Chapter 15
Evaluating Scientific Tourism Potential for Nature-Based Destinations: Expert Validation and Field Testing of Criteria and Indicators in the Aysén Región of Chilean Patagonia

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Abstract The evolution of tourists' motivations is generating new approaches to tourism. One of them is scientific tourism (ST), which involves travel experiences with a focus on participation in scientific studies of various disciplines. ST has evolved significantly over the last decade in Chilean Patagonia, driven by public policies and the interest of various academic and private actors. These actors argue that involving travelers in research initiatives taking place in Patagonian destinations allows them to develop lasting connections with the heritage and institutions of these territories. This chapter presents an innovative process, including stakeholder identification, semi-structured survey interviews, and document analysis, to develop a matrix of weighted criteria to assess the potential for sustainable ST development within a destination. The process involves weighing four criteria: scientific research possibilities, supply of services to support scientific travel, value chain coordination, and current demand for ST in the destination. Each of these criteria is operationalized through a set of indicators that make it possible to evaluate

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the strengths, weaknesses, and opportunities for the sustainable development of scientific tourism services in the destination. Then, the method is field tested in the Aysén Region of Chilean Patagonia, affording the opportunity to further evaluate its assessment capacity.

Keywords Patagonia · Scientific tourism · Tourism destination · Tourism resources · Protected areas

15.1 Introduction

The evolution of tourists' motivations and behaviors has promoted the emergence of new approaches to tourism, diverging from the traditional sun and beach, mass tourism approach (Araújo Pereira and de Sevilha Gosling 2017; Pearce 2009). For example, scientific tourism (ST) represents a market niche that attracts visitors whose main motivation for travel is expanding their scientific knowledge and, above all, participating or collaborating in scientific studies (Bourlon and Mao 2011; Bourlon et al. 2021; Kosiewicz 2014; West 2008). Successful ST contains all the attributes of ecotourism in addition to human capital as a key factor and, in some cases, high-level technical equipment (Laing 2010). Opportunities for ST have emerged across diverse disciplines and in the different stages of the methodological process of research, creating tourism experiences that attract a variety of interests.

Public policies that promote Chile as an excellent natural laboratory for its resources and for the advancement of some scientific disciplines such as astronomy, glaciology, oceanography, and ecology, among others, have spurred interest in developing ST across Chilean Patagonia (Aguilera and Larrain 2018). The creation of new research centers and the interest of various academic and private actors have allowed Chile to become a natural laboratory for the advancement of scientific disciplines (Szmulewicz and Veloso 2013). However, the concept of ST is new to the Chilean tourism industry, and in many cases, the initiation of ST operations has outpaced regional ST planning. Thus, additional research is required to support adequate planning and integration of ST within the series of consecutive steps required for the creation of finished ST products (i.e., ST value chain; Veloso 2021).

The main objective of this chapter was to apply a new methodological tool to evaluate the potential of tourist destinations for the development of ST. After identifying the actors involved in each of the links of the ST value chain, a matrix of criteria and indicators was applied to evaluate the potential of a destination for sustainable ST services and programs. Then, our study participants, a sample of national and international ST experts, weighed each criterion and the associated sub-criteria indicators according to their importance for evaluating the potential for sustainable ST development within a destination. Finally, the matrix was applied to

the Aysén Region in Chilean Patagonia, which stands out for its high presence of protected areas and its progress in ST initiatives.

15.2 Theoretical Framework

While the first studies on ST date back to the early 1990s, most of the available research has occurred in the last 5 years. The progression of these studies allows us to identify advances in the conceptualization of ST as well as the development of ST typologies and tourism experiences. Fortunately, a certain consensus has been reached regarding the benefits and requirements of destinations for the operation of ST programs.

Bourlon and Mao (2011) clarified the components of ST, emphasizing the importance of tourist participation in structured scientific activities and the supervision of experts or researchers. They recommended a mandatory orientation and training session to train tourists with respect to data collection, following the scientific method. The main objective of ST participants is to improve their knowledge and understanding of the place they are visiting. They seek to enrich their education, develop experience complying with research protocols, or strengthen research networks, among other motivations. By acquiring new knowledge, travelers feel that they are living an out-of-the-ordinary experience. The duration of the activity—an average of 8 days—is generally longer as compared to other types of tourism, allowing time for the necessary training, adequate integration into the new environment and the research experience, or the fulfillment of precise scientific objectives (Bourlon et al. 2021). This longer duration supports efforts by the Chilean Subsecretary of Tourism to promote the development of new forms of special interest tourism that increase arrivals and spending through longer stays (Chilean Subsecretary of Tourism 2012).

Some benefits of ST are that it can contribute toward increasing the educational level of the local population and promote the care—and therefore conservation—of natural resources (Ilyina and Mieczkowski 1992; Suguio and De Almeida 2011). ST offers many other potential benefits. It contributes to the resilience of communities and territories through the creation of shared knowledge and understanding of the essential socio-ecological characteristics and dynamics of the site (Bourlon et al. 2021). It supports the dispersion of tourist destinations visited by scientists as they make new trips to the sector after their field research. And it attracts researchers, their undergraduate and graduate students, national and international amateurs, and additional visitors—beyond the scientific community—by mobilizing families, friends, students, and other networks associated with scientists to visit the territory to learn about the ST work (Bourlon and Mao 2011).

The concept of ST has ignited interest from a variety of actors. Scientists see the potential of generating income to support the funding and dissemination of their research through leading ST programs (Pino 2020; Rozzi and Schüttler 2015). Entrepreneurs see an opportunity to insert innovative tourism products in their

offerings that are hard to replicate and, thus, protected from a competitive standpoint (Constabel and Veloso 2020). And social organizations see the possibility of promoting sustainable local development that is based on scientific knowledge.

ST provides opportunities to establish relationships between scientists, visitors, specialized interpreters and guides, and the community where the study will be carried out (Molokáčová and Molokáč 2011). The development of ST opportunities involves the transformation of a scientific resource (e.g., a scientific phenomenon or object of study) into a tourism product (Bourlon 2020), thereby linking researchers to the local stakeholders interested in safeguarding the heritage and the socio-ecological systems in which they live (Bourlon et al. 2021). Effective ST destinations should have a local community that is prepared with basic knowledge of the scientific discipline that is of interest to the ST participants (Kosiewicz 2014). In addition to the traditional tourism products and services, like lodging and accommodations, this requires the participation of scientists, specialized guides from host institutions, and logistical services for explorations and studies.

In Chile, ST has become linked to the implementation of public policies that seek to promote the country's unique natural characteristics and its potential for scientific research. One reason for this is that the development of ST opportunities has attracted respected researchers who, in turn, have helped install specialized research centers for the study of astronomy, and Antarctic and sub-Antarctic ecosystems, among others (Aguilera and Larrain 2018; Szmulewicz and Veloso 2013). The National Commission for Scientific and Technological Research has called Chile a *Natural Laboratory*, favorable to the practice of scientific disciplines linked to specific territorial elements, including the night skies of the Atacama Desert, the Mapuche culture, the Valdivian rainforest, Patagonia's freshwater reserves and glaciers, and Antarctica.

There are not many specialized and validated methodologies for a general evaluation of a territory's tourism potential. One existing method, designed by the Inter-American Center for Tourism Training (CICATUR) and the Organization of American States (OAS) in 1979, established the parameters to be considered to estimate tourism development potential by inventorying the tourism heritage, the definition of hierarchies, and the subsequent categorization of tourism resources through field reconnaissance. Specifically looking at the evaluation of a destination's potential for the development of new forms of tourism, Szmulewicz and Álvarez (2002) designed and applied a method using wine tourism and vineyards as a case study. Based on demand, they identified a set of criteria they could evaluate to place potential wine tourism operations on a scale ranging from the destination's current level of tourism to their ideal level of tourism development.

Previous reviews have identified four basic approaches to the evaluation of tourism resources (Arnandis-i-Agramunt 2018; Camara and Morcate Labrada 2014; Varisco et al. 2014; Leno Cerro 1990). The first is analytical and considers the presence or absence of certain components. Intrinsic values of the resource are rated in order to evaluate natural areas, beaches, and, with some later modifications, other types of resources. A second approach aims to determine the value of possible alternative and compatible tourism resource-use opportunities that are not yet

commercial in nature and therefore do not have a market value. A third approach is based on the evaluation of resource demand preferences expressed by tourists. This approach assumes that the higher the value placed on a given resource, the greater interest it will attract among potential or actual users. Finally, the last approach employs analytical methods to develop demand valuations from qualitative assessments, allowing researchers to weigh variables of interest.

To date, there is limited evidence of the application of any of the above approaches to evaluate ST resources and development opportunities. Within Chilean Patagonia, the methodology that comes closest is the approach designed by the Center for Investigation in Ecosystems of Patagonia (CIEP) (Bourlon 2020; Bourlon et al. 2021). Three criteria have been identified as important for supporting an ST offering: (1) a scientific topic of national or international relevance; (2) relevance of the scientific topic to local actors, including its relevance for inclusion in their tourism activities; and (3) capacity of local actors to generate a tourism offer with adequate services (specialized guides, logistic and transfer services, among others).

15.3 Methods

This study establishes and applies a tool to evaluate the potential of tourist destinations for the development of ST. The chapter results reflect a three-stage study: (1) a survey interview developed to evaluate ST competence and to collect stakeholder weightings of four criteria and underlying indicators for evaluating the potential for ST development; (2) stakeholders across the ST value chain were identified and asked to complete the survey and the survey results were then validated through focus groups; and (3) the study authors completed a document analysis process and replicated the process of criteria weighting using data from existing documents in combination with their own local expertise. The following sections outline the study process in terms of the local ST context, the participant survey, the survey data analyses, and the document analysis/author validation.

15.3.1 Scientific Tourism Context: The Aysén Region of Chilean Patagonia

The Aysén Region is located in Chilean Patagonia, south of the Lake District and north of the Magallanes Region. It is bordered by the Pacific Ocean to the west and Argentina to the east. Aysén is the third largest geographic region of Chile, yet one of the least populated. It is considered an extreme zone by the Chilean government due to its level of isolation, low population density, reduced presence of public services, and limited level of socioeconomic development (Gale et al. 2013). Landscapes within the Aysén Region vary greatly, from the Patagonian steppe to the

fjords, passing through the Andes Mountain range, with its glaciers, lakes, rivers, forests, and pastures. The region has ecosystems whose values are internationally recognized and critical for biodiversity conservation (Mittermeier et al. 2003). Due to the presence of the Southern Ice Fields, the region contains one of the largest freshwater reserves on the planet.

Eighteen of Chile's 100 SNASPE Protected Areas are distributed throughout the Aysén Region, covering approximately 53,000 km^2 and representing more than a third of Chile's total protected lands (Gale et al. 2018). Various initiatives have been undertaken in an effort to develop and enhance ST in this region since 2007. Although Aysén is considered an excellent location for ST and numerous individual ST initiatives have occurred (Bourlon and Mao 2016), the formalized supply of ST remains very low.

15.3.2 Participant Survey Interviews

Based largely on the work of Bourlon and Mao (2016) and a supporting literature review, the ST value chain was characterized, identifying five categories of ST actors: (1) producers (tour guides, etc.); (2) providers (equipment and raw material providers); (3) intermediaries (travel agencies, etc.); (4) ST support institutions (research institutions, etc.); and (5) ST demand group (ST travelers). Snowball sampling was employed to develop a list of ST experts within the five categories (Naderifar et al. 2017).

A group of 50 stakeholders from different countries (Chile, France, Canada, USA, Mexico, and Germany) was interviewed: 20 participants representing the ST producers' group, 10 participants from ST support institutions, 10 participants representing ST intermediaries, and 10 participants from the ST demand group of travelers. The provider's group was not explicitly represented as a sampling group, though the backgrounds of several participants did overlap in this area. A semi-directed interview was conducted to have each participant complete an evaluative survey where they were asked to weigh the importance of criteria and sub-criteria indicators for determining the potential of sustainable ST development within a region.

15.3.3 Participant Survey Components

The survey interviews consisted of two parts. First, the participant's level of ST competence was gauged, and second, the participant's perceived importance of criteria and indicators to consider in planning for ST development was evaluated. These criteria and indicators were developed through a bibliographic review and

forum discussions with working groups within the Scientific Tourism Network (Veloso 2021).

Unique sets of questions were developed to evaluate the levels of ST competence of the participant groups. The questions centered around the prevalence of ST within participants' professional experiences, their self-assessed knowledge regarding ST, and their experiences with supporting and implementing ST experiences (Table 15.1). The average competence score was 14 out of 40, and only data from participants who scored above average were included in the results of this chapter. This requirement was to provide a sense that our data represent the perspectives of individuals who can be considered *experts* when it comes to evaluating the potential for sustainable development of ST.

Study participants were asked to weigh four criteria (scientific potential, the supply of support services, the coordination of stakeholders, and current demand) according to their perceived influence on the territory's potential to develop ST. The first criterion, *scientific potential*, was understood as the scientific character of a territory and indicated the diversity and uniqueness of the scientific elements that might be investigated in a territory. The region's scientific potential helped identify scientific disciplines with the greatest potential to connect with scientific travel programs in order to develop ST experiences.

Table 15.1 Participant-tailored survey questions used to assess scientific tourism competence

Unique surveys	Questions used to evaluate scientific tourism competence
Designed for scientific travelers	Experience in scientific travel within your country Experience in international travel for scientific purposes Level of use of tour operators for the logistical organization of your scientific explorations Level of the utilization of specialized services
Designed for researchers	Degree of theoretical knowledge you have about scientific tourism The extent to which the concept of scientific tourism is used in their research, projects, and publications Level of referencing to works by foreign authors in their research on scientific tourism Degree of knowledge about scientific tourism experiences in the national and international context
Designed for ST support institutions	Degree of knowledge you have about scientific tourism Experience in supporting the development of scientific tourism programs Level of support for the development of scientific tourism networks Degree of support for research projects, studies, and publications on the subject
Designed for ST producers (tour operators)	Experience in the operation of scientific tourism programs, scientific explorations, and/or excursions for scientists or similar Degree of diversity in the operation of the services of these programs: logistical aspects, transportation, lodging, guiding, etc. Degree of awareness of the demand for this type of travel Level of management of the different segments by scientific tourism

The second criterion corresponded to *the supply of support services for scientific travel*, which reflected the relevance of the facilities offered within the territory to welcome ST, including the specialized supply of lodging, food, transportation, and human resources capable of operating ST products and programs. This criterion also considered the general tourism offer that complements the visitor's experience, including programs before or after the scientific program, the availability of souvenirs, recreational activities, currency exchange offices, etc., and the level of alignment between the actual destination image and the development of ST.

The third criterion was *scientific tourism stakeholder coordination*, which refers to the linkages that exist between stakeholders across the ST value chain. In cases where a strong connection between stakeholders was perceived, the types of existing stakeholder relationships were analyzed (formal, informal, legal, or de facto, etc.), as well as the level of connection. Specifically, we sought to identify connections between actors belonging to the same level of the value chain (i.e., intra-link) and connections between groups of actors across the value chain (i.e., inter-link).

The fourth criterion, *current demand*, involves the analysis of the demand dynamics and the different types of tourists that were attracted by the range of ST products (e.g., students, affinity groups, families). An understanding of current demand assisted in the evaluation of ST initiative viability. Some of the information that was relevant for this criterion included information about the volume of visitors arriving, their level of motivation to see and understand its scientific resources, their nationality or region of origin, and their main scientific and recreational motivations.

Participants weighted each of these criteria by assigning each one a percentage (for a total of 100% across the four criteria). Participants were then asked to assign another weighted percentage to several sub-criteria indicators within each criterion (for a total of 100% per criterion). Participants had the opportunity to recommend new indicators (in addition to those provided); however, no new indicators were reported. The provided indicators are listed in Tables 15.1 and 15.2.

15.3.4 Participant Survey Data Analyses

To validate the criteria for evaluating a region's ST potential, the mean percentage weight of each criterion was calculated (Table 15.2). Similarly, a weighted average was applied to define the relative weight of each sub-criteria indicator for these criteria. Once the relative weight of the criteria and indicators had been established by the participants, the matrix was validated through a focus group composed of 30 representatives of professionals, public institution representatives, and tour operators. The responses of the experts in the focus group were very similar to the survey interview results.

Table 15.2 Criteria and indicators for evaluating the potential for scientific tourism

Criteria	Indicators	%
Scientific potential of the territory 40%	1. Natural and cultural elements and phenomena of scientific relevance	21
	2. Importance given to research by the local community	13
	3. Exoticism of natural and cultural elements and phenomena	11
	4. Scientific infrastructure and equipment	10
	5. Valuation of scientific research	10
	6. Scientific dissemination and popularization programs	9
	7. Institutions with disciplines related to relevant topics	9
	8. Presence of important scientific networks	8
	9. Recognition of researchers in the scientific community	6
	10. Recognized graduate programs	3
Offer of support services for scientific travel 25%	1. Hospitality facilities for scientific travelers	20
	2. Qualified human resources to connect science and tourism	20
	3. Destination tourism image	17
	4. Formal scientific products and programs offered	13
	5. Connectivity	12
	6. Tourist products and services before and after the scientific trip	10
	7. Promotion of scientific internationalization	8
Articulation of scientific tourism stakeholders 25%	1. Joint strategies to promote scientific tourism	28
	2. Linkage in the scientific tourism value chain	27
	3. Willingness to welcome scientific travelers	25
	4. Programs to promote research networks	20
Current demand 10%	1. Travelers' appreciation of the territory	35
	2. Reasons for the trip	26
	3. Number of tourist arrivals for scientific purposes	17
	4. Profile of scientific travelers	16
	5. Origin (nationality)	6

15.3.5 Application of the Criteria Within the Aysén Region

Once the criteria had been validated, the research team field tested their results by applying a similar evaluation process to the Aysén Region. Background information provided by the Aysén regional government, other relevant public services, and academic/research centers were systematized and identified through consultations and review of data. This information included evaluation reports of public policies and programs, studies by private organizations, scientific publications, and data from

sources referenced in websites or press releases that report on the regional situation for each indicator of each criterion.

The authors of this study, who are knowledgeable about the region and public policies in the fields of science, education, and tourism, weighted each criterion individually on a Likert-type scale (from 1 to 5) to evaluate the potential for ST development specifically within the region of Aysén. Subsequently, a consultation meeting was held to engage in a triangulation process whereby the research team discussed each individual evaluation and corroborated agreements or disagreements in their conceptualization of how weights should be assigned. Once the group's evaluations were complete, the average weighted values were used to calculate the results given in Table 15.2.

15.4 Results

15.4.1 Criteria for Scientific Tourism

The survey participants were asked to weigh the four criteria presented in the survey for their impact on Chilean Patagonia's potential for ST development: (1) scientific potential, (2) the supply of support services, (3) stakeholder coordination, and (4) current demand. The criteria were weighted as follows: 40% for scientific potential, 25% for stakeholder coordination, 25% for the supply of support services, and 10% for current demand (Table 15.2). The weight for the *supply of support services* (25%) encompassed (a) the scientific value of the territory as the main motivation for the trip, and (b) how support services can be developed later, without (c) ignoring the importance of this criterion in the quality of the traveler's experience. The weight for the *stakeholder coordination* (25%) considered the uniqueness of ST offerings, as this criterion tends to be quite fundamental within the tourism industry as a whole (Szmulewicz and Veloso 2013). *Current demand* was weighted much lower in relation to the other criteria, at 10%. Some experts who were consulted explained that the current demand for ST was not indicative of ST potential; rather, they considered the presence of scientific resources, the actors, and their coordination as more important for generating demand.

15.4.2 Defining the Four Criteria for the Evaluation of ST Potential

Participants assigned weights to indicators to better explain and contextualize the four criteria for evaluating ST potential (Table 15.2).

Within the *scientific potential* criterion, the highest average weight was given to the *natural and cultural elements and phenomena of scientific relevance* indicator

(21%), suggesting these elements are capable of motivating the development of scientific projects in the territory. Another relevant aspect to be considered is the *importance given by the local community to research on ST topics* (13% average weight). Several indicators received similar weighting, including the degree of *exoticism of the natural and cultural elements and phenomena of scientific relevance* (11% average weight), the *infrastructure and scientific equipment* (10% average weight—laboratories, workstations, equipment), the *valuation of scientific research by public and/or private institutions* through support and financing programs (10% average weight), the *communication capacity* for scientific dissemination and popularization programs (9% average weight), *scientific institutions* with disciplines related to the relevant aspects of ST (9% average weight), and the presence of important *scientific networks* (8% average weight). Some aspects of lesser relevance that should also be considered include the *recognition of researchers* (6% average weight) by the scientific community, scholarships, awards, and *recognized graduate programs* (3% average weight) in terms of their being accredited, and their trajectory, in years.

For the second criterion, *supply of support services*, the evaluation of existing *specialized hospitality facilities* available for ST travelers, and *qualified human resources* were each attributed high importance with 20% average weights, that is, the identification of lodging services, food, transportation, and souvenirs, among others, that allow for good reception of the ST visitor was considered important, as was the identification of specialized guides and translators that connect researchers and the tourism industry. The third highest average weight was associated with the *tourist image of the destination* (17% average weight). Other considerations that received lower weights included formal *scientific products and programs that are currently offered*, such as scientific explorations and research stays (13% average weight), and the digital *connectivity* within the ST destination (12% average weight).

Four indicators within the *scientific tourism stakeholder's coordination* criterion were given similar importance, all with average weights between 20% and 30%. These included the *review of programs that promote research networks* (both public and private), analyzing how the *actors in the value chain are linked* (whether or not they communicate and carry out joint actions), *joint strategies* (public and private) for promoting ST, and *willingness to welcome ST* (acceptance by researchers, research centers, tourism business, and the community at large).

Finally, for the *current demand of ST* criterion, understanding the *valuation of ST travelers*, mainly in terms of the perception of tourism satisfaction within the territory, was considered particularly important with an average weight of 35%. Next were *visitor motivations* (both scientific and general), with an average weight of 26%. Other important considerations were the estimation of the *proportion of tourists who visit for ST-related reasons* (17% average weight) and understanding *traveler profiles for ST* (purchasing behavior, age, scientific discipline, etc.—16% average weight). Interestingly, *visitor nationality* was rated as a less important indicator, with an average weight of 6%, suggesting that it may not be crucial to understand when evaluating the potential of a territory for ST since every destination has the potential to attract visitors.

15.4.3 Assessing the Potential for Scientific Tourism Within the Aysén Region of Chile

To field test the participant results, we replicated the participants' assessment of the importance of the criteria and indicators of ST development potential with an analysis that was specifically focused on the Aysén Region in Chilean Patagonia. Our weightings were based on our review of local data and analyses of existing documentation. Our logic in conducting this field test was that if our analysis closely aligned with the participant survey data, then we would have obtained a measure of validity for the process of analyzing ST potential within a region and also a sense of the potential for ST within the Aysén Region.

Column A of Table 15.3 shows the same weightings for each of the ST criteria, as determined by our study participants (from Table 15.2). Column B outlines the indicators for each criterion, and Column C lists the average of our (the authors) weightings of each indicator in terms of their importance for the region of Aysén. Column D represents the actual presence of each indicator within the Aysén Region (scale of 1–5; 1 = not present, 5 = very present) that we (the authors) assigned to each indicator. Column E represents the product of the importance weight (Column C) and the presence rating (Column D) that we assigned to each indicator. The score in Column F represents the total importance/presence (Column E) score for each criterion, weighted according to the overall weights the participants had assigned to each criterion in Column A (see Table 15.2).

15.4.4 Scientific Potential of the Aysén Region

Several considerations emerged from our own analysis of Aysén's scientific potential. Within the region, the most prominent fields of research that involve ST focus either on flora and fauna or on land dynamics (Bourlon et al. 2021). These two fields of study attract the attention of regional, national, and international research groups. There are also a small number of community organizations and local non-governmental organizations that promote citizen science, demonstrating that regional communities value research and are interested in collaborating in work on scientifically relevant topics. Examples of these groups include the Pitipalena Añihue Marine Protected Area Foundation and the NGO Aysén Mira al Mar, among others (Bourlon 2020).

Patagonia's international recognition for housing some of the most diverse and pristine remaining landscapes and historical Indigenous communities has caused the region to attract a large number of domestic and international researchers (Gale et al. 2013). However, the infrastructure for science is limited and there are very few scientific field laboratories within the region. While the level of resource allocation

Table 15.3 Gauging the potential for scientific tourism within the Aysén Region of Chilean Patagonia

A	B	C	D	E	F
Criteria	Indicators	%	Rating (1–5)	Importance/ presence product	Score
Scientific potential of the territory 40%	1. Natural and cultural elements and phenomena of scientific relevance	21.3	4	0.84	1.3
	2. Importance given to research by the local community	13.1	4	0.52	
	3. Exoticism of natural and cultural elements and phenomena	10.8	5	0.55	
	4. Scientific infrastructure and equipment	9.7	2	0.2	
	5. Valuation of scientific research	9.7	4	0.4	
	6. Scientific dissemination and popularization programs	8.5	3	0.27	
	7. Institutions with disciplines related to relevant topics	9.1	2.3	0.21	
	8. Presence of important scientific networks	8.4	2.7	0.22	
	9. Recognition of researchers in the scientific community	6.4	2	0.12	
	10. Recognized graduate programs	2.5	1	0.03	
	Weighted average of the ten indicators	*100*		*3.35*	
Offer of support services for scientific travel 25%	1. Hospitality facilities for scientific travelers	20.1	2	0.4	0.7
	2 Qualified human resources to connect science and tourism	19.5	3	0.6	
	3. Destination tourism image	16.7	4.5	0.77	
	4. Formal scientific products and programs offered	13.3	3	0.39	
	5. Connectivity	12.3	1.5	0.18	
	6. Tourist products and services before and after the scientific trip	10.8	4	0.4	
	7. Promotion of scientific internationalization	9.1	2.3	0.18	
	Weighted average of the seven indicators	*100*		*2.92*	

(continued)

Table 15.3 (continued)

A	B	C	D	E	F
Criteria	Indicators	%	Rating (1–5)	Importance/ presence product	Score
Articulation of st stakeholders 25%	1. Joint strategies to promote scientific tourism	28.1	3.5	0.98	0.8
	2. Linkage in the scientific tourism value chain	26.6	2.2	0.59	
	3. Willingness to welcome scientific travelers	24.1	4.5	1.13	
	4. Programs to promote research networks	20	2	0.4	
	Weighted average of the four indicators	*100*		*3.1*	
Current demand 10%	1. Travelers' appreciation of the territory	34.7	3	1.04	0.3
	2. Reasons for the trip	26.3	3.3	0.87	
	3. Number of tourist arrivals for scientific purposes	17	3	0.51	
	4. Profile of scientific travelers	16	2.8	0.45	
	5. Origin (nationality)	6	5	0.3	
	Weighted average of the five indicators	*100*		*3.17*	

within the region to scientific research is low, it remains significant when compared with the national average and when considering the region's low population density (Lozano et al. 2010). Public funds have allowed a considerable level of researchers to work within the region, though few internationally recognized researchers have been involved to date. This would be an important step considering the literature on ST development remains of local origin. International recognition of local researchers who stay within the region would be helpful for the development of a niche ST industry.

To date, the scope of ST research has mainly been at the regional level (Rivera-Polo et al. 2018). There are still few academic institutions installed within the region, and the number of scientific networks is low. However, there are links with researchers from other parts of the world, such as the Scientific TourismNetwork (www.scientific-tourism.org) initiated in 2018, and an ST group of initiatives included in the strategic roadmap of the ANID agenda for science, technology, innovation, and knowledge creation for the southern macrozone of Chile (NODO CTCI Austral, https://nodocienciaaustral.cl/) that seeks to develop and promote tourism that is connected with science and collaborations between researchers.

15.4.5 Scientific Tourism Support Services Offering in the Aysén Region

There are very few specialized lodging facilities for the ST traveler within the region. Scientists use the usual tourism facilities and must be self-sufficient when it comes to working in the field, which can be difficult given the frequently harsh environmental conditions. Although there is a significant level of services provided by general (non-ST specific) tour operators and travel agencies (http://recorreaysen.cl/; Chilean National Tourism Service 2017), the region of Aysén has a low level of services when compared with other emblematic destinations in Chile (Chilean Subsecretary of Tourism 2012).

Connectivity in the region remains weak (Muñoz and Torres Salinas 2010; Aysén Regional Government 2005), which considerably increases the costs of research. Flight rotations are relatively infrequent, transport is focused mainly on the larger towns, and digital connections are weak and unstable, all of which make field work difficult. There are three main laboratories that support ST field activity: one laboratory in Caleta Tortel, one in Raúl Marín Balmaceda, and the old school/pioneer museum in Cerro Castillo. A similar situation exists surrounding specialized human capital for ST, where few specialized professionals have been identified and few professional guides offer services specific to ST (Bourlon et al. 2021).

When it comes to considering the region's tourism image, the Patagonia brand stands out, which is internationally recognized for its commitment to protecting natural resources, for its focus on remote and pristine settings, and for visitor safety to remote settings. Although ST products have been identified (e.g., Scientific Products Catalog) and there is motivation and interest on the part of operators and guides, there is no formal and continuous offer in the market (Bourlon 2020). Existing ST products have emerged through publicly funded projects and the support of the Center for Investigation in Ecosystems of Patagonia (CIEP; www.ciep.cl) and its partners. Although there are national programs, like the Chilean National Agency for Research and Development (ANID) Regional program, that promote the dissemination of the region's research, resources dedicated to this end are relatively low in proportion to GDP and the existing strategy does not focus on participatory sciences that could favor ST (Lozano et al. 2010).

15.4.6 Scientific Tourism Stakeholder Articulation in the Aysén Region

There are science and innovation programs in place that support ST, but no specific joint strategies for ST have yet been identified. The coordination of the ST value chain is still weak. Some initiatives have been led by CIEP with support from

Chilean or international public funds, including the creation of an ST network and the incubation of a dedicated ST operator in Aysén (Exploraysen S.A.) whose mission was to promote ST products provided by the actor/partners (Bourlon 2020; Bourlon and Mao 2016). However, once public funding ends, the continuity of these types of initiatives by private entities has been low. Other institutions, such as the Universidad Austral de Chile, the Universidad de Magallanes, the Chilean National Corporation for Development (CORFO), and the Chilean National Tourism Service (SERNATUR), have promoted and supported small ST initiatives (Bourlon et al. 2022). Furthermore, local interest in receiving scientific travelers has been documented in several publications (Bourlon 2020). There are some programs that promote ANID research networks and resources from the Regional Government of Aysén, but these resources are low in comparison to other development priorities such as infrastructure and promotion of traditional extractive activities.

15.4.7 Current Scientific Tourism Demand Within the Aysén Region

The demand for ST in the Aysén Region of Chile has not been investigated to the degree that it has in other regions of the world, including North American, European, Brazilian, and other Chilean markets (Chilean National Tourism Service 2017). Interviews and information in the press indicate that scientists who come and work at CIEP, the Universidad Austral de Chile, or other science and technology organizations are very interested in staying longer. There is an emotional affinity with the region on the part of visiting scientists (Bourlon and Mao 2016; Gale et al. 2013). There are no studies to date into the number of arrivals for scientific reasons, but it is estimated that in proportion to other segments, this is low, particularly with respect to the national level as in the Atacama area and in relation to the Astronomical observatories. The profile of the visitor to the Aysén Region, which is of an age group and income stratum higher than the national average, suggests that there is a potential interest in buying products of higher value and higher cost (Chilean National Tourism Service 2017; Chilean Subsecretary of Tourism 2012).

Overall, the Aysén Region has a strong potential for scientific tourism due to scientific relevance in certain fields, but weak growth prospects due to the lack of specific public and private scientific outreach and low current levels of participatory science programs. New incentive programs for scientific research, such as those included in the NODO CTCI Austral roadmap, should increase the relevance of the region for ST and help connect science and tourism in the territory.

15.5 Conclusions

In Chile, public policies that promote the advancement of science in fields related to the natural landscape have spurred interest in ST opportunities. As a relatively new concept, the initial ST programs and operations within the region have shown potential and sparked interest in further developing this niche within regional tourism planning initiatives. To continue to build on current ST offerings within the Aysén Region of Chilean Patagonia, an analysis of the regional potential for ST development is needed, as well as data that informs strategic priorities in terms of regional ST investment. This knowledge will help the region build an ST industry that maximizes sociocultural benefits to the communities and promotes sustainable economic profitability while minimizing environmental impacts.

Considering the importance of innovation in isolated territories and emerging nature tourism destinations, the development of ST appears as an interesting opportunity for social and economic development based on science and knowledge. Hence the importance of having methodologies to quantify or estimate the opportunity gaps that the region has for a sustainable ST industry that benefits the spectrum of actors in the value chain including local communities. Based on similar criteria and indicators to those outlined in this study—(1) scientific relevance; (2) the supply of support services for scientific travel; (3) coordination between the actors involved in this type of travel; and (4) the current demand for scientific travel in the territory—the strengths, weaknesses, and opportunities within a territory can be evaluated. ST planning can be further informed by engaging stakeholders who have local expertise in examining ST potential across such criteria. For each criterion, a set of indicators can be used to evaluate the potential of a territory.

Within the specific context of the Aysén Region of Chilean Patagonia, the method demonstrates the considerable potential for ST development. Our analysis demonstrated the region has good scientific potential (3.35 out of a maximum of 5), an average supply of support services for the scientific traveler (2.92), good evidence of articulation of actors to facilitate ST (3.10), and that current demand is incipient and significant (3.17). This qualitative evaluation highlights key attributes of the territory. Although the Aysén Region has an established trajectory of ST development in Chile, it seems important to continue applying the methodology to specify and establish programs to reduce the gaps identified for reaching the region's full level of sustainable ST operation. Throughout the Aysén Region and Chilean Patagonia more generally, it is necessary to improve land, air, and digital connectivity. The region would also benefit from the generation of specialized hospitality facilities for the scientific traveler, which will contribute to the increase in demand for this new form of tourism. In addition, it is important to advance coordination efforts between the actors of the value chain of ST with strategies that ensure current and future initiatives remain sustainable over time.

Although our work suggests that the proposed criteria and indicators may be generalizable, they should be reviewed and possibly adapted to destination contexts when applied to new regions. We recommend this methodology for local managers

seeking to develop ST, especially where it is possible to collect information across each of the four indicators as outlined in this chapter. This method provides a guide for identifying the gaps and quantifying costs and efforts associated with successful and sustainable ST development. It is important to consider that once initiated, the evaluation of the potential for ST destinations is dynamic in nature. Thus, a periodic replication of the process is necessary, including revalidation of the weighted indicators with focus groups. And much will depend on those who lead the initiative to promote ST and the emphasis they place on intervention, development, and innovation criterion and indicators within the framework of their specific development strategy.

A territorial strategy, based on these guidelines, has the ultimate goal of contributing to greater objectivity when making decisions regarding this new form of tourism. In addition, researchers and scientific institutions can contribute to the territory's socioeconomic development by promoting initiatives that improve scientific infrastructure and equipment, strengthen national and international networks, and increase recognition of relevant discoveries within a territory. The creation of science-based undergraduate and graduate training programs can, in turn, foster the development of new knowledge and regional human capital and thus strengthen the capacities of local community actors.

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