoration intends to shift degraded environments into a recovery trajectory, supporting the redevelopment and persistence of a native species assemblage, while still enabling adaptation to local and global changes (Gann et al. 2019). Often, the primary intent

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of restoration efforts is to regain ecological integrity and resilience, and little acknowledgement of the human landscape is used to drive goals or targets (Hallett et al. 2013).

The inclusion of place-based values has been called for in environmental management, stewardship, and conservation (Augustine and Dearden 2014, Artelle et al. 2018). In this paper we build off work by Augustine and Dearden (2014) and Artelle et al. (2018) by calling for the inclusion of place-based values into the practice of ecological restoration. In many instances, place-based relationships have been driving factors in increasing ecosystem productivity and biodiversity across local and regional levels (Trant et al. 2016, Bird and Nimmo 2018, Cox et al. 2019). We propose that to encourage culturally and ecologically relevant, community-engaged restoration projects, place-based values should be incorporated into restoration practice. We define place-based values-led restoration as efforts that convey clear, consistent objectives that are informed by inter-generational local knowledge, express aspects of respect to all ecosystem components, and aim to sustain ecosystem biodiversity and productivity. Place-based values led restoration is distinct from terms such as "ecocultural restoration" and "socioecological restoration" in that place-based values-led restoration projects are geographically, temporally, and culturally specific to place. Indigenous led restoration is often place-based; however, place-based values-led restoration does not have to be Indigenous led.

British Columbia (BC), Canada is exceptional for its ecocultural diversity. BC contains diverse ecosystems that support some of the last intact wildlife communities found in North America (Shackelford et al. 2017). BC comprises Indigenous territories inhabited by Indigenous Nations with inherent rights and title to access and harvest land and resources (BC Treaty Commission 2020). Despite the genocidal attempts of colonialism to assimilate Indigenous peoples and lands, and to extinguish Indigenous rights and title, Indigenous peoples, their laws, cultures, landscapes, and management practices have endured. Indigenous peoples have been present in BC since time immemorial (at least 14,000 years; McLaren et al. 2015, 2018) and the potential for land and sea management practices extends back thousands of years. Accordingly, this stewardship has contributed to the unique biodiversity of the province (Turner 2007).

In this paper we, (1) explore how place-based values established specific Indigenous practices that influenced productivity and biodiversity in BC (our research draws on historical examples, although we respect that this stewardship is still practiced by Indigenous peoples today), and (2) discuss how cultivating place-based values in restoration initiatives can contribute to creating and sustaining diverse and productive ecocultural landscapes that provide reciprocal benefits to humans and non-humans alike. We draw on examples from the literature and from our own experiences. S.B.W. (settler) is a graduate student working with and for the Wuikinuxv Nation on terrestrial ecology and restoration; S.A. (Hul'q'umi'num') is a graduate student, policy advisor, and clam garden restoration practitioner; A.F. (settler) is the Wuikinuxv Stewardship Director; D.L.M. (Cree/settler) is an ethnoecologist, archaeologist, and faculty member; N.S. (settler) is a restoration ecologist and faculty member; J.W. (Wuikinuxv) is an Indigenous scientist and Wuikinuxv Council member; A.J.T. (settler) is a historical ecologist and faculty member.

Place-based values

A literature review and discussions between co-authors highlighted four important features of place-based value systems:

1. Belief systems: Place-based values are grounded within a belief system that promotes respect (Turner and Mathews 2020). Many Indigenous belief systems ascribe to various versions of relational worldviews, which assume all ecosystems components are related, interconnected, and that the survival and success of each is dependent on the survival, success, and reciprocity of others (Henderson 2000, Salmón 2000, Kimmerer 2014). Crucial to this belief is that humans are neither above nor below others in the circle of life and all life is equally sacred (Henderson 2000, Wilson 2008, Atleo 2011, Tuck and McKenzie 2015).
2. Knowledge: Place-based value systems are informed by dynamic, inter-generational, or long-term knowledge of place, such as Indigenous knowledge (IK) or local ecological knowledge (LEK). IK is grounded in spiritual worldviews and cultural values and has emerged from centuries of survival strategies and cultural systems that have sustained Indigenous communities (Simpson 2004, Smith 2012); different systems and bodies of knowledge are held by different Indigenous groups (Kawerak Inc. 2017, https://kawerak.org/wp-content/uploads/2018/04/Kawerak-Knowledge-and-Subsistence-Related-Terms.pdf). IK includes traditional ecological knowledge (TEK; Kawerak Inc. 2017), which relates to Western concepts of ecology and the environment; however, not all definitions of TEK recognize the effects of Indigenous worldviews/values/beliefs on cumulative knowledge systems (Dudgeon and Berkes 2003, Simpson 2004). LEK encompasses long-term knowledge of place, including ecosystem processes and how humans have affected these processes. However, LEK does not have to be inter-generational and can be informed by a different worldview and set of responsibilities than IK (e.g., one that is not relational; Gann et al. 2019).
3. Conduct: Place-based values guide principles, protocols, objectives, practices, and rituals that safeguard against exceeding ecological limits now and into the future (Turner and Berkes 2006, Artelle et al. 2018). This includes the observations, experimentations, and persistent practices that inform Indigenous knowledge.
4. Attachment to place: Place-based values are grounded in a connection to a specific land and/or seascape.

Over time, the connections and feedbacks between these, other features of place-based values, and the surrounding environment, shape place-based value systems, place-based peoples, and their environments, resulting in the co-evolution of an ecocultural landscape.

Place-based values support biodiverse, productive ecosystems

Evidence from multiple forms of knowledge suggests that complex, integrated environmental management systems developed historically by Indigenous peoples contributed to patterns of biodiversity and productivity seen across BC, many of which persist today (e.g., Hoffman et al. 2017, Cox et al. 2019, Fisher et al. 2019, Armstrong et al. 2021). Indigenous management systems are the conscious and skillful application

of any combination of methods that sustains or enhances the availability, abundance, diversity, and/or quality of a resource or resource habitat over generations (Turner 2014). Indigenous management systems are value-led (Artelle et al. 2018) and in this way, many Indigenous management systems are consistent with the concept of stewardship (Lertzman 2009, Whyte et al. 2016). Stewardship is primarily concerned with the conservation and sustainability of the resource at hand because of values that imply an obligation to that resource (Lertzman 2009). While acknowledging that not all Indigenous management is necessarily in line with stewardship (nor does it need to be) in this paper and in the examples we focus on, we will use the terms interchangeably.

Ecocultural land and seascapes created by Indigenous management in BC include (but are not limited to): stone fish trap communities, eelgrass harvesting meadows, seaweed harvesting rocks, estuarine root gardens, crabapple and hazelnut orchards, berry gardens, forest gardens and wapato gardens (White 2003, Turner and Turner 2008, Cullis-Suzuki et al. 2015, Hoffmann et al. 2016, Lepofsky et al. 2017, Mathews and Turner 2017, Armstrong et al. 2021). Place-based values directed the stewardship that sustained these complex and resilient ecosystems for millennia. In this section we describe two additional ecocultural environments: Coast Salish oak-meadow gardens (hereafter referred to as oak-meadow gardens and also known as Garry oak habitats, ecosystems, etc.) and clam gardens in an effort to demonstrate how the features of place-based value systems (beliefs, knowledge, conduct, and attachment to place) contribute to shaping the biodiversity and productivity of these environments.

We provide historical examples not to romanticize the past (both anthropogenic burning and clam gardening are still practiced today), but to demonstrate some of the ecological consequences of non-Western, long-term landscape management, values, and worldviews. Both oak-meadow and clam garden ecosystems are found across large geographical regions and we discuss their stewardship in generalized terms. However, it should be recognized that the practices and beliefs associated with the stewardship of oak-meadow and clam gardens were far more culturally, spatially, and temporally diverse than we have described in this article.

Anthropogenic landscape burning in oak-meadow gardens

For millennia across southwestern Vancouver Island and adjacent lands, Coast Salish peoples have consistently and expertly employed anthropogenic burning, which has become integral to creating oak-meadow gardens (Fig. 1A; Pellatt and Gedalof 2014, Lake and Christianson 2019). A principal motivation for this has been to create habitat that supports the productivity of the nutritionally and economically important root, blue camas (*Camassia quamash* and *Camassia leichtlinii*; Turner 1999, Beckwith 2004, Storm and Shebitz 2006). Unlike large and destructive wildfires these controlled, low-intensity fires served additional often simultaneous purposes, including increasing the productivity of other culturally important plants such as berries, clearing travel routes, creating fire breaks near habitation sites, accelerating nutrient cycling, and promoting early successional vegetation that attracts more game (Boyd 1999, Turner 2014, Lake and Christianson 2019, Hoffman et al. 2021).

Fig. 1. Examples of ecosystems associated with Indigenous management: (A) Cowichan Garry Oak Preserve in WSÁNEĆ territory, South Vancouver Island, British Columbia (BC; photo courtesy Kelly Fretwell), (B) clam gardens in WSÁNEĆ territory, Gulf Islands National Park Reserve, BC (photo courtesy Iain Robert Reid), (C) crabapple orchard in Wuikinuxv territories, Central Coast, BC.

Coast Salish fire management has been based on leadership and inter-generational knowledge transfer (Turner 1999). Using fire effectively requires significant local knowledge and expertise, including a fine-tuned understanding of different environmental and climatic indicators specific to a place. Short-term factors informed burns, such as prevailing wind direction, and soil moisture (Turner 1999). Decadal and longer term factors that Coast Salish fire managers considered are planning burning frequency with the intention of reducing fuel loads to lower fire intensity, considering the desired patterns of habitat succession across a landscape, creating productive ecological edges, and deliberating on plant community health due to long-term weather patterns (Turner 1999, 2014). Landscape burning was a sacred ceremonial practice and an art form, informed and guided by cultural protocols and Indigenous laws and were only to be overseen by experts who had life-long training on the subject (Turner 2014).

In many cases, burning experts were community or house leaders, who would direct community members on the proper timing and extent of burns (Turner 2014). In other cases, the responsibility of burning was carried out by designated stewards. Protocols endowed a responsibility to keep sites properly tended through the use of fire. For example, camas meadows and oak habitats were often burned every year or two. Without fire, these open landscapes would have transitioned to closed canopy forests that yield a relatively low amount of food species (Turner 2014). It was recognized that fire was an important factor in maintaining and sustaining habitats that yielded food security. Whether it be by house leaders or designated stewards, fire management was deeply respected and conducted at the optimal times and under appropriate conditions in order to ensure food resources were consistently available (Turner et al. 2013).

Mature oak trees sustain little damage when exposed to low intensity fire at moderate intervals (3–5 years; Hamman et al. 2011, Long et al. 2016). At the ground level, fire consumed moss, leaf litter, dry grasses, shrubs, as well as young trees and seedlings of non-fire adapted species (such as many conifer species; Hamman et al. 2011). In Coast Salish territories, this created suitable seedbed for fire-adapted species and stimulated the germination of grasses and forbs (Gedalof and Franks 2019). Fire enabled the development of alternative system states by creating an open canopy and enabling grass and forb growth that would not be seen in a closed-canopy forest (Pellatt and Gedalof 2014). Diversity can be increased through the creation of environmental heterogeneity—patches of habitat at multiple ecosystem states spread throughout the landscape (Smith and Wishnie 2000, Balée 2006, Ponisio et al. 2016). A diversity of successional stages can attract species that utilize the landscape in different ways and enables the co-existence of many species in a given area (Fuchs 2001, Bird et al. 2016, Bliege Bird et al. 2018). Ultimately, low intensity burning at moderate intervals created open Coast Salish oak-meadow garden complexes: highly diverse, forb-dominated communities with a sparse overstory of oak and Douglas-fir (*Pseudotsuga menziesii*; Pellatt and Gedalof 2014, Pellatt et al. 2015). At local scales this created one of the most biodiverse terrestrial communities in Canada (Fuchs 2001) and increased habitat heterogeneity at the landscape level.

Clam gardens

Clams (Phylum Mollusca Class Bivalvia) are a food resource for many coastal Indigenous peoples across BC, important throughout the year and vital in the winter. In the past, clams were eaten raw, steam cooked, or preserved by smoke-drying (Deur et al. 2015, Lepofsky et al. 2015, Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016, Salter 2018). Clam gardens are a system of mariculture constructed by building rock walls or terraces near the lowest intertidal zone of a shoreline (Fig. 1B; Groesbeck et al. 2014, Lepofsky et al. 2015, Smith et al. 2019). These human constructed intertidal rock-walls trap sediment and reduce the slope of beaches, creating both a soft sediment terrace and novel rocky reef habitat that increase the habitat, productivity, and standing stock of native clams (*Saxidomus gigantea, Leukoma staminea, Clinocardium nuttallii, Tresus* spp., *Macoma* spp.; Hul'q'umi'num' Treaty Group 2011, Groesbeck et al. 2014, Jackley et al. 2016). Historical coastal peoples from northern Washington up to Southeast Alaska left an extensive record of clam gardens throughout their territories (Smith et al. 2019).

Building, maintaining, tending, and harvesting clam gardens requires a wealth of knowledge, which would have been learned over time through observation and experimentation at a specific place (Deur et al. 2015, Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016, Olsen and W̱SÁNEĆ Leadership Council 2019). To maximize productivity, clam gardens must be positioned at a specific tidal height and the substrate must be aerated and of optimal grain size (Groesbeck et al. 2014, Jackley et al. 2016). The practice of harvesting larger clams and leaving juveniles behind allowed for a proliferation in both size and numbers (Deur et al. 2015, Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016).

Conduct around clam garden maintenance and harvesting was tightly controlled to ensure the continuance of this food resource. In Kwakwaka'wakw territories clam gardens were traditionally owned by specific families and harvests were governed by the heads of these families (Deur et al. 2015, Jackley et al. 2016). Rules such as, (1) restricting access to specific harvesting locations, (2) limits on the duration of harvest, and (3) intentional harvest closures to allow for population recovery, were imposed to ensure that clam resources were not overexploited (Deur et al. 2015, Jackley et al. 2016). These guiding principles also displayed an intimate knowledge of clam garden responses to anthropogenic and environmental effects (Deur et al. 2015).

Inherent to beliefs of respect for all life forms, many Indigenous peoples recognize that animals have familial communities (Atleo 2011). For many Indigenous groups throughout coastal BC, clams are regarded as being relatives in a different form, having families and societies in a similar fashion to humans (Deur et al. 2015). Clam families and societies have abilities and needs, and if clam harvesters were able to ensure that clams had their needs met, it was believed that the clams had the ability to support the needs of humans by presenting themselves abundantly for harvest (Deur et al. 2015). These beliefs guided practices that fostered respect and reciprocity for clams as well as increasing clam biomass and encouraging sustainable harvests.

Clam gardens enhanced clam productivity and also diversified coastal community assemblages (Deur et al. 2015, Cox et al. 2019, 2020). Ecological and archaeological investigations demonstrate higher growth rates, survivorship, densities, and biomass of clams in walled gardens (despite harvesting pressures) as opposed to non-walled beaches of similar tidal height, slope, and substrate (Groesbeck et al. 2014, Jackley et al. 2016, Toniello et al. 2019). Additionally, the in-and-epi faunal communities of clam gardens are distinct from similar mud and sand flat habitats (Cox et al. 2019). These patterns of productivity and diversity persist in community assemblages even though the clam gardens that were studied had not been actively stewarded for over 150 years (Cox et al. 2019, Toniello et al. 2019). Further, the rock wall structures trap sediment and create habitat for a variety of other marine species such as seaweeds, sea cucumbers, crabs, and small fish (Lepofsky and Caldwell 2013, Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016, Olsen and W̱SÁNEĆ Leadership Council 2019). In turn, the abundance of clams and their associated faunal communities supported higher trophic level consumers such as seabirds, river otter, raccoon, and mink, thus increasing local diversity (Deur et al. 2015).

Examples of place-base values in restoration efforts

Across BC, values-led restoration approaches exist in both Indigenous and non-Indigenous communities. We have defined place-based values-led restoration as efforts that convey clear, consistent objectives that are informed by inter-generational local knowledge, express aspects of respect to all ecosystem components, and aim to sustain ecosystem biodiversity and productivity. The practices that stem from place-based values-led restoration should recognize the role humans have played in ecosystem stewardship and serve to further connect people to place. When possible, these restoration efforts should incorporate long-term management and engagement plans. Below, we

describe two case studies of contemporary Indigenous restoration:

Wuikinuxv lhènx̌ (crabapple) project
Wuikinuxv territories are located in a remote region on the central coast of BC (Fig. 2). The Wuikinuxv village of Katit is the full-time home of ~60 people and a further ~250 Wuikinuxv Nation members are based elsewhere (British Columbia Assembly of First Nations [date unknown]), and return throughout the year for seasonal hunting and fishing. In the past crabapple (*Malus fusca*) was an important source of food for humans, bears, and other animals throughout Wuikinuxv territories (J. W., *personal observation*).

Fig. 2. Map of coastal British Columbia showing the approximate location of the Lhènx̌ (crabapple) orchards in Wuikinuxv territories and the clam gardens in the Gulf Islands National Park Reserve located in Coast Salish territories. Map courtesy of the Hakai Institute.

Pacific crabapple is an iconic plant for coastal First Nations; it is named in over 31 languages (Turner 2014) and was an important component of historical diets (Turner and Turner 2008). The fruits of crabapple trees (*lhènx̌* in ’Wuikala) were a culturally important food, served and gifted at feasts throughout Wuikinuxv territories (Compton 1993). They could be eaten fresh, dried, or stored in oil or water (Compton 1993). Crabapple trees were used for multiple purposes: the hardwood was used for tools such as spoons and digging sticks, the bark was chewed for hunger suppression, and licorice ferns (*Polypodium glycyrrhiza*) and lichens (*Usnea* and *Alectoria*) were collected from crabapple branches and used as medicines and materials (Compton 1993).

Wuikinuxv elders have recollections of tree management by fertilizing, pruning, and transplanting *lhènx̌* trees into groves or orchards (Fig. 1C). However, genocidal colonial policies disrupted traditional Wuikinuxv land management practices and *lhènx̌* trees have not been stewarded in over 80 years, which may be the reason they no longer fruit. A lack of *lhènx̌* has resulted in decreased food resources for wildlife in the territories. Over this same time period, a variety of factors, mostly importantly commercial overfishing, have decimated local salmon stocks (Gresh et al. 2000). Salmon and *lhènx̌* fruit are two important food sources for bears (Adams et al. 2017) and their decline has contributed to bears scavenging in the village, increasing potentially dangerous human-bear interactions. Western methods of bear control often resulted in bears being killed by Conservation Officers, which upset Wuikinuxv Nation members (J.W., *personal observation*).

Beginning in early 2020 the Wuikinuxv Stewardship Department initiated a *lhènx̌* re-management project in collaboration with some of the authors of this paper. The intent of this project was to increase productivity of *lhènx̌* by restoring historically managed trees and cultivating volunteer trees. The project goals were to provide bears with more food in the form of *lhènx̌* at sites throughout Wuikinuxv territory (and in doing so, entice them out of the village), and to reconnect people in the community (especially youth) with harvesting and managing *lhènx̌* trees through participation in restoration and monitoring. In order to achieve these goals, the following objectives have been set: (1) survey existing orchard and volunteer sites throughout Wuikinuxv territories, (2) increase crabapple production using management methods remembered by elders, e.g., pruning and fertilizing, (3) monitor the survival/production of re-managed trees, (4) monitor the bear consumption of crabapples at restoration sites, and (5) engage and encourage community participation through restoration and harvesting events.

Evidence of place-based values directing the Wuikinuxv *lhènx̌* project are identifiable within the goals and objectives of the project. IK has been used to inform survey and restoration sites. Elders have provided inter-generational knowledge to determine which restoration treatments are to be applied to trees. Increasing *lhènx̌* production for bear consumption shows respect to animal life forms and monitoring tree survival and *lhènx̌* production displays respect for plant life forms. Monitoring also demonstrates conduct that is committed to the sustainability and productivity of *lhènx̌* in the long term. Encouraging community engagement in restoration events recognizes the value of human stewardship and further ensures long-term project sustainability by cultivating new human-environment relationships.

It is worth noting that the re-management of *lhènx̌* trees at historical orchards may recreate historical conditions. Although this is often a goal for many restoration projects, it is an unintentional by-product in this case. The specific goal of this project (increased *lhènx̌* production for bear consumption) is emphasized in the new practice of cultivating volunteer trees, which may create a novel ecosystem.

Hul’q’umi’num’ and W̱SÁNEĆ clam garden restoration in the Gulf Islands National Park Reserve
In southernmost BC lie the Gulf Islands, home of endemic coastal ecosystems, a Mediterranean climate, and within the traditional territory of 19 Coast Salish Indian Bands, including Hul’q’umi’num’ and W̱SÁNEĆ communities. This region is also one of the most densely populated marine areas in Canada with two major urban centers, international shipping routes,

commercial fishing industries, marine tourism industry, and over 3 million people (Bodker and Philibert 2016). Hul'q'umi'num' and W̱SÁNEĆ peoples have actively stewarded this coastal landscape for millennia, shaping many novel ecosystems including clam gardens. In Coast Salish territory the physical structure of low tide rock wall is supported by a system of beach tending practices including tilling, selective harvesting, garbage removal, and discouraging predators (such as river otters, raccoons, and mink) through monitoring (Deur et al. 2015, Lepofsky et al. 2015, Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016, Olsen and W̱SÁNEĆ Leadership Council 2019).

Over 11,000 years of continuously rising sea levels (Fedje and Sumpter 2009, James et al. 2009) has meant intertidal rock walls —dating to the mid-late Holocene—require continuous maintenance to function as intended (Smith 2019). Without this maintenance clam garden rock walls become fragmented and intertidal terraces creep below ideal tidal heights for target species. However, clam gardening within Coast Salish territory has been interrupted because of colonial practices, land privatization, pollution, commercial overharvesting (Fediuk and Thom 2003), and a lack of maintenance (Lepofsky et al. 2015). Many beaches throughout the Gulf Islands currently have low densities of clams (Parks Canada 2010). Elders state clearly that to bring beaches back to life, people need to be on the clam gardens, caring for them again (Hul'q'umi'num' Treaty Group 2011, Lepofsky et al. 2015, Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016, Olsen and W̱SÁNEĆ Leadership Council 2019).

Following the guidance of Coast Salish knowledge holders, in 2014 Hul'q'umi'num' and W̱SÁNEĆ Nations, in collaboration with Parks Canada, began a restoration experiment (led by one of the authors of this paper) to bring people back onto beaches and re-establish ancient human-nature relationships by reintroducing Coast Salish beach tending practices to untended clam gardens (Fig. 2). Since 2014, project goals have evolved and now include (1) ensuring functional densities of all key clam garden species, (2) ensuring food species are safe for human consumption for generations into the future, and (3) building the financial and resource capacity for Coast Salish Nations to lead this work into the future. Each goal includes elements that require ecological restoration, cultural resurgence, policy reform, and strengthened relationships.

These goals not only increase ecosystem health through the maintenance of intertidal productivity and biodiversity, but also provide opportunities for Coast Salish people to reconnect with territory and practices, learn intergenerationally on the land, and improve the way Indigenous knowledge and Western science are used together within contemporary resource management. One important element of the work includes training youth in language, culture, and science. Since 2014, this has included intergenerational restoration efforts as well as annual science and culture camps for youth.

All restoration practices come from the people of these places. For instance, Hul'q'umi'num' and W̱SÁNEĆ knowledge holders emphasize the importance of supporting key species that are missing from untended clam gardens in order to restore the relationships between those ecosystem components (Hul'q'umi'num' - Gulf Islands National Park Reserve Committee 2016). Restoration practices have been refined through careful observation of changes that occur to habitat structure and condition, shifts in water movement, species characteristics, and ecosystem diversity. Efforts to restore clam gardens are based on a growing understanding of the critical role humans have played, and continue to play, in shaping, maintaining and protecting the landscapes and seascapes we value today.

DISCUSSION

In this paper we have outlined how the enactment of place-based values through Indigenous stewardship has influenced patterns of productivity and biodiversity in order to create an appreciation for the role of place-based values in the evolution of landscapes. We described two contemporary restoration initiatives that have incorporated place-based values into their practices. Incorporating place-based values into restoration efforts provides a critical opportunity to appreciate the potential for humans to shape and sustain future ecosystems. In the discussion, we consider some of the realities of integrating place-based values into restoration work to help inform opportunities moving forward.

In Table 1, we outline how the features of place-based values might translate into questions, restoration action, and have provided examples from the Wuikinuxv *lhènx̌* project to help conceptualize the actions. These actions and questions can be applied to urban, rural, and large- or small-scale restoration initiatives as a framework to begin applying place-based values to restoration planning and implementation. The localized and site-specific nature of place-based values make them particularly applicable to restoration planning and design, which is also site specific (Kimmerer 2000).

Reconsidering the reference and how to measure success

Identifying the place-based values associated with a site can help to understand the past processes that shaped the site. Ecological restoration requires in-depth knowledge about ecosystems and their dynamics, including an environment's relationship to humans and their societal values, activities, patterns of resource use, and impacts (Uprety et al. 2012). Without the knowledge of how or why a landscape came to be, restoration projects can produce landscapes without meaning (Allison 2004). For example, Olwig (1995) argues that the restoration of a Danish River from a linear feature to a meandering stream will be done in vain unless the ancient agricultural system that originally created meandering streams is resurrected. A clear understanding of all the processes (environmental and societal) that shaped the landscape being restored is required to avoid ecological impracticality or harm.

Many of the landscapes we seek to preserve were created by millennia of human intervention and their restoration will require sustained human management. For example, continuous and frequent anthropogenic burning created a complex oak-meadow ecosystem, which contains a mosaic of open canopy stands and prairie habitat, and their restoration and recovery will be dependent on a regime of frequent, low-intensity, intentional burning (Pellatt and Gedalof 2014). This concept of human-sustained ecological restoration diverges from other concepts of restoration that center human-free visions of resilience. For example, rewilding frameworks aim to "minimize or gradually

Table 1. Proposed Framework for initiating a place-based values (PBV) approach into restoration planning and implementation. Inspired by Table 2 in Artelle et al. 2018. This framework was built for people considering how to implement place-based values in restoration and to clarify how actions relate to the features of place-based value.

PBV Feature	Action	Questions	Examples from the Wuikinuxv *Lhènx̌* Project
Knowledge, Belief System, Attachment to place	Identify knowledge holders.	Who are the people already associated with this place? Who carries the knowledge of this place and this system? Who will be associated with this place and who will be the knowledge holders of the future? Is any knowledge sensitive?	Determined via Stewardship Committee meeting discussions and conversations with elders and community members.
Knowledge, Belief System, Attachment to place	Identify the values associated with the place.	Which ecosystem services should be prioritized? Cultural/spiritual priorities?	Values embedded in Wuikinuxv culture. Priorities determined as above: care for place and non-human kin and engage youth so they can re-learn traditional practices.
Belief System	Identify values that should/could be associated with place.	(Especially if there are none identified in step 2)	
Knowledge, Belief System	Decide on which values should be prioritized.	Whose privilege is it to decide this? Who holds decision-making authority? Whose decision-making authority will require support to be equitably included?	Stewardship Committee and Councils privilege to support the project with resources. Community support integral to Council support.
Conduct, Knowledge	Translate values into objectives.	Do these objectives ultimately foster social-ecological resilience?	Objectives determined based on priorities.
Conduct	Translate objectives into practice.	Are there already practices in place? What are their effects?	No practices currently in place, only memories of past practices.
Conduct	Enforce/encourage practices.	Evaluate how to best do this: Laws? Policy? Cultural protocol?	Requested funding to create a small work team dedicated to fulfilling objectives. Enlisted a graduate student to support work team.
Knowledge, Attachment to place	Share efforts, educate.	Are all community members informed? Do all communities members have an opportunity to contribute and spend time on the land?	Work team to engage with Stewardship Committee on a yearly basis and organize school trips to restoration and harvesting sites. Project updates and invitations to join restoration/harvesting events shared via community Facebook page.
Conduct, Knowledge	Monitor and adapt.	Are the practices and effects benefitting humans and the ecosystem? How can they?	Work team to monitor tree growth, fruiting, and bear visitation on a yearly basis and adapt treatments based on monitoring data and Stewardship Committee/community feedback.

reduce human interventions" (Perino et al. 2019:1). However, passive management techniques such as rewilding may not be appropriate for the restoration of landscapes with complex human-environment relationships (McIver and Starr 2001, Shackelford et al. 2019). Identifying the persistent human influences that shaped landscapes can help to inform the future role of humans in long-term management plans.

Including place-based values in restoration provides a chance to consider how humans and non-humans have used, and will use, the site in question. Recognition that humans can provide beneficial services to ecosystems, and that they are not always the source of environmental degradation, enables human-led restoration projects to be less focused on bringing back the imagined and static historical state of an ecosystem, and more focused on developing an ecocultural landscape that provides reciprocal benefits to all members of the affected communities (human and non-human) through ongoing practice (Armstrong et al. 2021, Lee et al. 2021). Incorporating place-based values into restoration projects could entail the inclusion of introduced species if they are important culturally (Pfeiffer and Voeks 2008). For example, the herb *Plantago major* was imported to North America during the arrival of European colonists and is now considered naturalized (Rousseau 1966, Mack and Lonsdale 2001, Kimmerer 2014). In the years since its arrival, *P. major* has become an important medicinal plant for many Indigenous communities (Kuhnlein and Turner 1991, Pfeiffer and Voeks 2008, Kimmerer 2014). Dandelions (*Taraxacum*), Pacific oysters (*Crassostrea gigas*), and potatoes (*Solanum tuberosum*) are further examples of non-native species that have become culturally or economically important to their places of introduction (Miossec et al. 2009, Jones et al. 2011, Wenstob 2011, Larson et al. 2014). Although these species have provided cultural, medicinal, ecological, or economic benefits, there can be complex consequences to species introductions. For example, on the

islands of Haida Gwaii, non-native Sitka black tailed deer (*Odocoileus hemionus sitkensis*) are an important food source culturally. However, through grazing on the forest understorey, they have reduced the diversity of plant and animal communities (Martin et al. 2010). Restoration planning informed by geographically and temporally dynamic place-based values would need to be considerate of all interconnected ecological and cultural ecosystem components when considering the maintenance or removal of species (Augustine and Dearden 2014).

Utilizing place-based values in restoration also provides the opportunity to revitalize human-environment connections. When restoration work focuses too heavily on technical aspects of projects (e.g., seed density and mixtures, germination trials), the chance to cultivate personal connections with the environment is lost (Higgs 2003). However, cultural engagement requires multiple efforts, long-term commitments, and thoughtful deliberation (Higgs 2003). Incorporating place-based values into restoration planning can provide community members and practitioners the opportunity to collaborate on the design, goals, and objectives of restoration. Active incorporation of these values can also lead to stronger connections between restoration practice and the names and stories associated with places (Gray and Rück 2019). These cultural dimensions of the environment highlight our meaningful relationship with the landscape, and further strengthen human connections and attachments to place (Simpson 2014). Place-based storytelling can provide inter-generational guidance for stewardship (Wehi and Lord 2017) and provide alternative methods of engagement. Successful engagement is key to sustaining ecological restoration (Higgs 2003) and can also enhance human well-being (Rey Benayas et al. 2009, Poe et al. 2016).

Indigenous inclusion and colonialism

Colonization introduced an onslaught of disease, epidemics, displacement, and attempted assimilation across the globe (UN General Assembly 2011). By removing Indigenous peoples from their territories and disrupting embedded relationships to place, colonialism has not only been harmful to human communities, but also to non-human kin (Wildcat 2009, Irlbacher-Fox 2014). The early foundational definition of restoration as a recovery of an ecosystem to a self-sustaining state, free from human influence (Society for Ecological Restoration International Science & Policy Working Group 2004) erased the historical and enduring role of Indigenous land and seascape stewardship (Dickson-Hoyle et al. 2021). As restoration evolves to a deeper understanding and inclusion of human-ecosystem relationships, critiques of colonialism and/or Western science cannot be absent from discussions of climate change and environmental degradation. Without their explicit inclusion, restoration will continue to erase Indigenous relationships to place and fail to address the underlying harmful and unsustainable systems that have led us to a point of climate and environmental crises in the first place (Jimmy et al. 2019).

For non-Indigenous practitioners, it is important to recognize that place-based and Indigenous communities hold knowledge about the Earth and other beings differently than Western scientists do (Black Elk 2016, Whyte et al. 2016), and acknowledge that there is an unevenly shared responsibility for creating ecological crises. In many cases, Indigenous stewardship modified environments and created beneficial ecological legacies, such as shell middens providing nutrient subsidies to forests making vegetation larger, more productive, and more diverse than areas without shell middens (Cook-Patton et al. 2014, Trant et al. 2016). On the other hand, Western and/or colonial management practices often transform environments. For example, clear-cutting forests, mining, dams, and large-scale agricultural all fundamentally change landscapes, often irreversibly. This erasure of place has ramifications for social-ecological integrity but can be actively countered through considerate restoration (Dickson-Hoyle et al. 2021).

With consent and consideration, engaging with Indigenous communities/scientists/restoration practitioners on restoration projects can provide opportunities to support reciprocal benefits for all communities involved (human and non-human; Lee et al. 2021). However, particular care should be taken to ensure engagement methods are not extractive (Liboiron 2021, Trisos et al. 2021). Inclusion should not create burden for Indigenous communities, whose capacities are sometimes limited because of historic and current colonial policies. Intellectual property rights should be protected and sensitive information (such as harvest locations) should not be made public (Trisos et al. 2021). Indigenous knowledge and expertise should be paid for, in a manner equal to how a professional or academic expert would be paid (Liboiron 2021). When envisioning long-term projects involving cross-cultural collaborations, all parties should commit to developing stamina, flexibility, and humility (Jimmy et al. 2019). This will increase capacity to sustain relationships to humans with other ways of knowing, which will ultimately create better relationships to the land for all involved (Jimmy et al. 2019).

Unfortunately, Indigenous knowledge is often considered subjective evidence, only acceptable when supported by Western science (Liboiron 2021). This methodology maintains the supposed superiority of Western science over Indigenous knowledge (Simpson 2004, Liboiron 2021) and further exacerbates the linked processes of environmental and cultural degradation. However, Indigenous-led restoration can provide opportunities to strengthen movements of reconciliation, decolonization, and Indigenous self-determination (Dickson-Hoyle et al. 2021). Restoration and monitoring can demonstrate Indigenous continuity in territorial occupation that can help assert rights and access to traditionally managed lands (Armstrong and Veteto 2015), and provide evidence for Treaty negotiations (in countries such as Canada). Restoring "relationships of mutual obligation between land and people" and considering people as beneficial components of functioning ecosystems can disrupt Western and/or colonial beliefs of land as property and resource (Burow et al. 2018:60). Encouraging human facilitated ecosystem recovery with methods informed by Indigenous Knowledge can re-awaken traditional land use practices and connect younger generations to their ancestral territories and traditions (Simpson 2014, Wehi and Lord 2017). Restoration and re-management of particular places that are important for people's lifeways and identities (aka cultural keystone places) can provide opportunities for land-based teaching and learning and contribute to the integrity and resilience of Indigenous communities (Deloria and Wildcat 2001, Simpson 2014, Cuerrier et al. 2015).

CONCLUSION

The formation of place-based values is circular: restoration practice is one method of spending time on a landscape that leads to the formation of beliefs, knowledge, and rituals, which accumulate into place-based values (Berkes and Turner 2006). These acquired values guide a dynamic, co-evolving relationship with place and inform future generations on respectful, sustained relationships with their surroundings (Artelle et al. 2018). The contemporary movement and settlement of people around the world may seem like a barrier to the formation of place-based values. However, this globalization can be responded to by learning from and being respectful of the knowledge, laws, and protocols of the place-based people at a given location (Kimmerer 2014, Frid 2020). Creating space for Indigenous-led restoration practice to re-claim stewardship roles will be vital to support the well-being and cultural identity of Indigenous peoples and aid in processes of decolonization and Indigenous self-determination (Simpson 2014, Dickson-Hoyle et al. 2021).

Whether new-formed or millennial, relationships between place-based people and their environment not only enable sustained long-term human well-being but are also critically important in supporting the health and resilience of ecological communities (Cuerrier et al. 2015, Bird and Nimmo 2018). As displayed in examples of Indigenous stewardship across BC, forming, fostering, and incorporating place-based values into ecological restoration can help design resilient ecocultural ecosystems that sustain.

Responses to this article can be read online at:
https://www.ecologyandsociety.org/issues/responses.php/13370

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Erratum: The original PDF of this publication did not include the entire Literature Cited. The error was corrected on 14 September 2022.

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