To What Extent Did Indigenous Peoples Manage Clam Gardens Along the Intertidal Zone on the Coast of British Columbia?

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Abstract

This paper was originally written for Dr. Tara Holland's EVSC 201W: Environmental Science in Practice. The assignment asked students to develop and answer a Question in environmental science that is of particular interest and answer the question through analyzing relevant literature. The paper uses APA citation style.

While Indigenous knowledge has existed and sustained populations for thousands of years, it is only recently that Western science is beginning to scratch the surface on understanding Indigenous ways of life. Through developing this understanding, much Indigenous knowledge is being acknowledged as scientific. One of the many examples is the presence of Indigenous built and maintained clam gardens off the coast of British Columbia. These clam gardens were built by Indigenous peoples for the purpose of having a reliable and sustainable food source. This study serves as an analysis of the given Western and Indigenous scientific literature pertaining to clam gardens and how the given findings relate to Indigenous clam gardens being viewed as scientific. The results of the analysis illustrate that Indigenous people's maintenance of clam gardens has been so extensive that it has ultimately increased marine production and biodiversity and can be dated back nearly 3.5ka off the coast of British Columbia. These findings are significant as they can go a long way towards countering the erasure of Indigenous peoples from the land and aiding in gaining land back.

Introduction

Increasingly around the globe Western science is acknowledging Indigenous knowledge as scientific (Deur et al., 2015; Lepofsky & Caldwell, 2013; Mistry & Berardi, 2016; Sidik, 2022). Examples of this can be seen in Indigenous stewardship, maintenance of global forest cover to mitigate climate change and that approximately 86% of global biodiversity hotspots occur on Indigenous maintained land (Beattie et al., 2023; Fa et al., 2020). However, this acceptance and acknowledgment is very recent and there remains debate and apprehension. Recently, Indigenous maintained clam gardens have become an area of interest to Western scientists for food management strategies as the world increasingly suffers from climate change, with many leading contributors being related to food production and management (Salmon, 2000). Indigenous peoples engineered clam gardens along beaches for a reliable and nutrient rich food source (Dick et al., 2022; Groesbeck et al., 2014; Holmes et al., 2022). These gardens consist of a rock wall formed at the low tide mark to section off and flatten the upper portion of the beach for clam habitat (Deur et al., 2015; Dick et al., 2022; Lepofsky et al., 2021). The rock wall is intentionally placed to ensure that at high tide water carrying nutrients and sediment will enter into the garden for the clams' benefit and that during low tide the water cannot enter the garden for clam harvesting (Deur et al., 2015; Toniello et al., 2019). As clam gardens continue to be researched from a Western science lens, Indigenous peoples' management strategies gain worldwide recognition which ultimately supports their efforts in attaining sovereignty and land back (Groesbeck et al., 2014; Lepofsky et al., 2021). As such, this analysis ultimately aims to answer to what extent did Indigenous peoples manage clam gardens along the intertidal zone on the coast of British Columbia through exploring the intersection of Indigenous knowledge and Western science. To answer this question, current debates, gaps and areas of agreement and disagreement surrounding the clam gardens impacts on productivity and biodiversity, temporal scale, and effects due to colonization will be assessed.

Background

Indigenous Values & Beliefs

One of the greatest contributors in the extensive maintenance of clam gardens along the Coast of British Columbia is attributed to the respect Indigenous peoples hold towards the natural world and the value they place in maintaining reciprocal relationships with the land (Deur et al., 2015; Groesbeck et al., 2014;

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Lepofsky & Caldwell, 2013). For example, many Indigenous groups place themselves on an equal pedestal to the natural world and view living and non-living beings as their kin (Salmon, 2000; Deur et al., 2015; Dick et al., 2022). As such, clam gardens being equivalent to kin does not permit any space where it is acceptable to take their presence for granted and hold little value for what they provide in terms of nutritional value, opportunity for cultural connections and more. Rather, Indigenous peoples tended to clam gardens with the utmost care and responsibility, acknowledging how crucial clams are as a food source, especially in times of hunting hardship when non-sedentary animals are scarce (Dick et al., 2022; Lepofsky & Caldwell, 2013). Clan Chief Kwaxsistalla Adam Dick of the Kwakwaka'wakw Nation, who is the only known living individual with a firsthand account of clam gardening, discusses the Kwakwaka'wakw and other Pacific Northwest Coast peoples' experiences and traditions surrounding clam gardens (Deur at al., 2015; Dick et al., 2022). He claims that in his territory is it believed that clams have their own families and societies coinciding with their own needs and abilities (Deur et al., 2015). Such views originated from oral story and knowledge being passed down generation to generation and coincided with their beliefs surrounding reciprocal relationships and equal positionality of the natural world (Deur et al., 2015; Lepofsky & Caldwell, 2013; Jackley et al., 2016). Clams were featured in much of Chief Adam Dick's culture and lifestyle such as childhood songs, the utilization of the shells to scrape beaver hides as well as being used as containers for food and oil (Deur et al., 2015). The widespread appearance of clams in the Pacific Northwest Coast Indigenous clans' ways of life is not coincidental and reflects their views of respecting the clam and not allowing any to go to waste. Without these teachings and passing down of knowledge and this outlook on nature and the environment, clam gardens would not have thrived or been as sustainable as they were. This is made evident when food systems in place today are considered, with many of them having social and cultural disconnect and contributing to climate change on a global scale (Vermeulen 2012).

Indigenous Methods of Clam Gardening

Indigenous peoples had numerous strategies to maintain traditional clam gardens along the coast of British Columbia (Dick et al., 2022; Deur et al., 2015; Lepofsky & Caldwell, 2013). Clan Chief Kwaxistalla Adam Dick discusses the Pacific Northwest Coast peoples' extensive strategies and traditions surrounding clam gardens (Deur et al., 2015). He claims that his clan learned over many years that

clam habitat could become more suitable for increased clam production by clearing sections of the beach of large rocks to increase the sandy area available for the clams (Deur et al., 2015). Further, emphasis was also placed on ensuring the habitat did not become too dense with clams as this would cause competition for nutrient intake and growth, ultimately limiting production (Holmes et al., 2022; Jackley et al., 2016; Lepofsky et al., 2022). As such, Indigenous peoples would thin out the clams which would allow the younger clams more opportunity to reach their optimal size (Deur et al., 2015; Dick et al., 2022). Another strategy implemented by the Kwakwaka'wakw nation involved digging the clams through the insertion of a wooden stick into the substrate. Once the stick was embedded in the substrate, it was wiggled back and forth to loosen the sediment surrounding the clams and aerate the substrate in the clam gardens. These traditional Kwakwaka'wakw techniques had been passed down through oral tradition as it had been observed through the clan over centuries to increase clam productivity, allowing larger clam sizes and faster growth rates (Deur et al., 2015).

Discussion

Impacts on Productivity

Indigenous people's maintenance strategies of clam gardens contributing to increased production of clams has been extensively agreed upon and researched by Western scientists. One particular study which illustrates elevated production was conducted on Quadra Island, British Columbia (Groesbeck et al., 2014). This study measured clam densities, biomass, and growth rates of clams through comparing non-walled vs walled beaches and found that walled beaches, which replicate the walls that were present in ancient clam gardens, had elevated clam densities, biomass and growth rates of clams compared to non-walled beaches (2014). A subsequent study was performed by Jackley et al in Kwakshua Channel, northwest of Quadra Island, which also aimed to attain results relating to clam garden productivity (2016). The authors compared diversity, density and biomass of clams in walled beaches and non-walled beaches and found through precise measurement that the clams present in the walled beaches had greater biomass, density and growth rates (2016). Their results highlighted that butter clams had nearly two times the biomass and density compared to unmodified beaches (2016). Years later, researchers set out again to Kanish and Waiatt Bay on Quadra Island to further understanding regarding to what extent Indigenous peoples increased the habitat for clams by constructing clam gardens and how this affected clam productivity (Lepofsky et al., 2021). Through site surveyal and GIS

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analyzation, Lepofsky and her colleagues found that Indigenous peoples increased clam habitat on Quadra Island through the construction of clam gardens by approximately 26-36% (2021). Increased clam habitat allows for elevated clam production as the clams tend to grow larger and in a denser manner (Lepofsky et al., 2021; Toniello et al., 2019). These studies performed by Western scientists illustrate a clear unanimous agreement that Indigenous management systems surrounding clam gardens along the coast of British Columbia increased the production of clams which in turn ensured they remained a reliable food source.

Impacts on Biodiversity

To further study what environmental impacts clam gardens pose to their surroundings, scientists performed studies to better understand the biodiversity present in these Indigenous maintained areas. In 2019, a group of scientists set out to Helcate and Calvert Island to provide the first scientific empirical quantification of Indigenous maintained clam garden influence on marine biodiversity (Cox et al., 2019). Cox and his colleagues assessed taxonomic diversity and density of infaunal communities between clam gardens and unmodified beaches through the sampling of infaunal cores and photographing benthic habitat to predict species diversity. The group of scientists found that clam gardens have increased infaunal diversity compared to all other sites along Helcate and Calvert Island. The authors attributed these conclusions to the Indigenous practice of utilizing shells and gravel in their clam garden maintenance strategies which provide spaces for larvae to settle and can elevate the abundance of nutrients in the soil, ultimately altering the soil chemistry (Cox et al., 2019; Deur et al., 2015). This research provides crucial evidence that the ancient techniques and strategies of Indigenous peoples altered the marine biodiversity along a specific portion of British Columbia so extensively that the effects can still be viewed thousands of years later. However, while this research presents Indigenous clam gardens as so extensive they are considered ecosystem altering structures, it remains the first of its kind, ultimately leaving gaps in verification of these findings by other scientists and groups.

Temporal Scale of Clam Gardens

While Western scientists' research found increased productivity and biodiversity, it remained relatively unknown how long these Indigenous structures had been maintained. As such, in 2019, two different studies were being conducted on clam gardens located in Quadra Island, British Columbia using radiocarbon dating and

subsurface testing (Smith et al., 2019; Toniello et al., 2019). Both studies dated the Indigenous ancient structures to approximately 3.5 thousand years ago, aligning with a known time of increased human settlement on Earth (Smith et al., 2019; Toniello et al., 2019). Three years later, a subsequent study was conducted using GIS and radiocarbon dating on Quadra Island which found that the tested clam gardens are 3.8 thousand years old (Holmes et al., 2022). While there is a slight discrepancy between the first two studies and the most recent study placing Indigenous clam gardens on a temporal scale, there is still a general agreement that the practice of Indigenous maintained clam gardens demonstrates clear intentionality and extends over thousands of years.

The Effects of Colonization

One of the largest gaps in Western scientific literature and first-hand accounts from Indigenous peoples and their knowledge can be attributed to European colonization. When European settlers arrived in Canada and colonized the land Indigenous peoples lost significant knowledge surrounding their practices, culture and more. One of the many losses consisted of the extensive practice of clam gardening (Deur et al., 2015; Dick et al., 2022; Lepofsky et al., 2021). Colonization of Indigenous land has resulted in significant gaps in firsthand accounts of clam gardening. As such, researchers have had to source information from a multitude of scientific methods to piece together the puzzle that is clam gardening along the intertidal zones in British Columbia (Deur et al., 2015; Toniello et al., 2019). Chief Kwaxsistalla Adam Dick remains the only known Indigenous person with firsthand accounts of clam gardening as he was hidden from residential schooling (Deur et al., 2015; Dick et al., 2022). Chief Dick discusses the extent that colonial rule has negatively affected once thriving clam habitat through the dredging of harbours, oil and gas exploration, construction of sewage plants, logging and more (2022). Chief Adam Dick's observations parallel the research and findings of Toniello and his colleagues in which they radiocarbon dated clam gardens in Kanish Bay, British Columbia (2019). The group of scientists found that approximately 3500 years ago clam gardens began to be intensively managed by Indigenous peoples for food purposes, however they found that this did not cause the population of clams to suffer due to the sustainable measures the Indigenous peoples put in place (2019). Around the 18th century is when Toniello et al., found that there was a significant decline in clam size, population and growth which corresponds to a time in which Indigenous peoples were pushed out of traditional lands and their knowledge erased through residential schooling under colonial rule

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(2019). The findings of Toniello and his colleagues and the firsthand account of Chief Adam Dick illustrates that clam gardens thrived and were extensively maintained along the coast of British Columbia through Indigenous stewardship. However, European colonization commenced an era of erasure of culture, sustainable food practices and knowledge which ultimately has led to gaps in Indigenous knowledge and scientific literature surrounding clam gardens.

The Recency of Clam Gardens in Western Science

There are very limited disagreements present in the Western scientific literature regarding the extent in which clam gardens were maintained along the coast of British Columbia which can be attributed to how recent research has been published regarding this Indigenous food management strategy (Cox et al., 2019; Dick et al., 2022; Holmes et al., 2022). Western scientists are just beginning to scratch the surface regarding these ancient structures, with very minimal first-hand accounts being present to validate their findings (Deur et al., 2015; Dick et al., 2022). Further, much of the research being conducted on clam gardens is occurring on Quadra Island due to the vast presence of clam gardens compared to the rest of the Pacific Coast (Groesbeck et al., 2014; Lepofsky et al., 2021; Toniello et al., 2021). Conducting research in the same location limits the variability of results that may be found and compared to illustrate possible disagreements in causation and findings. However, it is crucial to note that as clam garden research continues along the coast of British Columbia and the rest of the Pacific Coast there is larger possibility for disagreement in the literature.

Conclusion

While there remain gaps in the scientific research regarding clam gardens due to colonization and the recency of the subject, the agreements of Western scientists' findings are extensive and provide tangible evidence that Indigenous clam garden maintenance strategies were purposeful in increasing clam productivity and ecosystem biodiversity, ultimately depicting Indigenous methods as scientific. Many if not all researchers have found that Indigenous people's food management strategies, such as clam gardens, are rooted in larger social views and values such as the importance of maintaining reciprocal relationships with non-human beings. These beliefs systems and values of Indigenous peoples positively contributed to intertidal ecosystems and resulted in extensive intertidal maintenance of clam gardens such as increased clam habitat, and increased production of clams. The extent in which Indigenous peoples maintained clam gardens ultimately ensured a

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reliable and sustainably managed food source for thousands of years on the coast of British Columbia. As Western science continues to explore and accept Indigenous methods and stewardship as scientific, it is crucial to keep in mind the broader framework in how far this research can go on a global scale towards Indigenous sovereignty and countering the erasure of Indigenous presence on the land.

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