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Reshaping forest management in southern Patagonia: a qualitative assessment

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ABSTRACT

The intensive forest use has caused a significant transformation around the world. Sustainable forest management (SFM) has emerged as an alternative to address concerns regarding resource use, conservation, and socioeconomic benefits. Evidence suggests that its application remains inconsistent. In Argentina, the national government passed a law addressing management aiming to provide guidelines and incentives to steer practices into a sustainable framework. The objectives were: (a) understand what the concept of SFM means to participants in Tierra del Fuego; (b) identify and assess how different factors influence the adoption of SFM; (c) review the stakeholder perceptions on recent regulatory changes; and (d) identify the steps required for improving management. We conducted 52 semi-structured interviews with stakeholders and parties at the national level. New regulatory arrangements were implemented for a short-time before this research was undertaken, and we could not evaluate the success of reform. The study provided deep insight into the policy-making process, and the views held by different stakeholders. The historical mismanagement of the resource, together with an unfavorable past relationship with authorities, has promoted short-term perspectives which resulted in behaviors inconsistent with SFM. Moreover, the characteristic demographic composition brings a social component not identified in the broader literature as relevant for SFM adoption.

KEYWORDS

Sustainable forest management; forest reform; native forest management policies; law regulation; Tierra del Fuego

Introduction

Intensive temperate forest management over the last century or more has caused a significant transformation of the resource (Bauhus, Puettmann, & Messier, 2009), reflected in simplified forest structures in many parts of the world (Ehrlich, 1996). Even though temperate forests are not globally threatened in terms of surface coverage (Millennium Ecosystem Assessment [MEA], 2005; Sedjo, Goetzl, & Moffat, 2014), their use and management have caused significant reductions in biodiversity conservation values (Berg et al., 1994; Sayer, Chokkalingam, & Poulsen, 2004; Lindenmayer et al., 2012), while also affecting their capacity to provide the original wide range of ecosystem services (Luque, Martínez Pastur, Echeverría, & Pacha, 2011). In this context, sustainable forest management (SFM) appears as a dynamic and multidisciplinary concept which could

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provide the answer to temperate forest management issues by including the interaction of technical, social, and economic components (Kohm & Franklin, 1997; Gustafsson et al., 2012). The Ministerial Conference for the Protection of Forests in Europe (MCPFE, 2011) provides a definition of SFM which will be used for providing a scope to this article:

The stewardship and use of forests and forest lands in a way, and, at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.

However, although the global trend toward SFM appears to be positive, a closer examination at regional or local scales reveals problems with their implementation (Food and Agriculture Organization of the United Nations [FAO], 2010).

Numerous efforts to steer forest management practices into a sustainable framework have been made in the last decades (Smith, Colan, Sabogal, & Snook, 2006). These include a wide array of instruments originating both from the public and private sectors—such as regulatory arrangements, economic incentives, information programs, and market tools (e.g., certification processes). Several studies have delved into the level of success achieved by these instruments in different settings (Contreras-Hermosilla & Vargas Ríos, 2002; Serbruyns & Luyssaert, 2006; Smith et al., 2006; Boscolo, Snook, & Quevedo, 2009; Carroll & Buchholtz, 2014). Findings show that, for most cases, the outcome is highly dependent on the socioeconomic setting and on historical arrangements. Often, barriers for SFM implementation have been related to expected associated incremental costs (Eid, Hoen, & Økseter, 2001; Kishor & Constantino, 1994; Putz, Dykstra, & Heinrich, 2000; Sedjo et al., 2014); the failure of SFM regulations to address social issues related to forest management, including negative impacts on the livelihoods of forest dependent communities (Colchester et al., 2006; Carroll & Buchholtz, 2014); unclear land tenure systems (Fearnside, 2001; Owubah, Le Master, Bowker, & Lee, 2001; Elías, Larson, & Mendoza, 2009; Damnyag, Saastamoinen, Appiah, & Pappinen, 2012); and poor behavioral norms rooted by previous governance systems (Smith et al., 2006).

In Argentina, recent regulatory changes related to native forest management have been introduced with the passing of National Law 26331/07. This new law and its Regulatory Decree (2009) represent a modest step toward SFM by establishing the minimum standards that native forest management has to meet in all Argentine territories. This article focuses on temperate forests in Tierra del Fuego, Argentina, which represent one of the most important natural resources of southern Patagonia, not only in terms of timber production, but also in terms of ecosystem services (Luque et al., 2011; Zagarola, Anderson, & Veteto, 2014; Soler, Schindler, Lencinas, Peri, & Martínez Pastur, 2015). However, one century of intensive harvesting (since European colonization) and the ad hoc nature in which they were managed for many decades, have resulted in an irregular forest structure with low ecological and economic value, hence calling for a revision of the existing arrangements (Gea Izquierdo, Martínez Pastur, Cellini, & Lencinas, 2004). The purposes of this study are to understand what SFM represents to the participants, to identify the factors that are influencing the adoption of SFM in the region, the perceptions of the different stakeholders on the recent regulatory changes, and which they believe are the required steps for improving forest management on the island.

Methods

The archipelago of Tierra del Fuego is located in the southernmost part of the South American continent, across the Magellan Strait and extending as far south as Cape Horn. The main island (Isla Grande of Tierra del Fuego) has an area of 48,100 km² and is located between 52° 30' and 55° 00' S, and 65° 00' and 69° 00' W. It is geopolitically divided between Argentina and Chile, with an approximate 60% under Chilean administration and the remaining 40% under Argentinian control (Klepeis & Laris, 2006). We carried out the study in the Argentinian section of the island early in 2012. Native forests in this area comprise more than 700,000 ha (Collado, 2001) and mostly located south 54° S (Figure 1). Three main species belonging to the *Nothofagus* genus can be found in these forests: *N. pumilio*, *N. antarctica*, and *N. betuloides*. Early indigenous groups used wood for varied purposes such as firewood, building of canoes, and tools. However, it was not until European settlement in the late 19th century that the forest use diversified and intensified (Bridges, 1948). Commercial harvesting began during the middle of the 20th century, when the population on the island significantly increased (Gea Izquierdo et al., 2004). With regard to forest tenure, almost half of the forests fall under private ownership, while the other half are public (national or provincial; Collado, 2001). Fuegian forests under the National Parks Administration represent 3.4% of their cover (Secretaría de Ambiente y Desarrollo Sustentable de la Nación [SAYDS], 2007) while another 40% of the forests fall

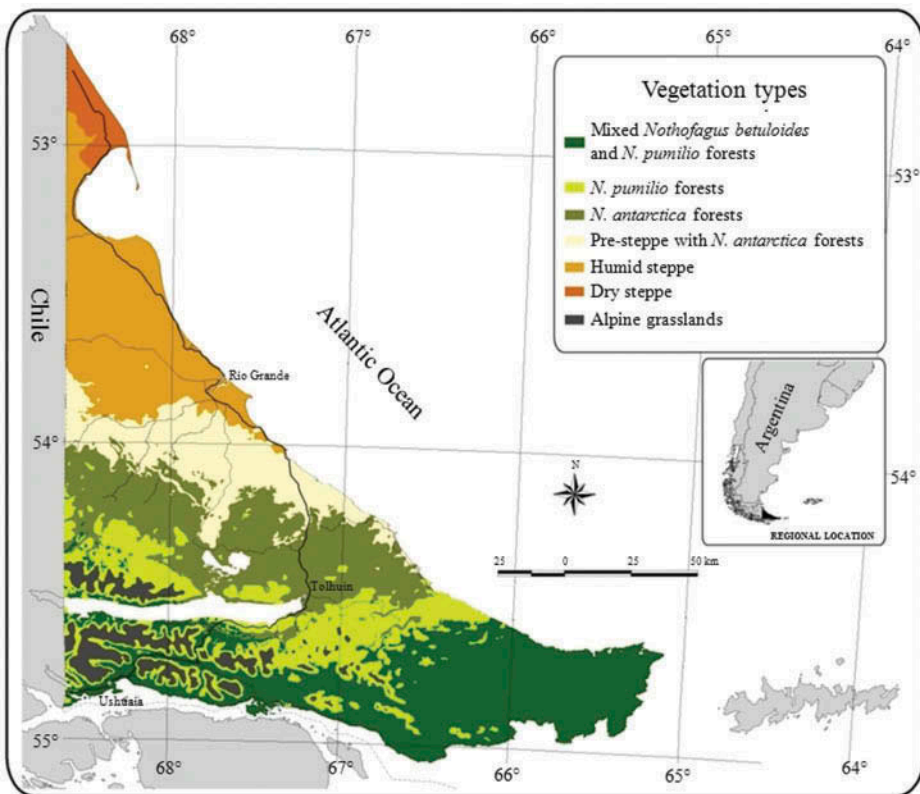


Figure 1. Vegetation distribution in Tierra del Fuego (adapted from Allué et al., 2010).

under the protective forest category according to the Provincial Forest Law 145 (Collado, 2001), and new national native forest legislation (National Law 26331/07).

Data collection proceeded in two stages. First, we conducted a review of official documents, regulations, procedures, reports, and scholarly articles to provide the setting for fieldwork and to understand the history of management, the character of the Fuegian forest resource, as well as the history and demographic composition of the local community. Document relevance was determined by the relation to the question asked, the currency and timeliness of the information, and the type and quality of source. Then, the first author conducted 52 semi-structured interviews between the months of February and March in 2012 with key stakeholders from the island and mainland. The interviewees were purposively selected from the timber industry, national and regional forest authorities, forest scientists, land owners, universities, nongovernmental organizations (NGOs), forest associations, and others from the recreational sector such as tourism companies and the National Park Administration (Table 1).

The interviews used open-ended questions to allow the participants to provide their insights on what they believed the main elements of SFM were, considering whether they mentioned the three different spheres included in the MCPFE definition (ecological, economic, and social) and which were the required steps to achieve it. The questions also aimed to understand which factors the participants identified as influences for forest management on the island and also their perception regarding the recent regulatory changes, without the constraints of narrowly focused questions. However, we structured the interviews around an initial set of topics identified in previous research (Table 2), and participants were asked to assess their perceived level of influence on forest management on the island. We analyzed the interview data using a qualitative approach including four stages as described by Lamnek (1989) and Sarantakos (1993): (a) transcription, (b) coding,

Table 1. Reference system for participant identification, gender, and age distribution.

Participant group	Reference	Number of participants
Researchers	R	8
Concession and sawmill owners, timber processing industries, forest technicians, and forest associations	P	15
Landowners	LO	3
Other stakeholders: NGOs, tourism operators, National Park Administration	OS	3
Universities	U	8
National Forest Agency	NFA	4
Provincial Forest Agency	PFA	5
Other provincial agencies	OP	6
Gender distribution	%	Number of participants
Female	23	12
Male	77	40
Age range	%	Number of participants
20–30	5.8	3
31–40	21.2	11
41–50	42.3	22
51–60	25.0	13
61–70	3.8	2
71–80	1.9	1

Table 2. Topics included in interviewing schedules.

Area	Related topics
Policy and regulations	Regulations and reinforcement Relationship with the authority Forest harvesting fees New regulatory framework (National Law 26331/07)
Education and communication	Information availability Education
Social	Local community profile Role of local NGOs Land tenure issues
Market	Market concerns Role of certifications
Costs	Does managing the forest in a sustainable way result in differential (increased/reduced) operational costs?

(c) generalization, and lastly (d) control in which we listened to each interview for a second time to detect both information omission as well as concepts not properly coded. Also, findings and patterns identified in the generalization phase were confirmed. Not only did we consider the contents of the interviews, but also whether topics came in as a spontaneous response to open questions and prompts, or whether we had to ask specifically about them towards the end of the interview. Such consideration contributed to the conclusions of the research in terms of the importance assigned by the participants to given factors; that is, if they spontaneously mentioned a factor it was considered as relevant to the participant, whether if we had to specifically ask him about it, it was considered of secondary importance to the respondent unless specified otherwise. When presenting the views of the participants, we preserved the anonymity of the participants by using a reference system where each of them is identified by means of a combination of the corresponding reference code (Table 1) and a consecutive number (e.g., R1 represents Participant 1 of the researchers group, PFA2 stands for participant 2 of the provincial forest agency group).

Results

SFM definition: dual perceptions

Early in the interviews, we asked participants to define SFM and describe the factors they believe encompass this concept. The resulting perspectives can be grouped into two main clusters as follows: (a) SFM as forest surface preservation and legal compliance; and (b) SFM as ecological, social, and economic sustainability.

SFM as forest surface preservation and legal compliance

For most interviewed forest concessionaires, sawmill owners, and local forest technicians, SFM is achieved by maintaining forest coverage, which in turn would be able to sustain the timber industry in the future. Many mention the need to comply with legal requirements related to harvesting restrictions in areas where either steep slopes or waterways exist. However, for many of the respondents among this group, forest sustainability, as they understand it, does not appear to be a concern, as they rely on the fact that *Nothofagus* forests have good regeneration capacities. The proof, they claim, can be

found in numerous areas of the island which have been cleared or burnt in the past and which currently present dense secondary growth:

The forest continuity is not at risk, and never was, not even when no management plans were required by the authorities on the island. ... The reason behind this is because lenga (*N. pumilio*) forests have such a spectacular regeneration, so aggressive, that not even fire events have managed to stop it from recovering. (P1).

No matter how carelessly the forest is harvested, it is never bad enough so as to affect its recuperation. The forest will recover. In fact, there are no degraded areas on the island. (P5)

In addition, the respondents within this group characterize the Fueguian forest as “old and with low sanitary conditions” (P8, P11), whose quality can only be improved through harvesting and management. As such, forest use appears as a necessary condition to ensure its quality from a wood production standpoint and permanence in time.

SFM as ecological, social, and economic sustainability

Respondents from the national and provincial Forest Agencies, research and educational institutes, other provincial agencies, the tourism and recreational sectors, and two forest technicians share a broader perspective of SFM. In their definition, they include not only preservation of forest cover and ecosystem protection through legal compliance, but also social and economic factors. That is, the forest is considered to be a provider of ecological and socioeconomic well-being:

A SFM is one that encompasses environmental sustainability in which the forest remains being a forest that can provide the original environmental services, and at the same time provides good quality jobs. (PG1)

SFM is the rational use of the resource, and at a rate, that allows its preservation while improving the conditions, both social and economic, of the related communities. (U8)

SFM necessarily includes the community and is not pure conservationism. The fundamental part is that we can integrate the living of communities in the forest. (NG2)

While more highly qualified individuals shared the latter view, those with fewer or no qualifications considered SFM almost exclusively as forest cover preservation. Therefore, SFM appears as a more inclusive and broader concept for those highly trained, while those who had lower qualifications tend to hold narrower views of forest sustainability.

Constraints and opportunities

The interviews show that it is not possible to separate drivers and barriers simplistically, as what appears to be an opportunity to improve forest management for a given participant group or individual, may be regarded as a constraint for another. Therefore, in the following sections, we will be broach the main topics that were raised when asking the interviewees about what motivated or constrained SFM on the island, identifying consensus and contesting opinions: (a) regulations, reinforcement, and relationship with the forest authority; (b) forest harvesting rates; (c) education; (d) community involvement; (e) land tenure; (f) timber products' market influences; and (g) operating costs.

Regulations, reinforcement, and relationship with the forest authority

The existence of a strong regulatory agency, sound regulations, and efficient controls was mentioned by all the stakeholder groups as a necessary condition to achieve SFM. Perceptions of past and current situations differed among individuals, but agreement existed based on the fact that previous regulatory arrangements and past relationships with the authorities still bear upon the present. From the interviews, three distinct stages could be identified in the recent regulatory history of forest management in Tierra del Fuego. The first stage corresponds to the decades that preceded the creation of the province of Tierra del Fuego in 1992, in which forest management on the island was controlled by the national authorities (Instituto Nacional Forestal-IFONA) based in Buenos Aires. The large distance between timber companies and the authority caused significant delays in response times; however, the potential for corruption appeared to be minimal during this period, as national authorities and local producers were distant, reducing chances for irregular negotiations:

Earlier, if forest producers wanted to challenge an infringement notice, they had to travel all the way from Tierra del Fuego to Buenos Aires. Once there, authorities were dealing with much bigger companies which operated in other regions, and therefore, the producer, who had a significant influence on the island, realized that at a national level he could not negotiate on the same terms. (P4)

The second stage started in 1992 when the province of Tierra del Fuego was created, and a gradual transfer from national to local forest administration occurred, and a local forest agency was eventually created (Dirección General de Bosques-DGB). In this early period, when DGB was in its first stages of development, the position of the forest director was not always filled. As a consequence it was often carried out by functionaries selected from among the governing political party which, as many interviewees point out, led to a political use of forest administration.

The last stage comprises the years from 2010 to the present, in which the forest agency is run by a forest director selected through an open selection process, reducing the probability of political use of the resource, and consequently improving relations with the local producers. Even so, the perception from the interviews was that elements from past arrangements still negatively influence the relationship between producers and the forest authorities, hindering the transition process. [Table 3](#) reviews these distinct periods, establishing a difference between the positive and negative aspects as perceived by the respondents ([Table 3](#)).

However, some significant issues mentioned were independent of these three time periods. For instance, provincial authorities were perceived to have low levels of interest in the forest resource, which has been evidenced by a lack of long-term vision in both past and present regulatory arrangements. For example, even when local legislation allows for forest concessions in public forests up to a maximum of 20 yr, in practice, most producers operate within a 5-yr timeframe at the most, as currently harvesting permits are hardly ever granted for longer timeframes (P1). This arrangement, as such, is believed to provide no incentive for medium- or long-term management. On the other hand, some respondents from the local forest agency have suggested that more often than not, once a forest inspector detects a contravention and raises an infringement note to the provincial justice department, this latter agency fails to impose penalties (PFA4, PFA5). Consequently, the

Table 3. Description of regulatory arrangement periods as extracted from interviews.

Period	Tierra del Fuego National Territory	Early stages of Tierra del Fuego Province	Forest Director selection through open process
	Before 1992	1992–2010	2010–present
Forest Agency profile Positives	National Agency distant from Island producers Lower levels of corruption were acknowledged by interviewees, as familiarity between local producers and national forest authorities was low	Provincial Agency political profile Local interests better addressed Reduced bureaucracy levels	Provincial Agency technical profile Decisions on forest management less influenced by political factors and more focused on the resource instead Stricter and more egalitarian control processes
Limitations	High bureaucracy levels	Close relationship between authorities and producers, which affects controls: “Laws are often breached due to the familiarity between agents and forest operators” (P4) Politics highly influencing on forest management on the Island	

image of the authority is often negatively affected by such dispensations and as the public loses respect and trust for the forest agency, and inspectors, with time, no longer see a point in pursuing infractions. Lastly, the survey showed that although most interviewees agree on an improvement in controls over the last years, many still perceive them as lacking the strength to steer operations into a sustainable framework: “Forest operators are usually confident that nothing will happen. . . . One out of every three or four infractions is normally detected, and still, nothing might happen” (P5); “Human resources within the Forest Agency are scarce and not enough to control every operation” (PFA3).

Forest harvesting rates

Provincial Forest Law 145/95 foresees the payment of fees for harvesting operations in both public and private forests, which should contribute to a specific fund (Fondo Forestal) to ensure compliance with this law. As the text of the regulation provides no specification as to how these fees are to be levied, different systems have been applied through time. Timber volume, however, has always been the unit used for charging purposes, and what differed were the methods for estimating it. For some years, harvested volumes in large operations were calculated prior to the harvest by surveying the forest and estimating a potential volume per hectare, which simplified the quantification process. For small producers though, every harvested log was measured after the harvesting, thus increasing the inspector’s workload. From 2010 onward, fees for all types of operations have been levied using this latter process.

Many participants from the survey identified the forest concession rate system as a tool, which, if used properly, should promote sustainable practices on these forests. Having said that, the way it is currently applied raised many concerns among the different groups: (a) value of forest harvesting fees, (b) fund destination, and (c) volume or area-based fees.

Value of forest harvesting fees. While many participants from the provincial regulatory agencies agreed on the value being too low to promote a sustainable and rational use of

the forest (OP1, OP4, OP3, U2), some producers expressed the opposite, as higher fees would make their operations economically unsustainable (P1, P8). Those who believed the fees were too low often stated that current arrangements act to the detriment of promoting an increase in the products' added value, which in turn, affects the social sphere of sustainability.

Fund destination. Other concerns were related to the destination of these funds. While Provincial Forest Law 145/95 requires that these fees should be used for a provincial forest fund, some argue that a proportion of the fees has instead been used for general funding needs of the province, hence losing an opportunity of being reinvested in intermediate treatments and restoration, while also demonstrating the authority's lack of interest in the resource (R1).

Volume or area-based fees. Lastly, arguments against the volume-based fees state that such an arrangement promotes unsuitable forest practices, as many producers choose to extract the best individuals of the stand, leaving low quality trees and logs behind. This selective harvesting often results in stands with low regeneration capacities, as the gaps have not been created following a proper silvicultural prescription, but instead being determined by sawmill product demand (OP3, R1).

Education

Understood as formal instruction, scientific knowledge transference, and information provision, education was mentioned by several participants in the survey as a relevant mechanism to influence forest management processes. As such, many respondents expressed a significant concern regarding the limited availability of forest professionals to promote the development of the forest sector, as well as to deal with the growing workloads generated by the new native forest law at national and provincial levels. This constraint is evidenced by a significant decline in enrollments in, and completion of, forestry programs in recent years (Global Forest Resources Assessment [FRA], 2010), as well as the recent closure of the tertiary forestry program offered in the city of Rio Grande (NFA1, P4). While some of the respondents emphasized the key role certain research institutes are playing in the improvement of forest practices on the island (NFA1, OS1), other stakeholders expressed the need to improve communication between scientists and the general public to better profit from the studies being conducted: "The lack of knowledge transference is very significant. The information should be made available for us in a way we can understand and apply" (LO2). In spite of the hindrances identified in the communication processes among stakeholders in Tierra del Fuego, opportunities for improving these were also pointed out. As many respondents observed, the cascading effect of successful practices should not be overlooked: "The biggest operators are those who dare innovate, but as soon as positive results are evidenced, others follow" (R3); or "Many forest producers need to see to believe" (P4). The significant role these informal mechanisms have in communicating best practices should not be disregarded in small communities such as those in Tierra del Fuego, where communication channels are short, and consequently are efficient in spreading the word.

Community involvement

Hardly, any of the survey participants mentioned the community as a driver constraint for SFM, but instead had to be specifically asked about its role, suggesting that the level of engagement at the national and provincial levels is still too low to exert any real influence on forest management. When asked, most of the respondents agreed that the community lacks any interest in forest management, both at the national and regional levels. This attitude acts to the detriment of the resource as calls for improvement are for most cases rare. In Tierra del Fuego, the causes of this apparent lack of interest appear to be rooted in the specific demographics of the island, which differ from the rest of the country as a result of the set of policies aimed at attracting investment, development, and immigration to the island. These have resulted in a significant influx of settlers from other regions of the country, as well as from neighboring nations. These immigrants have, in many cases, been described as solely attracted by the availability of work and the possibility of improving their economic situation, and uninterested in a long-term stay on the island:

In general, almost all Patagonian communities are the result of recent migratory processes, and consequently, are very heterogeneous. As such, these communities are driven by the original aims of most immigrants, which are mainly economic. (U3)

People do not feel they belong here, and for that reason, they are not interested in the environment per se, least of all in the forest. (PFA3)

Land tenure

In Tierra del Fuego, where issues related to land ownership are rare, the ownership of forests is still sometimes unclear, because private owners have, in some cases, purchased and paid for public land, but the state claims that the forest cover itself still belongs to the province until purchased separately. As such, many respondents from the researchers and landowners' groups (R1, R5, L1, L3) have pointed out in the interviews that those concessionaires that operate in public lands often mismanage forests as the landowner in this particular case—the provincial government—shows a lack of interest in the resource and fails to enforce regulated practices. In contrast, private owners are deemed to be more concerned about their forests, and as such, require those concessionaires operating on their lands to comply with regulations and good practices (R1, R5, L1, L3, Martínez Pastur et al., 2007). These findings do not necessarily mean that forests under private ownership are always better managed than those in public. Rather, what they show is that most respondents from the survey not only believe the forest authority should improve its enforcement mechanisms, but also that the province should prioritize the surveillance of its own forestlands.

Timber products' market influences

In the survey conducted for this study, hardly any respondent mentioned market-related instruments as drivers for improving forest management on the island. When specifically asked to comment on their perceptions regarding market influence, the following three points came out with a high degree of consensus among participants. First, domestic markets (regional and national ones) have, in general, low requirements in terms of sustainability. Customers are still focused on quality, price, and delivery times, though

exports to mainland Argentina require some evidence that commercialized timber belongs to legal harvesting operations (approved management plans, tax payments, etc.): “Customers are solely interested in receiving the product. There is no benefit from working properly” (P6). Second, higher demands are sometimes imposed by foreign governments and customers; however, the amount of timber sent for export is not yet significant enough to steer any local change. Third, certifications do not play a major role in Fuegian or Argentinean markets as customers there do not establish a difference between certified and noncertified sources and products. In fact, none of the forest producers interviewed had been requested to comply with any particular standard, and the only concessionaire on the island that had decided to certify following corporate guidelines expressed having difficulties in finding a market niche for its certified products. In addition, there is skepticism about what improvements are really achieved through certification. While some forest technicians and members from the regulatory agency feel that improvements are evident in certified operations, as shown by road planning, harvesting operations, and social conditions, other stakeholders are of the view that certifications do not necessarily imply these changes will take place.

Operating costs

From the survey, costs did not appear as a constraint to sustainability. Although timber producers and forest concessionaires acknowledged that implementing sustainable practices and complying with regulations often implied higher internal costs, this was not perceived in a negative way. Rather, what they viewed as an obstacle is the lack of legal enforcement, which, in turn, allows for a significant amount of illegal timber to be traded in the market. As such, products which are obtained from noncompliant operations can be sold at lower prices, disadvantaging those who do comply: “Our business suffers when there is a lack of control from the authority as high amounts of illegal wood can be found in the market, lowering prices and causing unfair competition” (P6). This emphasizes the need for regulatory agencies to ensure the costs for compliance are assumed by all stakeholders in the local forest industry.

New regulatory framework

Law 26331/07 establishes a framework for native forest management in Argentina by defining a baseline for their management together with the aim of improving their use and conservation status through economic incentives and institutional promotion. This new law and its regulatory decree established the classification system that distinguishes three categories of allowed interventions with respect to native forests, based on their endangered status and other biophysical criteria. Category I (red) represents forests of high conservation value which should not be transformed. Category II (yellow) corresponds to forests of medium conservation value which can be used within a SFM plan, and category III represents forests with low conservation value which can be transformed. Despite the nationwide scope of this law, it is believed to have been prompted by deforestation in the northern provinces of Argentina, where the loss of native forest cover has mainly occurred due to the expansion of the agricultural frontier (Montenegro et al., 2004; Luque et al., 2011). In fact, many interviewees pointed out that this law is not as relevant to the other regions of the country, as forest management elsewhere faces constraints that differ from

the ones in the North: “The native forests law was aimed at reducing the deforestation rates, and this is not a widespread problem of Patagonia, as its soils are not suitable for agricultural purposes” (U1). In addition, most participants from the forest industry sector, as well as others from the national Forest Agency (NFA3), universities (U1), and research institutes (R2, R5), believe the law stemmed from a purely conservationist perspective. This view is supported by the fact that several environmental NGOs (Fundación Vida Silvestre Argentina [FVS], 2012; Greenpeace, 2012) were closely involved in the passing of the law, exerting significant pressure on the legislators. As such, the initial conservationist profile of the law generated resistance from those groups on the island who support the concept that the forests are not only providers of ecological benefits, but also of social and economic well-being.

Tierra del Fuego adhered to the national regulation in April 2012, although the debate on how to implement it on the island had started several years earlier. During that period, a participatory process led by the local forest agency was launched with the aims of understanding the implications and impacts of the new regulation and classifying its forests according to the new management categories. A number of projects were submitted in the framework of the pilot program permitting both local producers and DGB to test the new mechanisms with positive outcomes (PFA1, PFA2). The improvement introduced by the national law relies on the significant amount of funds anticipated both for national and provincial forest authorities to provide the economic means for conservation and management projects, along with the coverage of the internal costs. Never before in the history of native forest management in Argentina, has such a large fund been assigned to this purpose. Yet, when analyzing the interview responses regarding this new arrangement (Table 4), perceptions are varied, and in some cases this new regulation is actually considered a constraint.

Those who belonged to the national and provincial regulatory agencies see the main limitations in the lack of capacities within their structures (NFA1, NFA3): “The main constraint is placed in the national and provincial authorities, who currently do not have the capacity to administer such high amount of funds” (NFA1), and in the active resistance that landowners (OP1, PFA2) and forest producers (R7) offered when presented with the forest classification proposal. The new legal framework requires provincial forest agencies to have an internal structure capable of conducting the forest classification within their territories through participatory processes, reviewing, and auditing the management and conservation projects submitted, as well as administering the newly assigned funds. These capacities are bound to be limited, and as many highlight (OS2, R1, R2, R5, PFA5, NFA1, NFA3, P14, L2), their build-up would require a considerable amount of time. Although Article 6 of the National Law 26331/07 foresees the provision of technical and economic assistance to all regions, there have been delays in providing this assistance to the province of Tierra del Fuego until 2012 as acknowledged by an interviewee from the National Forest Agency and a University participant: “I am aware that there are issues and delays as to transferring the money to the provinces” (NFA1); “The funds the law foresees are not being released in their totality” (U1).

As for the participatory process, those participants belonging to the local regulatory agency believe it was conducted in a positive and constructive manner, in which all the relevant parties were involved at the early stages (OP2, OP4, PFA2, PFA5, OS1):

Table 4. Interviewees' attitudes toward the new regulatory framework.

Attitude	Topic	Reference
Positive	Institutional reinforcement through new fund	"The funds made available by this law do not have an apparent effect on the forests yet, but its benefits can already be perceived in the local authorities' capacities" (NFA2).
	Economic incentives for conservation and management	"I see this legislation as an excellent opportunity to assign funds for management purposes" (PFA1). "I believe it is very positive that the National Government invests in protecting native forests" (P2).
	Participatory process	"The participatory process was very enriching ... as dialogue went on, the attitudes of the producers shifted. It was something between a negotiation and a dialogue to adapt forest classification to traditional forest use" (OP2). "It was a complicated process but the outcome was good" (OP4).
	Pilot stage (Resolution 256/09)	"I believe this experimental stage provided credibility to the legislation" (PFA1).
Negative	National and provincial authorities not prepared to administer funds	"The main constraint is placed in the national and provincial authorities, who currently do not have the capacity to administer such high amount of funds" (NFA1). "The Forest Agency never had a significant budget. Therefore, it is not appropriate to change this situation overnight by handing them over the whole funds. ... The law should have foreseen this and include a progressive process which would allow agencies to organize their administrative procedures" (NFA3).
	Slow release of funds which increased distrust in the new legislation	"I am aware that there are issues and delays as to transferring the money to the provinces" (NFA1). "The funds the law foresees are not being released in their totality" (U1).
	Lack of knowledge and consensus on what the funds are for	"Due to mistakes in how National authorities implemented the Law, it is perceived as a way to receive funds, without understanding what these funds are for. ... Provinces are already thinking on how to spend this money disregarding the original aim" (R1).
	Clashing interests	"The law at a provincial level is halted due to economic interests. The landowners refuse to have their forests classified ... same goes for forest producers" (PFA2).
Negative	Uncertainty on the availability of funds	"The incentive can be a good thing. Still, I am in doubt whether the money will reach the provinces" (OP3). "Many provinces were not ready to submit projects, as they were uncertain on whether the National authority would send the funds" (R2).
	Disorganized participatory process: Information was not provided in advance and no dialogue existed	"I took part in some of the meetings, but they were far from throwing any light into the matter. It seemed as if they (the Forest Agency) were in a rush to solve in a few hours something that would require more time and detailed analysis" (P3). "It was a semi-participative process ... as everything we said was not taken into account" (P4). "The province failed to provide clear information as to the implications of each category nor did they offer printed copies of the map. ... Besides, all meetings were held in Ushuaia while many landowners reside here" [referring to the northern part of the island]. ... It was not a process in which we all decided how to classify the Island's forests. It was imposed, though one could sometimes negotiate swapping around areas. But these were not really participatory meetings" (LO2).

(Continued)

Table 4. (Continued).

Attitude	Topic	Reference
	Risk that law and funds are used exclusively for conservation purposes, hence limiting production activities	<p>"During the policy implementation process, we [referring to Fueguian legislators] tried to balance the situation of the Patagonian region compared to other provinces . . . , which benefited more from this law. . . . We then sought after an even distribution of funds by enhancing conservation rather than production. . . . Therefore, we argued for higher payments for areas classified as restricted or red, and no payment for areas that could be transformed" (OP4).</p> <p>"I am concerned with the fact that the incentive will serve to halt forest production" (OP3).</p> <p>"The provincial government was seeking to get as much forest into Category I because this means the province would receive more funds. Therefore, since the province wants to stop all productive activities in the forest, this proposed classification appeared as a great opportunity" (P4).</p> <p>"The overall feeling was that it had to be like this, because the law had to be passed as soon as possible and the province needed the highest amount of restricted areas as possible" (LO2).</p>

The participatory process was very enriching . . . as dialogue went on, the attitudes of the producers shifted. It was something between a negotiation and a dialogue to adapt forest classification to traditional forest use. (OP2)

It was a complicated process but the outcome was good. (OP4)

However, landowners (LO1, LO2, LO3), several producers (P3, P4), and other contacts interviewed (OS2, R3, R6) presented a contrasting standpoint, in which a lack of communication appeared to rule the process. Forest classification, they said, had already been defined at the time consultation took place, thus giving little room for modification (LO2, LO3). The perception was that the authorities were aiming for a given percentage of each of the three categories (particularly for Category I, restricted), regardless of the actual characteristics of the existing forest as supported by the following statements from an interviewee from the provincial government, a landowner, and a participant from the forest industry:

During the policy implementation process, we [referring to Fuegian legislators] tried to balance the situation of the Patagonian region compared to other provinces . . . , which benefited more from this law. . . . We then sought after an even distribution of funds by enhancing conservation rather than production. . . . Therefore, we argued for higher payments for areas classified as restricted or red, and no payment for areas that could be transformed. (OP4)

It was not a process in which we all decided how to classify the island's forests. It was imposed, though one could sometimes negotiate swapping around areas. But these were not really participatory meetings. The overall feeling was that it had to be like this, because the law had to be passed as soon as possible and the province needed the highest amount of restricted areas as possible. (LO2)

I do not agree with the final classification the province presented, and this is because the higher the amount of areas that are classified as restricted, the more money the provincial government will receive. Therefore, since the province wants to stop all productive activities in the forest, this proposed classification appeared as a great opportunity. (P4)

This, if real, may have been fostered by Article 32 of National Law 26331/07, which foresees the distribution of national funds among the provinces taking into account a higher value per cover for those classified as Category I and a lower value for those classified as Category III:

Article 32: The '*Fondo Nacional para la Conservación de los Bosques Nativos*' will be distributed annually between the provinces that have elaborated and approved by means of a provincial legislation their native forest classification. The national authority, altogether with provincial agencies will determine the amount to be distributed for each province based on: (i) the percentage of native forests surface declared by each province; (ii) the relationship between total surface and forest surface for the province; and (iii) the conservation categories declared, assigning higher values per hectare to category I than to category III.

Other participants mention that the way in which the process was carried out was not efficient, as information was not provided in advance so as to allow stakeholders to prepare for what was going to be discussed. In the meetings, they said, little time was given for processing the information and this was read by landowners and producers as an imminent need for the province to pass this law, which once approved, implied the reception of national funds:

I took part in some of the meetings, but they were far from throwing any light into the matter. It seemed as if they [referring to the forest agency] were in a rush to solve in a few hours something that would require more time and detailed analysis. (P3)

It was a semi-participative process ... as everything we said was not taken into account. (P4)

The province failed to provide clear information as to the implications of each category nor did they offer printed copies of the map. ... Besides, all meetings were held in Ushuaia while many landowners reside here [here is referring to the northern part of the island]. (LO2)

On the other hand, the interviews reveal a consensus regarding the unplanned manner in which the national law was released. Neither national nor provincial forest agencies were prepared to manage such large budgets or the increased workloads related to them (project revision, approval, funds assignation, audit, etc.; OS2, R1, R2, R5, PFA5, NFA1, NFA3, P14, L2):

The Forest Agency never had a significant budget. Therefore, it is not appropriate to change this situation overnight by handing them over the whole funds. ... The law should have foreseen this and include a progressive process which would allow agencies to organize their administrative procedures. (NFA3)

Therefore, significant delays and setbacks have occurred in their implementation.

This has not, however, discouraged the different groups from identifying the potential benefits which may be obtained from this law. Even with the problems that have been pointed out, the overall feeling on the island is that the adjustments introduced by this new regulation represent a unique opportunity to steer positive changes in current practices on the island: "I see this legislation as an excellent opportunity to assign funds for management purposes" (PFA1); "I believe it is very positive that the National Government invests in protecting native forests" (P2).

Steps toward SFM

Toward the end of the interviews, we asked the participants about the specific changes that they believed were needed to ensure the sustainability of the forest resource. Unlike the previous topics, there was greater unanimity in the opinions expressed: (a) institutional capacity reinforcement; (b) long-term planning of the resource; (c) forest concession fees; (d) education; and (e) forest products added value.

Institutional capacity reinforcement

Perhaps the most frequently mentioned concern to address is related to the role of the forest agencies, both at the national and provincial levels. These agencies are perceived as lacking the resources to fully comply with their duties, and as a consequence controls are deemed inefficient in steering any changes. Not only do members from both agencies concur with this view (PFA2, PFA4, PFA5, NFA3), but also forest producers (P6, P7, P14) and other stakeholders (OS2, U2, U5, U6). However, as some point out, the funds foreseen by the new native forest law appear as an opportunity to address this gap, an opportunity which, as many observe, needs to be seized (NFA3, NFA4, LO1).

Long-term planning of the resource

For some forest producers and researchers, forest sustainability on the island relies on the inclusion of long-term considerations in regulations (P1, P2, P5, P11, R1, R2, R3). To this end, they propose modifying existing legal arrangements to enhance the engagement of forest producers in long-term practices by means of increasing the duration of concessions and permits and promoting intermediate silvicultural treatments. The intention is that harvesting an area would not be considered as a one-time intervention, but instead, as the use of an area which should be managed for the future. This, however, needs to be paired with a stable economic and political environment which would provide the appropriate setting for long-term investments of this sort:

I believe that long-term policies are fundamental for the sustainability of the resource, as well as the economic setting where companies operate. When the economic cycles are so short, it is hard for companies to plan with a mind-set in the long term. Both the economy and the politics need to be stable. (P3)

Forest concession fees

Current arrangements encourage producers to harvest the stands selectively, leaving behind unwanted material, thus affecting the overall forest quality. Returning to the previous system in which volumes were estimated per unit area harvested was mentioned by many as a way to improve not only forest management, but reducing workloads of the forest agency, which in turn, could focus on improving harvesting operations (R1, OP3).

Education

Participants from every group mentioned the need to increase education in one way or another. On the one hand, the awareness of the community of the importance of the forest as a recreational, ecological, and economic resource needs to be increased to ensure adequate and informed levels of participation as well as to promote responsible consumption attitudes (NFA2, R4, R5, OP2). In terms of formal education, forest producers highlighted the lack of

professionals specialized in timber processing techniques to add value to the local timbers (P2). And with regard to scientific extension, the permeability between local researchers and the legal authority is deemed to be low, hindering the transference of knowledge (R3, R6).

Forest products added value

In order to address the social sphere of forest sustainability, many of the respondents state that the government should promote the development of secondary timber industries, where the timber products would be given a higher value, generating jobs and improving the social conditions on the island (P2, P13, PFA2, OP2, U2). In addition, this would increase awareness in society as to the value of the resource, since it would be seen as a provider of well-being which needs to be preserved and taken care of: “By developing the local timber industry and the added value chain, people would start valuing the environment in general, the forest, and the products manufactured from its timber. It is an opportunity to generate identity” (OP1).

Discussion

Understanding how forest management practices can be reshaped into a sustainable framework requires the acknowledgment of both the physical and the social environment (Luque et al., 2011; Zagarola et al., 2014). Results from the interviews we conducted in Tierra del Fuego, however, have shown that the main factors that appear to influence forest management are in most cases a result of historical arrangements and the relationship between the legal authority and the different actors. Although technical silvicultural knowledge is deemed to be essential for sound forest management, its availability for the study location did not appear as a significant constraining factor. This supports the assertions made by Walters, Sabogal, Snook, and De Almeida (2005); Song, Wang, Burch, and Rechlin (2004); and Pattanayak, Mercer, Sills, Yang, and Cassingham (2002), who indicate that restrictions to the implementation of given forest practices are hardly ever technical in nature, but instead, rely more on socioeconomic factors. As such, to achieve SFM in the island, the focus should be placed mainly on understanding the broader social, economic, and legal settings, rather than solely on developing technical prescriptions.

While the Fuegian case shares several aspects with the background research in terms of the hindrances posed by ineffective regulations and their application, the interviews reveal a novel social component that could be significantly affecting forest management on the island. Tierra del Fuego, enjoying the benefits of tax exemptions from the Argentinean national government to promote the occupation of the Argentine portion of the island, has undergone an exponential population growth in the last decades, strongly modifying the island demographic composition. While several studies have concluded that the feeling of attachment to a place increases with the length of residence time (Hernández, Martín, Ruiz, & Hidalgo, 2010; Lewicka, 2011), other studies relate responsible environmental behavior with the extent to which people identify themselves with a given place (Hernández et al., 2010). However, whether strong bonds with a place would necessarily imply an increased environmental care is not yet clear (Scannell & Gifford, 2010). The Fuegian example provides some indirect evidence to support but also to reject these ideas. On the support side, respondents have recognized that because most immigrants expect to stay in Tierra del Fuego for only limited periods of time, they are more likely to show low

place attachment, which in turn may be disrupting the level of engagement with environmentally responsible practices. However, as we pointed out in the Results section, there is a dual perception of what SFM implies, being those who consider SFM solely as forest surface preservation and legal compliance among those inhabitants that have been in the island for longer times, several generations in some cases, and therefore expected to have developed a stronger attachment to the island. On the contrary, those who pointed out the three spheres of sustainability in their definition, as well as the importance to keep them balanced, are mostly either noninhabitants to the island or recently arrived immigrants (Zagarola et al., 2014).

The perception that the local population is relatively uninterested in their natural resources and environment as a whole is further supported by the absence of any local NGO focused on such issues. Those NGOs which do operate on the island are mostly dedicated to urban issues such as the informal settlements in both the main cities and the need for municipal planning. However, one of these NGOs called *Finisterrae*, did exert significant influence between 1990 and 2010. Many respondents remember and cite the active participation of this organization in the environmental policies during one particular period in which a U.S. based company (Trillum Co.) had purchased large areas of forestlands in Chilean and Argentinean Tierra del Fuego, with the intention of logging 272,000 and 76,616 ha, respectively (Klepeis & Laris, 2006). The NGO was successful in delaying the initiation of any activities from this company, until the existing provincial regulatory framework was modified to incorporate a series of proposed modifications, which included banning exports of logs and chips outside the island. To date, this company has been unable to resume any logging operations on the island, although it is currently selling rights to harvest stands on their properties to other local sawmill producers. Many of the respondents did not agree with the way issues and information had been handled by *Finisterrae* during that period, as they believed the resistance posed by the NGO was mostly influenced by nationalist feelings which refused to accept foreign companies managing Argentinean forests and, in turn, never opposed harvesting operations by local companies (R1, P4, LO1), which were already causing a significant negative impact on Fuegian forests (Luque et al., 2011; Soler et al., 2015). Despite this, the respondents did recognize the positive and unprecedented role this kind of organization played in a Fuegian community that appeared indifferent to what happened to its resources: “The most significant contribution of this NGO was the construction of an environmental awareness on the island” (U4). Another point worth mentioning is that public involvement in Tierra del Fuego is not constant, but has a distinct periodic nature. It seems to be a response to particular events, such as the one previously described or forest fires, falling away once the episodes that stimulated the participation are solved. Given these uneven levels of interest and participation, it is difficult for the public to influence current forest operations on the island.

While social and market demands can be useful in steering forest management into SFM (Viana, Ervin, Donovan, Elliott, & Gholz, 1996; Newsom, Bahn, & Cashore, 2006; Ebeling & Yasué, 2009; Cubbage, Diaz, Yapura, & Dube, 2010), the absence of strong public pressure and a still meager demand for sustainable forest products in Tierra del Fuego appear to highlight the need for state interventions to steer better forest practices. However, the efficacy of regulations, and in particular the recently introduced National Law 26.331, in achieving SFM was deemed to be limited by the participants of the survey due a provincial government

which appears to hold a rather limited interest in the resource, which in turn does little to promote commitment with legal arrangements. According to Contreras-Hermosilla and Vargas Ríos (2002) and Serbruyns and Luyssaert (2006), for regulations to deliver satisfactory results, government efforts should be first directed at achieving the legitimacy of forest regulations from the different stakeholder groups, which has often been accomplished by establishing consultative processes when designing policy reforms. This shift from top-down approaches, where the agencies carefully guard the decision-making processes for themselves, to bottom-up approaches, where win-to-win situations are sought through dialogue, is believed to result in policies that better suit the given settings. The Fuegian case suggests that the acceptance of the newly introduced regulations would have been enhanced had the participatory process been more inclusive and informative. Some stakeholders, such as landowners and forest concessionaires, felt sidelined during the forest classification process required by the new law. Despite this, since the law foresees a periodic revision of the forest classification through an open process, the provincial forest agency has the opportunity to amend this situation in the next revisions. This can be done by improving the scoping of stakeholders and providing sufficient information in advance to enrich discussions and allow concerns to be raised. Regarding the economic incentives foreseen by the new set of regulations, their effective implementation offers a unique opportunity for intermediate silvicultural treatments, which until now had barely been applied, as the economic benefit from such practices was not expected to be seen anywhere in the near future. Probably the most valuable recommendation for Tierra del Fuego would be to seize the unique opportunity that a forest management reform provides.

The approach taken for this article was more qualitative than quantitative, as was employed by several other studies (Contreras-Hermosilla & Vargas Ríos, 2002; Silva et al., 2002; Lachapelle, McCool, & Patterson, 2003; Ebeling & Yasué, 2009), since the objective was to identify the factors that are influencing the adoption of SFM in Tierra del Fuego. The approach of this article can also be quantitative, and this can be a limitation of our study compared with other recent studies (e.g., Fagerholm, Käyhkö, Ndumbo, & Khamis, 2012; Plieninger, Dijks, Oteros-Rozas, & Bieling, 2013; Mouchet et al., 2014). Beside this, through the use of this methodology we can identify some key topics that can help us to understand the main factors that influence the forest management sustainability. For example, most concession owners, forest technicians, and even members from the provincial forest agency consider the existing regulations, the lack of reinforcement, and the past and present relationship with the forest authority as a significant constraining factor to achieving SFM. The fact that harvesting permits are only granted for short periods of time, added to a perceived lack of interest in the resource from the local forest authority, as well as ineffective reinforcement of regulations, have fostered a short-term perspective toward timber extraction on the island. Forest harvesting rates were also spontaneously mentioned by most participants as a significant factor that influences SFM on Tierra del Fuego. However, opposite views were held by different participant groups, as members from the provincial agencies and some university researchers believed the current value was too low to promote a sustainable use of the resource, concession owners stated that increasing the fees would make their operations unsustainable. Education appeared as a constraint for most of the respondents, as a decline in forest professionals on the island as well as a limited knowledge transference between the research institutes were usually mentioned. Both increased operational costs—often paired

with sustainable operations—and market influences were hardly mentioned by any respondents when prompted about the factors that were influencing SFM in Tierra del Fuego, appearing therefore as not significant for the time being. As for the local community, Fuegian inhabitants are mostly described in the interviews as being weakly committed with the environment as a whole and with a lack of interest in the forest resource, an attitude which has been linked with the lack of place attachment. Nevertheless, further research should be conducted to provide a better understanding of the deeper implications of this relationship and its influence on forest management, which would in turn allow for improved strategies. Other participants showed distrust as to what the funds would be used for, and whether it would be assigned to improving forest management or solely for conservation purposes, halting timber production and affecting the livelihoods of timber producers. Despite these differences and concerns, most of the respondents still expect that positive changes in the forest management on the island will occur following the passing of the new provincial law. Therefore, the national and provincial governments as well as the forest agencies should try to ensure that newly introduced mechanisms are running smoothly and functioning well before too long. In doing so, changes in perceptions and behavioral norms could be achieved, which in turn would improve the management of the forest resource. Nevertheless, it should not be expected that the new regulatory framework as it currently exists will solve all forest management issues.

Conclusions

We have set to out to analyze how different factors influence the adoption of SFM in Tierra del Fuego, Argentina, as well as the perceptions from the different stakeholders regarding the recently introduced native forest management legislation and the required steps to improve forest management on the island. The views on most of the constraints and drivers for SFM and on the native forest management law varied among respondents. The interviews showed that the introduction of the new legislation on native forest management in Tierra del Fuego generated contrasting views regarding some stages of the policy-making process which were not regarded as being particularly inclusive by most of the concession owners, forest technicians, and land owners, but most participants from the provincial agencies believed these stages were conducted in an inclusive and organized manner. Agreement existed, however, regarding the unplanned manner in which this regulation was launched, as both the national and provincial agencies were not ready to administer the amount of funds foreseen by this new law. The dynamic nature of the context as well as the underlying uncertainties on which the new regulations are based will most probably require later revisions and modifications (Dovers, 2003). Even so, the need to take on an adaptive approach should not be regarded as a failure of the introduced policies, but instead as an essential requirement for their success.

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References

- Allué, C., Arranz, J. A., Bava, J. O., Beneitez, J. M., Collado, L., & Garcia-Lopez, J. M. (2010). Caracterización y cartografía fitoclimáticas del bosque nativo subantártico en la Isla Grande de Tierra del Fuego (Patagonia, Argentina). *Forest Systems*, 19(2), 189–207.
- Bauhus, J., Puettmann, K., & Messier, C. (2009). Silviculture for old-growth attributes. *Forest Ecology and Management*, 258(4), 525–537.
- Berg, A., Ehnström, B., Gustafsson, L., Hallingbäck, T., Jonsell, M., & Weslien, J. (1994). Threatened plant, animal, and fungus species in Swedish forests: Distribution and habitat associations. *Conservation Biology*, 8(3), 718–731.
- Boscolo, M., Snook, L., & Quevedo, L. (2009). Adoption of sustainable forest management practices in Bolivian timber concessions: A quantitative assessment. *International Forestry Review*, 11(4), 514–523.
- Bridges, L. (1948). *The uttermost part of the earth*. London, UK: Hodder and Stoughton.
- Carroll, A., & Buchholtz, A. (2014). *Business and society: Ethics, sustainability, and stakeholder management*. Mason, OH: Cengage Learning.
- Colchester, M., Boscolo, M., Contreras-Hermosilla, A., Del Gatto, F., Dempsey, J., Lescuyer, G., ... Wells, A. (2006). *Justice in the forest: Rural livelihoods and forest law enforcement*. Bogor, Indonesia: Centre for International Forestry Research.
- Collado, L. (2001). Tierra del Fuego forest: Analysis of their stratification through satellite images for the forest province inventory. *Multiequina*, 10, 1–16.
- Contreras-Hermosilla, A., & Vargas Ríos, M. T. (2002). *Social, environmental and economic dimensions of forest policy reforms in Bolivia*. Bogor, Indonesia: Centre for International Forestry Research.
- Cubbage, F., Diaz, D., Yapura, P., & Dube, F. (2010). Impacts of forest management certification in Argentina and Chile. *Forest Policy and Economics*, 12(7), 497–504.
- Damnyag, L., Saastamoinen, O., Appiah, M., & Pappinen, A. (2012). Role of tenure insecurity in deforestation in Ghana's high forest zone. *Forest Policy and Economics*, 14(1), 90–98.
- Dovers, S. (2003). *Are forests different as a policy challenge?* In D. B. Lindenmayer & J. F. Franklin (Eds.), *Towards forest sustainability* (pp. 15–30). Washington, DC: Island Press.
- Ebeling, J., & Yasué, M. (2009). The effectiveness of market-based conservation in the tropics: Forest certification in Ecuador and Bolivia. *Journal of Environmental Management*, 90(2), 1145–1153.
- Ehrlich, P. R. (1996). Conservation in temperate forests: What do we need to know and do? *Forest Ecology and Management*, 85, 9–19.
- Eid, T., Hoen, H. F., & Økseter, P. (2001). Economic consequences of sustainable forest management regimes at non-industrial forest owner level in Norway. *Forest Policy and Economics*, 2, 213–228.
- Elías, S., Larson, A., & Mendoza, J. (2009). *Tenencia de la tierra, bosques y medios de vida en el altiplano occidental de Guatemala*. Guatemala City, Guatemala: Editorial de Ciencia.

- Fagerholm, N., Käyhkö, N., Ndumbaro, F., & Khamis, M. (2012). Community stakeholders' knowledge in landscape assessments: Mapping indicators for landscape services. *Ecological Indicators*, 18, 421–433.
- Food and Agriculture Organization of the United Nations (FAO). (2010). *Global forest resources assessment 2010: Main report*. Rome, Italy: Author.
- Fearnside, P. M. (2001). Soybean cultivation as a threat to the environment in Brazil. *Environmental Conservation*, 28(1), 23–38.
- Fundación Vida Silvestre Argentina (FVS). (2012). *Ley de bosques*. Retrieved from http://www.vidasilvestre.org.ar/que_hacemos/nuestra_solucion/cuidar_nuestro_mundo_natural/ordenamiento_territorial/ley_bosques
- Gea Izquierdo, G., Martínez Pastur, G., Cellini, J. M., & Lencinas, M. V. (2004). Forty years of silvicultural management in southern *Nothofagus pumilio* primary forests. *Forest Ecology and Management*, 201, 335–347.
- Global Forest Resources Assessment (FRA). (2010). *Evaluación de los recursos forestales mundiales 2010*. Rome, Italy: FAO.
- Greenpeace (2012). *Un arduo camino a la ley de bosques*. Retrieved from <http://www.greenpeace.org.ar/blogbosques>
- Gustafsson, L., Baker, S., Bauhus, J., Beese, W., Brodie, A., Kouki, J., . . . Franklin, J. (2012) Retention forestry to maintain multifunctional forests: A world perspective. *Bioscience*, 62(7), 633–645.
- Hernández, B., Martín, A. M., Ruiz, C., & Hidalgo, M. C. (2010). The role of place identity and place attachment in breaking environmental protection laws. *Journal of Environmental Psychology*, 30(3), 281–288.
- Kishor, N. M., & Constantino, L. F. (1994). Sustainable forestry: Can it compete? *Finance and Development*, 31(4), 36–39.
- Klepeis, P., & Laris, P. (2006). Contesting sustainable development in Tierra del Fuego. *Geoforum*, 37(4), 505–518.
- Kohm, K. A., & Franklin, J. F. (1997). *Creating a forestry for the 21st century*. Washington, DC: Island Press.
- Lachapelle, P. R., McCool, S. F., & Patterson, M. E. (2003). Barriers to effective natural resource planning in a “messy” world. *Society and Natural Resources*, 16, 473–490.
- Lamnek, S. (1989). *Qualitative sozialforschung: Methoden und techniken*. Muenchen, Germany: Beltz, Psychologie Verlags Union.
- Lewicka, M. (2011). Place attachment: How far have we come in the last 40 years? *Journal of Environmental Psychology*, 31(3), 207–230.
- Lindenmayer, D., Franklin, J., Löhmus, A., Baker, S., Bauhus, J., Beese, W., . . . Gustafsson, L. (2012). A major shift to the retention approach for forestry can help resolve some global forest sustainability issues. *Conservation Letters*, 5(6), 421–431.
- Luque, S., Martínez Pastur, G., Echeverría, C., & Pacha, M. J. (2011). Overview of biodiversity loss in South America: A landscape perspective for sustainable forest management and conservation in temperate forests. In: C. Li, R. Laforzezza, & J. Chen (Eds.), *Landscape ecology in forest management and conservation: Challenges and solutions for global change* (pp. 357–384). Berlin, Germany: Springer.
- Martínez Pastur, G., Lencinas, M. V., Peri, P. L., Moretto, A., Cellini, J. M., Mormeneo, I., & Vukasovic, R. (2007). Harvesting adaptation to biodiversity conservation in sawmill industry: Technology innovation and monitoring program. *Journal of Technology Management & Innovation*, 2(3), 58–70.
- Millennium Ecosystem Assessment (MEA). (2005). *Ecosystems and human well-being: Current state and trends* (Vol. 1). Washington, DC: Island Press.
- Ministerial Conference on the Protection of Forests in Europe (MCPFE). (2011). *Sustainable forest management*. Retrieved from <http://www.foresteurope.org>
- Montenegro, C., Gasparri, I., Manghi, E., Strada, M., Bono, J., & Parmuchi, M. G. (2004). *Informe sobre deforestación en Argentina*. Buenos Aires, Argentina: Dirección de Bosques, Secretaría de Ambiente y Desarrollo Sustentable.

- Mouchet, M. A., Lamarque, P., Martín-López, B., Cruzat, E., Gos, P., Byczek, C., & Lavorel, S. (2014). An interdisciplinary methodological guide for quantifying associations between ecosystem services. *Global Environmental Change*, 28, 298–308.
- Newsom, D., Bahn, V., & Cashore, B. (2006). Does forest certification matter? An analysis of operation-level changes required during the SmartWood certification process in the United States. *Forest Policy and Economics*, 9(3), 197–208.
- Owubah, C. E., Le Master, D. C., Bowker, J. M., & Lee, J. G. (2001). Forest tenure systems and sustainable forest management: The case of Ghana. *Forest Ecology and Management*, 149, 253–264.
- Pattanayak, S. K., Mercer, D. E., Sills, E. O., Yang, J. C., & Cassingham, K. (2002). Taking stock of agroforestry adoption studies. *Agroforestry Systems*, 57, 173–186.
- Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land Use Policy*, 33, 118–129.
- Putz, F. E., Dykstra, D. P., & Heinrich, R. (2000). Why poor logging practices persist in the tropics. *Conservation Biology*, 14(4), 951–956.
- Sarantakos, S. (1993). *Social research*. Melbourne, Australia: MacMillan Education.
- Sayer, J., Chokkalingam, U., & Poulsen, J. (2004). The restoration of forest biodiversity and ecological values. *Forest Ecology and Management*, 201, 3–11.
- Scannell, L., & Gifford, R. (2010). The relations between natural and civic place attachment and pro-environmental behavior. *Journal of Environmental Psychology*, 30(3), 289–297.
- Secretaría de Ambiente y Desarrollo Sustentable de la Nación (SAyDS). (2007). *Primer inventario nacional de bosques nativos: Informe nacional*. Buenos Aires, Argentina: Author.
- Sedjo, R. A., Goetzl, A., & Moffat, S. O. (2014). *Sustainability of temperate forests*. Washington, DC: RFF Press.
- Serbruyns, I., & Luysaert, S. (2006). Acceptance of sticks, carrots and sermons as policy instruments for directing private forest management. *Forest Policy and Economics*, 9(3), 285–296.
- Silva, E., Kaimowitz, D., Bojanic, A., Ekoko, F., Manurung, T., & Pavez, I. (2002). Making the law of the jungle: The reform of forest legislation in Bolivia, Cameroon, Costa Rica, and Indonesia. *Global Environmental Politics*, 2(3), 63–97.
- Smith, J., Colan, V., Sabogal, C., & Snook, L. K. (2006). Why policy reforms fail to improve logging practices: The role of governance and norms in Peru. *Forest Policy and Economics*, 8(4), 458–469.
- Soler, R., Schindler, S., Lencinas, M. V., Peri, P. L., & Martínez Pastur, G. (2015). Retention forestry in southern Patagonia: Multiple environmental impacts and their temporal trends. *International Forestry Review*, 17, 1–15.
- Song, Y., Wang, G., Burch, W. R., & Rechlin, M. A. (2004). From innovation to adaptation: Lessons from 20 years of the shift forest management system in Sanming, China. *Forest Ecology and Management*, 191, 225–238.
- Viana, V. M., Ervin, J., Donovan, R. Z., Elliott, C., & Gholz, H. (1996). *Certification of forest products: Issues and perspectives*. Washington, DC: Island Press.
- Walters, B. B., Sabogal, C., Snook, L. K., & De Almeida, E. (2005). Constraints and opportunities for better silvicultural practice in tropical forestry: An interdisciplinary approach. *Forest Ecology and Management*, 209, 3–18.
- Zagarola, J. P., Anderson, C. B., & Veteto, J. R. (2014). Perceiving Patagonia: An assessment of social values and perspectives regarding watershed ecosystem services and management in southern South America. *Environmental Management*, 53, 769–782.