Chapter 14
Sociocultural Valuation of Ecosystem Services in Southern Patagonia, Argentina

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Abstract Understanding sociocultural values towards ecosystem services (ES) facilitates a decision-making process across multiple management objectives. The aim of this chapter was to analyse the stakeholders' perceptions of ES, wellbeing and connectedness to nature at regional level in Southern Patagonia (Santa Cruz Province, Argentina). For this, we designed a questionnaire and conducted 451 face-to-face semi-structured interviews, in which 168 corresponded to local residents and 283 to foreign visitors. Ecosystem services were classified depending on the degree of perceived importance and vulnerability for wellbeing. From this, 12 ES (5 provisioning, 6 cultural and 1 regulating) were perceived as important for wellbeing. Analysing the perceptions of vulnerable ES by each local stakeholder, we found that both groups of locals and decision-makers perceived provisioning services (mainly livestock, fresh water, timber, fishing and shellfish) and regulating (erosion control, habitat for species and climate regulation) as important ones. Survey respondents generally indicated a high level of connectivity with nature

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being similar for both locals and visitors. Our results showed that social perception of values can substantially contribute to identify ES by focusing on the conflicts that emerge among different stakeholder groups. The sociocultural information of the present study can provide important inputs into negotiations in a decision-making process, allowing participants to compare positive and negative impacts of various options for ES management.

Keywords Decision-making process · Landscape planning · Human wellbeing · Stakeholder perception

1 Introduction

There is international recognition that ecosystem services (ES) are directly or indirectly related to ecosystem structures, functions or processes that contribute to human wellbeing (MEA 2005). In Southern Patagonia (Santa Cruz Province), previous studies at regional level reported results of provisioning ES such as timber from native forests (Peri et al. 2019a) and livestock and firewood from silvopastoral systems (Peri and Ormaechea 2013) and regulating ES such as soil carbon (Peri et al. 2018) and nitrogen content (Peri et al. 2019b) and some studies that analysed cultural ES at landscape level (Martínez Pastur et al. 2016; Rosas et al. 2020). However, in areas like Patagonia, sociocultural values such as social needs and perceptions of the stakeholders towards ES usually are poorly investigated in ES assessments (Bryan et al. 2010; Chan et al. 2012). The perceptions of the stakeholders about ES depend on their type of knowledge, place attachment and how they interact with the natural ecosystems surroundings (Russell et al. 2013), e.g. local stakeholders with longer time of residency near protected areas placed more value on the ES provided by their ecosystems (Sodhi et al. 2010).

Using sociocultural valuation enables the assessment of a broad range of ES by making explicit the stakeholders' interests (Chan et al. 2012). A good understanding of the social perception of values is required when designing agricultural and environmental policies to promote multifunctionality taking into account the views of stakeholders with different roles and interests (van Oudenhoven et al. 2012). Geijzendorffer et al. (2015) highlighted the need to analyse the role of multiple stakeholder groups and their relationships with the provision, demand and management of ecosystem to improve sustainable management. Furthermore, the importance of feeling connected to nature or the connections between ecosystems and people facilitate a decision-making process of benefits that ecosystems provide to societies (de Groot et al. 2010). In particular, the cultural ES represent intangible dimensions of the links between people and ecosystems that determine human preferences and values from psychological, social and spiritual aspects (Satz et al. 2013). In this context, human wellbeing surveys can be used to evaluate the importance of ES from stakeholders whose wellbeing is more directly dependent on ES or external people (tourists or visitors) with less dependency on ES (Reed et al. 2009). This chapter presents results

from an analysis of stakeholders' perceptions of actual ecosystem services, wellbeing and connectedness to nature at regional level in Southern Patagonia (Santa Cruz Province, Argentina). For this, based on participant observation and semi-structured interviews, we designed a questionnaire and conducted 451 interviews.

2 Study Area and Methodology

The study area of the present work was the whole province of Santa Cruz (243,943 km^2) located between latitudes 46° 00′ and 52° 30′ S (South Patagonia, Argentina) (Fig. 14.1). The main economic activities have been related to mining (e.g. coal, gold, silver), livestock (e.g. notably sheep), agriculture (e.g. crops and fruit production near the Andes Mountains and valleys) as well as oil and gas after its discovery near Comodoro Rivadavia in 1907. Natural steppe grasslands, characterized by the presence of tussock (*Festuca*, *Stipa*), short grasses (*Poa*, *Carex*) and shrubs, occupy near 85% of the land and contribute as a main feed resource for sheep rearing for meat and wool production (Peri et al. 2013). The Andean native forests

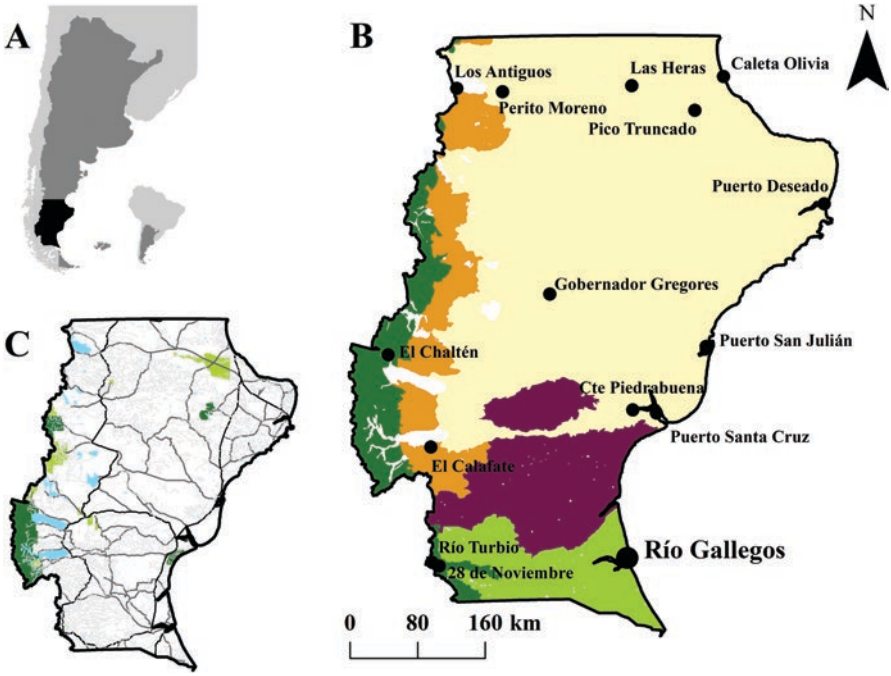

Fig. 14.1 Characterization of the study area: (**a**) location of Argentina (dark grey) and Santa Cruz Province (black); (**b**) provincial cities and main ecological areas (light pink = dry steppe, light green = humid steppe, purple = shrublands, orange = sub-Andean grasslands, dark green = forests and alpine vegetation); (**c**) main roads, rivers and lakes and natural reserve network (dark green = national parks, light green = provincial reserves)

cover a narrow (near 100 km) and long (near 1000 km) strip of land. The southern beeches, lenga (*Nothofagus pumilio*) and ñire (*N. antarctica*), are the most common forest species, covering 335,450 ha. In the irrigated valleys, there are approximately 3600 ha protected by windbreak (1500 km) to allow establishment of fruit trees, pastures and horticultural crops and to protect agricultural crops, livestock and rural houses (Peri and Bloomberg 2002). Instead sheep farming introduced in the late nineteenth century has been the main economic activity, where tourism became an ever more important part of Patagonia's income. The climate in this region is dry, cold and windy. Rainfall decreases from 800 to 1000 mm to 200 mm yr^{-1} from west to east across the Andes Mountains, which act as an orographic barrier to moist winds coming from the west. Temperatures are highest from December to February and present their minimum during June–July. The predominant wind direction is from the south-southwest quarter. Severe and frequent windstorms occur in spring and summer, with wind speeds over 100 km h^{-1}. For distances and climate, Patagonia is sparsely populated with a density of 1.9 inhabitants km^{-2}.

2.1 Survey Design

The research methods included a combination of qualitative and quantitative techniques on ES assessments (Pereira et al. 2005; Martín-López et al. 2012). The techniques used semi-structured interviews and direct face-to-face surveys. We conducted a total of 451 face-to-face randomized surveys, in which 168 corresponded to local residents and 283 from visitors. The sample size was representative at a 95% level related to the populations in each provincial locality for local's surveys and according to the touristic demands for visitors (Table 14.1). This represented a sampling error of less than ±5%.

The surveys included the following sections: (i) the respondents' relationship with the study area; (ii) the respondents' perception of important and vulnerable ES in the area; (iii) the perception of wellbeing by the residents in the study area; (iv) the drivers of change operating in the study area; (v) the respondents' environmental behaviour; and (vi) socio-economic information. For both questionnaires, locals and visitors, the population sampled was randomly selected to cover a wide range of respondents' backgrounds (age, sex, type of work). More participants were female (57.4%) and the average age was 39.1 years.

2.2 Identification and Valuation of Important and Vulnerable ES

The first part of the questionnaire used in the survey was designed to explore the knowledge of local people with the study area and their existing knowledge about ES delivery. In the second part, each respondent selected the three main ES (provisioning, regulating and cultural) and determined which are the most important and

Table 14.1 Distribution of surveys carried out in Santa Cruz Province sorted by cities and towns for locals according to total population (234,132 people) and for visitor related to touristic demand

City/town	Population %	Surveys for locals	% touristic demand	Surveys for visitors
Río Gallegos	35	52	18	48
Caleta Olivia	19	29	8	22
Pico Truncado and Las Heras	15	23	1	3
El Calafate and El Chaltén	8	18	42	118
Puerto Deseado	5	11	9	28
Río Turbio and 28 de Noviembre	6	12	5	12
Puerto San Julián	3	6	6	15
Piedra Buena and Pto. Santa Cruz	4	8	6	16
Perito Moreno and Los Antiguos	3	5	5	14
Gobernador Gregores	2	4	2	7
Total	**100**	**168**	**100**	**283**

vulnerable for wellbeing from a panel designed with examples and pictures of the potential ES provided by the studied area. The list of ES (Table 14.2) was derived from interviews to experts, bibliography and classifications used in previous studies (MEA 2005; CICES 2013). The panels with images (pictures) were chosen as a means to facilitate respondents' comprehension of ES.

Then, ES were classified into four types using an importance-vulnerability matrix: critically perceived as both important for wellbeing and vulnerable (score 4), important but not vulnerable (score 3), vulnerable but not important (score 2) and less relevant neither are perceived as important for wellbeing nor as vulnerable (score 1) (Palomo et al. 2011). The aim of the importance-vulnerability matrix was to prioritize ES in the study area according to how they are perceived by the stakeholders. We calculated the median number of respondents, expressed in percentages, who perceived the ES' importance and vulnerability; we then used those figures as cut values to decide which ES were highly perceived as important or vulnerable.

2.3 Local Perceptions of Wellbeing

A section of the questionnaire explored the local respondents' wellbeing through a set of 20 items related to the 5 components (basic materials for a good life, health, good social relations, security and freedom of choice and action of human wellbeing) identified in the Millennium Ecosystem Assessment (MEA 2005). These items were also measured on a Likert scale, ranging from 1 (completely disagree) to 4 (completely agree). Although wellbeing was measured at an individual level, some items were related to the perceptions on the community performance since wellbeing is a multidimensional concept. To examine the responses regarding wellbeing,

Table 14.2 Potential ecosystem services detected as provided in Southern Patagonia and included in the direct face-to-face questionnaires conducted. Images (pictures) were included for each service type to facilitate respondents' comprehension of ES

Category	Service division	Service group	Service type	Example in Southern Patagonia
Provisioning	Nutrition	Biomass	Traditional agriculture	Fruit trees, berries, lucerne
			Intensive agriculture (greenhouse)	Tomato, lettuce, strawberry, chard
			Livestock	Sheep, cow
			Fishing and shellfish	Trout, snook, spider crab, mussels
			Forest harvesting	Mushrooms, berries
			Medicinal, therapeutic products	Honey, infusion for tea
		Water	Fresh water	Water for agriculture and human consumption
	Materials	Biomass	Timber	*Nothofagus* and poplar wood
			Construction materials	Stones, boulders, sands
	Energy	Renewable abiotic energy sources	Clean energy	Wind power and solar energy
Regulating	Maintenance of physical, chemical, biological conditions	Atmospheric composition and climate regulation	Climate regulation	CO_2 sequestration from vegetation
		Pest and biological invasions control	Reduction in incidence, risk	Invasive alien species (*Hieracium praealtum*, *Taraxacum officinale*)
		Soil formation and composition	Soil fertility	Water courses and riversides, litter
		Lifecycle maintenance, habitat and gene pool protection	Habitat for species	Natural protected areas for huemul (*Hippocamelus bisulcus*), carpenter woodpecker (*Colaptes pitius* and *Picoides lignarius*), chinchillón anaranjado (*Lagidium wolffsohni*)
			Pollination	Pollinating insects

(continued)

Table 14.2 (continued)

Category	Service division	Service group	Service type	Example in Southern Patagonia
	Mediation of flows	Liquid flows	Water regulation	Riparian vegetation, water infiltrations
		Mass flows	Erosion control	Desertification, deforestation, vegetation cover threshold
Cultural	Spiritual and symbolic interactions with ecosystems	Other cultural outputs	Existence	Satisfaction for species conservation: huemul (*Hippocamelus bisulcus*)
			Tranquility and relaxation	Water, snow, forest and mountainous landscapes
	Physical and intellectual interactions with ecosystems	Intellectual and representative interactions	Traditional knowledge	Traditional *boleadoras* for hunting animals, ethnographic museums, animal herding
			Environmental education and scientific knowledge	Books, research and activities about the environment and traditions in Patagonia
			Aesthetic enjoyment	Beautiful landscapes
			Local identity	Cook an entire lamb across an iron cross over an open fire
		Physical and experiential interactions	Recreational hunting and fishing	Small-game and big-game hunting (hare, fox, goose, guanaco) and fishing (trout)
			Nature tourism	Hiking, horse riding, mountain activities
			Rural tourism	Related to traditional sheep stations, gastronomy and agro-tourism

we first used Cronbach's alpha test (Cronbach 1951) to analyse the internal consistency of the 20 wellbeing items. Then, we performed a hierarchical cluster analysis (HCA) to explore how the different components of human wellbeing were perceived and identified.

Respondents were sorted into three stakeholder categories to determine which social actors were affected by changes to ES delivery. These were (i) high degree of influence in decision-making group involved in ES decision-making processes (people with the capacity to affect policies or sustainable development plans such as local mayor, nature protection agents, scientists); (ii) locals dependent on provisioning ES (tour operators, fishermen, farmers, adventure enterprises); and (iii) locals

not directly dependent on ES (public workers, residents, local teachers, students, technicians, retired residents). We explored differences in the perceived importance of ES for wellbeing among the stakeholder groups by using the non-parametric Kruskal-Wallis test. Also, to test the links between vulnerability of ES and their effect on human wellbeing, a principal component analysis (PCA) was used. Vulnerability of ES was measured on a Likert scale, ranging from 1 (most vulnerable) to 5 (no vulnerable).

2.4 Connectedness to Nature

For both local and visitors, we used the Inclusion of Nature in Self (INS) scale as 'the extent to which an individual includes nature within his/her cognitive representation of self' (Schultz 2001). For this, participants were asked to select from a series of five overlapping circles labelled 'self' and 'nature'. The item read 'Please circle the picture that best describes your relationship with the natural environment. How interconnected are you with nature?' Scores ranged from 1 (where the circles touched but did not overlap) to 5 (where the circles were nearly entirely overlapping). For visitors, the Nature Relatedness Short Version (NR-6) was chosen because it is a widely used measure of the subjective wellbeing and environmental variables as a self-nature connection construct (Nisbet and Zelenski 2013). It displays a similar pattern of correlations as the full 21-item scale (Nisbet and Zelenski 2011). Four items of the NR-6 scale assess the self-identification with nature, a sense of connectedness that may be reflected in spirituality, awareness or subjective knowledge about the environment (e.g. 'My relationship to nature is an important part of who I am'), and two items capture individual differences in the need for nature and comfort with wilderness (e.g. 'I take notice of wildlife wherever I am'). Participants respond to statements using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), and items are averaged with higher scores indicating stronger connectedness.

3 Results

3.1 Identification and Valuation of Important and Vulnerable ES

Ecosystem services were classified depending on the degree of perceived importance and vulnerability for wellbeing. Twelve ES (5 provisioning, 6 cultural and 1 regulating) were perceived as important for wellbeing. Clean energy, fresh water, aesthetic values, tranquillity and relaxation, livestock, traditional knowledge, nature tourism, environmental education, existence, fishing and shellfish, intensive

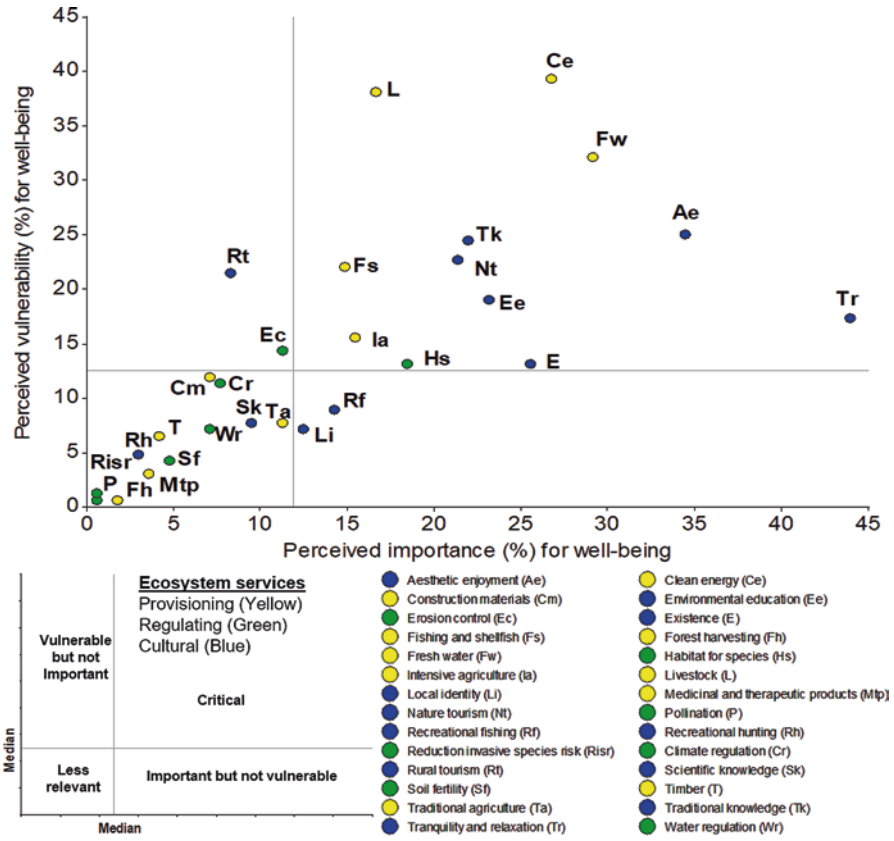

Fig. 14.2 Scatter plots representing the perceived importance of ecosystem services for wellbeing (x-axis) and the perceived vulnerability (y-axis) in Santa Cruz Province, Patagonia, Argentina

agriculture and habitat for species were the critical ES. The important but not vulnerable category was characterized by cultural ES including recreational fishing and local identity (Fig. 14.2). The category of vulnerable but not important ES included rural tourism and erosion control. Lastly, in the category of less relevant services, we found some regulating (e.g. pollination), some provisioning (e.g. forest harvesting) and some cultural services (e.g. recreational hunting).

3.2 Local Perceptions of Wellbeing

The reliability for the human wellbeing for the 20 items determined by Cronbach's alpha was 0.857, suggesting that the different dimensions of human wellbeing were highly intercorrelated. The HCA shows how different components of wellbeing relate to each other (Fig. 14.3). The following five main groups of dimensions of

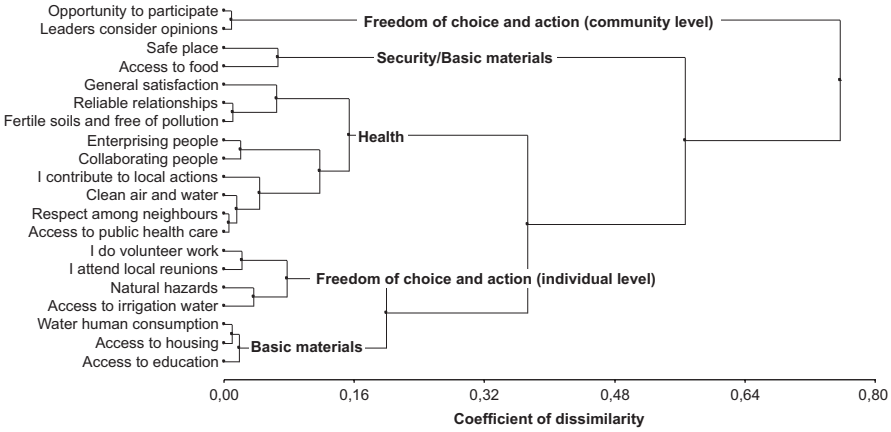

Fig. 14.3 Hierarchical cluster analysis (HCA) performed with questions regarding the five different components of wellbeing at the local level from stakeholders in Santa Cruz Province (Patagonia, Argentina). The Bray and Curtis distance and Ward's method were used as agglomerative techniques

human wellbeing were identified: two clusters grouping answers regarding one of the five components of human wellbeing (e.g. health and basic materials for a good life), one cluster grouping answers related to security and basic materials and two clusters regarding individual and community freedom of choice and action. Community freedom of choice was expressed in terms of having the opportunity to participate freely in ES community management. The general cluster involving basic materials, health, good social relations and security had a better overall rating than those regarding freedom of choice and action (Table 14.3).

Table 14.4 shows the results of the Kruskal-Wallis tests where the perceptions of vulnerable ES by each stakeholder group were compared. The local stakeholder groups comprised local dependent on provisioning ES and locals not directly dependent on ES. Both groups consisted of people who resided in the study area, and their level of knowledge and familiarity with the study area was high. The third group is related to a high degree of ES decision-making processes. Both groups of locals and decision-makers perceived provisioning services (mainly livestock, fresh water, timber and fishing and shellfish) and regulating (erosion control, habitat for species and climate regulation) as important (Table 14.4). Although all groups perceived the cultural services of existence and environmental education as important, traditional knowledge was significantly more relevant for local dependent on provisioning ES (Table 14.4).

The links between vulnerability of ES and their effect on human wellbeing among stakeholders are presented in Fig. 14.4. The first PCA axis (74.9% of the total variance) represented in the positive loadings mainly the perceptions of vulnerable cultural services (particularly aesthetic values and traditional knowledge) associated with locals dependent on provisioning ES and locals not directly dependent on provisioning ES (Fig. 14.4). The second PCA axis (15.9% of the total variance)

Table 14.3 Mean and standard deviation (S.D.) of the set of 20 items related to the 5 components of human wellbeing identified in the Millennium Ecosystem Assessment (MEA 2005): the basic materials for a good life, health, good social relations, security and freedom of choice and action. Items are ordered by the preference score (1–4) obtained in the questionnaires

Item statement	Dimension of wellbeing	Mean	S.D.
I have access to food	Basic materials	3.67	0.62
It is a safe place to live	Security	3.48	0.73
I have access to housing	Basic materials	3.14	1.06
I have access to fresh water for consumption	Basic materials	3.08	1.07
I have everything to live happily	Basic materials	3.07	0.84
I have access to education	Basic materials	2.99	1.04
I have access to fresh water for irrigation	Basic materials	2.86	1.17
Water and air are clean and unpolluted	Health	2.75	0.96
Soils are fertile and free of pollution	Health	2.73	0.86
I contribute to local causes or charity actions in my community	Freedom of choice and action (individual level)	2.69	1.06
I have access to the public health system	Health	2.68	0.97
There are good relations among the neighbours in town	Good social relations	2.66	0.86
Neighbours respect each other	Good social relations	2.64	0.98
It is probable that a natural accident could happen in the future (landslides, fires, floods)	Security	2.51	1.14
Neighbours take initiative	Freedom of choice and action (community level)	2.48	0.93
We collaborate to improve the village	Good social relations	2.42	0.90
I volunteer in activities for the benefit of the town	Freedom of choice and action (individual level)	2.29	1.13
I participate in meetings about town issues	Freedom of choice and action (individual level)	2.12	1.12
I have the opportunity to participate in the decision-making process	Freedom of choice and action (community level)	1.67	0.82
The municipality leaders take into account my opinion	Freedom of choice and action (community level)	1.65	0.82

represented in the positive loadings the group of decision-makers associated with perceptions of regulating ES (particularly climate regulation) as vulnerable ES (Fig. 14.4).

3.3 Connectedness to Nature

Survey respondents generally indicated a high level of connectivity with nature being similar for both locals and visitors (Fig. 14.5). For the self-and-nature circles, only about <2% of the respondents indicated that they felt separate from nature,

Table 14.4 Perceived importance of ecosystem services for wellbeing considered by stakeholders, in percentage (%), and differences among stakeholders calculated by the Kruskal-Wallis test

	Stakeholders			
Ecosystem services	High degree of influence in decision-making	Locals dependent on provisioning ES	Locals not directly dependent on ES	Kruskal-Wallis
Provisioning				
Traditional agriculture	12.5	7.8	13.6	$X^2 = 0.39$
Intensive agriculture	18.8	14.1	10.2	$X^2 = 0.35$
Livestock	18.8	20.3	21.6	$X^2 = 0.20$
Fishing and shellfish	18.8	29.7	14.8	$X^2 = 2.58$
Forest harvesting	6.3	3.1	10.2	$X^2 = 0.56$
Construction materials	0.0	1.6	5.7	$X^2 = 0.25$
Fresh water	31.3	37.5	39.8	$X^2 = 0.18$
Clean energy	12.5	10.9	15.9	$X^2 = 0.31$
Timber	31.3	25.0	22.7	$X^2 = 0.22$
Medicinal and therapeutic products	12.5	7.8	8.0	$X^2 = 0.06$
Regulating				
Climate regulation	37.5	23.4	19.3	$X^2 = 1.64$
Habitat for species	37.5	31.3	30.7	$X^2 = 0.32$
Water regulation	6.3	18.8	27.3	$X^2 = 2.18$
Erosion control	37.5	26.6	38.6	$X^2 = 1.07$
Soil fertility	43.8	23.4	23.9	$X^2 = 1.46$
Reduction invasive species risk	0.0	4.7	8.0	$X^2 = 0.31$
Pollination	0.0	1.6	4.5	$X^2 = 0.15$
Cultural				
Existence	31.3	29.7	23.9	$X^2 = 0.33$
Traditional knowledge	12.5	42.2	26.1	$X^2 = 4.47$**
Tranquility and relaxation	25.0	14.1	18.2	$X^2 = 0.58$
Local identity	0.0	12.5	11.4	$X^2 = 0.64$
Environmental education	37.5	17.2	23.9	$X^2 = 1.45$
Scientific knowledge	12.5	12.5	13.6	$X^2 = 0.01$
Nature tourism	0.0	7.8	5.7	$X^2 = 0.24$
Recreational hunting	12.5	20.3	15.9	$X^2 = 0.37$
Recreational fishing	18.8	18.8	10.2	$X^2 = 1.01$
Rural tourism	18.8	14.1	6.8	$X^2 = 0.92$
Aesthetic enjoyment	6.3	21.9	29.5	$X^2 = 2.62$

**Indicates statistical significance at the $p < 0.05$

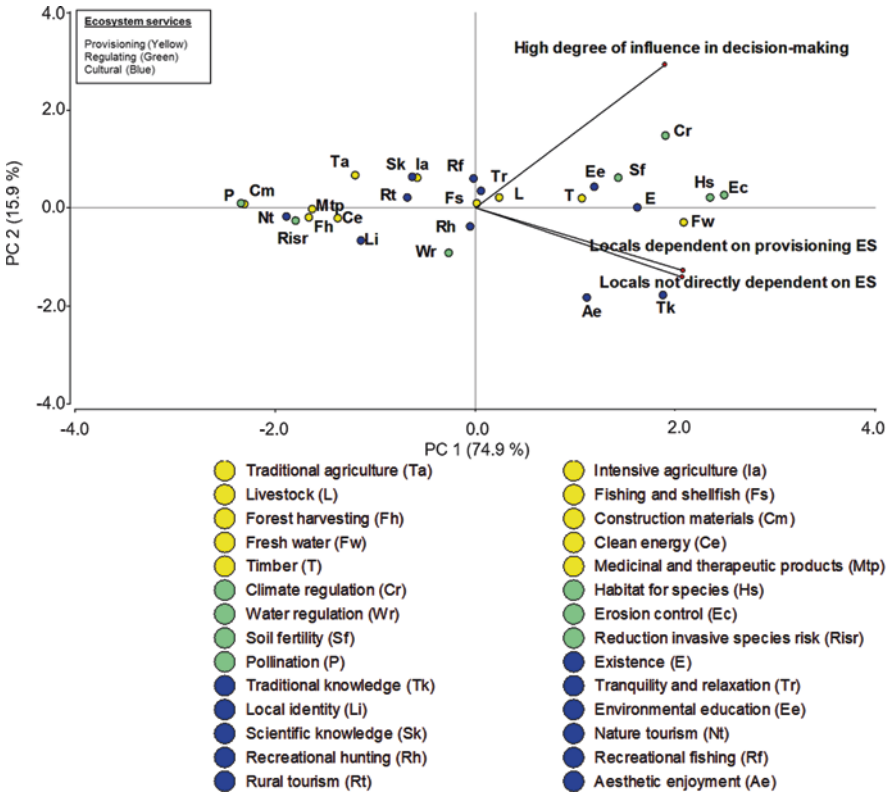

Fig. 14.4 Principal component analysis (PCA) plot of stakeholders and vulnerable ecosystem services in Santa Cruz Province (Patagonia, Argentina)

whereas more than 54% (52.4% for locals and 56.5% for visitors) identified with the circles depicting self and nature as mostly the same (scores 4 and 5, Fig. 14.5).

The Nature Relatedness Short Version (NR-6) analysis determined that visitors scored a high self-nature connection (Table 14.5). From this the highest score was related to individual differences in the need for nature and comfort with wilderness, as well as awareness of local wildlife (e.g. 'my ideal vacation spot would be a remote, wilderness area').

4 Discussion

We found that 12 ES (5 provisioning, 6 cultural and 1 regulating) were perceived among stakeholders as important for wellbeing. Usually, people tend to identify ES that can be perceived by the senses or more directly linked to the human-made components of landscapes such as agriculture and other extractive activities detected in the present work (Lewan and Söderqvist 2002; Lamarque et al. 2011). However,

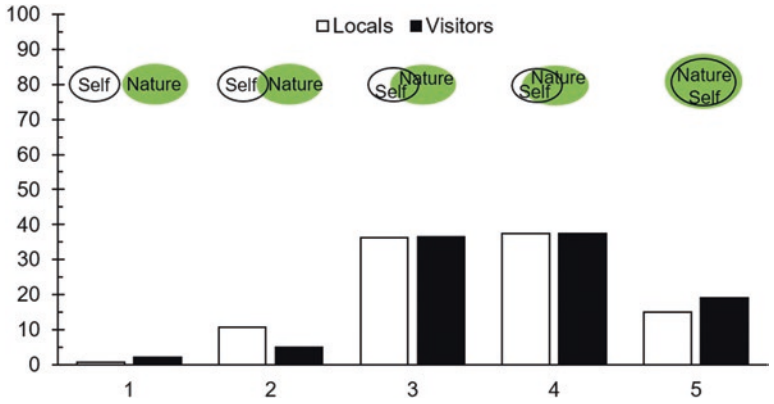

Fig. 14.5 Relationship with the natural environment for both local and visitors using the Inclusion of Nature in Self (INS) scale (expressed in percentage) in Santa Cruz Province (Patagonia, Argentina)

Table 14.5 Mean and standard deviation (S.D.) of the set of six items related to the Nature Relatedness Short Version (NR-6) used to measure the subjective wellbeing and environmental variables for visitors (Nisbet and Zelenski 2013). Response categories for items were 1 (strongly disagree), 2 (moderately disagree), 3 (neither agree nor disagree), 4 (moderately agree) and 5 (strongly agree)

Item	Mean	S.D.
(i) My ideal vacation spot would be a remote, wilderness area	4.02	1.03
(ii) I always think about how my actions affect the environment	4.08	0.99
(iii) My connection to nature and the environment is a part of my spirituality	3.76	1.06
(iv) I take notice of wildlife wherever I am	4.24	0.87
(v) My relationship to nature is an important part of who I am	4.02	0.91
(vi) I feel very connected to all living things and the earth	3.76	1.10

regulating and cultural ES, associated with less tangible components of landscapes, had been also identified by stakeholders in rural systems, as it was the case here for traditional knowledge (Hauck et al. 2013; Martín-López et al. 2012). From these, the provisioning ES of livestock production, fishing, fresh water, clean energy and intensive agriculture were the critical ES and highly related to the semi-arid characteristics of the study area. Regarding livestock production, natural grasslands occupy most of Santa Cruz Province and are the principal food resource for sheep, reared for meat and wool (Peri et al. 2013, 2016). However, in Patagonia over the last 70 years, we have witnessed extensive degradation of once productive steppe ecosystems (desertification) (Golluscio et al. 1998). Thus, heavy and unsustainable grazing conditions threaten the future of livestock productivity, therefore threaten-

ing the long-term wellbeing of the local economy (Aguiar and Sala 1998; Bertiller and Bisigato 1998). Regarding fishing as critical, mainly in coastal and marine areas in Patagonia, it may be reflected the unsustainable practices that generate anthropogenic drivers related to food production and marine biodiversity (Rocha et al. 2014). However, there is limited information about ES provided by marine and coastal habitats and ecosystems, creating knowledge gaps about the importance that people assign to these areas (Martin et al. 2016). Provisioning fresh water also was perceived as critical. In the study areas, most important watersheds are located at the Andes where main rivers fed and cross the plateau steppe and outflow to the Atlantic Ocean. People may perceive that livestock, farming, energy and urban and rural populations will be impacted by climate change-induced changes in glacier runoff and therefore less available water coming from glaciers and mountain forests (Cuesta et al. 2019). The glaciers of the Southern Andes showed the highest glacier mass loss rates worldwide with more than 40 m water equivalent over the period 1961–2016 (Zemp et al. 2019). Meier et al. (2018), covering the area between 41 and 56°S, reported an absolute glacierized area loss of 5455 km^2 (19.4%) in the last ~150 years, where the annual area reduction increased by 0.25% for the periods 2005–2016. According to Aylward et al. (2005), this ES provides a great contribution to human wellbeing if society improves the design and management of water resource infrastructure, establishes more inclusive governance and integrated approaches to water management and adopts water conservation technologies and demand management that increase water productivity. Another reason that may explain why provisioning ES were highly identified as critical in the study area relates to the contribution of traditional activities and knowledge not only to food provision but to the delivery of other ES, such as landscape aesthetic values or tranquillity and relaxation as contributions to wellbeing. This is consistent with rural areas suffering from depopulation where traditional agriculture was highly related to the maintenance of local identity and to the contribution of social capital and enhancement of wellbeing (Pereira et al. 2005).

Habitat for species was the only regulating ES perceived as critical. This is consistent with the idea that habitat for rare or endangered species decreases due to several factors related to human activities (e.g. forestry, ranching, mining) or climate change (Newbold 2010; Badiane et al. 2017; Godsoe et al. 2017). For example, for huemul (*Hippocamelus bisulcus*), the most threatened flag species of Southern Patagonia, Rosas et al. (2017) found that habitat losses occurred in the extreme potential distribution areas (northern and southern areas of Santa Cruz Province), related to the increasing ranch activities. Also, Rosas et al. (2018) showed hotspots of lizard biodiversity in the north-east area as related to conditions of desertification due to livestock breeding production. The knowledge of habitat requirement for a target species is a key issue in the management and conservation planning (Villero et al. 2017).

The important but not vulnerable category was characterized by cultural ES including recreational fishing and local identity. Martínez Pastur et al. (2016) reported that local identity in Santa Cruz was mainly related to small cities (e.g. El Chaltén and El Calafate) and areas with special cultural interest (e.g. Cueva de las

Manos UNESCO World Heritage) associated with the presence of flora, terrestrial native fauna, water (e.g. sea coast, lakes and rivers) and human buildings. Recreational fisheries (mainly fishing in fresh water in lakes and rivers by locals and international fly fishermen) are developed throughout Patagonia, both in Chile and Argentina, with a significant local and regional economic impact (Vigliano and Alonso 2000). Although recreational fishing was classified as important but not vulnerable, there are evidences of a rudimentary fresh water stock assessment in Patagonia, a declining quality in several trout recreational fisheries (both in catch rate and size of the fish caught) and the introduction of exotic fishes (Pascual et al. 2007).

When the reliability of human wellbeing on nature was analysed, different dimensions of human wellbeing were highly intercorrelated, e.g. we found that items regarding the basic materials for good life, security, health and good social relations had higher appraisals among stakeholder groups. In contrast, issues regarding freedom of choice and action received lower scores and differences among stakeholder groups. This suggests that differences in beliefs and preferences are also often linked to differences in the power to pursue goals (McShane et al. 2011).

We disaggregated ES values at a stakeholder group level to analyse if perceptions of wellbeing relate to sociocultural values (Table 14.4). We found that both locals and decision-maker groups perceived provisioning services (e.g. livestock, fresh water, timber and fishing) and regulating (e.g. erosion control, habitat for species and climate regulation) as important. We found also that while all groups perceived the cultural services of existence and environmental education as important, traditional knowledge was significantly more relevant only for locals dependent on provisioning ES. Thus, while the local development professionals who resided in the study area (locals not directly dependent on ES) tended to acknowledge mostly the cultural dimensions of land use relating the endangerment of traditional and aesthetic values, the local's dependent on provisioning ES tended to relate it to the degradation of their livelihoods. Relationships between vulnerability of ES and their effect on human wellbeing among stakeholders determined they the perceptions of vulnerable cultural services (particularly aesthetic values and traditional knowledge) associated with locals dependent on provisioning ES and locals not directly dependent on provisioning ES. The group of decision-makers presented perceptions of regulating ES (particularly climate regulation) as vulnerable ES. These divergent stakeholder priorities can be used to visualize possible trade-offs between different ES, mainly because people's willingness to conserve one ES might be at the expense of another (Martín-López et al. 2012).

Both respondents, locals and visitors, indicated a high level of connectivity with nature by using the Inclusion of Nature in Self (INS) scale. Also, the Nature Relatedness Short Version (NR-6) analysis determined that visitors scored a high self-nature connection mainly related to individual differences in the need for nature and comfort with wilderness, as well as awareness of local wildlife. This highlights that environmental values derive from a sense of connectivity with nature and measure a value orientation that underlies environmental concern and behaviour (Dutcher et al. 2007). Nature relatedness contributes to potentially important implications by contributing to human wellbeing as well as environmental sustain-

ability and protection (Saunders 2003). However, cultivating a greater sense of connectivity in the effort to achieve ecological and economic sustainability may require working through and across existing belief systems.

5 Recommendations for Policy Makers

One of the most important challenges in ES is managing the emerging trade-offs for making decisions (Bennett et al. 2009). In this context, our results showed that social perception of values can substantially contribute to identify ES by focusing on the conflicts that emerge among different stakeholder groups. We found that perceptions of the relationships between ES and individual wellbeing varied at stakeholder group level. Divergent sociocultural values among stakeholder priorities can be used to visualize possible trade-offs between different ES. This was because people's willingness to conserve one ES might be at the expense of another. However, value conflicts do not only arise from perceiving different ES, but they can also arise from different content in valuing the same ES, implying contrasting actions or policies (Trainor 2006). Although there were differences in perceptions between stakeholders according to their particular interests, they also shared common views for many ES. Also, we confirmed that sociocultural valuation is case sensitive by detecting differences in perceptions in different areas and stakeholder-sensitive tool by detecting differences in perceptions among stakeholder groups.

Decisions should follow concrete goal or objectives in ways that are meaningful to local residents and to stakeholders, such as promoting sustainability, promoting human wellbeing or achieving better management of a resource, but also the procedures involved in the decision-making process itself, focusing on public processes of inclusion and deliberation (Norton 2005). Although there is a plurality of values associated with the complex and multifaceted services, the sociocultural information of the present study can provide important inputs into negotiations, allowing participants to compare positive and negative impacts of various options for ES management. Since decision-making processes are based on value systems usually derived from particular scientific disciplines, our results became important because they represented the diversity of perspectives from broader segments of society, which are directly affected by the outcomes of such decisions (Lynam et al. 2007). Traditional environmental management strategies that do not take into account stakeholders' and local communities' perceptions of ES on wellbeing can fail by social resistance (Menzel and Teng 2009). Therefore, encouraging experience exchange through participatory mechanisms is very relevant to guarantee that multiple stakeholders with contrasting perceptions regularly interact and discuss about their interests, needs and management of ecosystem services (Kenward et al. 2011). This participatory system could be implemented by local governments and mediated by third-party institutions at different organizational levels and adapted to the cultural and geographical characteristics of each social-ecological system.

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