

Article

Setting Up Roots: Opportunities for Biocultural Restoration in Recently Inhabited Settings

Carter A. Hunt ^{1,*} , Melanie E. Jones ², Ernesto Bustamante ³, Carla Zambrano ³, Carolina Carrión-Klier ^{3,4}  and Heinke Jäger ³ 

¹ Department of Recreation, Park and Tourism Management, and Anthropology, Pennsylvania State University, University Park, State College, PA 16802, USA

² Department of Recreation, Park and Tourism Management, Pennsylvania State University, University Park, State College, PA 16802, USA

³ Charles Darwin Research Station, Charles Darwin Foundation, Santa Cruz, Galapagos 200102, Ecuador

⁴ Department of Geography, Pennsylvania State University, University Park, State College, PA 16802, USA

* Correspondence: cah59@psu.edu

Abstract: Biocultural approaches to restoration, which recognize the unique ways of understanding of socioecological challenges by Indigenous and local communities, have gained traction in recent decades. Yet, less attention has focused on biocultural opportunities where there is no Indigenous population or traditional knowledge to draw upon. This ethnographic study inductively assesses data gathered from interviews with farm owners on Isabela Island in the Galápagos Islands, where human presence is a function of recent migration. These interviews, corroborated with archival information and participant observation, center on farmer attitudes regarding restoration of *Scalesia cordata*, a highly endangered plant species, endemic to Isabela. The resulting analysis identified four themes of overlap with the biocultural restoration literature: cultural keystone species, sense of place, informational pathways, and recognition of socio-ecological feedback loops. Findings indicate that *Scalesia* remains a valued cultural keystone species providing tangible and intangible benefits to local residents, and its survival serves as a metaphor for farmers' own wellbeing. Thus, even locations where place-based knowledge by a native population is not evident, critical biocultural elements exist that can be integrated into restoration efforts. Farmers also exhibited clear connections between restoration and tourism in Galápagos, paving the way for the application of biocultural theory to the analysis of tourism-supported restoration efforts elsewhere.

Keywords: cultural keystone species; sense of place; sustainability; tourism; Galápagos; Ecuador



Citation: Hunt, C.A.; Jones, M.E.; Bustamante, E.; Zambrano, C.; Carrión-Klier, C.; Jäger, H. Setting Up Roots: Opportunities for Biocultural Restoration in Recently Inhabited Settings. *Sustainability* **2023**, *15*, 2775. <https://doi.org/10.3390/su15032775>

Academic Editors: Somidh Saha, Kripal Singh, Shalini Dhyani, Debbie Bartlett and Bryan A. Endress

Received: 26 October 2022

Revised: 29 December 2022

Accepted: 30 January 2023

Published: 3 February 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The United Nations deemed 2020–2030 the Decade on Ecosystem Restoration to support normative undertakings to improve biodiversity or ecosystem functioning [1]. The emergence of restoration as a prominent research and policy theme reflects the growing recognition that humans have pushed their own ecosystem beyond critical thresholds that sustain human well-being. The “Planetary Boundaries” have been one influential means of recognizing these thresholds, including the ways that agriculture creates drivers of land use change and intensification and corresponding biodiversity loss [2]. Restoration is now seen as essential to maintain the productivity and capacity of socio-ecological systems to meet the Sustainable Development Goals [3] and other needs of society [1]. Restoration has thus moved from a strategy for preventing species or ecosystem loss to a strategy for the maintenance of overall human well-being. Understanding the best ways to go about restoration, including in complex socio-cultural milieu, is increasingly urgent.

One way of applying socio-cultural elements to thinking about restoration is through biocultural approaches. Biocultural scholarship emerged from the fields of biological anthropology and human ecology, and through studies of populations with long-term

presence and ecological integration with particular geographic contexts [4]. Biocultural approaches reflect the recognition that Indigenous and local communities can offer unique ways of understanding, and therefore addressing, socioecological challenges [5,6]. Biocultural diversity comprising the “realm of Indigenous and local people’s worldviews and livelihood strategies and their effects on biodiversity” are increasingly invoked to address sustainability challenges [3] p. 644. Today, biocultural approaches are applied far beyond anthropology and human biology, bringing important attention to the cultural values and practices of human populations and their associated communities in landscapes undergoing transformation. Yet, in an age of increasingly mobile and migratory human populations, gaps in understanding remain regarding how to best pursue restoration in contexts where there is no long-term human presence or where there is limited traditional ecological knowledge to draw upon.

The purpose of this study is to explore the biocultural dynamics of potential restoration efforts in contexts that have undergone recent human inhabitation. We seek answers to overarching questions such as: *what opportunities exist for biocultural restoration where there is no Indigenous population or traditional ways of knowing to draw upon, and instead where populations are composed primarily of recent migrants? At what point does the knowledge being applied in such contexts become traditional?* To answer these questions, we carried out ethnographic research in the Galápagos Islands, where the archaeological record establishes “anthropogenic impacts as restricted to the last 500 years” [7] p. 169. Data were gathered from Galápagos resident farmers regarding their perspectives on conservation and restoration of *Scalesia cordata*, a species endemic to southern Isabela. Just as the ancestor of the Darwin’s finches radiated into several different (endemic) finch species [8], the ancestor of the genus *Scalesia* radiated into 15 (endemic) *Scalesia* species on 11 different islands. For this reason, the *Scalesia* species have developed an “iconic reputation” as the “Darwin’s finches of the plant world” [9] pp. 4990–4991. Three of these *Scalesia* species grow into trees up to 15 m, *Scalesia cordata* being one of them, and their ranges overlap with the climatic zones suitable for agriculture in the highlands of the more humid islands. Areas covered by these three *Scalesia* tree species have therefore been cleared in the past to make space for agricultural crops. As a consequence, only about 1% of the total original *Scalesia* cover remains today. In the case of *Scalesia cordata*, it is a mere 0.1% of the original extent [10].

Exploratory in nature, this ethnographic case study inductively assesses qualitative interview data gathered from local farmers on Isabela, where human presence is largely a function of migration in recent decades. In addition to original interview data, this theoretically driven analysis incorporates reviews of scholarly literature on biocultural approaches to restoration; archival research of government, NGO, and other local agency documentation relevant to the Isabela context; and significant participant observation gathered by our team members over their combined decades of residence and applied research in Galápagos. These sources of data and their integrated analysis here provide compelling answers to the overarching research question of how biocultural approaches to restoration can be undertaken where human presence is largely a function of recent migration.

2. Literature Review on Biocultural Conservation and Restoration

Restoration can be done by allowing the natural regeneration of overexploited ecosystems or by planting trees and other plants [11]. In isolation, ecological restoration thinking can, even when well-intended, emphasize particular functions of ecological systems to the neglect of the people living within the system [12]. Failing to account for socio-cultural elements can result in discounting humans’ rights to their natural resources and cultivating unjust solutions that do not represent the best interests of local human populations [1,5,13,14]. Systems thinking integrating sociocultural and ecological elements accepts the connections between people and nature, recognizes their intrinsic links within the same system, and is generally more likely to promote longer-term sustainability and conservation of such systems [6,15–18]. As a result of these social science insights brought about by biocultural approaches, they have moved to the forefront of broader sustainability research [3]. Ac-

cordingly, restoration efforts have recently “shifted their targets from merely ecological recovery to holistic landscape restoration,” acknowledging that people are connected to their environment and rejecting culture-nature dualism [19].

2.1. Origin and Evolution of Biocultural Approaches

Biocultural approaches have been studied in the context of many activities. The origins of biocultural theory are often traced to biological anthropology, especially human ecology [4], fields interested in understanding human biological variation. These early approaches to biocultural research on human origins were later complemented with political economy and political ecology perspectives that also addressed contemporary poverty and well-being [20,21]. Biocultural research came to recognize the “grinding poverty of structural violence, social and political inequalities, and the subjection of groups in colonial and postcolonial economies, created vulnerabilities” that were neither natural nor inevitable [22] p. 3. Paralleling the growing recognition of need to account for socio-cultural and subjective aspects of socio-ecological systems in order to understand systemic resiliency, biocultural approaches have emerged to study agriculture [23–25], forestry [26], poverty [21], conservation [13,17,27], fishing [28,29], health [30], and even tourism [31–33].

While there is an assortment of definitions for biocultural approaches to restoration, they typically converge on the central theme of human-nature interconnectedness. Biocultural approaches provide a lens to restoration that dispels culture-nature dualism and values all forms of life and knowledge [14]. Equalizing the value of different stakeholders is important ethically, but also allows biocultural conservation and restoration projects to move forward. Successful restoration projects require support by all stakeholders, and this is inherent to biocultural approaches [19,34]. Moreover, restoration must be place-specific to accommodate for the unique socio-ecological system at play [35]. Biocultural approaches can thus be more holistic than ecologically focused forms of restoration as they focus on the linkages between people and the landscape on which they live [3,4,36].

Biocultural approaches also highlight place-based, multigenerational knowledge (often Indigenous) as critical to the success of environmental restoration efforts [3,5,6,23,36]. Objectives of these methods of restoration include, but are not limited to, the following: (1) strengthening the connections between people and their environment, in turn fortifying the resilience of socio-ecological systems and their adaptive capacities [3,17,26,37], and (2) restoring the ecological integrity of a landscape while simultaneously upholding the cultures, identities, and livelihoods of local peoples [3,5,6,17,23,35,37]. This latter objective highlights the critical value of emic views of in situ human populations regarding their culture, identity, and livelihoods as central to enabling biocultural restoration efforts.

2.2. Key Themes in Biocultural Restoration

Despite growing diversity within the biocultural literature (e.g., [4]), there are several recurring themes in the scholarship of biocultural approaches: cultural keystone species, senses of place, means of diverse biocultural knowledge sharing, and socio-ecological systemic feedback loops (Figure 1).

2.2.1. Cultural Keystone Species

A first theme involves cultural keystone species. Extending the ideas regarding ecological keystone species, species integral to an entire ecological system, biocultural literature embraces the idea of cultural keystone species. Cultural keystone species are species of value in a local culture. They can serve as a source of identity, nutrition, medicine, material, and spirituality [19,38,39]. Much like ecological keystone species, cultural keystone species are vital to the social systems on a landscape [38]. They foster cultural and ecological integrity and functionality, and their loss can be socio-ecologically catastrophic [37,38]. For this reason, cultural keystone species overlap considerably with those considered to be ecological keystone species [38]. Restoration of cultural keystone species thus often contributes to the restoration of the local socio-ecological system more broadly [19,37]. Despite

speculation on how to measure the value of a cultural keystone species [37], Garibaldi and Turner [39] p. 5 created six criteria for determining cultural keystone species: “(1) intensity, type, and multiplicity of their use; (2) naming and terminology in a language; (3) role in narratives, ceremonies, or symbolism; (4) their persistence and memory of use in relationship to cultural change; (5) level of unique position in culture; and 6) the extent to which they provide opportunities for resource acquisition from beyond the territory.” These criteria provide a useful template for identifying cultural keystone species.

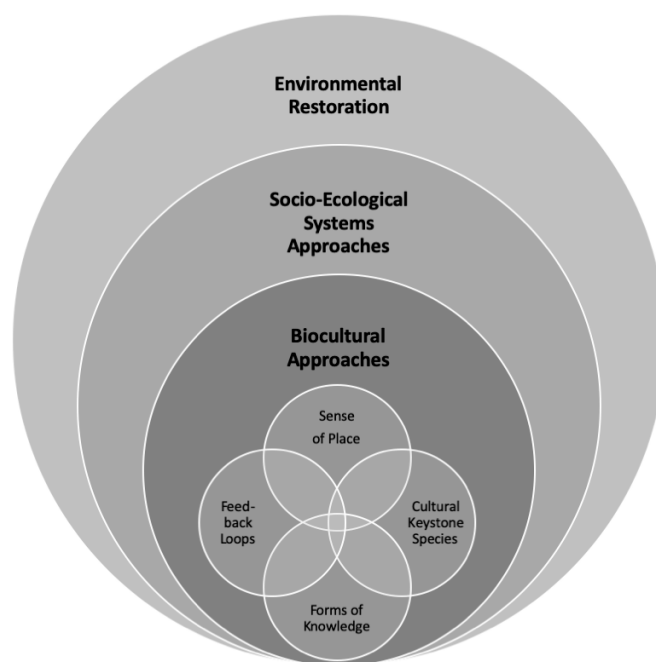


Figure 1. Theoretical framework of biocultural restoration.

2.2.2. Sense of Place

A second theme in the biocultural restoration literature is sense of place. An individual's or group's sense of place involves attachment to both material and non-material items on a landscape [40]. There “has remained a consistent pattern in the ecosystem service literature to identify sense of place as a management or communications tool with which to engage local communities” [41] p. 2. Work on sense of place and its role in biocultural restoration tends to emphasize the value of humanistic understandings based on qualitative methods [41]. Such approaches better capture the ways that “emotional attachment to place can serve as a bridge between ecosystem functioning and stakeholders' engagement in environmental stewardship” [42] p. 49. Understanding of sense of place is central to understanding what opportunities exist for biocultural approaches to restoration. By incorporating ideas such as cultural ecosystem services, biocultural research can reveal the ways that restoring degraded environments sustains the sense of place that supports overall human well-being in many contexts [40]. A biocultural approach to restoration reinforces these connections between human well-being and place [23,37].

2.2.3. Diverse Knowledge Sharing

A third theme involves diverse pathways of biocultural knowledge sharing. Existing literature suggests that exploring informational pathways is an integral aspect of biocultural understanding. The knowledge of most value for informing restoration is often held by local, often Indigenous, populations, accumulated over lengthy histories of engagement with local ecological contexts [3,13,17,23]. This locally held knowledge is commonly considered a part of a biocultural heritage that is inextricably linked to structure, function, memory, and resilience of local socio-ecological systems [5,6,43]. Drawing upon multiple knowledge systems is known to be a key to successful conservation and restoration efforts [13,17].

While Indigenous knowledge is usually more ecologically integrated than the knowledge associated with recently arrived immigrant populations [44], little remains known about the forms and pathways of knowledge of most use in contexts where human presence has been relatively recent.

2.2.4. Systemic Feedback Loops

A fourth theme involves feedback loops, between social and ecological systems and also within elements of social systems themselves. In an analysis of biocultural approaches to conservation, Gavin et al. [17] p. 140 provides a definition of socio-ecological systems: “coupled human and natural systems that are complex, dynamic, unpredictable, and heterogeneous at multiple spatial and temporal scales, shaped by reciprocal feedback loops, and characterized by nonlinear dynamics, time lags, thresholds, and linked social and ecological processes.” Across many definitions of biocultural approaches to restoration, there is consistent reference to these feedback loops. As noted in earlier sections, biocultural understandings emphasize the critical feedback loops between ecosystem functioning and human well-being [13,36]. Put simply, a healthy ecosystem will support human well-being, which in turn will support a healthy ecosystem. In contrast, a degraded ecosystem will also degrade human well-being, often leading in vicious, self-reinforcing cycles of impoverishment and land degradation [45–48]. Identifying feedback between ecological and socio-cultural elements of local systems—as well as local understandings of these feedback loops—is key to designing holistic restoration strategies that value and empower local communities [14,16,19,36].

2.3. Biocultural Restoration in Island Contexts

Biocultural approaches to restoration scholarship have emerged from many island contexts, where the literature often focuses on biocultural restoration of traditional agriculture [23]. Islands are described as “ideal models” to study and apply biocultural restoration, as island socio-ecological systems are smaller and less complex due to size and isolation [23,37,49]. Furthermore, Pacific islands, like the Hawaiian Islands, have a prominent Indigenous presence that can inform ecological and agricultural restoration efforts [25,50]. While human inhabitation of islands has required particularly strong and balanced human-environmental balances [51], settler colonialism often disrupted such finely tuned balances, thereby initiating the changes that led to the growing need for biocultural restoration strategies. In this regard, island contexts serve as canaries in the coalmine for how biocultural restoration can help confront sustainability challenges being experienced across the globe [3].

2.4. Research Questions

Preserving Indigenous culture and knowledge is of utmost importance, and the bounty of literature pertaining to this issue is admirable. Yet, there is a gap in the academic writing concerning biocultural approaches when Indigenous peoples are not physical present on a landscape. To account for such situations, the following research is guided by the overarching questions: (1) *what opportunities exist for biocultural restoration where there is no Indigenous population, no traditional knowledge to draw upon, and where populations are composed primarily of recent migrants*, and (2) *at what point does the knowledge being applied in such contexts become traditional?* In light of the biocultural literature reviewed above (Figure 1), we also seek answers to the following specific questions:

- Is *Scalesia cordata* a cultural keystone species on Isabela Island, and if so, how is this reflected in farmers’ perspectives towards its restoration?
- What are the elements of sense of place on Isabela and how do they influence farmers’ thinking about ecological restoration?
- What forms of knowledge acquisition and sharing exist among farmers that can be leveraged into restoration efforts?

- How are feedback loops between human and environmental well-being reflected in farmer perspectives and how might any associated vicious cycles be turned into virtuous ones via restoration efforts?

3. Materials and Methods

3.1. Study Site

Nowhere is understanding the social drivers of anthropogenic disturbance more urgent than in treasured natural places such as UNESCO's first Natural World Heritage Site, the Galápagos Islands [52]. Analyses to date have confirmed that the Galápagos remained free of any human presence that might result in the accumulation of ecological knowledge of the islands until 1535 [7,53–56], when the wayward ship of the Bishop of Panamá Tomás de Berlanga made the first recorded visit. Early human history was documented in accounts of pirates, buccaneers, English whalers, and Spanish mapping expeditions that visited as early as 1693, yet there remained no permanent inhabitants until the 19th century, when Ecuadorian settler colonist efforts got underway on Floreana, San Cristóbal, and Isabela islands [57–59]. Human presence remained a mere 1400 residents into the 1950s. Little growth or demographic change occurred in the small agricultural communities established by the earliest “pioneers”, who migrated to the islands through the mid-20th century. Land reforms on the Ecuadorian mainland later characterized the islands as part of an agricultural frontier, thus creating a first modern driver of migration [59,60]. In-migration fuels population growth [57,59,61], with just 36% of the 2015 population born in the islands [62]. An additional 275,000 international and domestic tourists visit Galápagos each year [63].

As a cluster of small, isolated islands of volcanic origin, the Galápagos archipelago harbors very fragile insular ecosystems. With high endemism and visitation rates, Galápagos is often associated with charismatic species, such as the giant tortoises, flightless cormorants, and marine iguanas. However, there are also around 1310 plant species on the islands, at least 810 of which were introduced. Of the remaining around 500 native species, about 37% are endemic to the islands [64,65]. *Scalesia* is easily the most iconic plant genus. Its ancestor arrived to the islands around 3 million years ago and radiated into 15 different species [9]. Yet, the most charismatic species of *Scalesia* are the three endemic tree-forming species that grow into trees up to 15 m in height [9]. In the past, these species formed dense *Scalesia* forests in the humid highlands created by the archipelago's primary volcanoes, before areas had been cleared to make space for agricultural crops [10]. The remaining forest remnant patches contribute a vital habitat for endemic tortoises and highly endangered birds [66,67]. The situation for *Scalesia cordata* on southern Isabela is dire. As human presence on the island has grown into a permanent population of approximately 3500 residents [62], the total population of *Scalesia cordata* has been reduced to only about 0.1% of its original distribution [10] (Figure 2, where tiny *Scalesia cordata* patches are just visible in red).

3.2. Study Design

The rapid ethnographic research design implemented here specifically sought emic views of *Isabeleño* residents. Emic views represent place-based and culturally specific knowledge of members of local populations [68–70]. Such views are often contrasted with etic views of those with more generalizable knowledge, typically scholars and scientists. As Fetterman notes, “the validity of an emic construct is based on the native informant's or community member's views, not on the external social scientist's views. Emic perceptions are shared views of cultural knowledge from the insider's ‘normative’ perspective” [71] p. 249. Capturing emic perspectives are essential for understanding the biocultural perspectives on keystone species, sense of place, knowledge sharing, and systemic feedback loops. A research design based on ethnographic interviewing and participant observation is the most common means of accounting emic views [72,73].

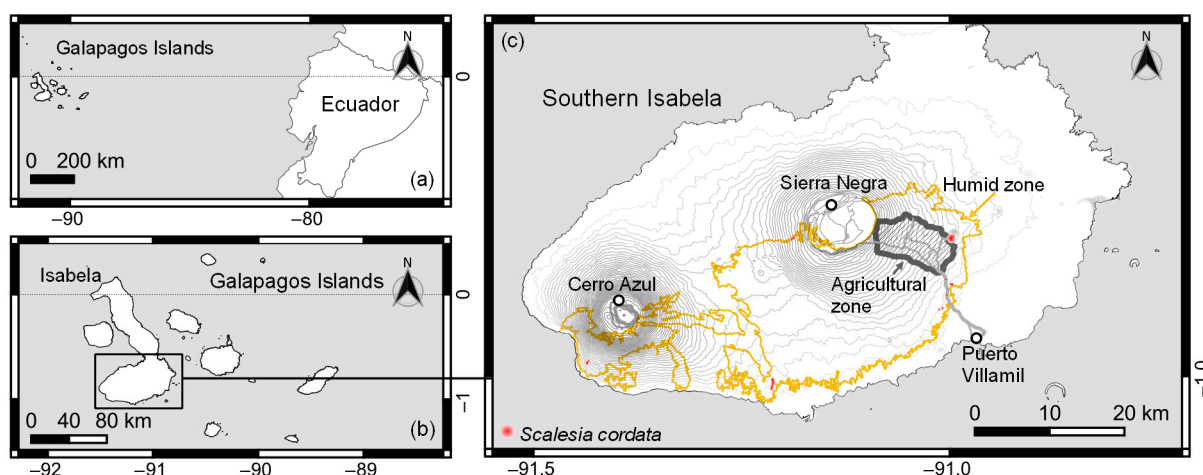


Figure 2. Location of the Galapagos Islands in the Pacific Ocean (a), study area within the archipelago (b) and distribution of *Scalesia cordata* on Southern Isabela Island (c).

3.3. Data Collection

The data analyzed in this study were drawn from several sources: existing scholarly literature; archival document and project reports of scientific, non-governmental, and governmental organization in Galápagos; participant observation of the research team during combined decades of research in the islands; and a set of twenty ethnographic interviews with farm owners on Isabela. The analysis that follows focuses on, but is not limited to, the data gathered in these 20 ethnographic interviews that focus on several themes: (1) the location and perceived status of *Scalesia cordata* on Isabela; (2) the perceived influence that *Scalesia* restoration would have on farm activities, including benefits and/or negative consequences; (3) extent of interest in having *Scalesia* on farms; (4) the biggest challenges, problems, and limitations to farming on Isabela; (5) the impacts and conflicts associated with invasive species on farmlands; (6) how farming knowledge is acquired; (7) the types of training that have been most valuable for farm production; (8) importance of conservation in general in Galápagos; and (9) demographic information (e.g., birthplace, residence time in Galápagos, household and family size, farm size and activities, products cultivated, livestock present, and number of workers on each farm). To identify and recruit interviewees to the study, a purposive sampling strategy was implemented with farm owners on Isabela [72]. These farm owners were known to our team from prior trainings and conservation projects conducted on Isabela.

Among our team are individuals with long-term research in the study region on a variety of issues—endemic and invasive species, plant distributions, cultural and gastro-nomic heritage, tourism, human-environment relations, and cultural and human history of the archipelago. One author is a plant ecologist and principal investigator of invasive and endangered plants for the islands' longest-standing conservation science foundation, the Charles Darwin Foundation. Two individuals are also foundation staff stationed on Isabela trained in social sciences. Two additional authors are university researchers specializing in environmental anthropology and ethnographic research methods. This background of our team provides extensive participant observation data acquired over time. The newly acquired interview data provide an important sociocultural complement to long-term invasive plant monitoring and applied conservation research for the endemic and highly endangered *Scalesia cordata*.

3.4. Analysis Plan

Interview data were fully transcribed in Spanish. Preliminary structural coding was carried out in Excel. This form of coding is particularly suitable for categorizing aspects of interview transcripts and field note entries as related to farm and livelihood activities, on-site behaviors and/or resources, sociocultural background, and responses to thematic in-

interview questions. Structural codes parse out the data for easy retrieval and for subsequent querying with other thematic codes [74]. All qualitative interview data, existing archival data, scholarly literature, and detailed field notes were then integrated into a corpus of text within a project file in MAXQDA software, a tool that facilitates further thematic coding of qualitative data. To capture subjective cultural perspectives on our research questions, this second cycle of inductive, thematic coding was performed on the entire corpus of compiled ethnographic data, consistent with the approaches outlined by Saldaña [75]. Iterative review of the coded data and our coding structure within MAXQDA identified emergent themes based on repetitions in responses, sociocultural categorization of phenomenon, use of metaphors and analogies to convey local perspectives, and theory-related materials [76].

Regarding validity and reliability, ethnographic research methods such as those employed here are distinguished by high internal validity due in large part to the use of participant observation and a data collection and analysis strategy [68,72,73,77,78]. As influential methodologist Bernard further notes, “Participant observation gives you an intuitive understanding of what’s going on in a culture and allows you to speak with confidence about the meaning of data. Participant observation lets you make strong statements about cultural facts that you’ve collected. It extends both the internal and the external validity of what you learn from interviewing and watching people. In short, participant observation helps you understand the meaning of your observations” [77] pp. 317–318. Creswell and Poethjens concur that the employment of the type of prolonged engagement and persistent observation of cultural groups aids the researchers in determining the information most salient to the study purpose [72].

As noted above, our team has decades of combined research experience in the research setting, thus bringing formidable participant observation and ethnographic understanding to the analysis. Validity and reliability are also supported by the triangulation of corroborating evidence from multiple sources, including the participant observation, semi-structured interviews, and secondary and archival research [76]. Forms of understanding derived from existing literature, archival documentation, the research team’s working knowledge, and the newly obtained interview data supported the interpretation, corroboration, triangulation, and explanation of the findings reported below. Reliability was further reinforced by peer review and debriefing that occurred between team members during in situ data collection as well as during later thematic analysis and write-up [77].

Since attribute-based data was not sought here, a representative, probability-based sample was not appropriate. Rather, we sought participants out on the basis of their cultural expertise with farming in the Galápagos. As such, “the inference that can be drawn from qualitative data concerns the nature of the phenomenon being studied but not its prevalence or statistical distribution” [79] p. 277. Thus, while our analysis does not have representational generalizability as conceived in more quantitative approaches to research, our findings based on qualitative data and analysis are nevertheless generalizable inasmuch as they provide a contribution toward greater understanding of the meanings and processes related to biocultural restoration.

Lastly, it cannot be denied that any research setting will contain factors that are unique. Our use of rich, thick description in presenting our findings—including many direct quotes from farmers themselves—allows other researchers to determine how and where findings are transferrable to other research themes or settings [72]. By providing extensive detail regarding our observation, interviews, and the study context, we provide the ability to gauge and assess the findings and their relevance to other settings [79].

4. Qualitative Results

This section presents findings of the ethnographic assessment of farmer perspectives on the restoration of *Scalesia cordata*. Given their prominence in the biocultural restoration literature, key themes used to organize our theoretical framing above are retained here to organize the results of our qualitative analysis.

4.1. Cultural Keystone Species

Findings from the interview data strongly recognize *Scalesia* species in general in Galápagos, and *Scalesia cordata* specifically on Isabela, as a cultural keystone species. As noted in Table 1, *Scalesia cordata* meets each of the criteria created by Garibaldi and Turner [39]. Regarding utilitarian values, several farmers discussed using *Scalesia cordata*, “... for construction—the small houses on our farms because there was no other material with which to build, we used it for the entire infrastructure of a house, and it was a very good wood ... They were extremely large and thick trees, very good fertile trunks, and now those no longer exist.” In addition to its utility as lumber, *Scalesia* was also integrated into living fences for controlling livestock. Additional uses of *Scalesia* are connected to ecosystem services that benefit the farmers, such as soil quality, seed dispersal, and shade (discussed further in section below on feedback loops). *Scalesia* has a consistently recognized tangible material value among Galápagos farmers.

Table 1. Cultural keystone species criteria applied to *Scalesia cordata*.

Criteria	<i>Scalesia</i> in Galápagos
1. Intensity, type, and multiplicity of use	Utility for wood, tourism, ecosystem services, agricultural services
2. Naming and terminology in a language	<i>Scalesia</i> seen in vegetational zone, place names, tours
3. Role in narratives, ceremonies, or symbolism	Symbol, icon, representation of Galápagos
4. Persistence and memory of use in relationship to cultural change	Used in everyday conversation, seen as a species to preserve for future generations
5. Level of unique position in culture	No other similar native species
6. Extent to which it provides opportunities for resource acquisition from beyond the territory	Used as a means of securing livelihoods through tourism nationally and globally

Interview data also revealed themes of spirituality and usefulness related to this cultural keystone plant. Farmers associated *Scalesia* with many symbolic ideas, including but not limited to, the presence of God. A few farmers shared the view that since all living things are created by God, plants and animals of Galápagos should be protected, especially those that are endemic like *Scalesia cordata*. Other interviewees expressed that *Scalesia* “is an icon of Isabela,” and “is a symbol of our Galápagos islands.” The species is seen as a living representation of Galápagos itself. Accordingly, the name *Scalesia* is incorporated into the names of a plethora of businesses, tour operators, hotels, community organizations, street names, and so forth.

In our twenty interviews, the words “native,” “unique,” and “endemic” were referenced twenty-seven times. A consensus emerged among interviewees that *Scalesia* should be preserved because it is Galapagueño, because it is unique, because it is endemic, and because it is part of what makes Galápagos home to Galapagueños. Beyond the material values indicated above, it is clear that *Scalesia cordata* also holds high nonmaterial value in culture in contemporary Galápagos culture. Consequently, farmers felt that efforts to restore *Scalesia cordata* on Isabela will provide concrete improvements to ecological functioning and support the more abstract, intangible values associated with this cultural keystone species [19,37].

4.2. Sense of Place

Interview data also made it apparent that *Scalesia* is strongly linked to a sense of place in Galápagos. The comments of one Isabeleño farmer epitomize the way that “place” was frequently referenced in our interviews: “[*Scalesia* should be conserved] Because it is a native tree, and we would like to have the experience of having something native here. If a [restoration] project is carried out, [people can] visit us and get to know our place.” Projects to restore *Scalesia* are thus seen to coincide with the preservation and protection of what interviewees call “our place.” In describing what the loss of this native species would mean to island residents, deep personal connections are revealed: “[If] what is on the island is

lost, the root where we live is lost.” Such quotes reflect how deeply integrated *Scalesia* is in residents’ sense of place on Isabela and across Galápagos more broadly.

Qualitative analysis of farmers’ interview data also revealed an aesthetic, emotional connection to *Scalesia cordata*. Many farmers indicated enthusiasm to plant *Scalesia* because they love nature in a broad sense but also because they consider *Scalesia cordata* in particular to be beautiful (e.g., beauty was referenced 16 times in the 20 interviews). One informant stated simply, “It is pretty, it fascinates me, and it has a good aroma.” Another informant said that the main personal benefit of planting *Scalesia* would be “the happiness, which is the greatest thing—seeing many animals close by, not only me, but being able to share it.” This quote exhibits an acute awareness of how *Scalesia* harbors habitat for other species, how residents derive happiness from seeing characteristic flora and fauna, and how a healthy *Scalesia* habitat is seen as linked to quality of life. Thus, beyond other extrinsic material values, restoration of *Scalesia cordata* would appear to support other intrinsic values by constituting “home” and serving as a source of psychological well-being—both core elements of sense of place.

4.3. Knowledge Sharing

Farmers were asked to explain where they were learned the agricultural knowledge and skills they employ on Isabela. Their responses indicate four primary sources of their knowledge and skill: family members, first-hand experience, trainings, and the internet. Seventy percent of those interviewed indicated that their agricultural knowledge was passed down by family members (e.g., grandparents, parents, and spouses). Given that 60% of the informants originally hail from mainland Ecuador, much of the family knowledge is derived from practices developed in dramatically different ecological contexts. Many farmers expressed how their own past experience provided them with the knowledge they need as a farmer. Such experience resulted from past jobs on other farms as well as their own trial-and-error learning while working their own land. As one informant explained, he was “learning from nature itself.” Fifty-five percent of informants also received formal training in cultivation. Such trainings are rare, though occasionally workshops have been offered from the Ministry of Agriculture and Livestock or local research foundations to improve agricultural techniques and ensure practices are consistent with conservation mandates in the islands. Only a few farmers referenced internet platforms such as YouTube to further self-teach how to cultivate effectively on Isabela.

Although interviewees did not have prior experience planting *Scalesia*, all of them expressed their own ideas regarding how *Scalesia* could best be maintained on their land in the future. Such comments provided indications of interest in preserving *Scalesia cordata* and in passing along the knowledge of how to do so to the next generation. One interviewee said, “[*Scalesia* should be conserved] Because it is an endemic plant, and we should have it, and take care of it for the new generations so that they also recognize it and know that it is endemic.” This quote indicates the desire to preserve *Scalesia* to pass down knowledge of endemism on Isabela to future generations. Thus, while there was no Indigenous presence in Galápagos and no long-standing local knowledge to draw upon, farmers on Isabela are nevertheless keenly interested in developing and sharing the knowledge needed to ensure the long-term presence of this cultural keystone species that forms part of the sense of place in Galápagos.

4.4. Feedback Loops

Interview data also exhibited much recognition of feedback loops between various elements of the local socio-ecological systems in which *Scalesia cordata* exists. For starters, *Scalesia* trees are known to serve as a habitat for several endemic finch species in Galápagos. This ecological linkage was universally recognized by Isabela farmers, one of whom indicated that “... Inside the forests [of *Scalesia*] are groups of finches. It is a special habitat for this kind of bird,” while other farmers in turn noted the importance of finches in the process of seed dispersal. Other ecosystem services provided by *Scalesia* that were referenced in the

interviews include air purification and water provision. Referencing ecosystem services broadly, another farmer said, “I believe that all the plants with their distinct characteristics serve the environment, especially because they purify the air, and we are breathing pure air . . . now if the plant disappears . . . we are going to have more contaminated air because this. This plant especially helps us to clean the air.” Other farmers noted, “ . . . it is always said that the trees [such as *Scalesia*] attract the water.” The role of *Scalesia* in soil creation was also referenced, as one farmer describes, “if the leaves fall, it also recovers the soil because the vegetational humus is important in conserving the soil.” Another highlighted benefit of *Scalesia* on agriculture is shade. *Scalesia* are tall trees that can provide shade to crops, especially the famous Galápagos coffee [80], animals, and people—all of which are regulation and supporting ecosystem services valued by farmers.

A major source of angst among farmers is the abundance of invasive species in Galápagos [64]. On Isabela, farmers struggle with the encroachment of guava and blackberry on their properties. One interviewee discussed the challenges with managing encroached land and offered a potential future strategy: “For example, in the agricultural zone we have blackberry in quantity, a very resistant plant, very difficult to treat. On the other hand, if we have native forests that are not invasive, we can even alternate forests of endemic plants with areas to grow crops.” This farmer sees an easier future in land management through agroforestry; alternating land use between agriculture and *Scalesia* forest. The invasive guava is also problematic. Regarding control of guava, one farmer indicated that “If we take away the *Scalesia*, and encounter the guava, for the fruit will come problem animals, like rats.” There is thus a belief that as *Scalesia* are lost, guava and other invasive plants populate and thereby create more habitat for additional invasive species (e.g., rats) or agricultural pests. With ecosystem services (e.g., soil, shade, and water) and invasive species control being vital for crop production, there is keen awareness of the socio-ecological feedback loops that jeopardize such services. Loss of *Scalesia*, and conversely its restoration, are thus seen as having an important feedback loop for agricultural success.

4.5. The role for Tourism in Biocultural Restoration

Beyond the four elements of biocultural approaches to restoration reviewed above, the theme of tourism also surfaced in nearly all interviews. While this is not surprising given the dominance of tourism in the overall economy of the archipelago, that the linkage between *Scalesia* restoration and tourism would feature so strongly in farmers’ discourse was not anticipated. In fact, tourism was mentioned a total of 62 times among the 20 interviews. Interviewed farmers perceive direct and indirect benefits from tourism. They identify agritourism on farms as providing the most direct benefits to their livelihoods as well as to *Scalesia* conservation. As one informant explained, “ . . . in the future, the agritourism farm will be built for this little plant . . . ” Another farmer explained how the sense of place embodied by *Scalesia* would contribute to the success of agritourism:

. . . because Galápagos is the heritage of nature and humanity, people come to see things and plants that they have not seen elsewhere. And what is their objective? It is to become acquainted with things that they have not seen. And if we harm plants that are unique, and they are lost, then why [come to] Galápagos . . . ?

This emic view reflects how tourism and *Scalesia* are inextricably linked in Isabeleño farmers’ eyes. Another informant invokes a colloquial use of the word *papa* (potato) as a proxy reference to money when describing the indirect linkages between farmers and tourism:

It [*Scalesia* loss] would affect me a lot because here in Galápagos we all live from tourism, so to say that because I am a farmer, I don’t live from tourism, I am wrong. We all live from tourism. Here if there is no tourism there is no ‘*papa*’ for anyone. Why? Because as a producer, if there is low tourism, and the stores and restaurants buy from me, what if there is no tourism?

In their descriptions, without direct visitation to farms, these farmers clearly see a feedback loop between their own livelihoods and tourism-related conservation of *Scalesia*, especially since the local hotels and restaurants serving visitors to the islands are the primary market for much of what farmers produce on Isabela. Thus, when tourism visitation is low in the archipelago (e.g., during the COVID-19 pandemic), there are less tourists buying food in stores and restaurants, and therefore less produce is purchased from farmers. Yet, as the islands return to pre-pandemic levels of visitation (as it was as of mid-2022), linkages between tourism, conservation, and livelihoods will again strengthen. Isabela residents recognize the conservation value of tourism, and inversely, the value of conservation for tourism and thus their own socio-economic well-being. These interwoven biocultural elements are conceptually summarized in Figure 3.

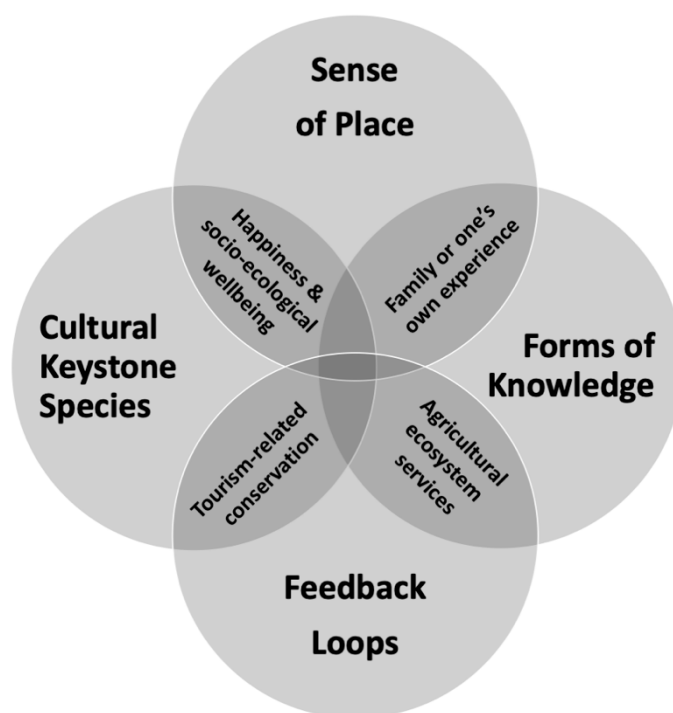


Figure 3. Interwoven relationship between the four primary biocultural analysis themes.

5. Discussion of Interwoven Biocultural Elements

The literature on cultural keystone species suggests that they tend to provide a sense of identity, nutrition, medicine, material, and spirituality to a culture [19,38,39]. By all indications, including the criteria developed by Garibaldi and Turner [39], we see *Scalesia* serving as a cultural keystone species that provides material and non-material value to farmers on Isabela, including important roles in ecosystem functioning [38]. Interviewed farmers also recognized that *Scalesia* enhances ecosystem functioning, thereby positively impacting their crop production. This corroborates ecological research indicating that having *Scalesia* on adjacent farms in Galápagos increases farmers' crop yields, namely by attracting pollinators [81]. With larger crop yields, farmers are more likely to make stable profits, fortifying individual livelihoods.

There is also strong overlap between *Scalesia* as a cultural keystone species and its role in creating a sense of place on Isabela. Despite the high rate of migration and low number of years spent on Isabela among many of the interviewees, *Scalesia* supports the cultural identity of Isabeleños. The strong association between *Scalesia* and sense of place is exhibited in quotes referencing "place" and the "roots" of where they live. As one farmer explained, "[Losing *Scalesia*] would be a shame because it is an icon of Isabela." Not only are the ecological (and agricultural) functions of *Scalesia* recognized, but the data collected here suggest strong associations with more abstract ideas of happiness and

human well-being. Thus, even though a sizeable human population has only recently been established in Galápagos in general, and on Isabela in particular, it is nevertheless clear that restoring *Scalesia* to the landscape would strengthen the connection between people and place in Galápagos—an important objective of biocultural restoration [19,23]. This evidence suggests that even newly arrived human populations can thus be sources of biocultural information supportive of ecological restoration.

Scholars discussing biocultural knowledge sharing tend to emphasize that multiple knowledge systems are needed for successful restoration [3,13,17]. While neither Indigenous people nor local native knowledge were present in Galápagos at the time of initial European arrival or later Ecuadorian settler colonist efforts on several islands, farmers interviewed here did identify several valid sources of knowledge and forms of knowledge sharing that overlap with biocultural theory. Given the amount of information gathered from local family members and personal experiences working the land on Isabela, much of the derived agricultural knowledge reflects strong links to local sense of place [41]. Such links between knowledge sharing, culture, and sense of place are on display in the following comments:

“Personally, if we cultivate or have something native to Galápagos, it is important because the new generations learn from an early age what it means to take care of, protect above all, and therefore maintain an area—not to make a forest and then come and cut it down. It is my priority that our future generations, my nephews, grandchildren, etc. know, live together and believe that mentality of continuing to maintain.”

These insightful comments also indicate clear recognition of inter-generational feedback loops regarding emerging local knowledge of agricultural ecosystem services, that is, ideas overlapping considerably with the provisioning, regulating, and supporting services provided by *Scalesia*. Once again, despite the lack of long-term human presence used to inform restoration strategies elsewhere (e.g., [6,23,25]), recently arrived immigrant populations in Galápagos have an intimate knowledge of *Scalesia*'s role in socio-ecological and temporal feedback loops and stand to be essential allies in restoration efforts.

5.1. Future Directions

One particularly notable contribution of the findings here involves the ways that tourism figures squarely within biocultural discussions within the Galápagos context. With the vast majority of human activity and impact occurring in the islands in the last 70 years, a period of time that overlaps with the rapid growth and dominance of tourism in the archipelago [82], it should not be surprising to hear tourism referenced so frequently in farmers' interview data. The linkages between tourism and other livelihood sectors (e.g., both farming and fishing) are very clearly understood amongst the local population, as noted here:

Yes, because we are living in a place that is protected, that its economy is based on tourism, it is one of the main activities that we carry out, if they are not protected we will not have to offer for tourism since all these things are important for our development: conservation, science, tourism, all these activities are important including agriculture and fishing in the islands.

What is more surprising is how little biocultural literature engages with the ways that these theoretical perspectives might inform tourism studies. Despite much attention to biocultural approaches to conservation (e.g., [17,26,29,83,84]), there is virtually no writing that applies biocultural approaches to conservation tourism or ecotourism. Exceptions involve a study analyzing the use of “extended reality” in tourism contexts [31] as well as online and offline representations of Indigenous biocultural diversity to reinforce efforts to conserve biodiversity and restore wildlife [85]. Although a few other authors have conducted biocultural research linking food systems and tourism [32,33], biocultural theory remains otherwise absent in tourism studies. A major implication of the findings here is

that biocultural approaches to conservation-oriented tourism (i.e., ecotourism) remain an underexplored avenue of research.

Furthermore, as Cohen and Fennell note, “Plants play a major and diverse, but little recognized, role in tourism” [86] p. 589. Our results indicate that *Scalesia* play a major role in tourism on Galápagos, and that tourism could play an essential role in restoration in this context. Ecotourism has been lauded for its ability to break vicious cycles of poverty and environmental degradation (e.g., [87]), as well as the institutional support it can create for enabling greater conservation than would otherwise exist in tourism’s absence [88]. Yet, the vast majority of ecotourism scholarship has focused on the conservation of animal species. Additionally, while writing that links ecotourism and restoration has emerged (e.g., [89,90]), it does not engage with biocultural theory. Future research exploring not just how biocultural approaches can inform tourism-supported conservation of plants as well as animals, but also how they can inform the design and management of other forms of tourism (e.g., cultural heritage or gastronomical tourism) would likely yield important insights just as it has in the conservation and restoration literature.

Furthermore, there is little literature discussing biocultural approaches in an urban or peri-urban context. In fact, Constant and Taylor argue, “Rural values for ecological restoration were dominated by biocultural restoration objectives to revive Indigenous knowledge and local practices and inter-generational learning experiences. Trade-offs exist among urban groups where forests are valued for employment and tourism” [91] p. 1. With restoration practice not limited to rural areas [12], understanding how biocultural approaches can be utilized in a world of urbanization and globalization is vital in conserving socio-ecological systems.

5.2. Limitations

A key limitation of the present study is that data were collected in fall 2020 during the COVID-19 pandemic. At this time, many Isabela residents who would normally be consumed in tourism activities near the coast returned to their lands in the highlands. Relocating there had the dual benefit of providing social isolation and helping maintain food security through cultivation efforts as cargo shipments from the mainland became less frequent. Yet, as a result, farmers had more production but less local market than ever and virtually no external export opportunities. These conditions heightened an overarching desire to “overcome market limitations by bringing the market to us,” as one farmer exhorted. The return to the land also provided farm owners with time to contemplate alternative uses of their farming and grazing lands, including the possibilities of getting their farms more involved in tourism. Other islands in the archipelago have seen substitution and geographic displacement of farming activities in order to open up tortoise viewing opportunities for tourists [67]. Those islands thus provide food for thought for Isabeleño farmers. To the extent that biocultural restoration via tourism, be it related to giant tortoises or *Scalesia* trees, improves local livelihoods and thus local adaptive capacity, it is likely to be taken up by residents eager to improve yields from their property. Future studies comparing how farms engaged in various mosaics of farming, ranching, and tourism fare in terms of social, economic, and environmental well-being would be a fruitful path of future research.

6. Conclusions

As a sensitive ecological context that is under accelerating human pressure in recent decades, the Galápagos context serves as a petri dish for the planet, allowing pressures on the “planetary boundaries” to be observed unfolding in nearly real time. More recently, scholars are further recognizing the societal boundaries being of exceeding the planetary boundaries [92]. One means of incorporating social ideas into biodiversity conservation is via biocultural approaches to species restoration. To that end, this analysis sought answers to the overarching questions such as: *what opportunities exist for biocultural restoration where there is no Indigenous population or traditional ways of knowing to draw upon, and instead where*

populations are composed primarily of recent migrants, and at what point does the knowledge being applied in such contexts become traditional? By reviewing theoretical ideas regarding biocultural approaches to restoration and conservation, we further explored how ideas regarding cultural keystone species, sense of place, knowledge sharing, and feedback loops intersect around *Scalesia cordata* on the island of Isabela in the Galápagos archipelago.

Contributions of this work are several. First, as a context where a native population did not exist, and thus where traditional ecological knowledge or local Indigenous knowledge as traditionally conceived did not exist prior to European arrival, we show that biocultural elements nevertheless exist and can therefore be critical to integrate into *Scalesia* restoration efforts. Second, unlike many restoration contexts where there is at least some opposition among particular stakeholders (e.g., ranchers afraid of livestock loss when wolves were restored to the Yellowstone ecosystem), we found universal support for the conservation and restoration of *Scalesia cordata*. As part of the ecological context that drew the recent immigrant population to Isabela in the first place, *Scalesia* remains a valued cultural keystone species that provides both tangible and intangible benefits to local residents. Its survival even serves as a metaphor for their own well-being. Finally, this work revealed a role for tourism within biocultural theory, something that to date has been virtually ignored. Given the strong links between tourism and conservation, and the growth in scholarship on biocultural approaches to conservation, future studies of biocultural approaches to tourism remain warranted. Here, the seeds have been planted.

Author Contributions: Conceptualization, H.J. and C.A.H.; Methodology, H.J., C.A.H., E.B.; Formal Analysis, C.A.H., H.J., E.B., M.E.J.; Investigation, E.B., C.Z.; Resources, H.J.; Data Curation, C.A.H.; Writing—Original Draft Preparation, C.A.H., H.J., M.E.J.; Writing—Review & Editing, C.A.H., H.J., M.E.J.; Visualization, C.A.H., M.E.J., C.C.-K.; Supervision, H.J.; Project Administration, H.J.; Funding Acquisition, H.J. All authors have read and agreed to the published version of the manuscript.

Funding: Funding for research upon which this article draws came from Fondation Franklinia (Award #2021-06) and the Keidanren Nature Conservation Fund (Award #2021-0275). Additional support for members of the author team came from the Fulbright Scholar Program (Award #9437-EC Research), the US National Science Foundation (Awards #2020555, #2105726, and #1828822), and a Fellowship in Sustainability Science from the Charles Darwin Foundation.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Penn State University (STUDY00015419, 8 June 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions and privacy concerns regarding participant consent process.

Acknowledgments: The authors wish to thank the Galápagos National Park Directorate for issuing research permit PC-18-21 and the Charles Darwin Research Station for administrative and technical support related to this project. We thank Miriam San José and Anna Walentowitz for their help with the interview questionnaire and Marita Velarde for her support on Isabela. A special thank you to the 20 farmers who shared their time and wisdom with us. This publication is contribution number 2474 of the Charles Darwin Foundation for the Galápagos Islands.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Fischer, J.; Riechers, M.; Loos, J.; Martin-Lopez, B.; Temperton, V.M. Making the UN decade on ecosystem restoration a social-ecological endeavour. *Trends Ecol. Evol.* **2021**, *36*, 20–28. [[CrossRef](#)] [[PubMed](#)]
2. Rockström, J.; Steffen, W.; Noone, K.; Persson, Å.; Chapin, F.S., III; Lambin, E.; Lenton, T.M.; Scheffer, M.; Folke, C.; Schellnhuber, H.J.; et al. Planetary boundaries: Exploring the safe operating space for humanity. *Ecol. Soc.* **2009**, *14*, 32. [[CrossRef](#)]
3. Hanspach, J.; Jamila Haider, L.; Oteros-Rozas, E.; Stahl Olafsson, A.; Gulsrud, N.M.; Raymond, C.M.; Torralba, M.; Martín-López, B.; Bieling, C.; García-Martín, M.; et al. Biocultural approaches to sustainability: A systematic review of the scientific literature. *People Nat.* **2020**, *2*, 643–659. [[CrossRef](#)]

4. Wiley, A.S.; Cullin, J.M. What Do Anthropologists Mean When They Use the Term *Biocultural*? What Does *Biocultural* Mean? *Am. Anthropol.* **2016**, *118*, 554–569. [CrossRef]
5. Brondizio, E.S.; Aumeeruddy-Thomas, Y.; Bates, P.; Carino, J.; Fernández-Llamazares, Á.; Ferrari, M.F.; Galvin, K.; Reyes-García, V.; McElwee, P.; Molnár, Z.; et al. Locally based, regionally manifested, and globally relevant: Indigenous and local knowledge, values, and practices for nature. *Annu. Rev. Environ. Resour.* **2021**, *46*, 481–509. [CrossRef]
6. Reyes-García, V.; Fernández-Llamazares, Á.; McElwee, P.; Molnár, Z.; Öllerer, K.; Wilson, S.J.; Brondizio, E.S. The contributions of Indigenous Peoples and local communities to ecological restoration. *Restor. Ecol.* **2019**, *27*, 3–8. [CrossRef]
7. Anderson, A.; Stothert, K.; Martinsson-Wallin, H.; Wallin, P.; Flett, I.; Haberle, S.; Heijnis, H.; Rhodes, E. Reconsidering precolumbian human colonization in the Galápagos Islands, Republic of Ecuador. *Lat. Am. Antiq.* **2016**, *27*, 169–183. [CrossRef]
8. Petren, K.; Grant, B.R.; Grant, P.R. A phylogeny of Darwin’s finches based on microsatellite DNA length variation. *Proc. R. Soc. Lond. B* **1999**, *266*, 321–329. [CrossRef]
9. Fernández-Mazuecos, M.; Vargas, P.; McCauley, R.A.; Monjas, D.; Otero, A.; Chaves, J.A.; Guevara Andino, J.E.; Rivas-Torres, G. The Radiation of Darwin’s Giant Daisies in the Galápagos Islands. *Curr. Biol.* **2020**, *30*, 4989–4998.e7. [CrossRef] [PubMed]
10. Mauchamp, A.; Atkinson, R. *Rapid, Recent and Irreversible Habitat Loss: Scalesia Forest in the Galápagos Islands. Galápagos Report 2009–2010*; GNP, GCREG, CDF and GC: Puerto Ayora, Galápagos, Ecuador, 2010; pp. 108–112.
11. UNEP. United Nations Decade on Ecosystem Restoration 2021–2030. 2022. Available online: <https://www.decadeonrestoration.org/> (accessed on 15 October 2022).
12. Cairns, J.; Heckman, J.R. Restoration Ecology: The State of an Emerging Field. *Annu. Rev. Energy Environ.* **1996**, *21*, 167–189. [CrossRef]
13. Caillon, S.; Cullman, G.; Verschuuren, B.; Sterling, E.J. Moving beyond the human–Nature dichotomy through biocultural approaches: Including ecological well-being in resilience indicators. *Ecol. Soc.* **2017**, *22*, art27. [CrossRef]
14. Lyver, P.O.; Akins, A.; Phipps, H.; Kahui, V.; Towns, D.R.; Moller, H. Key biocultural values to guide restoration action and planning in New Zealand: Biocultural values for restoration. *Restor. Ecol.* **2016**, *24*, 314–323. [CrossRef]
15. Bennett, N.J.; Roth, R.; Klain, S.C.; Chan, K.; Christie, P.; Clark, D.A.; Cullman, G.; Curran, D.; Durbin, T.J.; Epstein, G.; et al. Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biol. Conserv.* **2017**, *205*, 93–108. [CrossRef]
16. Berkes, F.; Colding, J.; Folke, C. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*; Cambridge University Press: Cambridge, UK, 2008.
17. Gavin, M.C.; McCarter, J.; Mead, A.; Berkes, F.; Stepp, J.R.; Peterson, D.; Tang, R. Defining biocultural approaches to conservation. *Trends Ecol. Evol.* **2015**, *30*, 140–145. [CrossRef]
18. Winter, K.; Lincoln, N.; Berkes, F. The Social-Ecological Keystone Concept: A Quantifiable Metaphor for Understanding the Structure, Function, and Resilience of a Biocultural System. *Sustainability* **2018**, *10*, 3294. [CrossRef]
19. Sena, P.H.A.; Gonçalves-Souza, T.; Gonçalves, P.H.S.; Ferreira, P.S.M.; Gusmão, R.A.F.; Melo, F.P.L. Biocultural restoration improves delivery of ecosystem services in social-ecological landscapes. *Restor. Ecol.* **2022**, *30*, e13599. [CrossRef]
20. Leatherman, T. A space of vulnerability in poverty and health: Political-ecology and biocultural analysis. *Ethos* **2005**, *33*, 46–70. [CrossRef]
21. Leatherman, T.L.; Goodman, A.H. Expanding the biocultural synthesis toward a biology of poverty. *Am. J. Phys. Anthropol.* **1997**, *102*, 1–3. [CrossRef]
22. Leatherman, T.; Goodman, A. Building on the biocultural syntheses: 20 years and still expanding. *Am. J. Hum. Biol.* **2020**, *32*, e23360. [CrossRef]
23. Bremer, L.; Falinski, K.; Ching, C.; Wada, C.; Burnett, K.; Kukea-Shultz, K.; Reppun, N.; Chun, G.; Oleson, K.; Ticktin, T. Biocultural Restoration of Traditional Agriculture: Cultural, Environmental, and Economic Outcomes of Lo’i Kalo Restoration in He’eia, O’ahu. *Sustainability* **2018**, *10*, 4502. [CrossRef]
24. Johns, T.; Sthapit, B.R. Biocultural diversity in the sustainability of developing-country food systems. *Food Nutr. Bull.* **2004**, *25*, 143–155. [CrossRef]
25. Lincoln, N.K.; Rossen, J.; Vitousek, P.; Kahoonei, J.; Shapiro, D.; Kalawe, K.; Pai, M.; Marshall, K.; Meheula, K. Restoration of ‘āina malo ‘o on Hawai‘i Island: Expanding Biocultural Relationships. *Sustainability* **2018**, *10*, 3985. [CrossRef]
26. Allen, W.H. Biocultural restoration of a tropical forest: Architects of Costa Rica’s emerging Guanacaste National Park plan to make it an integral part of local culture. *BioScience* **1988**, *38*, 156–161. [CrossRef]
27. Cuerrier, A.; Turner, N.J.; Gomes, T.C.; Garibaldi, A.; Downing, A. Cultural keystone places: Conservation and restoration in cultural landscapes. *J. Ethnobiol.* **2015**, *35*, 427–448. [CrossRef]
28. Berkes, F. *Sacred Ecology*; Routledge: Abingdon, UK, 2017.
29. Stephenson, J.; Berkes, F.; Turner, N.J.; Dick, J. Biocultural conservation of marine ecosystems: Examples from New Zealand and Canada. *Indian J. Tradit. Knowl.* **2014**, *13*, 257–265.
30. Dressler, W.W. What’s cultural about biocultural research? *Ethos* **2005**, *33*, 20–45. [CrossRef]
31. Arts, K.; Rabelo, M.T.O.; De Figueiredo, D.M.; Maffey, G.; Ioris, A.A.R.; Girard, P. Online and offline representations of biocultural diversity: A political ecology perspective on nature-based tourism and indigenous communities in the Brazilian Pantanal. *Sustainability* **2018**, *10*, 3643. [CrossRef]

32. Daltabuit, M.; Leatherman, T.L. The Biocultural Impact of Tourism. In *Building a New Biocultural Synthesis: Political-Economic Perspectives on Human Biology*; Goodman, A.H., Leatherman, T.H., Eds.; University of Michigan Press: Ann Arbor, MI, USA, 1998.
33. Leatherman, T.; Goodman, A.H.; Stillman, J.T. A critical biocultural perspective on tourism and the nutrition transition in the Yucatan. In *Culture, Environment and Health in the Yucatan Peninsula*; Springer: Cham, The Switzerland, 2020; pp. 97–120.
34. Abhilash, P.C. Restoring the Unrestored: Strategies for Restoring Global Land during the UN Decade on Ecosystem Restoration (UN-DEER). *Land* **2021**, *10*, 201. [\[CrossRef\]](#)
35. Janzen, D.H. Tropical Ecological and Biocultural Restoration. *Science* **1988**, *239*, 243–244. [\[CrossRef\]](#)
36. Morishige, K.; Andrade, P.; Pascua, P.; Steward, K.; Cadiz, E.; Kapon, L.; Chong, U. Nā Kilo ‘Āina: Visions of Biocultural Restoration through Indigenous Relationships between People and Place. *Sustainability* **2018**, *10*, 3368. [\[CrossRef\]](#)
37. Winter, K.B.; Ticktin, T.; Quazi, S.A. Biocultural restoration in Hawaii also achieves core conservation goals. *Ecol. Soc.* **2020**, *25*, 26. [\[CrossRef\]](#)
38. Coe, M.A.; Gaoue, O.G. Cultural keystone species revisited: Are we asking the right questions? *J. Ethnobiol. Ethnomedicine* **2020**, *16*, 70. [\[CrossRef\]](#)
39. Garibaldi, A.; Turner, N. Cultural Keystone Species: Implications for Ecological Conservation and Restoration. *Ecol. Soc.* **2004**, *9*, art1. [\[CrossRef\]](#)
40. Poe, M.R.; Donatuto, J.; Satterfield, T. “Sense of Place”: Human Wellbeing Considerations for Ecological Restoration in Puget Sound. *Coast. Manag.* **2016**, *44*, 409–426. [\[CrossRef\]](#)
41. Ryfield, F.; Cabana, D.; Brannigan, J.; Crowe, T. Conceptualizing ‘sense of place’ in cultural ecosystem services: A framework for interdisciplinary research. *Ecosyst. Serv.* **2019**, *36*, 100907. [\[CrossRef\]](#)
42. Masterson, V.A.; Stedman, R.C.; Enqvist, J.; Tengö, M.; Giusti, M.; Wahl, D.; Svedin, U. The contribution of sense of place to social-ecological systems research: A review and research agenda. *Ecol. Soc.* **2017**, *22*, 49. [\[CrossRef\]](#)
43. Folke, C. Resilience. *Ecol. Soc.* **2016**, *21*, 44. [\[CrossRef\]](#)
44. Atran, S.; Medin, D.; Ross, N.; Lynch, E.; Vapnarsky, V.; Ek, E.; Coley, J.; Timura, C.; Baran, M. Folkeology, cultural epidemiology, and the spirit of the commons: A garden experiment in the Maya lowlands, 1991–2001. *Curr. Anthropol.* **2002**, *43*, 421–450. [\[CrossRef\]](#)
45. Cardinale, B.J.; Duffy, J.E.; Gonzalez, A.; Hooper, D.U.; Perrings, C.; Venail, P.; Narwani, A.; Mace, G.M.; Tilman, D.; Wardle, D.A.; et al. Biodiversity loss and its impact on humanity. *Nature* **2012**, *486*, 59–67. [\[CrossRef\]](#)
46. Diaz, S.; Fargione, J.; Chapin, F.S., III; Tilman, D. Biodiversity loss threatens human well-being. *PLoS Biol.* **2006**, *4*, e277. [\[CrossRef\]](#)
47. Fisher, B.; Christopher, T. Poverty and biodiversity: Measuring the overlap of human poverty and the biodiversity hotspots. *Ecol. Econ.* **2007**, *62*, 93–101. [\[CrossRef\]](#)
48. Painter, M.; Durham, W.H. (Eds.) *The Social Causes of Environmental Destruction in Latin America*; University of Michigan Press: Ann Arbor, MI, USA, 1995.
49. Wilson, E.O.; MacArthur, R.H. *The Theory of Island Biogeography*; Princeton University Press: Princeton, NJ, USA, 1967; Volume 1.
50. Gon, S.; Tom, S.; Woodside, U. ‘Āina Momona, Honua Au Loli—Productive Lands, Changing World: Using the Hawaiian Footprint to Inform Biocultural Restoration and Future Sustainability in Hawai‘i. *Sustainability* **2018**, *10*, 3420. [\[CrossRef\]](#)
51. Caujapé-Castells, J.; Tye, A.; Crawford, D.J.; Santos-Guerra, A.; Sakai, A.; Beaver, K.; Lobin, W.; Florens, F.V.; Moura, M.; Jardim, R.; et al. Conservation of oceanic island floras: Present and future global challenges. *Perspect. Plant Ecol. Evol. Syst.* **2010**, *12*, 107–129. [\[CrossRef\]](#)
52. Durham, W.H. *Exuberant Life: An Evolutionary Approach to Conservation in Galápagos*; Oxford University Press: New York, NY, USA, 2021.
53. Froyd, C.A.; Lee, J.A.; Anderson, A.J.; Haberle, S.G.; Gasson, P.E.; Willis, K.J. Historic fuel wood use in the Galápagos Islands: Identification of charred remains. *Veg. Hist. Archaeobotany* **2010**, *19*, 207–217. [\[CrossRef\]](#)
54. Rydén, S. Review: Archaeological Evidence of Pre-Spanish. Visits to the Galápagos Islands. Thor Heyerdahl and Arne Skjölsvold. *Am. Antiq.* **1958**, *24*, 88–89. [\[CrossRef\]](#)
55. Stahl, P.W.; Astudillo, F.J.; Jamieson, R.W.; Quiroga, D.; Delgado, F. *Historical Ecology and Archaeology in the Galápagos Islands: A Legacy of Human Occupation*; University Press of Florida: Gainesville, FL, USA, 2020.
56. Suggs, R.C. A reanalysis of Galapagos ceramics data. *Z. Für Ethnol.* **1967**, *92*, 239–247.
57. Carrion, C. Migración y crecimiento poblacional en las islas Galápagos. In *Galápagos: Migraciones, Economía, Cultura, Conflictos y Acuerdos*; Carrion Ospina, P., Falconí, C.C., Eds.; Corporación Editora Nacional: Quito, Ecuador, 2007; pp. 93–113.
58. Latorre, O. *El Hombre en las Islas Encantadas: La Historia Humana en Galápagos*; FUNDACYT: Quito, Ecuador, 1999.
59. Ospina, P. *Migraciones, Actores e Identidades en Galápagos*; Consejo Latinoamericano de Ciencias Sociales: Quito, Ecuador, 2001.
60. Scholte, P.; de Groot, W.T. From Debaste to Insight: There Models of Immigration to Protected Areas. *Conserv. Biol.* **2009**, *24*, 630–632. [\[CrossRef\]](#)
61. Ramos Viteri, W. Causas de la Colonización y Migración Hacia Galápagos; Efectos en el Desarrollo Sostenible de Santa Cruz. I Congreso Online Internacional Sobre Migración y Desarrollo. 2016; pp. 36–49. Available online: <http://www.eumed.net/libros-gratis/actas/2016/migracion/3causas.pdf> (accessed on 15 October 2022).
62. INEC. *Análisis de Resultados Definitivos Censo de Población y Vivienda: Galápagos 2015*; Instituto Nacional de Estadística y Censos (INEC): Quito, Ecuador, 2015.

63. Observatorio de Turismo. *Estadística Turismo Galápagos 2017*; Observatorio de Turismo: Puerto Ayora, Ecuador, 2017; Available online: <https://www.observatorioGalapagos.gob.ec/> (accessed on 21 July 2021).
64. Toral-Granda, M.V.; Causton, C.E.; Jäger, H.; Trueman, M.; Izurieta, J.C.; Araujo, E.; Cruz, M.; Zander, K.K.; Izurieta, A.; Garnett, S.T. Alien species pathways to the Galápagos Islands, Ecuador. *PLoS ONE* **2017**, *12*, e0184379. [\[CrossRef\]](#)
65. Tye, A.; Francisco-Ortega, J. Origins and evolution of Galápagos endemic vascular plants. In *The Biology of Island Floras*; Bramwell, D., Caujapé-Castells, J., Eds.; Cambridge University Press: Cambridge, UK, 2011; pp. 89–153.
66. Dvorak, M.; Fessl, B.; Nemeth, E.; Kleindorfer, S.; Tebbich, S. Distribution and abundance of Darwin’s finches and other land birds on Santa Cruz Island, Galápagos: Evidence for declining populations. *Oryx* **2011**, *46*, 78–86. [\[CrossRef\]](#)
67. Laso, F.J.; Benítez, F.L.; Rivas-Torres, G.; Sampedro, C.; Arce-Nazario, J. Land Cover Classification of Complex Agroecosystems in the Non-Protected Highlands of the Galápagos Islands. *Remote Sens.* **2019**, *12*, 65. [\[CrossRef\]](#)
68. Babbie, E.R. *The Practice of Social Research*; Cengage Learning: Boston, MA, USA, 2021.
69. Brettell, C. Theorizing migration in anthropology: The Social Construction of Networks, Identities, Communities, and Globalscapes. In *Migration Theory: Talking across Disciplines*; Routledge: New York, NY, USA, 2015; pp. 148–197.
70. Harris, M. History and significance of the emic/etic distinction. *Annu. Rev. Anthropol.* **1976**, *5*, 329–350. [\[CrossRef\]](#)
71. Fetterman, D.M. Emic/etic distinction. In *The Sage Encyclopedia of Qualitative Research Methods*; Given, L.M., Ed.; Sage Publications: Thousand Oaks, CA, USA, 2008.
72. Creswell, J.W.; Poth, C.N. *Qualitative Inquiry and Research Design: Choosing among Five Approaches*; Sage Publications: Thousand Oaks, CA, USA, 2018.
73. Patton, M.Q. *Qualitative Research and Evaluation Methods*; Sage Publications: Thousand Oaks, CA, USA, 2015.
74. Namey, E.; Guest, G.; Thairu, L.; Johnson, L. Data reduction techniques for large qualitative data sets. In *Handbook for Team-Based Qualitative Research*; Guest, G., MacQueen, K.M., Eds.; Rowman & Littlefield: Lanham, MD, USA, 2008; pp. 137–161.
75. Saldaña, J. *The Coding Manual for Qualitative Researchers*; Sage Publications: London, UK, 2015.
76. Bernard, H.R.; Wutich, A.; Ryan, G.W. *Analyzing Qualitative Data: Systematic Approaches*; Sage Publications: Thousand Oaks, CA, USA, 2017.
77. Bernard, H.R. *Social Research Methods: Qualitative and Quantitative Approaches*, 2nd ed.; SAGE Publications: Los Angeles, CA, USA, 2013.
78. Stake, R.E. *Qualitative Research: Studying How Things Work*; The Guilford Press: New York, NY, USA, 2010.
79. Ritchie, J.; Lewis, J.; Nicholls, C.M.; Ormston, R. (Eds.) *Qualitative Research Practice: A Guide for Social Science Students and Researchers*; Sage: London, UK, 2013.
80. Ortiz, F.; Henderson, S. *El cultivo de Café en la Isla Santa Cruz, Galápagos*; Conservación Internacional-Ecuador: Santa Cruz, Galápagos, Ecuador, 2011.
81. Geladi, I.; Henry, P.Y.; Mauchamp, A.; Couenberg, P.; Fessl, B. Conserving Galápagos landbirds in agricultural landscapes: Forest patches of native trees needed to increase landbird diversity and abundance. *Biodivers. Conserv.* **2021**, *30*, 2181–2206. [\[CrossRef\]](#)
82. Hunt, C.A.; Barragán-Paladines, M.J.; Izurieta, J.C.; Ordóñez, L.A. Tourism, compounding crises, and struggles for sovereignty. *J. Sustain. Tour.* **2022**, 1–18. [\[CrossRef\]](#)
83. DeRoy, B.; Darimont, C. Biocultural indicators to support locally led environmental management and monitoring. *Ecol. Soc.* **2019**, *24*, 21. [\[CrossRef\]](#)
84. Hong, S.K. Biocultural diversity conservation for island and islanders: Necessity, goal and activity. *J. Mar. Isl. Cult.* **2013**, *2*, 102–106. [\[CrossRef\]](#)
85. Branstrator, J.R.; Cavaliere, C.T.; Xiong, L.; Knight, D. Extended reality and sustainable tourism: Restorying human–wildlife relationships for biocultural conservation. *J. Ecotourism* **2022**, 1–17. [\[CrossRef\]](#)
86. Cohen, E.; Fennell, D. Plants and tourism: Not seeing the forest [n]or the trees. *Tour. Stud.* **2019**, *19*, 585–606. [\[CrossRef\]](#)
87. Durham, W.H. Fishing for solutions: Ecotourism and conservation in Galápagos national park. In *Ecotourism and Conservation in the Americas*; Stronza, A., Durham, W.H., Eds.; CABI: Wallingford, UK, 2008; pp. 66–89.
88. Stronza, A.L.; Hunt, C.A.; Fitzgerald, L.A. Ecotourism for Conservation? *Annu. Rev. Environ. Resour.* **2019**, *44*, 229–253. [\[CrossRef\]](#)
89. Blangy, S.; Mehta, H. Ecotourism and ecological restoration. *J. Nat. Conserv.* **2006**, *14*, 233–236. [\[CrossRef\]](#)
90. Ramírez, F.; Fennell, D. A comprehensive framework for ecotourism and wetland restoration: The case of Bogotá, Colombia. *J. Ecotourism* **2014**, *13*, 128–151. [\[CrossRef\]](#)
91. Constant, N.L.; Taylor, P.J. Restoring the forest revives our culture: Ecosystem services and values for ecological restoration across the rural-urban nexus in South Africa. *For. Policy Econ.* **2020**, *118*, 102222. [\[CrossRef\]](#)
92. Brand, U.; Muraca, B.; Pineault, É.; Sahakian, M.; Schaffartzik, A.; Novy, A.; Streissler, C.; Haberl, H.; Asara, V.; Dietz, K.; et al. From planetary to societal boundaries: An argument for collectively defined self-limitation. *Sustain. Sci. Pract. Policy* **2021**, *17*, 264–291. [\[CrossRef\]](#)

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.