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Concept Mapping: An Effective and Rapid Participatory Tool for Analysis of the Tourism System?

Chelsea L. Leven * and Keith Bosak

Department of Society and Conservation, W.A. Franke College of Forestry and Conservation, University of Montana, 32 Campus Drive, Missoula, MT 59812, USA
* Correspondence: 11ecogeo@gmail.com

Abstract: Sustainable tourism has grown rapidly in the last 35 years, both on the ground and as an area of academic study. However, the results of sustainable tourism development have proven to be mixed, with many unwanted outcomes stemming from its development in destinations around the world. Recent academic approaches to studying sustainable tourism development are increasingly turning towards social–ecological systems (SESs) thinking in order to embrace the inherent complexity and rapid change found in today's world. This stems partly from an understanding that tourism is a complex social–ecological phenomenon, and that its success relies on understanding its dynamics in a given location. While SES approaches to understanding complex phenomena such as tourism are well-developed, they tend to be resource-intensive and unwieldy in rapidly changing environments, such as those found in sustainable tourism destinations. Therefore, we hypothesized that a novel form of concept mapping based on an SES perspective and the paradigm of resilience thinking could address limitations in conceptualizing and understanding sustainable tourism as part of a larger SES. In this paper, we outline our method thoroughly, then evaluate concept mapping by assessing its effectiveness as a rapid assessment tool that enhances systems understanding while being easy to use in the field, privileging local knowledge, and emphasizing relationships within the SES. We focus on the method and its applicability rather than the results of the maps themselves. Through a case study in Ometepe, Nicaragua, our results showed that concept mapping revealed key drivers and values within the SES and emphasized the value of participatory and transdisciplinary tourism research. Our study demonstrates that concept mapping is an effective method for rapidly assessing the complexity of a tourism destination in a manner that is accessible, adaptable, and achievable.

Keywords: Latin America; methodology; Nicaragua; resilience; social–ecological system; sustainable tourism

Citation: Leven, C.L.; Bosak, K. Concept Mapping: An Effective and Rapid Participatory Tool for Analysis of the Tourism System? *Sustainability* **2022**, *14*, 10162. https://doi.org/10.3390/su141610162

Academic Editors: Mark Anthony Camilleri and Kyle Maurice Woosnam

Received: 14 June 2022
Accepted: 12 August 2022
Published: 16 August 2022

1. Introduction

For tourism development to contribute to global sustainability agendas, the functioning of tourism within its greater social–ecological system (SES) must be better understood. SESs are conceptualized by a fundamental recognition that human and natural systems are coupled, and SES thinking facilitates management approaches that focus on sustainability [1]. SES thinking is readily applied to sustainable tourism because of the inseparability between human and environmental systems in destinations [2,3]. However, methodological challenges in bringing SES theory to practice exist both within SES thinking [4–6] and tourism [7,8]

Much of the academic literature that links sustainable tourism with SES thinking analyzes the persistence of the tourism industry—i.e., whether tourism itself is being sustained. Sustainable tourism is most often conceptualized as impacting three spheres, the economic, environmental, and socio-cultural, whereby tourism activities provide benefits to each sphere while efforts are made to reduce negative impacts. The problem is that, oftentimes, one sphere (usually the economic) is preferred over the others and there is

little focus on the connections and dependencies between spheres and tourism activities. This often leads to a drive to sustain tourism rather than an understanding of the role tourism plays in the broader context of a destination. Sharpley [9], Moscardo [10], and Bosak [11] advocate for tourism to be reframed as a strategic tool for achieving desired goals or states within the system, rather than as the goal itself. System thinkers emphasize that modeling a system is a prerequisite for constructing an intentional system change, via a system interference such as tourism, as an iterative and adaptive process [12–16]. Therefore, for tourism to be used as a tool of development, researchers and practitioners must first improve their understanding of the greater SES that contains sustainable tourism by identifying components and relationships and evaluating how tourism functions as a livelihood, form of economic development, and socio-cultural exchange within an SES. However, our review of sustainable tourism scholarship reveals a dearth of effective and efficient methods to analyze tourism development within the complex adaptive system of a SES.

Our study suggests and evaluates concept mapping as a qualitative method to rapidly analyze how the sustainable tourism sector functions within SES dynamics of a specific destination. We designed a novel use of concept mapping that focuses on local participation and knowledge while applying fundamental systems understandings, particularly as derived from Levin [17], Liu et al. [18], Meadows [14], and Preiser et al. [6], providing a background of methodologies used within SES and sustainable tourism scholarship and ongoing challenges of conceptualizing tourism holistically. Then, we introduce concept mapping as a method to address the limitations in current methodologies, before evaluating the usefulness of the concept mapping methodology through a case study in Ometepe, Nicaragua. The results demonstrate that concept mapping offers a rapid assessment tool that is accessible, adaptable, and achievable. We do not present Ometepe-specific results of the concept mapping other than for illustrative purposes of our evaluation. We finish with a discussion of the benefits and challenges of this method and suggest opportunities for future use.

1.1. Sustainable Tourism within Social-Ecological Systems

The need for tourism development to contribute to sustainable social and environmental objectives is increasing with ongoing and projected growth for the tourism sector [3]. Entities such as the United Nations World Tourism Organization (UNWTO) and United Nations Development Programme (UNDP) endorse tourism's potential to provide local livelihoods, promote social development, enhance equity, and protect natural and cultural heritage as a way to contribute to sustainable development goals, particularly when emphasizing tourism in natural areas and low-GDP countries [19,20].

However, the realities of sustainable tourism outcomes are complex and include significant failures [21–27]. For example, in Nicaragua, a low-GDP country that draws significant tourism for its natural heritage, studies of tourism exposed violent exclusion to subsistence access for locals, exacerbation of socioeconomic inequalities, and negative environmental impacts [28,29]. These Nicaraguan examples indicate a broader trend that we note in sustainable tourism studies, in which, local voices are overlooked and complex dynamics and feedbacks are misunderstood or ignored, and yet local and external actors continue to promote the tourism sector.

Failures to achieve sustainable development goals through tourism may in part reflect shortcomings in methods used to conceptualize tourism. Recent trends in sustainable tourism scholarship embrace SES perspectives through the lens of resilience thinking [2,3,30], offering a promising direction. SES theory has foundations in complex adaptive systems, ecology, and sociology [15,31–33], and was originally developed for practical application to natural resource management using local actors' ecological knowledge [1,34]. SES perspectives are particularly useful for developing methods used to assess sustainable tourism destinations because they tend to conspicuously display interconnected human and environmental dynamics and have local actors deeply involved with tourism.

A review of SES methods by Vos et al. [5] highlights the lack of a standard methodology within SES studies, classifying over 300 methods within the analyzed texts. Findings in SES reviews by Herrero-Jáuregui et al. [4] and Gain et al. [35] also report a multiplicity of methods. SES methods vary significantly to include, e.g., spatial mapping and analysis, network analysis, historical profiling and reconstruction, interviews, facilitated dialogues, expert modeling, and games [5].

Notably, systems scholarship includes other leading thinkers who have developed rich frameworks to assess SESs, such as Ostrom [36,37]. Despite the value of frameworks as robust as Ostrom's, such frameworks can prove to be unfeasible to execute within typical field research constraints, especially outside of developed and democratic countries. Additionally, frameworks with detailed and massive indicator sets can be concurrently overwhelming and incomplete in their approach to complexity [38], particularly to non-specialists. With this study, we sought to develop a method that would be effective within typical field constraints while producing a rich analysis of tourism within a larger system.

Within SES schools of thought, resilience thinking provides practical approaches to system manipulation amidst the dynamic and uncertain nature of complex systems [39]. Whereas *resilience* is a system property, describing the capacity to retain identity and structure amidst disturbances [31,39], *resilience thinking* is a management paradigm, connecting theory and practice. Resilience thinking builds management and governance strategies through methods that solicit values from relevant actors in a system—asking about the desired resilience of what, to what [15], and for whom [40]. Resilience thinking methods focus on exposing relationships within a system rather than individual system components [14,15,17], while emphasizing complex system behaviors such as unpredictability, nonlinear and cross-scalar relationships, and the system capacity to learn, evolve, and adapt [1,15,17,39,41].

The SES-based resilience-thinking paradigm most influenced our research because of its relevant focus on empirical investigations and management applications. Resilience scholars combine multidisciplinary backgrounds, increasingly drawing from social science methods such as collective learning [42] to offer practical techniques, e.g., in the researcher and practitioner's workbook *Resilience Practice* [15]. Resilience thinking emphasizes participation and knowledge from local actors through methods such as concept mapping [43] and scenario planning [44,45]. Additionally, resilience supplements the concept of sustainability [46–48], which has brought resilience thinking to the forefront of conversations on sustainable tourism development [2,3,48].

1.2. Limitations in Methods Used to Analyze Tourism

Reviews of tourism research, as with SES research, show a plurality of methods. Social survey methods and case studies are popular methods within sustainable tourism [49]. Robust varieties of quantitative indicator systems are also well established, but the ease of use and translatability between studies is hindered by an excess of different indicators [50]. Sustainability indicators tend to provide the most valuable data for environmental components, with less attention given to other dimensions of tourism, such as social and governance [50], echoing problems within SES research. Sustainability indicators also get bulky; researchers generally employ more indicators to obtain data on more dimensions [50].

Sustainability indicators are measurable, valuable, and well-established within sustainable tourism. Problematically, indicators tend to be an overwhelming yet incomplete manner to represent complexity, failing to bring forward the dynamics most essential to understanding and manipulating the system. Therefore, sustainability indicators would benefit from further methods to better understand the complex relationships beyond indicator-driven data [38].

Resilience-thinking offers a useful methodological (as well as theoretical) direction for tourism studies. Tourism researchers have employed resilience thinking to build new models and indicators while treating tourism as the SES [8,51–54] or as a part of greater SESs [47,55]. However, these studies share a common assumption that the tourism industry

itself needs to be resilient and/or sustained. This assumption focuses primarily on the linear economic growth of tourism, which can undermine social, environmental, and economic goals by ignoring the inherent dynamics of SESs [11].

The results of a systematic literature review at the intersection of tourism studies and sustainability science show that SES approaches have merit for development planning, but account for a minority of approaches, and that social aspects within the SES are frequently overlooked [7]. The authors suggest using accessible methods that emphasize local participation with increased qualitative research. This recommendation is supported by Berkes and Folke [1], who assert that considerations of sustainability must emphasize humans within the SES; Liu [56], who adds that sustainable tourism requires integration of local communities into tourism development; and Strickland-Munro et al. [57], who emphasize that effective sustainable tourism research must be iterative, participatory, and transdisciplinary. Calgaro et al. [58] further argue that SES analyses for tourism must be augmented with specific consideration of pre-existing vulnerabilities in a destination in order to achieve social, economic, and ecological goals. Attention to vulnerability also enriches the understanding of spatial, temporal, and social scales that affect a system [58,59].

Sustainable tourism is founded upon complex connections between humans and their surroundings. However, analyses and conceptualizations of tourism have too frequently failed to address the complexity, artificially decoupling dimensions of tourism and the surrounding SES and attempting to reduce tourism to a linear and predictable phenomenon [51,53,60,61]. Specifically, we found three significant limitations repeated across SES-based studies of tourism.

The first limitation that we considered is that most studies linking tourism with SES thinking proceed to analyze the persistence or resilience of the tourism industry itself, despite the longstanding critique of this practice [9]. We wanted to avoid a focus on industry persistence because: (1) we did not want to concentrate our methodology on a particular variable. Instead, we sought to holistically analyze the SES in which the tourism sector functions, with explicit attention to tourism-related context. (2) The documentation of failures and successes within sustainable tourism development indicates that tourism may or may not achieve its purported goals within a given context. Similarly, sustainable development and resilience are both unstable targets that change based on normative goals and the best available science [13,62,63]. Tourism can be a tool for sustainable development but may not be the right one for a given context [9–11]. Consequently, we sought a method that did not qualitatively value or devalue tourism.

The second limitation is that, despite a proliferation of SES methods and frameworks in recent decades [64,65], the application of SES thought to tourism destinations is relatively new [2]. Unfortunately, many of the SES methods are unwieldy in the resources that they demand, such as time, money, and expertise. Additionally, tourism development is often rapid, and destinations are prone to a large variety of hazards that can halt tourism. Therefore, we sought a field method that could function as a rapid assessment tool while being feasible for a range of researchers and practitioners to use.

The third limitation derives from the infrequency with which local understandings and input are reflected in sustainable tourism strategies [28,66], despite established evidence that local representation is essential for successful sustainable tourism outcomes [28,67,68]. In our review of the literature, we found that local viewpoints are secondary, superficial, or absent from many studies that incorporate SES thinking, despite evidence that methods that coproduce knowledge with representative local actors can effectively describe an SES [15]. We contend that, as a necessary precursor to tourism development, local goals and values need to be explicitly addressed to understand the functioning of the system, increase the awareness of power dynamics and inequalities, and better anticipate potential failure points. In addition, if resilience thinking is to offer value to tourism planning, locals must partake in specifying the resilience of what, to what [15], and for whom [40]. Therefore, we wanted a field method to privilege diverse local knowledge and include input from local citizens throughout the research process.

SES-based resilience thinking offers constructive momentum for the planning and analysis of sustainable tourism, and the overall trend in tourism studies supports this. Our study builds upon prior applications of resilience thinking to tourism development and research while aiming to address these limitations. These limitations spotlight the lack of empirical methods used to analyze complexity. We sought a method that would collect data that embraced and captured a diversity of experiences and knowledge while also being logistically simple for field application and practical for facilitating ongoing management and systems learning. These goals form the basis for evaluating the success of our methodology.

We chose a qualitative versus quantitative methodology to confront the aforementioned limitations and on-the-ground realities. The co-production of research methods with locals encourages methods that are accessible, favoring qualitative studies. Overall, qualitative methodology can provide an efficient and rich understanding of complexity within exigencies of responding to real-world situations, while quantitative methods and data could be useful for future, specific management needs. The method we designed and assessed is a novel application of concept mapping.

1.3. Concept Mapping in Resilience Thinking and Tourism Studies

Concept mapping offers a participatory method to visually represent how the tourism sector functions within an SES. Concept mapping evolved in the 1970s and 1980s [69–71] as a way to model complex knowledge and has continued to develop as an interdisciplinary tool with a variety of forms and diverse users.

Concept mapping is used as an instrument for education, psychological assessment, conservation measurements, and planning and evaluation. Related methods of visually representing complex knowledge include institutional and stakeholder mapping [72,73]; participatory environmental modeling [74]; fuzzy cognitive mapping [75]; the dilemma cube [76]; and mental models for decision making [77] or organizing knowledge of experts [78]. Cognitive mapping has gained some traction in tourism studies [79–81], but takes a variety of forms, ranging from spatial to conceptual models, and has not been used to describe tourism in the context of SES thinking. Many of these methods require high levels of expertise and complicated forms of data analysis, and are most easily performed in highly democratized, first world nations.

Some tourism studies have used practical versions of concept mapping as a field method. Strickland-Munro, Allison, and Moore [57] suggest that verbal and visual forms of concept mapping can contribute to understanding SES focal scale and cross-scale interactions. Lupoli et al.'s [68] research into volunteer tourism utilized concept maps with a methodology called "the compass of sustainability". The results support the accessibility and effectiveness of concept mapping to privilege local knowledge and better understand tourism impacts. Furthermore, Lupoli et al. [68] advocate the continued use of concept mapping as a tool that can help organizations and community members to evaluate and monitor the process.

While some concept mapping involves geographic representation, the forms most influential for this study were those used to model ideas in a non-spatial manner. Gray literature and our participation in workshops at the theory/practice boundary indicated that concept mapping could collect rich data for tourism analyses, including system components, key issues, historical profiles, disturbances, system drivers, and key players. Conceptual models that fall within our idea of concept mapping have shown to be useful in advancing understandings between social and ecological disciplines [82]. Concept mapping facilitates rapid and efficient data collection directly from people who live their daily lives within the system [15,43,83]. The method's intuitive and reflexive nature makes it easy to engage residents and represent participants' understanding of the SES, including when results are unexpected for the researcher [43]. Additionally, concept mapping activities can specifically address weaknesses, disturbances, and interactions within the system, allowing space for the sociopolitical dynamics surrounding vulnerability to be represented [43,84].

1.4. Case Study Background: Ometepe, Nicaragua

To evaluate whether concept mapping could successfully transcend the limitations of other methods, we tested the method on Ometepe, Nicaragua. Local requests prompted our study at this destination. Ometepe is a 277 km^2 island in Lake Cocibolca (Lake Nicaragua), in the tropics of the Central American isthmus. The tourism sector is a growing part of the broader SES, with obvious social and ecological components. Twin volcanoes form Ometepe island. One remains active, and both provide rich volcanic soils to support agriculture and biodiversity. Tourism includes activities directly related to the volcanoes, such as summit treks, and pursuits that take advantage of volcanic geography, such as birding, beachgoing, and permaculture farming. Local geography also means that Ometepe is prone to natural hazards, including volcanic eruptions, hurricanes, and lahars (hereafter generalized as "landslides").

In April 2018, violent socio-political unrest erupted in Nicaragua, resulting in hundreds of deaths, the dismantling of significant public and private services, the unhinging of the economy [85,86], and devastation of the tourism industry [87,88]. We conducted concept mapping activities during this crisis, thus also testing how the methodology would function within a fraught and uncertain situation. In the following section, we first present a guideline of our proposed method, then used a case study on Ometepe to validate the procedure.

2. Materials and Methods

For our methodology, we utilized a research approach and sampling procedure that involved the local community, followed by a two-stage process of concept mapping. To address one of the noted limitations in methods, community members local to the destination were included in the research process in order to privilege local knowledge of sustainable tourism. The selection of community members was an iterative process in which researchers and all participants were explicitly asked to consider who else should be invited to participate in order to enrich perspectives. Participants were invited from diverse demographics inside and outside the tourism industry. This helped to address another limitation by de-emphasizing tourism as an obligatory and desirable part of the SES. As a final step of preparation, pilot studies were used to pre-test the method, which were useful to establish whether the process effectively collected the data needed to support the study and to identify practical concerns in applying the method [89].

Concept mapping activities were conducted in groups of participants and in spaces that were safe and encouraged participation. Power dynamics and social norms were observed during participant selection and during each research activity, proactively aiming to counteract ways in which social context might prohibit representative participation. These provisions follow Maslow's hierarchy of needs [90], with the intent that concept mapping is most productive if participants can function at the highest level of the hierarchy, which is associated with development, creativity, and problem solving. Introductory activities were used at the start of a concept mapping session to acknowledge participants' individual roles within the system and their personal importance to the study, and familiarize them with systems thinking. These introductory exercises were adapted to the local cultural context and offered expansive room for flexibility and innovation.

Next, the introduction to concept mapping included all of the supplies, such as large papers and markers, and examples of concept maps. Examples of concept maps of various disciplines and designs can easily be found on the Internet. We introduced concept mapping as fundamentally expressing components, oftentimes referred to as nodes, and the relationships between nodes. Beyond that, creativity was encouraged among participants. The facilitator(s) then stepped back as participants created concept maps. We considered this as Stage One of the concept mapping activity. It is important for researchers to document the maps at this stage (via, e.g., photos).

In Stage Two, the facilitator(s) probed deeper into system dynamics by asking questions derived from SES understanding and tourism research. These questions were de-

signed to address two limitations that we noted in tourism methodologies by applying holistic SES thinking to tourism and by positioning tourism as a component within a greater SES. We derived our Stage Two questions from Liu et al. [18] and Preiser et al. [6], combined with tourism-specific systems thinking derived from Calgaro et al. [58]. From these papers, we developed our line of inquiry along seven properties of SESs: (1) context and heterogeneity, (2) nonlinearity and thresholds, (3) feedbacks, (4) surprises and uncertainty, (5) resilience, (6) historical legacies and time lags, and (7) cross-scale interactions. Specific questions were developed with regard to local context, co-produced with local co-facilitator(s), and tested and improved through pilot studies. Data from completed maps were assessed in a systematic manner, with a focus on similarities and differences between maps, alignment with seven properties of SES, and emergent themes.

Next, we detail this method in context of our application through a case study in Ometepe, Nicaragua. Then, we evaluate our study against the methodological limitations that we sought to overcome, specifically looking at three metrics: is our method accessible, adaptable, and achievable? We review our outcomes in the Results section.

2.1. Research Approach

We conducted concept mapping activities in four communities. The meeting location for each activity provided a safe setting for all participants to engage, with explicit consideration of the ongoing socio-political situation. Accordingly, activities were conducted in public places without political affiliations (hotel or library), and which provided comfort and amenities for participants. The four communities were selected based on geographically distinct relationships to the volcanoes, diversity of local livelihoods, and viability of conducting research. Communities included: Moyogalpa and Altagracia, the two largest cities on the island and the hubs for transportation and local government; Santa Cruz, a beach community sprawled across the isthmus that links the two volcanoes; and Ciudadela, a community of approximately 200 families that was relocated from the neighboring location of Los Ramos in 2014 following multiple devastating landslides.

While the selected study locations were targeted for geographic differences, the close social networks on the island complicated the geographic representation. For example, some participants lived in one of the four communities, but worked in another, or vice versa.

2.2. Sampling Procedure

A total of 39 citizens participated in the data collection. Participants were found via a mix of purposive sampling, which is constructed from knowledge of the population and study purpose, and snowball sampling, in which participants recommend additional participants [91]. We began purposive sampling prior to initiating the mapping activities, based upon discussions with local key informants. We used snowball sampling to accumulate more participants, which continued during each research session as participants were asked to consider what voices from the island were not represented at the activity. Despite sampling procedures, the rather capricious nature of island schedules combined with crisis-induced economic hardships resulted in unannounced arrivals and absences at every mapping session. We collected basic demographic data in order to consider who was being represented in participation and to compare demographics between maps if results varied greatly. Demographic information of participants can be viewed in Table 1.

Table 1. Combined demographic information for study participants.

		Sex	Age	Primary Employment	Town of Residence	Town of Employment
Mapping Session Location	Altagracia	M	25	Fishing	Altagracia	Playa Taguizapa
		M	29	Tourism	Urbaíte	Moyogalpa
		M	32	Tourism	Altagracia	Altagracia
		M	36	Tour guide, Spanish teacher	Altagracia	Altagracia
		M	38	Tourism	Mérida	Mérida
		M	38	Teacher	Pull	Altagracia
		M	40	Tourism	Altagracia	Altagracia
		M	53	Tourism	Altagracia	Altagracia
		M	78	Museum historian	Altagracia	Altagracia
	Ciudadela	F	18	Student	Ciudadela	Ciudadela
		F	18	Student	Ciudadela	Ciudadela
		F	34	Door-to-door salesperson	Ciudadela	Ciudadela and nearby
		M	35	Carpenter, cabinetmaker	Ciudadela	Ciudadela
		F	38	Homemaker	Ciudadela	Ciudadela
		F	41	Farmer	Ciudadela	Ciudadela
		F	43	Homemaker	Sta Teresa (Ciudadela)	Sta Teresa (Ciudadela)
		M	44	Commercial driver, Farmer	Ciudadela	Ciudadela and Ometepe
		M	48	Builder	Ciudadela	Las Pilas
		M	?	?	Ciudadela	Farm near Ciudadela
	Moyogalpa	F	22	Business	Moyogalpa	Moyogalpa
		M	26	School	Moyogalpa	Moyogalpa
		F	27	Tourism	Altagracia	Moyogalpa
		F	28	Agronomy technician	Moyogalpa	Moyogalpa
		M	30	Tour guide, Plantain cultivator	Moyogalpa	Ometepe Island
		F	34	Restaurant	Moyogalpa	Moyogalpa
		M	39	Tour guide	Santa Teresa	throughout Nicaragua
		F	43	Non-governmental org.	Altagracia	Moyogalpa
		F	48	Employed	Moyogalpa	La Paloma
		M	52	Rents homes	Moyogalpa	Moyogalpa
		F	59	Federal employee	San Jorge	Across Rivas Department
	Santa Cruz	F	19	Tour business, student	Moyogalpa	Moyogalpa
		F	19	Tourism student	Urbaíte	Urbaíte
		F	20	Student, bartender	Balgüe and Altagracia	Balgüe
		F	21	Agriculture, tourism student	Mérida	Mérida
		M	28	Guide, Farmer	Mérida	Mérida
		M	30	Guide, Educational facilitator for non-governmental org.	Sintiope	Altagracia
		M	34	Guide	Balgüe	Ometepe Island
		M	42	Tour guide	Balgüe	Balgüe
		F	68	Business owner	Moyogalpa	Moyogalpa, Santa Cruz

Because the concept mapping was centered on the sustainable tourism sector, participants comprised a mix of workers from within the tourism sector (e.g., guides, hotel personnel) and those who did not work directly with tourism (e.g., farmers, schoolteachers). Along with our local informants, we anticipated that representation from a range of liveli-

hoods would provide a richer understanding of tourism than a more homogenous group. However, the distinction between livelihoods was not entirely straightforward, as many residents live in family compounds in which some members participate in the tourism sector whereas others do not. Additionally, it is typical for residents to engage in multiple economic and subsistence activities to create their livelihoods. Despite these complications, we asked participants to declare whether they did or did not work in tourism, which they all answered easily.

We personally invited most participants, but many were invited by local informants or other citizens interested in the research. All participants received a scripted verbal invitation, time for questions and answers, and opportunity for informed consent. They also received a formal letter of invitation explaining the research and concluding with a short series of questions. The questions did not require responses, but rather encouraged participants to think about system components and drivers, and particularly drivers that might occur over varied temporal scales and would therefore be less at the forefront of their thinking during the workshop itself.

Participation was anonymous, voluntary, and could be discontinued by the participant at any time. Participants were not compensated, but were reimbursed for related costs (such as bus fare) and provided with meals and refreshments during the study in order to alleviate potential hardship. We conducted concept mapping activities in four communities. The meeting location for each activity provided a safe setting for all participants to engage, with explicit consideration of the ongoing sociopolitical situation. Accordingly, activities were conducted in public places without political affiliations (hotel or library), and which provided comfort and amenities for participants. The four communities were selected based on geographically distinct relationships to the volcanoes, diversity of local livelihoods, and viability of conducting research. Communities included: Moyogalpa and Altagracia, the two largest cities on the island and the hubs for transportation and local government; Santa Cruz, a beach community sprawled across the isthmus that links the two volcanoes; and Ciudadela, a community of approximately 200 families that was relocated from the neighboring location of Los Ramos in 2014 following multiple devastating landslides.

While the selected study locations were targeted for geographic differences, the close social networks on the island complicated the geographic representation. For example, some participants lived in one of the four communities, but worked in another, or vice versa.

2.3. Data Collection

In conducting the concept-mapping activities, creating an environment in which participants felt physically, intellectually, and emotionally secure was paramount. Another priority for this study was to engage local community members in a research process that was useful for them. Our participatory process honored diverse local perspectives and engaged local citizens in every stage of the research. With input from local citizens, we aimed to create a methodology that was valuable as a process, rather than only for the results it produced.

We entered the research with the basic premise of visualizing concepts with nodes and relationships with links, but further development of the process was aided by a local professional familiar with SES thinking and forms of concept mapping. We conducted two pilot studies, which are not recorded in the data or results, but helped us to revise the method for successful application during the four formal research sessions.

Each concept map activity spanned approximately 6 h. Two maps were produced at each study location, for a total of eight maps. We facilitated each activity in Spanish alongside a local co-facilitator and followed the same activity outline for each session. We explained the aims of the research and emphasized that we were not leading a rigid procedure. Rather, we were facilitating the activity as an adaptive research process that welcomed ongoing participant feedback.

Our first introductory exercise derived from the activity "Draw How to Make Toast", [92]. Participants illustrated "How to make *gallo pinto*" (gallo pinto is the local traditional dish), then deconstructed the activity as a group. This light-hearted exercise carried merit by promoting systems thinking, demonstrating how naturally everyone broke a complex process into components and relationships, and reinforcing that responses were not wrong because they were different.

A subsequent exercise involved the co-creation of a timeline of disturbances to the tourism sector on Ometepe. This exercise communicated three essential ideas. It demonstrated how a "disturbance" was not necessarily good or bad; it provided background for both participants and researchers to understand historical legacies and time lags in the system; and the timeline introduced ideas of temporal and spatial scales. For the final part of this exercise, participants wrote their first interaction with tourism along the timeline, thereby helping individuals to recognize their own relationship to the tourism sector and reinforcing the value of everyone's individual system understanding. We included these disturbances as part of our concept map data analysis.

The final exercise before mapping included a full group discussion about the supply and demand of the local tourism industry. This exercise introduced tangible and intangible components within the tourism system and interactions between components—a foray into complexity, heterogeneity, and relationships of a system, with components and relationships comprising the "concepts" of the concept map. Participants also described the type of tourism on Ometepe. We have opted to use the term sustainable tourism in this manuscript as it is broad and representative of participants' designations, while recognizing that the term is problematic for the ambiguity and ethics in defining the term sustainable [93,94].

Then, we transitioned into creating concept maps, offering examples of what finished maps could look like with a diverse mix of Spanish-language examples from a relevant workshop [84]. For Stage One of the concept map creation, each study group was split into two smaller teams of 3–5 people each. One team worked directly in the tourism industry, and the other did not, acknowledging the imprecision of this division as explained previously. Next, we provided teams with large paper and a variety of supplies to create the map and gave teams the map title: "Conceptual map of the volcano-based tourism system". We suggested to teams that they begin with components (concepts) most fundamental to tourism and work outwards to describe how tourism functions within Ometepe Island (or whatever focal scale they determined). Each component comprised a tangible or intangible concept, creating a "node", with relationships drawn between nodes. We encouraged teams to simplify the system into the most important components and drivers, but not to oversimplify, following the advice of Walker and Salt [15].

Once each group completed a basic map of the system, Stage Two of the concept mapping commenced. Participants responded to Stage Two questions by visually modifying their maps with answers. Purposefully designed for this case study, Stage Two questions targeted SES properties through considering the effects of the sociopolitical crisis upon the SES broadly and the tourism sector specifically. As an example, teams were asked to show on the map "Where have people demonstrated the capacity to adapt or respond to the current situation?". In response, they might have highlighted a section of their map, or added a brief description. To aid in later analysis, we asked teams to put a (c), for "capacity", beside their response. Figure 1 shows examples of maps at the end of Stage One and at the end of Stage Two.

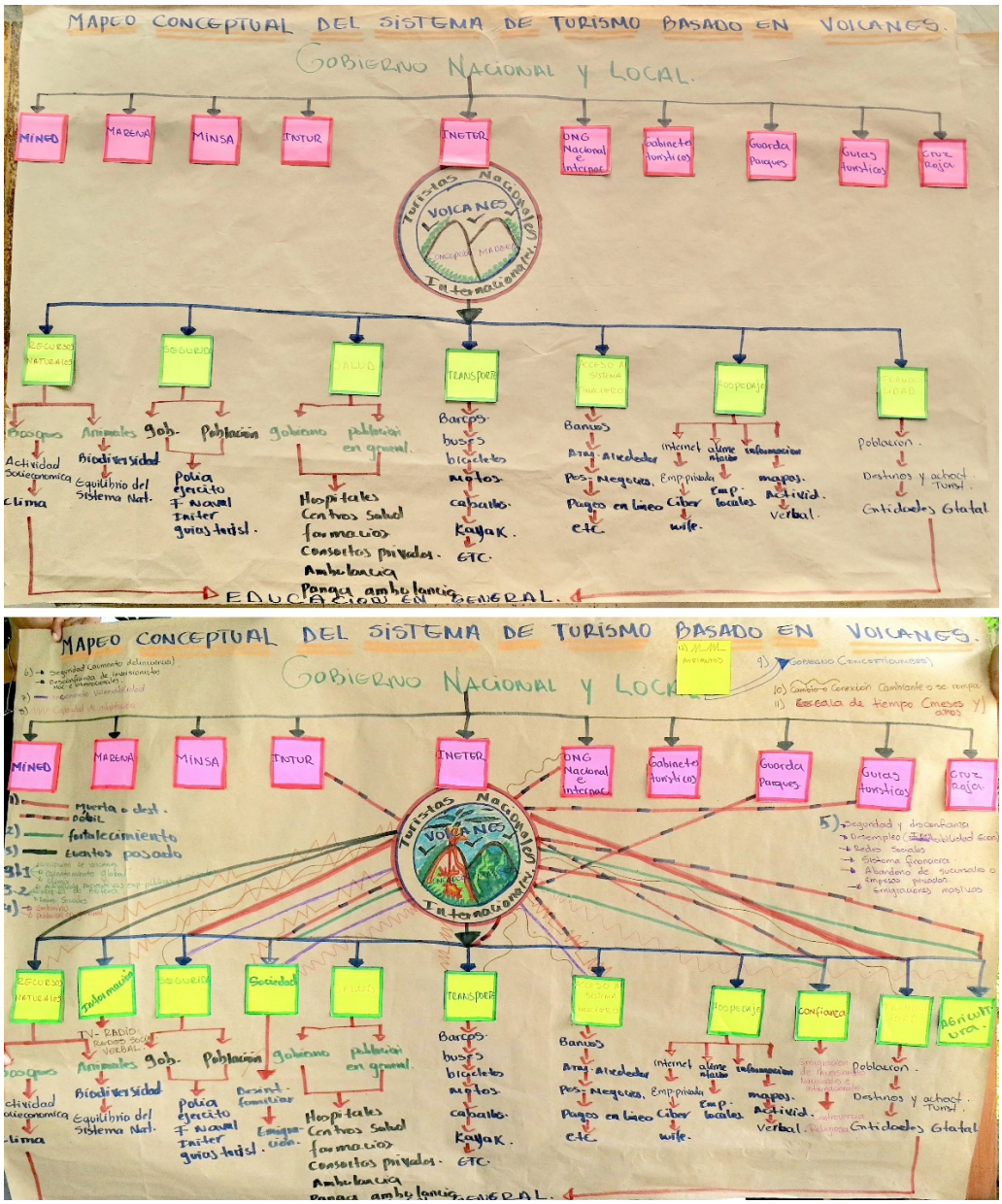

Figure 1. Concept map from Moyogalpa. Participants presented their maps at the end of Stage One (upper map) and at the end of Stage Two (lower map). Photos by C. Leven.

At the conclusion of each concept mapping activity, all team members attached anonymous, basic demographics to their maps. Participants were given the opportunity to present their maps, view the other team's map, and to reflect upon the activity. Suggestions that did not fundamentally alter the methodology were implemented in subsequent study sessions. Through each mapping activity, data were collected via the following products:

1. "How to make gallo pinto" drawings and the tourism disturbances timeline;
2. Photos taken of the maps during the process, particularly at the end of each stage;
3. The completed, large paper concept maps;
4. Extensive notes recorded during and within 24 h of each activity.

2.4. Data Analysis

Because this study sought to validate a rapid assessment tool that would be accessible even to those with basic resources, we ascertained that our data analysis did not require advanced technological tools. We created a spreadsheet listing the seven SES properties that participants had labeled on their maps and systematically completed the spreadsheet.

For example, one spreadsheet column contained "adaptive response to the current situation". Then, we input that seven out of eight maps listed "agriculture". Notes and ground-truthing revealed that many residents resumed agricultural livelihoods in place of tourism, for both subsistence and income generation. The capacity to engage in diverse livelihoods is a display of emergent properties within the system, an indicator of historical legacy and system memory, and a critical explanation of context. We found that data from the concept maps analyzed through an SES lens offered an essential understanding of how tourism functions within the system.

3. Results

For successful use as a method, concept mapping needs to provide a rapid assessment tool that enhanced systems understanding in a meaningful and holistic way while being easy to use in the field. This understanding needs to privilege local knowledge and focus on the relationships within the SES. Through evaluating the case study in Ometepe against these metrics, concept mapping demonstrated that it could provide a holistic assessment in a manner that was accessible, adaptable, and achievable.

The accessibility of the research was evaluated by its risk and costs, for both researchers and participants. Participants underwent no financial hardship to participate, the low time commitment alleviated personal hardship, and, through research design, it was easy to mitigate intellectual, emotional, and physical risks. The research budget for each study was small: paper and markers, printing costs, catering, and negligible reimbursements for participant transportation. Data analysis used basic spreadsheet software, and realistically could be handwritten if computer access was not possible. Therefore, this method was accessible because it was low risk and low cost.

Concept mapping is also accessible because it translates easily for diverse cultural and educational backgrounds. Participants ranged from having basic literacy to a doctorate degree, and all were able to contribute. Each participant team agreed on a visual representation of their mental models within approximately two hours. Additionally, accessibility was enhanced by the assistance of the local co-facilitator, who helped to answer questions and translate ideas into the appropriate cultural context. Finally, the low expenditure of time and money meant that the consequences were low had a session not produced usable data. To further this point, participants were highly engaged in every mapping activity, while they expressed less interest in the ultimate output of the research. Many expressed gratitude for the local platform to discuss island issues. One participant said, "Thank you. In my 8 years working as a tour guide, this is the best *capacatación* [training] I have ever attended". Another participant expressed interest in using concept mapping in the future for his own projects.

Concept mapping also proved to be a highly adaptable method. The introductory exercises were heavily informed by feedback from local informants and pilot study participants. Lessons learned from each mapping session were easy to incorporate into following sessions, without fundamentally altering the data collection.

The socio-political crisis particularly highlighted the adaptability of concept mapping. Although we initiated this project prior to the crisis, concept mapping was easy to adapt for data collection during a crisis. We followed local advice to arrange activities appropriately, and local government officials were excluded from joining group concept map activities. However, even in a calmer political climate, the presence of public officials would have reflected a power imbalance. Separating participants due to power imbalances is supported by the work of Berkes [95] and Kayat [96]. Foreigners also did not participate in mapping

activities. While this was partly intentional for similar power dynamic concerns, it was also due to the crisis.

Finally, and essentially, concept mapping proved to be achievable. Concept mapping was able to absorb surprises while retaining the fundamental steps needed to collect data. Surprises included the arrival of unexpected participants to mapping sessions, a high absence rate for confirmed participants at three of four sessions, and changing study schedules.

"Achievability" also necessitates achieving results via furthering systems understanding. Within research constraints that included a limited field time, low resources, and a tricky socio-political situation, concept mapping produced valid and useful data for analysis. Each case study map captured holistic system understanding as conceptualized by local citizens. The concept maps defined key relationships between different parts of the systems. The maps furthered systems understanding of the tourism sector by clearly providing data for basic properties of SESs, as well as the tourism-specific context. Figure 2 offers examples of systems understanding that arose through analyzing the concept maps.

Properties of SESs	Examples from Ometepe Data
Context and heterogeneity	Distinct components comprise system, and relationships between components reorganized following onset of the crisis
Nonlinearity and thresholds	Local enterprises closed and/or abandoned in response to tourism sinking below a critical threshold
Feedbacks	Positive correlation in decreasing relationship between local government and citizens
Surprises and uncertainty	Omnipresent potential for natural hazards
Resilience	Livelihood diversity; citizens reengage with agriculture and fishing after loss of tourism
Historical legacies and time lags	Knowledge and land availability still present that allow for resumed agriculture practices
Cross-scale interactions	National sociopolitical crisis destroys tourism on Ometepe

Figure 2. Examples of data reflecting SES properties collected from the Ometepe case study. Properties of SESs are derived from Liu et al. [18] and Preiser et al. [6].

4. Discussion

The results from the case study in Ometepe show that concept mapping offered an effective and holistic rapid assessment tool that privileged local knowledge and situated tourism within an SES. Success was derived from three principal reasons: concept mapping is accessible, adaptable, and achievable (Figure 3). The concept maps also elicit important themes specific to sustainable tourism development on Ometepe. From the data, it is possible to draw out values, social norms, key relationships, and interactions in the system. The ability to pull out essential relationships in a system within available research time shows why this is an effective rapid assessment tool.

Unexpected results reinforced the importance of local knowledge. For example, all participants noted the significance of domestic visitation to Ometepe, yet domestic tourism receives less attention at the national or international level. During mapping activities, it was easy to solicit additional information immediately from participants if needed. The straightforward process of asking participants to explain more about what they drew revealed a great deal about complex SES dynamics and tourism-specific contexts, including adaptive capacities, vulnerabilities, historical legacy, power relationships, and personal values. Though it would be possible to understand these dynamics via other methods, concept mapping proved to be very efficient.

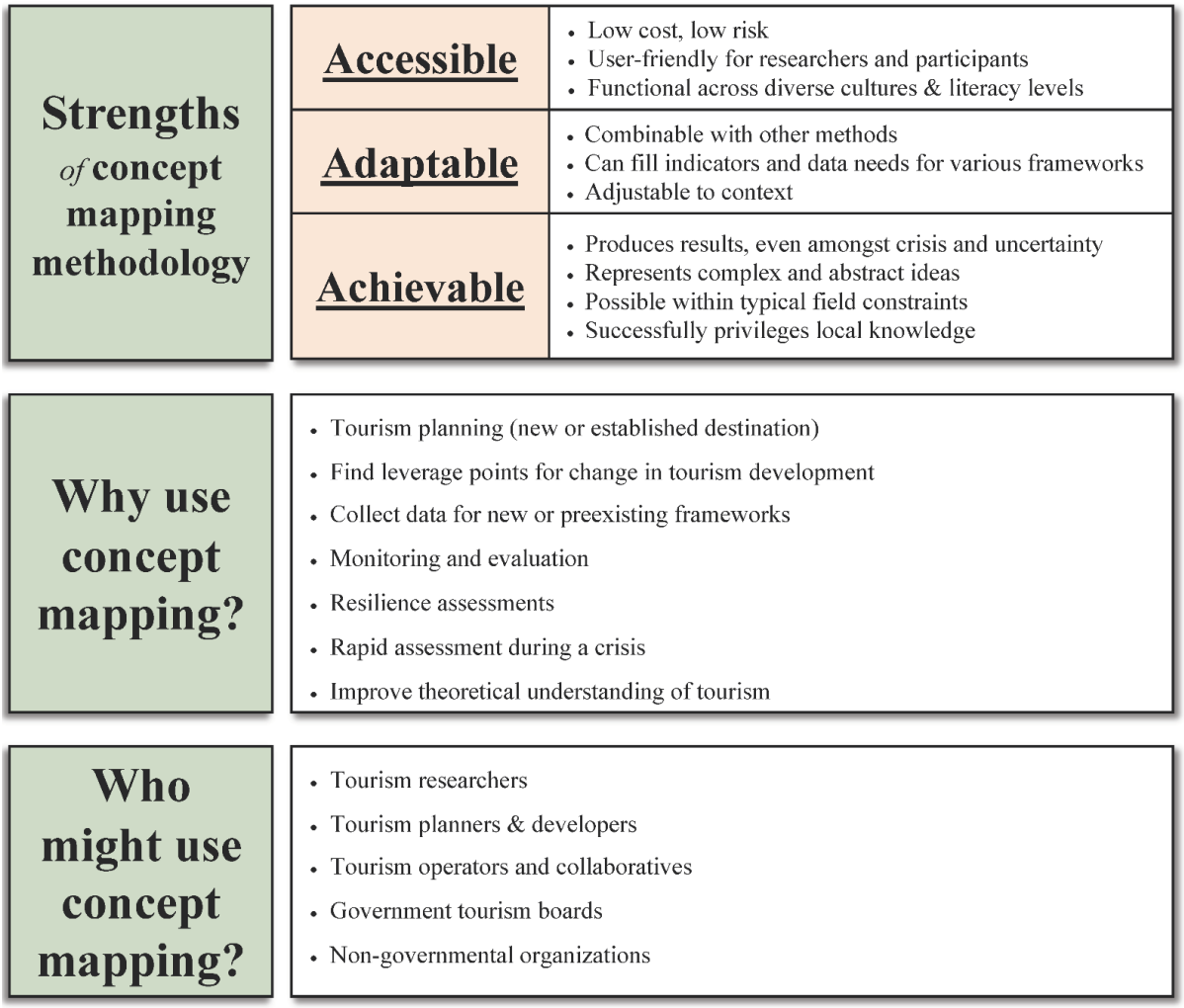

Figure 3. Demonstrated strengths and suggested uses of concept mapping.

Accessibility was enhanced by the available support of local contacts. These contacts were generated through local partnerships that the lead researcher established prior to arrival, in addition to three months of immersion in the field over the course of one year. When analyzing the maps, these contacts proved helpful for the occasional question of translation, or to offer greater context when we, as outsiders, could not understand an abbreviated relationship on the map.

Notably, there were challenges in making the method accessible to all participants. Though we focused on minimizing outside influence on the maps, we ultimately opted to offer participants some formulaic ways of addressing repeated challenges. The most challenging aspect of the exercise for participants was to make the system relationships that locals implicitly took for granted explicit for an outside researcher. One solution implemented after the first set of maps was to make it certain that groups specifically labeled every response to questions from Stage Two of the mapping process. Participants sometimes needed specific urging to clarify concepts, such as "Can you write what that arrow represents about the relationship between those components?" The heterogeneity among the finished concept maps is one measure of successfully minimizing researcher influence. These lessons learned and other observations are recorded in Figure 4.

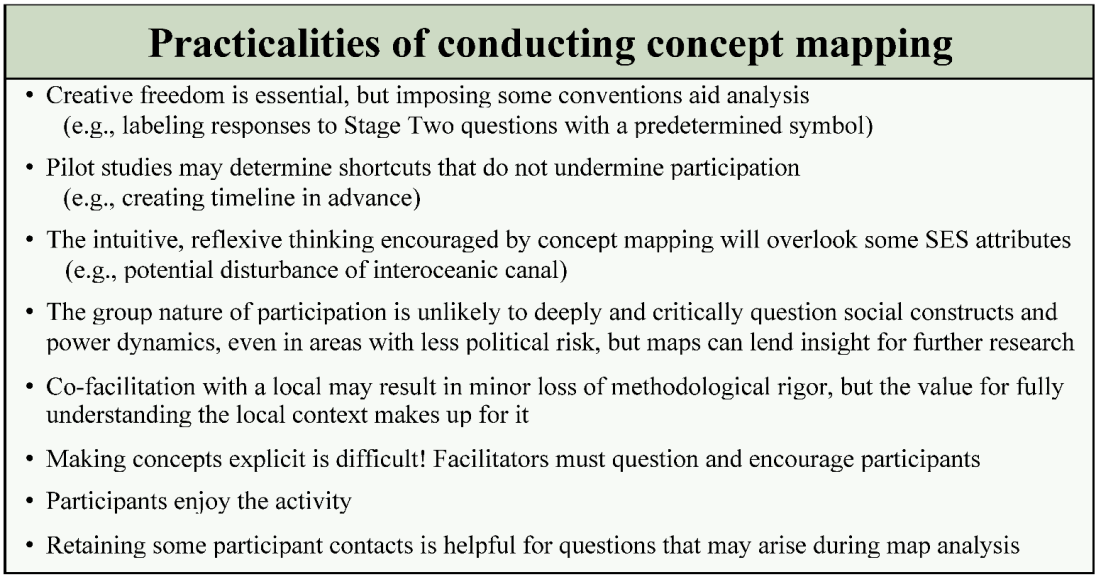

Figure 4. Key observations from using concept mapping in field research.

Nonetheless, some important SES dynamics likely remain absent from the maps, in part from time constraints and the intuitive nature of the maps, but also from the sensitive and precarious political nature of certain topics. Supplementing concept mapping with secondary research, field observations, and informal interviews allowed the researcher to note some of these absences. For example, no map noted the severe disturbance that would result if the proposed interoceanic canal gets built through Lake Nicaragua, nor did any map specify who and what caused hazardous land use practices. It is important to recognize that these absences and uncertainties are significant for analysis and could help to inform future research in a destination.

Additionally, there are limits to accessibility. Concept mapping will not be accessible in all political situations, nor to all cultures. This method is heavily based on specific conceptualizations of temporal and spatial scales. For cultures that do not conceive of time or space in the same manner, such as Australian aboriginals who do not conceive of time as linear, this method would be ineffective or need heavily altered [43].

The adaptable nature of concept mapping is useful if considering potential applications of the method. Specific focal scales or topics can be decided early in the research activity. Stage Two questions are highly adaptable and could easily incorporate additional methods, such as scenario planning or visioning exercises. The manner of data analysis can vary; for example, data could be inserted into other frameworks or software analysis. Additionally, the actual output of the concept maps is radically adaptable based upon participants. For example, words could be replaced by images, or groups could create their maps using computer software.

Potential applications of concept mapping within tourism destinations extends beyond its use in this study. The growing body of literature linking resilience and tourism reveals a desire to assess the resilience of tourism as an industry and form of economic development. Concept mapping can provide a first step in understanding the SES in which tourisms functions, a prerequisite to assessing resilience as a system property and for critically approaching the questions "resilience of what, to what, and for whom?" Concept mapping can also identify leverage points in a system, an important step if a resilience assessment is conducted with management or development interventions in mind.

With some roots in planning and evaluation, and its accessibility for both researchers and participants, concept mapping could also be applied as a tool for monitoring and evaluating disturbances in a tourism destination. "Disturbances" encompass surprise system perturbations and deliberate interventions, including those that are intended to

enhance sustainability. Tourism development is also a disturbance and potential intervention. Concept mapping allows for the rapid assessment of feedback loops and could help to explain unanticipated SES dynamics arising from interventions.

Another potential application of concept mapping is a method used to collect data for pre-existing indicators and frameworks. Concept mapping may offer an achievable way to collect data for respected frameworks, such as Ostrom's SES framework [36,37], or for many pre-existing indicators and frameworks derived from the Millennium Ecosystem Assessment, the Sustainable Development Goals, and other well-recognized international standards.

With a variety of potential applications for concept mapping, there is also a variety of potential users. Tourism researchers can apply the method to a variety of data needs. Tourism development initiatives stemming from the individual through institutional levels can consider the complexity of a system and monitor feedbacks, a critical necessity if sustainability is to be taken seriously. Tourism destinations frequently host a variety of non-governmental organizations (NGOs), arising from the social, cultural, and environmental contexts. NGOs could use the concept mapping to more holistically understand their mission in relation to the SES. Tourism operators, whether locally or externally based, and locally based tourism collaboratives, could use concept mapping for better understanding how tourism functions in their destination.

This case study in Ometepe is an early step in striving for the SES understanding of a tourism destination to improve achievability for social, environmental, and economic goals that are sustainable and just for future generations. Notably, the results display only a snapshot in time. Additionally, the small-scale, backpacker-style, volcano-based tourism comprising Ometepe's market is a niche form of tourism. Niche tourism accounts for too little of the tourism sector to clarify the global path to sustainable mass tourism [97]. Nevertheless, sustainable tourism development at a global scale can be incrementally informed by empirical studies from smaller focal scales. Our focal scale for concept mapping was destination-based. Concept mapping could prove equally illuminating in a destination receiving mass tourism. Concept mapping is a worthwhile assessment tool to have available, considering the tourism's projected growth trajectory, its propensity for explosive growth, destinations' susceptibility to crises, and the rapidity with which the tourism industry can rebound following a crisis. Additionally, concept mapping offers a method that is more exchange-based than extractive, which was supported by participants' enthusiastic feedback regarding the process itself and the discussions that it facilitated among community members.

Concept mapping illuminates the SES with data that can offer many potential uses, and highlights areas where more information, particularly quantitative, is needed. At its core, the value of concept mapping lies in the simplicity that it offers to access complexity, while privileging local knowledge.

5. Conclusions

Current tourism scholarship demonstrates limitations in how tourism is conceptualized and concurrently lacks practical and empirical methods to analyze the complexity with which the tourism sector functions within a greater SES. This manuscript details our concept mapping methodology and demonstrates the successful use of concept mapping to analyze the tourism sector in a case study. The novel use of concept mapping achieved a more holistic conceptualization of sustainable tourism than most sustainable tourism studies currently demonstrate via a method that we found to be accessible, adaptable, and achievable. This study provides methodological and empirical contributions to sustainable tourism research by supplying a needed method to capture challenging data, including complex relationships and local perspectives, while also being extremely practical for field application.

The simplicity and flexibility of concept mapping result in a method that could be useful for a variety of potential global applications and users within sustainable tourism. As a rapid assessment tool, concept mapping can highlight key interactions in the system.

Rapid system assessment is a priority for tourism destinations considering the negative social and ecological consequences that can accompany swift and haphazard growth of the tourism sector. Considering the susceptibility of tourism destinations to hazards, concept mapping could assist in a crisis response by understanding how system relationships have altered and what system attributes are valued.

While this study employs concept mapping to a small focal scale, the method offers potential to consider larger scales, including mass tourism destinations. Overall, concept mapping offers an improved method to conceptualize tourism within a system, and therefore a way to better understand and plan for how tourism can be used as a tool of sustainable development.

Author Contributions: Conceptualization, methodology, analysis, investigation, C.L.L.; writing—original draft preparation, C.L.L.; writing—review and editing, K.B.; supervision, K.B.; funding acquisition, C.L.L. and K.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by awards from the Alaback & Brewer Melipal Fellowship, American Association of Geographers (Applied Geography Specialty Group Student Research Fellowship), Associated Students of The University of Montana (Research and Creative Scholarship), Conference of Latin Americanist Geographers (Field Study Award), and Kenneth P. Davis Scholarship. Additional funding provided by the USDA Forest Service International Programs.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of The University of Montana (IRB Protocol No. 202-18, 17 October 2018).

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

Data Availability Statement: Not applicable.

Acknowledgments: This research was supported by input from Sarah J. Halvorson; Brian C. Chaffin, and Gretchen McCaffrey. Field work was supported in Ometepe by Nicaraguans who wish to remain anonymous.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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