Management tools for using and preserving natural resources: Criteria and indicators for multiple use of forests in Andean Patagonia of Argentina

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Abstract

Practical application of a set of criteria, indicators and verifiers (C, I & V) is presented. They are based on those suggested by the International Center of Forest Research (CIFOR) and have been specifically developed for a variety of uses in the Andean Patagonian forest region in Argentina. Considered uses are timber extraction, tourist and recreational use, cattle-breeding and agroforestry. These C, I & V were exhaustively discussed in an Interinstitutional Workshop where technicians of every related national and provincial institutions participated. During this meeting many of these C, I & V were agreed and improved while others must be greatly enhanced. With most of those C, I & V already accepted a Technical Normative was prepared, being the current internal official regulation employed by the local Forest Service to assess plans for multiple use of forests. All plans for multiple use of forest resources already presented by private professionals to the Forest Service of Chubut for evaluation and authorization were analyzed to get a first approach of the plausibility of this Normative.

Introduction

In 1995, the Patagonian Province Chubut (see Figure 1) made a wide study aimed to the generation of basic quantitative and qualitative information about forests "a priori" considered suitable for timber production, in order to plan afterwards the regional organization of forest resources (Carabelli, 1995). From the total forest area in the Andean region of Chubut –about 1,000,000 hectares-, 133,000 hectares of native forest have been classified as productive for timber-extraction, and 10,000 hectares of them have been and are currently exploited under some kind of forest management. In the above mentioned study, the native forest with potential for timber production was defined as the one which allows the periodic extraction of valuable round timber products and forest sub-products by means of rational exploitation.

In order to improve the extraction methods of round wood from these forests new Reference Regulations for Management Plans in Province Chubut (Chauchard, 1992) were brought into force in 1992. Such regulations were aimed to guide the preparation of Management Plans, and not to the Management itself. Regarding this matter it was considered that there was still a too incipient scientific and technical knowledge on the forest resource to make any serious and practicable management suggestions. Currently, as a result of several research work on valuable timber species dynamics and silviculture -"lenga" (*Nothofagus pumilio*) and "ciprés de la cordillera" (*Austrocedrus chilensis*)- (Bava, 1998; Loguercio, 1998; Loguercio *et al*., 1999)-, the importance of this problem has been lowered. The Reference Regulations require of those who intend to extract timber from native forests a forest felling or management plan, which has to be presented by a forester and assessed by the local Forest Service. Horizon for such plans goes no farther than 5 years (Berón *et al*., 1998). Exploitation works are planned and executed by private applicants (usually sawmills). Within this context the Provincial Forest Service has got an adequate framework of technical support for the decision-making related to the approval of those plans.

These plans have normally timber-extraction activities as their only objective (mainly round timber, the highest economic-value product) and the forest quality enhancement as timber source. Meanwhile, other possible uses appear as subordinated to timber-production, with the only exception of extensive stock farming, for which forests are considered as grasslands offering some shelter for animals. Local forest service demands to set fences able to protect intervened forest areas from cattle grazing. Fulfilling of this requisite is always very difficult since the cattle breeder loses productive space for his activity, whilst the forester has extra expenses considering that fence wire is not an usual item in forest activity.

At the same time serious legal problems come out for controlling the fulfilling of these rules, considering that there are three different offices in charge of forest lands in Province Chubut – the already mentioned

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forest administration, an office of colonization-promotion and the municipalities- and all of them have got different interests. This difference of interests has got a correspondence with the users since the uncertainty of land keeping versus land property and the rights to access to the resources has historically limited management strategies (Carabelli and Claverie, 1995). From tourist lenders point of view, landscape (see Annex II) care costs are usually assigned to the forest sector, which brings out strong conflicts that make it difficult or even ban putting into practice a forest multiple use (see Annex II).

Also having in mind that it is necessary to look at our natural resources in a non-fragmented but integral perspective, aimed towards economic utilization and also towards research, these circumstances have produced a stage on which a normative instrument is not only necessary but also urgent to provide a proper framework to the different actors, among which we find:

- Professionals, who face the challenge of making coherent and consistent technical suggestions to start up an enterprise that uses natural resources in an economically and biologically sustainable way,
- Timber producers who want to take up profitable activities to exploit the natural resources they are in charge of in the most integral way, and
- Managers of these resources, who lack testing tools to assess the contents of this kind of plans as well as control tools for the execution stages.

In such a context, this paper intends to show the *adaptation* of some general criteria, indicators and verifiers (C, I & V) suggested by the International Center of Forest Research of Indonesia (CIFOR) to a concrete region and specific circumstances in Argentina's Andean Patagonia, the *improvement* of these local C, I & V in an interdisciplinary and interinstitutional workshop and the *viability* of the arranged C, I & V, when practically applied to the assessment of plans for multiple use of forest resources in Province Chubut.

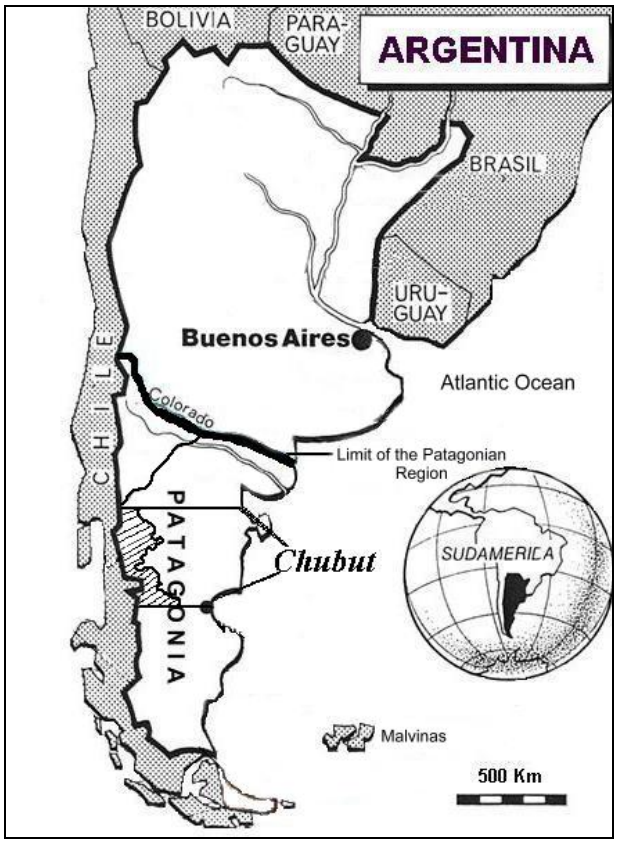

Figure 1: Patagonian Andes in Province Chubut, target area for the application of the proposed C, I & V.

Methods

The three well-differentiated stages, adaptation, improvement and feasibility of C, I & V had each specific methodological approaches.

For the first one, we set to the design of some C, I, &V based on the scheme suggested by CIFOR (see Annex II for a definition of these concepts), which has developed generic political, ecological, social and productive principles, criteria, indicators and verifiers related to forest multiple use.
Local C, I, &V were conceptually developed for: a) timber extraction, b) recreational and tourist uses of Patagonian landscapes, c) cattle breeding and d) agroforestry. In every case particular characteristics of the Andean Patagonian area at Province Chubut were considered.

To adapt the CIFOR C, I & V to local circumstances specialized bibliography was consulted and professionals from different disciplines were asked about specific matters, as well as landowners and officials from every institution directly or indirectly related to inspect the above mentioned land uses. Special emphasis was laid on defining verifiers, which must have a feasible quantitative demonstration when the plan for multiple use is running.

This level of the C, I &V adaptation process required the highest creative effort as well as its adequation to reality, since the verifiers are the quantification instruments which make the indicator measurable. Suggested verifiers are therefore based on existing technical information or scientific works which have been technically adapted, thus having, in most cases, a quantitative demonstration based on mainly local and regional experiences.

As for the place where a plan for multiple use will be performed, it was suggested an area so-called *Forest Management Unit* –FMU- where 'forest' points at ecological conditions instead of just timber production. A sub-area generically called 'intervention area' was also suggested within the FMU, where the different activities will be carried out along a certain period of time. 'Intervention' designates every activity related to a land use which will produce changes in the forest environment. On the contrary, 'non-intervened zone, area or forest' defines those sites still free from human influence or those with very low impact levels.

An Interdisciplinary 2-days Workshop organized by CIEFAP and Chubut Forest Service offered the adequate environment for the improvement of these someway "theoretical" C, I & V, which were exhaustively analyzed by a considerable group of technicians from different provincial and national institutions. Ultimate aim of this meeting was to build a strong tool, useful to professionals facing the challenge of composing plans for multiple use of forest resources and also to technicians responsible of controlling the plan execution. Considering these relevant aspects, it was intended that these C, I &V were simple enough to be checked on the field, related to each other and assessed by the inspection officers, both in the plan evaluation stage and in the execution-monitoring stage.

More than 40 technicians of different disciplines belonging to 9 national, regional and provincial institutions revised the pre-elaborated C, I & V. They discussed and enhanced the C, I & V and suggested ideas and concepts aimed to build up a technical normative to assess plans for multiple use of forest resources. This was somehow achieved because the Interinstitutional Workshop functioned as a meeting place for mutual learning, communication and viewing a desirable future with a reflective and creative attitude. The work scheme to analyze the C, I & V during the Workshop was set as follows:

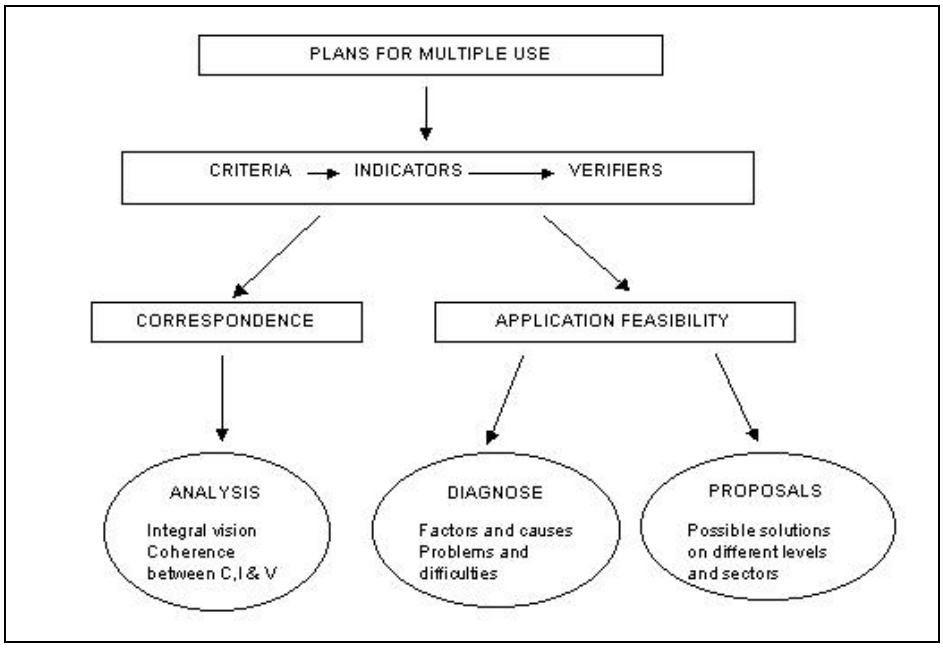

Figure 2: Methodology for the analysis and enhancement of local C, I & V for assessing Plans for Multiple Use of Forest Resources in Province Chubut.

Each assistant to the Workshop participated in one of the four work groups previously set by the organizers, which intended to guarantee as much as possible an interinstitutional and interdisciplinary equity. Each group dealt with a specific set of verifiers and its related indicator. The main objective of this task was to determine if it was necessary the fulfilling of those hypotheses to guarantee the sustainability of the resources under diverse uses in a simultaneous way.

Further on the groups were asked about the specific difficulties they could detect in the application of those verifiers and, as a consequence, which aspects would be advisable to take into account to put them into practice. As a final product they composed a list of those verifiers that within a technical normative could be required to professionals developing management plans.

The third stage of this process was to analyze all plans for multiple use, which had been presented for technical assessment to the local Forest Service. From the valuable experience of the Workshop we conducted a detailed examination to determine the matching level between contents of each plan and the finally approved C, I & V.

Results

C, I & V analysis and enhancement: The Interinstitutional Workshop

The most significant results of the group works during the Workshop are presented. They are shown in tables in order to make reading more accessible. For each work-group two charts are shown, one related to the correspondence analysis and the other to the diagnosis and feasibility of application of each C, I & V.

Group 1: Correspondence Analysis

C, I & V	Agreement	Observations
C.1. Forest exploitation guarantees timber volume and quality yield in the long term.	Yes	• In the description when speaking about increasing surface, it is boasted that we are talking about recovery of harmed areas. • Also in the description write: "according to the case maintain, increase or improve".
I.1.1. Silvicultural management enhances the productive condition of the remaining forest and/or promotes regeneration development	Yes	▪ No.
V.1.1.1. The number of renewals per hectare and per height class in regenerated forests guarantees a good amount of individuals with future timber potential	Yes	• Change the word "guarantees" for "promotes" or "it privileges" since this condition by themselves does not guarantee.
V.1.1.2. The annual average growth is above the growth values for non-managed natural forests	Yes	• Change "non-managed natural forests" for forests without appropriate management. • It does not remain clear if it is gross or timber volume. • Perhaps it would be better to evaluate the quality of the residual plants.
V.1.1.3. In the intervention area within the FMU all the prescripted felling stages are carried out simultaneously and according to the silvicultural plan (basically thinnings and cleanings)	Yes	• An objection to the consideration "simultaneously" is done.
I.1.2. Forest use produces a low impact in the forest	Yes	• Add "extraction trails" on the description.
V.1.2.1. Timber felling as well as non-timber trees felling is conducted in order to minimize damage to adjacent remaining trees and to regeneration	Yes	▪ No.
V.1.2.2. Design and building of extraction roads is the result of minimizing the area affected by these roads and of maximizing the accessibility efficiency	Yes	• Take into account maximum slopes.
V.1.2.3. Exploitation tasks do not cause soil erosion within work sites or in their adjacent areas	Yes	• Change "do not cause soil erosion" for "they cause minimum soil erosion".
V.1.2.4. Sound and visual disturbance produced by forest exploitation activities get minimized by mitigation zones	Yes	• Not only that are minimized through mitigation zones but also with the fulfillment of the technical norms.
V.1.2.5. Necromass volume produced during the exploitation does not exceed 50% of the existing volume in similar structures within non-intervened forests	Yes	• In the case of "ciprés de la cordillera" it can be relevant for fire prevention, but for "lenga" no relevancy was found.

Group 1: Diagnosis and feasibility of application

C	I	V	Diagnosis	TS	ES	Proposals	TI	EI
1	1	1	• There isn't enough applied research for the different places.	MT	ER	• Make research to know the number of necessary plants for every place.	MT	?
		2	• It doesn't function as immediate verifier.	MT	-	• It would be used for evaluating an intervention in the long term.	MT/LT	?
		3	• Need of greater training for technicians. • Operative problems with the post-treatment dynamics.	ST	ER	• Greater continuity in the training. Extension.	ST	ER
	2	1	• Need of greater training for workers.	ST	ER	• Greater continuity in the training.	ST	ER
		2	• There no exists the regulation to require its fulfillment.	ST	DR	• Elaborate the corresponding regulations. • Training of technicians in charge of road design and of the inspection staff.	ST	ER
		3	• Lack of training of technicians and the staff of the inspection office.	ST	ER	• Training must be carried out • Request annual reports of the state of monitoring points. • The regulation must include mitigation measures.	ST	ER
		4	• Lack of regulations.	ST	ER	• Greater control to ensure the fulfillment of the norms. • Elaborate regulations.	ST	ER

Used abbreviations: **C**: Criterion, **I**: Indicator, **V**: Verifier
TS: Time required to solve the problem, **ES**: Easiness to reach a solution, **TI**: Time to put into practice the verifier, **EI**: Easiness to apply the verifier (implementation –see Annex II-))
LT: Long term, **MT**: Middle term, **ST**: Short term, **ER**: Easy resolution, **DR**: Difficult resolution

Group 2: Correspondence Analysis

C, I & V	Agreement	Observations
C.1. Forest exploitation guarantees timber volume and quality yield in the long term	Yes	• Change into description: "amounts of timber stock" for "timber productivity". In "mass" add "forest".
I.1.3. Different-quality raw material is extracted	Yes	▪ No.
V.1.3.1 Quality classes are based on already existing classification systems, and there is a correspondence between standing and hauled trees classification (error estimates not higher than 20%)	Yes	▪ No.
V.1.3.2. Extracted logs of different qualities are taken to the sawmill for their industrial processing. Lower quality logs left in the forest do not exceed 50% of the whole extracted volume	Yes	▪ "Total felled": if it is height/stem = 50%, it is a little strict percentage..
V.1.3.3. Timber yield of plan-applicant enterprise is higher than the average yield value that is statistically characteristic for that enterprise's production	Yes	• Indicator/Verifier inconsistency. Verifiers don't fit the Indicator. • In the Satisfaction of the Verifier "must exceed in at least 5% the historical average yield value": it doesn't remain clear if it refers to the applicant´ industry or to the general average. • It is not sure that the technological factor is definitive to increase the saw coefficient since this subject depends more on the raw material.
C.2. Protection of the forest environment is guaranteed	Yes	• Incomplete description. • Alteration of ecosystem conditions (process): stock farming? fauna?. • Contradiction? Fragmentation prevents fires.
I.2.1. Risk of forest fires is minimised	Yes	▪ No.
V.2.1.1. Preventive actions delete or lower the annual area affected by fires within the FMU, comparing to those of previous years	Yes	• "Delete" is impossible. • It doesn't consider equipment, prevention programs, human factor, signalling. • It depends on the area of the UMF. • Add in the satisfaction: "guarantee early detection"
V.2.1.3. Amount of water sources, availability and accessibility are kept at the same level or they are increased	Yes	• Agreement with achieved information. Nevertheless it remains unclear how this situation increases the access to water sources. • Lack of storage (cisterns, others).
1.2.2. Landscape pattern is not altered. Forest ecosystem fragmentation is minimum comparing it to non-intervened forest landscapes	Yes	• Which type of scale has the pattern?
V.2.2.1. Forest environment fragmentation due to road networks is reduced to a minimum	Yes	• Inconsistency between Verifier and Satisfactor. Once again there is a problem with the scale. Need of a scenic perspective.
V.2.2.2. Diversity of flora and fauna native species is not altered from the mitigation area's central sector towards the non-intervened areas, comparing it to the biodiversity existing in these areas	Yes	• Where are the mitigation areas defined? Requires the plan conservation areas ?.· Inconsistency between Verifier and Satisfactor.
V.2.2.3. Edge area around the largest patch does not show significant change when compared to a non-intervened forest	Yes	• Non-satisfactory writing. The problem is in the perimeter-area relationship.
V.2.2.4. Average, minimum and maximum distances between two patches of the same cover type keep within natural variation levels	Yes	• At regional level it may cause problems if there are adjacent UMFs, since there can be overlapping.

Group 2: Diagnosis and feasibility of application

C	I	V	Diagnosis	TS	ES	Proposals	TI	EI
1	3	1	Applicable without problems with 20%.	ST	ER	• Work to reduce the error under 20%	MT	ER
		2	Applicable without problems.	ST	ER	• 50% is below the ordinary one, increase this percentage. • Include in satisfaction the subject "waste".	ST MT	ER ER
		3	F*actors/Causes* **1. Financial** • Profitability does not sustain the investment. • Sector´ indebtedness. **2. Cultural** • Little demanding market allows the subsistence. • Captive market, there is no competence. **3. Politician** • Lack of will, there is fear (unemployment). • Informal relations over the institutional ones (friends, contacts, favours, etc.). • Lack of information and training. **4. Legal** • There isn't legislation on minimum yield requirements. **5. Technical** • Quality of raw material - new management guidelines.	MT	DR	*Institutional level: projects and application* • Training in business management. *Institutional level: projects and application* • Promote situations to increase and improve political and technical dialogue.	MT	ER
2	1	1	*Factors/Causes* **1. Cultural** • Insufficient conscience about the need for investments. • Scarce conscience on the dangerousness of the use of fire. **2. Economic** • Investment is considered a government duty. **3. Legal** • The law doesn't oblige the owner. **4. Institutional** • Legal emptiness prevents the inspection office to be effective. • Lack of resources for control. • Permissive attitude.			*Institutions/Sector* • Consider the creation of consortiums for prevention. *Institutions, government* • Training campaigns. *Institutions, Government, authorities of application* ▪ Elaboration of a specific legal frame.	MT MT MT	ER ER DR
		3	• Everything well.					
	2	1	*Factors/Causes* **1. Technical** • Difficulties to determine the minimum. • The participation of the technician does not appear in the satisfaction.	ST	ER	*Institutions and projects* • Promote training of technicians in the region (roads, environmental impacts, etc.). • Modify satisfaction for: "participation of technicians with specific training". • Establish ranges of permissible road density (metres/hectare).	ST	ER
		2	**1. Technical** • Indicative species are not specified. • There is not enough knowledge to do it. **2. Institutional** • Provincial forest service can not inspect fauna.	ST	ER	• Generate mechanisms for feedback among application and research. • Request intervention of the pertinent office.	ST	ER
		3	**1. Technical** • Satisfaction is wrong enunciated. • Sizes of natural patches are not defined because they are unknown. • The relation between size of the intervened patch and the area of the UMF is not clarified. **2. Economic/Institutional** • The economic variable in relation to patch size is not considered, then application and control are difficult .	ST	ER	• "The area of the larger edge generated by anthropic activities is not bigger than the area of the edge generated by natural disturbance". • Carry out a study. • Define ranges for type of ecosystem. • Can be defined a limit in % of the area to be intervened?. • Consider the economic variable.	ST	ER
		4	• Inadequate enunciation as V.2.2.3.			• Lack of time prevented the enunciation.		

Group 3: Correspondence Analysis

Criterion – Indicator	Agreement	Observations	Desagreement / new criteria and indicators
C.1. A sustainable landscape use is done with tourist and recreation purposes	Yes	▪ No.	
I.1.1 Landscape use is ecologically-based planned	Yes	▪ No.	
I.1.2. Planned recreation and tourist activities adapt to the natural surroundings	Yes	▪ Social, economic and cultural issues should be included. This can originate new verifiers related to the administration, the satisfaction of the visitor, the economic benefit and the participation of the local community, all of them of difficult quantification. It is considered the possibility of non inclusion in this indicator. Instead of that a new one should be written and the description of the current one should be modified.	There should be a new indicator that comprised the enunciated subject.

Group 3: Diagnosis and feasibility of application

C	I	V	Diagnosis	TS	ES	Proposals	TI	EI	Observations
1	1	1	Lack of capacity and infrastructure of the application authority and private professionals for zoning.	ST	ER	Financing for training, infrastructure and/or recruitment that improves the technical capacity.	MT	DR	
		2	Need to establish a (quali-quantitative) standard to value landscape units.	ST	ER	Establish agreement on standard, in workshops, using as a base internationally accepted methodologies.	ST	ER	
		3	Lack of financing at an user level to evaluate the presence of avifauna. Lack of technical specific capacity in the application authority.	ST	ER	Incorporate a table showing indicators of avifauna on each environment.	ST	ER	
		4	Without problems.						
	2	1	Without specific problems.			Regulate the parameters that improve the quantification level.	ST	ER	
		2	Without specific problems.			Similar to the precedent.	ST	ER	
		3	Without specific problems.			Similar to the precedent.	ST	ER	
		4	Without specific problems.			Similar to the precedent.	ST	ER	
		5	**Suggested by the work group:** Design of a model for waste management in the UMF.						It needs to be defined and establish the method for its quantification.
		6	**Suggested by the work group:** orientated to the regulation of active tourism (rafting, rides, motorcycles, motocross, etc.).						Big spectrum of concerns, possibly generates another indicator.

Group 4: Correspondence Analysis

Criterion – Indicator	Agreement	Observations	No agreement / new criteria and indicators
C.1. Presence of cattle becomes compatible with native forest conservation and enhancement	Yes		
I.1.1. Sites with regeneration to be prevented from cattle breeding use are identified within the FMU	No	Indicator must be changed.	Areas for timber extraction, agroforestry, cattle breeding and conservation are identified.
V.1.1.1. Forest is zoned according to development stages and forage areas	No	Verifier must be changed.	Areas for timber extraction, agroforestry, cattle breeding and conservation are quantified.
V.1.1.2. Cattle load in forage areas and forest structures which can support it is determined.	No	Verifier must be changed.	Cattle carrying capacity on areas for exclusive cattle breeding use, mixed use, and potential timber yield are determined, these constituting the satisfaction of the verifier.
I.1.2. Those zones previously determined which for the sake of their development stage are susceptible of harm derived from forage are guaranteed protection	No	Indicator must be changed.	Cattle exclusion is guaranteed in those areas defined as for exclusive timber-extraction use.
V.1.2.1. Cattle are excluded from damage-risk zones	No	Verifier must be changed.	A cattle exclusion method (traditional wire netting, electric wire, etc) is implemented.
*There was no registered information about following verifiers correspondence: V.1.2.2., V.1.2.3., V.1.2.*4			
C.1. "Ñire" forests are studied, used and preserved in an integral way, enhancing their production capacity	No	The criterion about agroforestry is included in the criterion about cattle breeding.	Specific indicators for every forest system ("lenga", "ñire", "ciprés de la cordillera", mixed forest) must be defined. No agreement was reached about burned sectors towards considering them a different system (or not).

Group 4: Diagnosis and feasibility of application

C	I	V	Diagnosis	TS	ES	Proposals	TI	EI
1	1	1	It is necessary to define additional criteria.	ST	ER	The estate must define criteria for zoning at regional and small land ownership level.	MT/LT (essential)	DR (regional level) ER (ownership level)
			Lack of active policy from estate. Problems for tenure situations.	MT	DR	Promote the resolution of land tenure conflicts through the Plans for Multiple Use.	MT	DR
		2	Lack of methodologies to determine the cattle carrying capacity.	MT	ER	Develop methodologies. Need for interdisciplinary work.	MT ST	ER
	2	1	Economic problems (limitations).	ST	MR	Develop alternative methods and search new financial supporting sources.	ST/MT	MR/DR
			Limitations in the control.	ST	MR	Improve the control system.	MT	ER
Due to the changes suggested in the correspondence analysis the diagnose of the other verifiers was not carried out.								

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LT: Long term, **MT**: Middle term, **ST**: Short term, **ER**: Easy resolution, **MR**: Moderate possibility of resolution, **DR**: Difficult resolution

B. The Plans for Multiple Use of Forest Resources: Analysis from the perspective of the agreed C, I &V

Only some of on the Workshop agreed criteria were finally compiled in a document that the Chubut Forest Service began to use since August 2000 as *Internal Norm for the Assessment of Plans for Multiple Use*. Since then four (4) plans, which are analyzed within the context of this study, were presented.

These plans are usually elaborated with a common structure comprising a description of the legal status of the forest area where the plan will be applied, a description of the environment including geographical location, main physiographic and hydrographic characteristics, climate, vegetation, soil and fauna topics.

In the following table correspondence between final adopted criteria, indicators and verifiers and the contents of each plan for multiple use of forests in Province Chubut is in detail presented.

Forest use					
Forest exploitation guarantees timber volume and quality yield in the long term					
		Satisfaction of verifiers			
Indicator	*Verifier*	*Plan 1*	*Plan 2*	*Plan 3*	*Plan 4*
Silvicultural management enhances the productive condition of the remaining forest and/or promotes regeneration development	*In the intervention area within the FMU all the prescripted felling stages are carried out simultaneously and according to the silvicultural plan (basically thinnings and cleanings)*	**No** Due to the mainly overexploited condition of forests, only silvicultural treatments on regeneration groups of non-intervened sectors are suggested	**No** The application of a silvicultural group selection system is pointed out in the intervention area. It is proposed to cover the whole timber area in 30 years.	**No** Although there exists an intervention unit, silvicultural treatments have been not yet applied.	**No** The application of a silvicultural group selection system is pointed out in the whole timber area of the FMU.
Forest use produces a low impact in the forest	*Timber felling as well as non-timber trees felling is conducted in order to minimize damage to adjacent remaining trees and to regeneration*	**No** Because planning does not include timber exploitation. Only clausure to avoid cattle graizing, a post-monitorig of regeneration condition and forestation with scenic purposes are described.	**No** The plan considers specificallythe extraction of different quality raw material but it has been not yet authorized by the Forest service due to legal impediments.	**No** Felling and ringing are mentioned. Nevertheless ist is not pointed out how felling must be done.	**No** Mature and over mature trees challenging with future trees will be ringed. However ist is not pointed out how felling must be done.
	Design and building of extraction roads is the result of minimizing the area affected by these roads and of maximizing the accessibility efficiency	**No** This planning doesn't include timber exploitation.	**No** The plan has been not yet authorized.	**No** It is mentioned that timber extration must be avoided on slopes superior than 70% and that soils must not be destroyed, but they are just general issues.	**No** Road building and density are proposed but no graphic allocation (like a map) is presented.
	Exploitation tasks do not cause soil erosion within work sites or in adjacent areas	**No** This planning doesn't include timber exploitation.	**No** The plan has been not yet authorized.	**No** Because timber exploitation didn't begin.	**No** Because timber exploitation didn't begin.
	Sound and visual disturbances produced by forest exploitation activities get minimized by mitigation zones	**No** This planning doesn't include timber exploitation.	**No** The plan has been not yet authorized.	**No** Because timber exploitation didn't begin.	**No** Mitigation zones are not foreseen.
	Necromass volume produced during the exploitation does not exceed 50% of the existing volume in similar structures within non-intervened forests	**No** Although it is important to point out that on every sample plot during field survey all stem remnants of previous exploitations were measured.	**No** The plan has been not yet authorized.	**No** Because timber exploitation didn't begin.	**No** Because timber exploitation didn't begin.
Different-quality raw material is extracted	*Quality classes are based on already existing classification systems, and there is a correspondence between standing and hauled trees classification (error estimates not higher than 20%)*	**No** An statistically consistent equation for timber volume was employed although no tree-felling was done to estimate the statistical error.	**No** An statistically consistent equation for timber volume was employed although no tree-felling was done to estimate the statistical error.	**No** A method to classify the timber quality of stems on stand trees was applied. However no tree felling was done to estimate the statistical error.	**No** An statistically consistent equation for timber volume was employed although no tree-felling was done to estimate the statistical error.
	Extracted logs of different qualities are taken to the sawmill for their industrial processing. Lower quality logs left in the forest do not exceed 50% of the whole extracted volume	**No** Because this plan doesn't involve a timber exploitation.	**No** The plan has been not yet authorized.	**No** Because timber exploitation didn't begin. Only burnt trees were cut.	**No** Because timber exploitation didn't begin.

Protection of the forest environment is guaranteed					
		Satisfaction of verifiers			
Indicator	*Verifier*	*Plan 1*	*Plan 2*	*Plan 3*	*Plan 4*
Risk of forest fires is minimised	*Preventive actions delete or lower the annual area affected by fires within the FMU, comparing to those of previous years*	**Yes** Removal of combustible from trails and roads, building of perimetral and central belts.	**Yes** Removal of combustible from trails and roads, building of new roads and perimetral belt.	**No** There not exists a relationship between forest fires and silvcultural management.	**Yes** Removal of combustible from trails and roads.
	Amount of water sources, availability and accessibility are kept at the same level or they are increased	**Yes** Building of heliports and new water deposits which are indicated on a map.	**Yes** Building of heliports and new water deposits which are indicated on a map.	**No** There are no references to existing water sources nor to their accesibility.	**Yes** Building of heliports and new water deposits which are indicated on a map. A communication system and training of existing human resources are also included.
Recreation and tourism					
A sustainable use of the landscape is done with tourist and recreation purposes					
		Satisfaction of verifiers			
Indicator	*Verifier*	*Plan 1*	*Plan 2*	*Plan 3*	*Plan 4*
Landscape use is ecologically-based planned	*The FMU is zoned in general utilization classes*	**Yes** Classes are the following ones: Conservation, protection and restoration Recreation and sports Forest and agricultural activities.	**Yes** But only partially. Zoning is almost only related to a forest (timber extraction) use.	**Yes** Zoning is concerned with management zones and subordinated management units.	**Yes** Classes are the following ones: Conservation and protection Low-impact agricultural activity.
	Landscape units of high interest – for their scenic quality, rarity or form- are described and their accessibility is enhanced minimizing environmental impact	**Yes** Criteria are the following ones: Scenery potential Geomorphology Vegetation	**No** Only forest types are described.	**No** Panoramic points and suggested trails are only displayed on a map but they are not described.	**Yes** Criteria are the following ones: Panoramic visualization Geomorphology Vegetation
	Bird fauna within the FMU is surveyed. There are no changes on watching-frequency in areas where recreation or tourist use occur comparing them to non-intervened areas	**No** Bird fauna wasn't surveyed.	**No** Bird fauna wasn't surveyed.	**No** Bird fauna wasn't surveyed.	**No** Bird fauna wasn't surveyed, but a future survey is required to set watching points.
	Physical, chemical and biological pureness of water is kept at normal levels, within appropriate reference values	**No** Infrastructure and water related issues are not developed.	**No** It is mentioned that two panoramic sites and an accommodation will be built, but no reference is made to water issues.	**No** This issue is completely absent.	**Yes** Building of a septic chamber and a contact biologic filter.
Planned recreation and tourist activities adapt to the natural surroundings	*Carrying capacity is determined for each recreation spot and path*	**No** Although recreation is mentioned, no specific proposal is developed.	**Yes** Recent statistic data from public and private sources were used to calculate the carrying capacity for trekking and cavalcade.	**No** Only the building of a lodging for 12 people is mentioned.	**Yes** Recent statistic data from public and private sources were used to calculate the carrying capacity for trekking and cavalcade.
	Paths are designed detailing their characteristics as well as the necessary tasks for construction and maintenance	**Yes** Existing roads and trails are described from a scenic point of view and they are displayed on a map.	**Yes** It is proposed to rebuild and maintain existing roads and trails and to build new ones.	**No** It is just mentioned that two kind of trails for mountain bike and trekking will be built.	**Yes** Necessary tasks to rebuild or/and maintain existing roads and trails are exhaustively described.

	Notice board sets covering information needs for the visitor harmonize with the surroundings.	**No** Although recreation is mentioned, no specific proposal is developed.	**No** Because importance given to tourism is scarce.	**No** This issue is completely absent.	**No** This topic is completely absent, but considering the emphasis given to tourism and recreation, this issue could have be included.
	Sectors of high cultural or historical value are identified, preserved and used	**No** If such sectors exist they are not mentioned.	**No** If such sectors exist they are not mentioned.	**No** If such sectors exist they are not mentioned.	**No** If such sectors exist they are not mentioned.

Discussion

During the Workshop it becomes evident that *assessment, approval* and *monitoring* of plans for multiple use must be carried out in an interinstitutional way, thus being necessary the creation of proper strategies to enable an actual and productive work environment for the participant institutions. It was also pointed out that the actual unsatisfactory technical knowledge and training of staffs from different control institutions may be somewhat solved with specific standard information. On the other hand the information produced by new plans for multiple use may improve databases on these institutions.

It was also observed that regional management plans must be assumed as a frame for local plans. This leads to the necessity of gathering the current and possible uses of forest ecosystems in the Andean Patagonian region within regional plans. The Provincial Forest Service is just working on such instrument, essential for woodland management.

Some general observations on the analyzed plans for multiple use of forests can be formulated: Plan 1 mainly shows the scenic potential of the area, but it doesn't elaborate a specific proposal for a recreational and / or touristic use. This work highlights protection against forest fires, developing a detailed proposal. Plan 2 concedes noticeable relevancy to forest use (mainly for timber extraction), although it subordinates a detailed development of silvicultural prescriptions to new studies and specific planning. Plan 3 is very general, it examines several possible land uses but it doesn't consider in detail any of them. Plan 4 contemplates specific activities for an extractive forest management, but it recommends initiating them at year 20, due to present negative values of financial indicators.

In most cases, these plans coincide with the importance of counteracting the damage caused by cattle on forest regeneration. Almost all plans -except Plan 3- assign great relevance to forest protection against fire, when considering that permanence of forest resources depends almost exclusively on the control of this factor. Two of the four plans have not yet been approved by Chubut Forest Service due to legal impediments. The remaining two show an early degree of accomplishment, as expressed by technicians of the Forest Service.

Matching degree between C, I & V and plan contents is variable. Plans usually respect criteria related to timber exploitation and the use of the landscape for recreation and tourism. On the other hand, correspondence decreases between plan contents, indicators and verifiers as the specificity of a given evaluator increases. Lack of correspondence among verifiers and plan contents for timber exploitation is not necessarily negative, as it becomes evident that any plan assigns the greatest emphasis to this use.

Another aspect to consider is the scarce amount of plans that has been presented from 2000 up to the present. A possible explanation of this situation can be found in the virtual paralyzation of many economic activities related to the forests in Andean Patagonia. Reforestation with exotic species, for example, has decreased progressively from 2001 up to the present due to increasing difficulties for the payment to landowners of the national subvention precisely encouraging such activity. Although touristic flows have been increased in the 2002-03 season because of price increase of journeys to vacation places in other countries, due to the Argentinian currency depreciation, no correlation with the increase of the local offer has been verified, especially from landowners whose estates have a great scenic potential or make possible the occurrence of different sport activities, such as fishing, trekking, rafting, cavalcades or mountainbike. Complementarily,

the local extractive forest activity experienced between 2000 and 2002 a noticeable decline, mainly linked to a decrease of the building activity -also reflecting the monetary depreciation occurred at the beginning of 2002- which from the last season (2002-2003) is showing slight signals of recovery. All these factors, separately or assembled, have influenced and possibly will continue influencing a more extended and attractive economic use of the Andean Patagonian forests.

Another aspect that undoubtedly will influence the dynamics of forest land use not only in Province Chubut but in the whole Andean Patagonian region is the sale of land ownerships to foreign investors, just consolidated as a trend in the last five years and sometimes associated with a net land use change. These new owners are generally investors attracted by the beauty of natural scenarios, who probably are foreseeing in the medium-term increasing property prices. In other cases they have touristic goals, eventhough such purpose don't represent sometimes an obstacle for some traditional activities to continue (Carabelli *et al.*, 2000). As an additional concern, large areas have been granted for subsoil exploration with mining ends. This activity hasn't still led to concrete exploitations, but represents potentially a strong participation of external actors, constituted by big companies, in areas of remarkable environmental interest and hence with foreseeable impacts (Carabelli *et al*., 2000). In addition, the provincial State has not clearly defined the policy on public lands. In many cases, the provincial State only exists for the final recognition of what has already been executed by speculative land agents, despite being the owner and, in many cases, the single one capable of guaranteeing the maintenance of natural environments, landscapes and natural resources for all inhabitants. In such aspects, the Chubut Cordillera is still and to a large extent land of boldness, adventure and individual opportunities.

Nevertheless, it is encouraging that the Provincial Forest Service is strengthening its standards of evaluation using criteria, indicators and verifiers that as it has been expressly indicated at the beginning of this work, are based in counterparts with a wide and increasing international acceptance. This vision starts to be also shared by those private professionals that elaborate plans for multiple use of forest resources, as it has been just shown by analyzing these plans.

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Annex I: Criteria, Indicators and Verifiers for Multiple Use of Forests in Patagonia, Argentina

The C, I & V for each considered land use are presented here. Each verifier is described as well as the performance testing procedure.

A1. Forest use (timber extraction)

C.1. Forest exploitation guarantees volume and quality yield in the long term

Description: Currently, most native forests, mainly "lenga" (*Nothofagus pumilio*) forests, produce low saw timber volumes, mainly due to the deficient health quality. A forest use based on promoting regeneration and mass conduction, which guarantees proper conditions for the development of timber-qualified trees in the future, is a major condition to enhance quality and increase amounts of timber stock in native forests.

I.1.1. Silvicultural management enhances the productive condition of the remaining forest and/or promotes regeneration development

Description: Application of silvicultural systems is the basic requisite to get a good-quality timber forest. That is the main reason to carry out the exploitation work guided to favor regeneration, as well as caring for the remaining individuals with a good development potential in order to favor their growth and the achievement of a good timber quality.

V.1.1.1. The number of renewals per hectare and per height class in regenerated forests guarantees a good number of individuals with future timber potential

Description: This parameter has a direct relationship with type and intensity of felling, thus with the remaining cover percentage. The expectable number and quality of renewals in managed "lenga" forests is pointed out in table 1.

Table 1: Management parameters in "lenga" forests with special reference to regeneration (Source: Bava, 1998)

Forest structure	Silvicultural treatment	Total number of renewals (pl./ha)	Total number of renewals to be selected (pl./ha)
Upper layer: sparse old timber, *Lower layer*: Pole stage > 10 m height and 10 cm DBH	Selection thinning	5000	200
Upper layer: sparse old timber, *Lower layer*: Pole stage < 10 m height and 10 cm DBH	Selection thinning	5000-7000	200-250

References: DBH: diameter breast height; pl.: plants

Satisfaction of the verifier: Number and quality of renewals correspond to specified parameters.

In "ciprés de la cordillera" (*Austrocedrus chilensis*) forests seed production is usually abundant, has a very good spread and a germination rate varying between 20-80% (Bava and Gonda, 1995). However special microclimatic conditions are necessary for germination to occur, such as sheltered sites and moisture conservation, at least until plants have reached 30 cm in height and developed a root system to explore deeper horizons with a more constant moisture content along the whole year.

Satisfaction of the verifier: Keeping or generation of these conditions in the managed stands.

V.1.1.2. The annual average growth is above the growth values for non-managed natural forests

Description: In non-managed "lenga" forests the annual average growth varies between 1,5-2mm/year (for forest structures such as old timber and tall pole size timber with pole crops). Through thinnings and over-mature trees felling this increment can reach 4 mm/year (Schmidt and Urzúa, 1982; Schmidt, 1985). In volume, growth can turn from 0,5 m^3/ha/year to 3,5-4 m^3/ha/year. For managed "lenga" forests on medium-quality sites in Chubut, Rechene and Gonda (1992) predict a much higher variation, of 7,3 m^3/ha/year.

Satisfaction of the verifier: Measurable diametric-growth increase in goal-trees.

In non-managed "ciprés de la cordillera" forests current growth rates are about 5m^3/ha/year, which could duplicate with an appropriate management (Bava *et al*., 1992; Schmaltz and Gonda, 1995). For the evaluation work it is suggested to take a constant growth rate of 8m^3/ha/year as the forest management goal, considering site conditions.

Satisfaction of the verifier: Measurable volumetric-growth increase at stand level.

V.1.1.3. In the intervention area within the FMU all the prescripted felling stages are carried out simultaneously and according to the silvicultural plan (basically thinnings and cleanings)

Description: To reach a succesfully good timber-quality forest every prescripted treatment must be performed, a task which has to be certified by the inspection office. The fulfilling of this issue must be considered as a necessary investment.

Satisfaction of the verifier: Accomplishment of each planned treatment by the technician responsible for the plan.

I.1.2. Forest use produces a low impact in the forest

Description: A way to counterbalance the exploitation impact on the remaining forest is optimizing every "input" that such exploitation works require. This involves basic training to forest workers and a careful design of the road infrastructure to minimize damage due to tree-fall, erosion and timber storage.

V.1.2.1. Timber felling as well as non-productive trees felling is conducted in order to minimize damage to adjacent trees and regeneration

Description: Tree-fall can be guided in a determined direction with specific techniques. The inspection office must also require and check the accomplishment of the regulation related to the operation-training course chainsaw-operators must take and its corresponding carnet.

Satisfaction of the verifier: Satisfactory stump form and minimum fall impact on remaining plants and regeneration.

V.1.2.2. Design and building of extraction roads is the result of minimizing the area affected by these roads and of maximizing the accessibility efficiency

Description: Society's demands as well as respect for the environment must frame the main functions of networks of extraction roads (Gayoso Aguilar, 1993). Sustainable management as well as the optimization of forest social and economic functions widen the roads' utility beyond timber extraction and transport. For these reasons and for the high impact that road building has it is necessary to plan it in such a way that impact will be the lowest and accessibility will be guaranteed not only with extraction purposes but also to link tourist-interest places. Setting a maximum value for road density is a hard task. On the other hand forest entrepreneurs hardly ever build a widespread road network because of its high costs. From these considerations arises the need of a stronger control over quality of these networks than their number. We suggest that this verifier is headed towards assessment of the following mitigation measures (Gayoso Aguilar, 1995):

- Carefully consider the drainage strip at both sides of permanent water courses with a variable width of 20 to 100 meters according to soil fragility.
- Avoid tree felling into the courses protection stripes, timber floating and crossing of water courses
- Maintain roads, road drains and sewers and close, de-activate and re-forest those which get to be abandoned.
- Build palisades, railings and small dams in order to prevent sediment access and accumulation.
- Manage liquid wastes (fuels and lubricators) in a proper way and prevent spilling.
- Do the timber work in humid/wet periods, when road compaction is not so serious.

The professional in charge will have to determine road area and density, as well as the ones for timber storage and extraction roads, the estimated soil-removal volume and the amount, distribution and characteristics of every necessary task.

Satisfaction of the verifier: Road network building according to a plan and to a minimization of impacts.

V.1.2.3. Exploitation tasks do not cause soil erosion within work sites or in their adjacent areas

Description: An inventory of the current state of erosion processes can be done by interpreting air photographs and images, supported by field checking. As part of the *Environmental Diagnosis* (Carabelli, 1999) a list of erosion indicators must be composed based on geo-referenced satellite images and slope-maps. In this list maximum risk spots must be marked, in which a land sampling must be done aimed to monitoring changes attributed to interventions. For the environmental diagnosis we suggest using Table 2 where slope gradient classes correspond to those used in the preparation of main slopes maps for each of the 33 topographic charts of the Andean sector in Chubut. Description of each gradient is as follows (Carabelli, 1994):

- Range 0-9% Flat. Easy transit.
- Range 10-18% Slightly rolling. Easy transit.
- Range 19-32% Slightly hilly. Transit with tractor or bulls.
- Range 33-69% Hilly or rugged. Transit with forest tractor with caterpillar track and/or oxen.
- Range = 70 . Broken to very broken terrain. Impossible to carry out any exploitation activities.

Table 2: Soil protection indicators according to slope gradient and green cover (Ministerio de Medio Ambiente, 1998).

Vegetation			Indicators according to slope gradient in %				
			I	II	III	IV	V
Code	Vegetation layers over the map	Layer description	0-9	10-18	19-32	33-69	≥70
8	Dense forest	Stocking with density > 0,7 with non-deteriorated shrub or grass layers	1	1	1	1	1
7	Sparse forest	Stocking with density < 0,7 with deteriorated shrub or grass layers	1	0,8	0,6	0,4	0,4
6	Bush	Deteriorated shrubs	0,8	0,6	0,4	0,2	0,2
5	Mountainous grassland	Well-conserved grasslands	0,9	0,8	0,7	0,4	0,4
4	Non-vegetated area	Degraded grasslands	0,3	0,3	0,2	0,2	0,2
3	Tree cultivation	Dry cultivation	0,6	0,4	0,0	0,0	0,0
2	Irrigated farming	Irrigated crops	0,9	0,0	0,0	0,0	0,0
1	Non-productive	Bare fields	0,0	0,0	0,0	0,0	0,0

Once the maximum risk places have been identified, sampling work must be done, based on parameters shown in Table 3. To do this 1 m^2 plots will be set to see the over crusting, surface reduction and herbaceous strata, of 10 m^2 for shrubs and sub-shrubs and 100 m^2 for tree cover and the density of tracks and gullies.

Table 3: Evaluation system of erosion intensity (Ministerio de Medio Ambiente, 1998).

Code	Indicators
0	There are not exposed roots; there is not superficial over crusting; vegetal cover superior to 70%.
½	Slight root exposition; slight over crusting; slight soil accumulation in areas protected by roots, stones, etc. 30-70% vegetal cover.
1	Exposed root systems; formation of erosion pedestals; soil accumulations protected by vegetation with a height among 1-10 mm; slight over crusting; 30-70% vegetal cover.
2	Exposed roots, erosion pedestals and soil accumulations in areas protected by vegetation with thickness of 1 to 5 cm. Over crusting of the surface; vegetal cover among 30-70%.
3	Exposed roots, erosion pedestals and soil accumulations with thickness among 5 and 10 cm; slaking crust of 2 to 5 mm thickness; losses of thick material caused by superficial torrents or wind. Vegetal cover less than 30%.
4	Exposed roots, erosion pedestals and soil accumulations with thickness among 5 and 10 cm; losses of thick material, tracks with maxim depth of 8 cm; bare soil.
5	Cliffs; tracks with depth greater than 8 cm.; dunes; bare soil.

Satisfaction of the verifier: Keeping or reduction of erosion levels in critic zones within the FMU.

V.1.2.4. Sound and visual disturbance produced by forest exploitation activities get minimized by mitigation zones

Description: Both for conservation or utilization of natural resources by other activities (e.g. tourism and recreation) it is inconvenient that exploitation activities excessively alter forest harmony. Sound signals under 35 decibels (dB) are hidden among forest noises, such as wind or bird chattering. A chainsaw makes a noise reaching 95 dB. To reduce this moise pressure with the distance up to a level of 35 - 40 dB certain forest structures can be useful, such as pre-thicket, pole size timber, high and low pole crops with an average depth between 80 and 100m (Armbruster, 1998). With such distance it is also neutralized the visual impact of forest activities.

Satisfaction of the verifier: Forest structure maintenance with a width capable to fulfill its mitigation function.

V.1.2.5. Necromass volume produced during the exploitation does not exceed 50% of the existing volume in similar structures within non-intervened forests

Description: An excessive increase in necromass volume can have unwanted consequences from an aesthetic viewpoint, which annoys an eventual use for tourism in the intervention area. We must also consider alterations caused by exploitation wastes on streams and ravines, which can be dammed and consequently suffer an alteration of their courses.
On the other hand, and mainly in ciprés de la cordillera forests this accumulation considerably increases risk of fires. It also influences in a negative way the initial regeneration form, which threatens the quality of future trees. In terms of fuel-material quantification it must be established at least a plot per stand to enable necromass measurement whilst potential timber inventory is carried out.

Satisfaction of the verifier: Exploitation wastes disposition and volume are compatible with other uses on the FMU, specially for tourism.

I.1.3. Different-quality raw material is extracted

Description: Increase on extraction volumes, improvement of processing yields, diversification of production and added value to products must be a result of the silvicultural management, along with the consolidation of business know-how and perspective, new markets seeking-and-capture and the development and application of a governmental forest policy.

V.1.3.1 Quality classes are based on already existing classification systems, and there is a correspondence between standing and hauled trees classification (error estimates not higher than 20%)

Description: Determination of standing wood quality classes is a major aspect in the silvicultural practice on native forests in Patagonia, where several environmental factors, specially in previously non-managed forests, contribute in reducing wood quality. Quality classification systems have been developed, mainly for "lenga" wood, which must be applied to enhance estimation precision (Chauchard and Carabelli, 1992).
Complementarily a pre-sampling can be done -by classifying standing trees and felling these individuals to calculate the error estimation and enhance future estimations-. In addition, trees can be classified by their timber quality within the dasometric inventory plots. This can be done with the assistance of a local experimented chainsaw operator, already trained in using the classification system.

Satisfaction of the verifier: Timber volume inventory with sampling error <20%.

V.1.3.2. Extracted logs of different qualities are taken to the sawmill for their industrial processing. Lower quality logs left in the forest do not exceed 50% of the total extracted volume

Description: Aim of this verifier is that extraction of timber material do not get restricted to Good-Very Good quality logs. As it will be shown, this has a close relation with the next verifier (V.1.3.3). Logs must be again selected in lengths lower than 1 m, as well as big branches (up to a minimum diameter of 10 cm in thin top), in order to allow a more effective decomposition and better environment conditions for regeneration.

Satisfaction of the verifier: Transport and processing of logs shorter than traditional ones is done, as well as waste processing.

V.1.3.3. Timber yield of plan-applicant enterprise is higher than the traditional average yield value of the same enterprise

Description: In the case of Chubut forest industry, this average yield value is about 37% for "lenga", "ciprés de la cordillera" and "coihue" (*Nothofagus dombeyi*). Average yield values are 34%, 40% and 43% respectively. "Lenga" bole volume is the dominant one (48%), closely followed by "ciprés de la cordillera" (43%). "Lenga" timber yield ranges from a minimum of 25% up to a maximum of 42%, as for "ciprés de la cordillera" that range has its limits at 35% and 42% (Pantaenius *et al.,* 1994).
The satisfaction of this verifier will not be easy, because it requires a maybe substantial technological improvement in the established industrial capacity, whilst the inspection office will have to require a technological status higher than the current ones for new industries. This technological improvement is necessary not only to increase yield levels but also to add value and diversify production, leading to satisfy a regional and local demand that is eager to get more, more diverse and better-quality products. Considering Chubut forest industry as a whole, the goal must be the achievement of a timber yield beyond 40% for "lenga" and 45% for "ciprés de la cordillera" and "coihue".

Satisfaction of the verifier: The applicant industry's timber yield must exceed in at least 5% the historical average yield value achieved by that industry.

C.2. Protection of the forest environment is guaranteed

Description: Management actions go further than the simple application of silvicultural systems and techniques. An integral management must involve ecosystem protection activities, mainly preserving biodiversity and habitats, which can be affected by fires or habitat fragmentation. Prevention and road building intensity lessening are two major instruments to reach this goal.

I.2.1. Forest fires risk is minimized

Description: Forest fires represent one of the most serious disturbances on forest ecosystems. Though they are sometimes due to natural causes most fires in the Andean region are caused by human actions. Since a long-term forest management as a goods-and-services production process will be successful only in a fire-free scene, or in one with a very low fire-occurrence frequency and a very low incidence area, prevention measures are of prior importance.

V.2.1.1. Preventive actions delete or lower the annual area affected by fires within the FMU, comparing it to the one of previous years

Description: An effective prevention system design and application is a major requisite for a long-term management in any forest. Fire line roads and watch-towers, especially in rough lands of with difficult accessibility are two essential components of this system. It will also be necessary that the technician in charge for the FMU guarantees a minimum permanent guard-service, at least during the timber cutting highest-activity season.

Satisfaction of the verifier: Design and application of a prevention plan which enables quick access to any possible fire focus.

V.2.1.2 Silvicultural management within the intervention area in the FMU is performed in every present forest structure

Description: This verifier has the double function of monitoring a risk reduction of fire occurrence (preventive silviculture) by reducing and/or redistributing cover densities in other layers, whilst forest is conducted according to the silvicultural prescriptions (see V.1.1.3).

Satisfaction of the verifier: Intervention in every structure based on the technical proposal.

V.2.1.3. Amount, availability and accessibility of water sources are kept at the same level or increased

Description: Keeping water sources available for fighting against an eventual fire must be considered essential. Description and location of all available water sources within the FMU and its adjacent area will have to be presented as well as their accessibility degree (quick, regular, difficult).

Satisfaction of the verifier: Location and characterization of access ways to all water sources within the FMU and its adjacent area.

1.2.2. Landscape pattern (see Annex II) *is respected. Forest ecosystem fragmentation is minimum comparing it to non-intervened forest landscapes*

Description: Some man-due processes, e.g. forest fragmentation (see Annex II), modify the forest's spatial configuration. A landscape alteration as minimum as possible must be the forest management goal within the FMU area.

V.2.2.1. Forest environment fragmentation due to road networks is reduced to a minimum

Description: This verifier implies a severe restriction of road networks density no matter their type or use. Road design must arise from a very strict evaluation of forest exploitation tasks, in order to optimize the extraction flux with the least road infrastructure. This design needs the participation of a road building specialist and a detailed knowledge of the area's topography, mainly of the intervention area within the FMU. This verifier is complemented with the V.1.2.4.

Satisfaction of the verifier: Road building does not threaten the forest landscape's natural prevalence from a scenic perspective,

V.2.2.2. Diversity of flora and fauna native species is not altered from the mitigation area's central sector towards the non-intervened areas, comparing it to biodiversity in these areas

Description: Considerations on diversity of fauna will be limited to identifying and comparing present/absent bird species in intervened or non-intervened zones, given that birds are very sensitive to habitat changes. Diversity of fauna can be quantified through sampling and comparing intervened and non-intervened forests.

Satisfaction of the verifier: Impact on the habitat does not threaten the presence of flora and fauna native species.

V.2.2.3. Edge area around the largest patch does not show significant change when compared to a non-intervened forest

Description: Edge and limits are ecologically important features because they can work as selective filters or amplifiers for energy, matter and organism transference and disturbances between adjacent patches (CIFOR, 1999). To assess the edge area, the largest patch's edge extension must be compared to the one of a similar patch in a non-intervened forest, separated from adjacent patches by others natural environments, such as water-meadows and other areas having herbaceous or shrubby vegetation.

Satisfaction of the verifier: The largest patch generated by anthropic action, mainly road building, has got an edge area similar to the one of a natural patch.

V.2.2.4. Average, minimum and maximum distances between two patches of the same cover type keep within natural variation levels

Description: Distance measures between patches can be used to estimate particular patches isolation (CIFOR, 1999). Cover type refers to the vegetation cover form within the forest, such as shrub and tree-crown diameters in different layers. These measures are normally taken on air photographs and satellite images, but they need to be checked on field to establish the correspondence between the size of the gap or separation and its origin (silvicultural interventions, roads, among others).

Satisfaction of the verifier: Maximum, minimum and average inter-patch distances of anthropic origin are similar to the distances between natural patches, for adjacent patches of the same size both of anthropic or natural origin.

A2. Use of the landscape for tourism and recreation

C.1. A sustainable use of the landscape is done with tourism and recreation purposes

Description: Demand of singular touristic attractions in a certified natural environment is currently increasing. The Andean Patagonian region has a unique scenic capital. A clear directioning of touristic and recreation enterprises can become an income source of major importance within the multiple use context. That process should enable a clever use by means of product differentiation and valuing of scenic beauties near or within the FMU.

I.1.1 Landscape use is ecologically-based planned

Description: Each part of the landscape has a functionality, therefore a plan involving landscapes must take into account: a) protection and conservation of unaltered natural areas and those where the term 'natural' can be considered in a wider sense admitting human activities that do not harm the environment, and b) the rehabilitation and restoration of a wide range of areas, including sky-open quarries, contaminated waters, etc.

V.1.1.1. The FMU is zoned in general utilization classes

Description: The FMU or eventually the intervention area are zoned in order to reach acceptable standards of soil and water conservation (Carabelli, 1999b). Besides, this zoning has got some management objectives and thus, three wide categories are established on the basis of the landscape's characteristics: 1) Production zones, 2) recreation zones, and 3) protection zones. Zoning's detail level must strictly correspond to the FMU area or eventually to the intervention area. This means that small areas will have a higher separation level than the large ones. Table 4 shows the relation between analysis scales and plot size.

Table 4: Suggested relation between FMU area and analysis scales.

Ranges of area of land ownerships (ha)	Scales of analysis
1-50	1: 1000 – 1:2500
51- 100	1: 2500 – 1:5000
101-500	1:5000 – 1:10000
501-1000	1:10000 – 1:20000
> 1000	1:20.000 y menores

Satisfaction of the verifier: FMU or intervention area zoning adapted to dimensions of land ownerships.

V.1.1.2. Landscape units of high interest – for their scenic quality, rarity or form- are described and their accessibility is enhanced minimizing environmental impact

Description: When carrying out a general study of landscape units we must pay attention to the collection of certain variables such as: vegetation sets, soil uses, water bodies, structures and buildings, land forms. To perform the on-field scenic qualitative evaluation consideration of features on table 5 is suggested.

Table 5: Features to be considered in landscape units description and evaluation (Source: Ministerio de Medio Ambiente, 1998)

Feature	Description	V	Description	V	Description	V
Morphology	Very mountainous relief (cliffs, needles, great rocky formations) or else, relief of great superficial variety or very eroded or systems of dunes; or else presence of some very singular or dominant feature (eg. glacier)	**5**	Interesting erosive forms or relief different in size and form. Presence of interesting forms and details but not dominant or exceptional	**3**	Soft hills, flat valley bottoms, few or no singular detail	**1**
Vegetation	Great variety of vegetation types, with interesting forms, textures and distribution	**5**	Characteristic although similar to others in the region	**3**	Less or no variety or contrast in the vegetation	
Water	Dominant factor in the landscape; clean and clear appearance, white waters (rapids and cascades) or peaceful water sheets	**5**	Water in movement or in rest, but not dominant in the landscape	**3**	Absent or invaluable	
Color	Intense and different color combinations or nice contrasts among soil, vegetation, rock, water and snow	**5**	Some variety and intensity in the colors and contrasts of the ground, rock and vegetation, but does not act as dominant element	**3**	Very little variance of colors or contrasts, dull colors	**1**
Scenic background	The surrounding landscape promotes the visual quality	**5**	Surrounding landscape increases moderately the visual quality	**3**	Adjacent landscape does not exert influence in the quality of the ensemble	**0**
Rarity	Unique or either little ordinary or very strange in the region; real possibility to contemplate exceptional fauna and	**6**	Characteristic although similar to others in the region	**2**	Quite common in the region	**1**

	vegetation				
Human intervention	Free of esthetically not wanted performances, or with modifications that affect favorably the visual quality	**2**	Scenic quality is affected by little harmonious modifications, although not in its whole, or the performances do not add visual quality	**0**	Intense and large modifications, that reduce or nullify the scenic quality **-**

Those landscape units that get higher marks will have to be the prior ones for roads and panoramic points setting.

Satisfaction of the verifier: Description and qualitative arrangement of the identified landscape units.

A quantitative assessment of the landscape aptitude for recreation purposes may be done considering for instance the following parameters (Carabelli, 2002):

Hillside sloping degree
This parameter has a great significance to explain landscape composition. Supporting Keller (1976), it is assumed that when the terrain becomes steeper, has greater altitudinal differences and is more diverse, the scenic quality increases. The scale division in five levels of equal value (table 6) is done according to previous classification of hillside sloping. Hillside sloping can be measured by using the slope maps, which are available for the entire Andean region.

Water network density
The possibilities of developing a tourist region increase with the water network density because:
- landscape attraction is stressed, especially if there are winding water courses, flanked by steep hillsides and with scarce signs of human activity.
- camping places can be settled and use boats for sailing and exploring attractive spots.
- trout and salmon can be fished from middle November until the end of March every year.

In table 6 classification ranges are shown. These values are suggested to assess this landscape feature.

Water bodies area
Landscape scenic quality is doubtless stressed by the occurrence of small or large water bodies. The presence of lakes and ponds is thus considered in the valuation. The suggested valuation scale is shown in table 6.

Vegetation
The presence of "lenga", "ciprés de la cordillera" and "coihue" forests, normally on medium and high hillsides, strongly stresses the landscape scenic value. For this reason these forests are assigned a weighting factor 2 (table 6). Complementarily "ñire" forests get landscape-related importance within the context of an incipient farm tourism. However, proximity to farmhouses induces a more intense use of firewood and posts, and the presence of cattle limits potential for regeneration. These circumstances lessen their scenic potential.

Table 6: Valuation matrix of landscape aptitude for tourist and recreation use.

Landscape factor	Parameter	Class	Value	Weigh value
RELIEF	Slope steepness (%)	< 9	1	2
		< 18 – 9	2	
		< 27 – 18	3	
		< 36 – 27	4	
		> 36	5	
WATER	Density of hydric network	< 0,1	1	
	(Length of water flows in km/km²)	< 0,5 - 0,1	2	
		< 1 - 0,5	3	
		< 1,5 – 1	4	
		> 1,5	5	
	Lake surfaces (%)	> 75	5	
		51 – 75	4	
		25 – 50	3	
		5 – 25	2	
		< 5	1	
VEGETATION	Portion of "lenga" and "ñire"	> 90	5	2 (for lenga)
		71 – 90	4	
		51 – 70	3	
		31 – 50	2	
		< 30	1	

Satisfaction of the verifier: Description and quantitative arrangement of the identified landscape units.

V.1.1.3. Bird fauna within the FMU is surveyed. There are no changes on watching-frequency in areas where recreation or tourist use occur comparing them to non-intervened areas

Description: Their sensitiveness to habitat changes make birds good indicators of impact on the landscape. Complementing satisfaction of the verifier 2.2.2 for timber extraction and the planned zoning to satisfy verifier 1.1.1, a higher detail zoning will be necessary to identify the different bird-species habitats present in the FMU, both in already intervened sectors and in sectors without alteration. By means of ornithological surveys a list of birds on each habitat will be composed, also considering watching-frequencies (Thren *et al*., 1999). This information will allow the design of bird-watching paths being at the same time an indirect but effective indicator of the impact due to different activities and intensities of land use.

Satisfaction of the verifier: Habitat and bird fauna species identification and determination of relative and absolute abundance within intervened and non-intervened sectors.

V.1.1.4. Physical, chemical and biological pureness of water is kept at normal levels, within appropriate reference values

Description: Given that it is a major resource for the development of life it is unnecessary to explain the reasons for the conservation of drinking water sources. In the Andean-Patagonian native forest region there are no serious pollution problems affecting water sources, excepted those near highly populated places lacking sanitary treatment. For tourist and recreation systems where house building is expected, water quality must be downstream analyzed, and compared to pre-intervention values. Through this verifier the sanitary treatment is assessed. Parameters to be analyzed and the maximum values admitted are shown in table 7 (OSN-AGOSBA-SIHN, 1994).

Table 7: Reference values and parameters to assess water quality variation due to human activities (see Annex II for a definition of these concepts)

Parameter	Unit	Reference values
PH	U pH	6,5-8,5
Dissolved oxygen	mg/l	>5
Biochemical oxygen demand	mg/l	<3
Chlorides	mg/l	<200
Ammoniacal Nitrogen	mgN/l	0,02 (as NH3)
Nitrate	mgN/l	<10
Nitrite	mgN/l	<0,05
Total coliforms	NMP/100ml	<1000
Colifaecals	NMP/100ml	<200
Detergents	mg/l	<0,2
pesticides	mg/l	0
Turbidness-smell-colour		Non perceptible

Satisfaction of the verifier: Satisfactory values of water quality in all water bodies and courses within the FMU.

I.1.2. Planned recreation and tourist activities adapt to natural surroundings

Description: Any recreational and tourist enterprise headed to nature enjoyment must acquire an empathy as effective as possible between the expected activities and the natural environment where they take place. Thus the carrying capacity (see Annex II) must be determined with a low error incidence, as well as every installation, path and information infrastructure must be designed in order to acquire a deep identification with the natural surroundings within the FMU.

V.1.2.1. Carrying capacity is determined for each recreation spot and path

Description: Paths for walks and resting sites must be carefully planned considering the landscape. Thus the FMU's carrying capacity must be considered, or eventually the intervention area's. The basic idea associated to this concept is that a high numbers of tourists visiting a certain area will increase negative impact levels (Hammit and Cole, 1987; *fide* Courrau, 1995).

Satisfaction of the verifier: Determination of the carrying capacity for each suggested recreation site.

V.1.2.2. Paths are designed detailing their characteristics as well as the necessary tasks for construction and maintenance

Description: As for the necessary infrastructure to be built it is convenient to consider the internal road distribution, including paths for walking (Carabelli, 1999a). The design of these paths must arise from the landscape characteristics and its visual quality. Specially convenient are the occurrence of panoramic-view points, forest and relief structures which vary in short distances, different tree species and water bodies (small and large lakes). Each design will be special for each landscape and not a standard solution (Días and Bell, 1997). Each path may be named after its most outstanding characteristic or attraction, which normally is the walk's goal (Carabelli, 1999a). Path's character and subject will be defined as well as the starting point, length, walk-duration, difficulty degree, transit way and different carrying capacity, as it has been established by the verifier V.1.2.1. A brief summary will be provided describing what the visitor will be able to see and enjoy. The following path categories are suggested:

- Category 1: High transit path, wide, with open spaces, degree of minimum difficulty.
- Category 2: medium-transit path, marked semi-narrow trail, degree of minimum or medium difficulty.
- Category 3: Low-transit path, narrow to almost closed, degree of medium to high difficulty.

Road width must vary between 0.5 m and 2.5 m, this last case to allow two or more visitors to walk side by side
Resting-benches made of native species wood must be placed along the paths, as well as waste-bins next to them.

Satisfaction of the verifier: Detail of distribution and road building.

V.1.2.3. Notice board sets covering information needs for the visitor harmonize with the surroundings.

Description: Information is an essential condition during walks (Ammer and Pröbstl, 1991). Notice board can be charming near informative. Installation of signals notices must be arranged at the beginning, along and at the end of each route. To harmonize with the surroundings every item must be made of wood from native trees. Boards at starting points must tell the route's name, length and estimated time. These boards are complemented by a route map, plan or schema, clearly specifying each route branch, branch length, activities involved, panoramic views, etc (Antequera *et al*., 1999).

Satisfaction of the verifier: Detail of notice boards location and building.

V.1.2.4. Sectors of high cultural or historical value are identified, preserved and used.

Description: Many areas in the Andean Patagonian region are rich in legends and stories about Aboriginals, former settlers and 'criollos'. A great number of tourists are eager to combine walks with resting time during which a tour guide or a notice tell them some relevant anecdotal event. The notice-board set described in V.1.2.3 as well as specific brochure sets must inform and teach tourists about the social and cultural importance that such sites, buildings and objects have for the local people, and about the need of preserving them, thus suggesting not taking away any "souvenirs", not throwing wastes around, and so on.

Satisfaction of the verifier: Identification and proposal for using high historical and cultural interest sites.

A3. Cattle breeding

C.1. Presence of cattle becomes compatible with native forest conservation and enhancement

Description: The presence of cattle in native forests is a traditional activity both in historical and cultural terms. For this reason it is not realistic to think that this situation will be modified, neither in the short nor possibly in the long term. On the other hand the exclusion of cattle from forests must not be considered the only way to guarantee forest conservation, for in fact there are some situations where co-existence does work. Demonstration of this assertion is a hard and long-lasting work, and it will require a great effort to modify current conceptions.

I.1.1. Sites with regeneration to be prevented from cattle breeding are identified within the FMU

Description: Identifying forest sites which must be excluded from cattle munching is a management restriction that exceeds the requirements of a given use. Forage within the forest harms regeneration both by munching and stepping, and that fact significantly lowers the forest's future quality (Bava and Puig, 1992).

V.1.1.1. Forest is zoned according to development stages of regeneration and forage areas

Description: Complementing verifier 1.1.1 for tourism and recreation this zoning must specially emphasize the identification of incipient and advanced regeneration areas up to 3-m height and 10-cm-stem diameter.
All those forest structures having regeneration layers in a situation as described above will have to be clearly defined in maps. The same detail level must be applied in the case of forage zones (water meadows, heights-grasslands, etc). Suggested correspondence between analysis scales and land ownerships areas is shown in table 4.

Satisfaction of the verifier: Complementary FMU zoning in order to mark forage areas and forest regeneration sites.

V.1.1.2. Cattle load in forage areas and forest structures which can support cattle grazing is determined.

Description: Determination of cattle load for forage areas has a vital importance to avoid their degradation due to over-pastured, being their recovery impossible in some cases (Lloyd, 1992). At the same time, on those forest structures where regeneration is not necessary in the current forest management stage, cattle load will be calculated as long as grass development is there enough to feed cattle.

Satisfaction of the verifier: Determination of cattle load.

I.1.2. Those forest areas susceptible of harm derived from forage are protected

Description: The only guarantee that cattle will not damage regeneration is exclusion. To put it into practice the inspection office will have to promote measures and actions which prompt landowners to fulfill these regulations.

V.1.2.1. Cattle are excluded from damage-risk zones

Description: Unsafe regeneration areas must get under a protection system. The only way to put this regulation into practice is by installing a wire fence around these sectors. Thus the inspection office must arrange financing options through redirecting of national and/or provincial subsidies if possible. Money necessary for these activities could then be spent in fence building.

A possible alternative for the landowner when subsidies are not expectable is making fence-building cheaper. A comparative analysis between traditional fence costs and those of a high-resistance plastic one, considering two workforce-cost hypotheses and a 5-wire fence, showed that the most convenient alternative is the use of the plastic fence. This option represents 58% of steel-wire fence building cost considering the higher workforce cost hypotheses (in harsh and stony places) and 62% for the lower workforce cost hypotheses (in difficult less places). The main advantage does not arise from the wire's lower cost but from the quicker installation time. In the case of 7-wire fences, proportion is similar.

The minimum area to be fenced will arise from the sensitive structure's distribution estimation and sizes within the FMU or eventually the intervention area. If this distribution is aggregated most patches having harm-susceptible regeneration structures will be considered within the same fence. If this distribution is segregated and highly spread, an average value will have to be established from the top size values (highest/lowest regeneration site area) and the fence will be set only around those sectors with a value higher than the average. This is a criterion that must be deeply discussed.

Satisfaction of the verifier: Fence building around harm-susceptible areas.

V.1.2.2. In sites where cattle is not excluded cattle load is kept in balance with the admissible load for each sector

Description: In grasslands and in forest structures where regeneration is not necessary in the current silvicultural stage forage will be admitted in correspondence with the calculated carrying capacity. As animals will probably concentrate in those places having higher vegetation abundance, controls for this measure will not be necessary difficult.

Satisfaction of the verifier: Cattle distribution in non-sensitive areas according to the carrying capacity.

V.1.2.3 Green cover percentage is similar to the one of similar sites lacking cattle presence

Description: This verifier represents a complementary measure for controlling forage effects according to cattle load, which besides has a more accessible quantification. Through vegetation sampling in sectors with/without cattle comparisons will be enabled to know the native vegetation's alteration degree.

Satisfaction of the verifier: There is no permanent alteration in the green cover (connected with species-number decrease or change in its composition) within forage sites.

V.1.2.4. Soil structure and porosity do not vary related to similar sites free from cattle

Description: This verifier is also complementary with the two previous ones and allows to test how cattle stepping compacts and changes soil characteristics, modifying its structure and increasing erosion risk when stepping is combined with green cover elimination. Verifier's satisfaction will demand soil-samples analysis in those sites where surface alteration is evident because of green cover decrease or absence.

Satisfaction of the verifier: There is no permanent soil compactation due to cattle.

A4. Agroforestry

C.1. "Ñire" forests are studied, used and preserved in an integral way, enhancing their production capacity

Description: "Ñire" (*Nothofagus antarctica*) forests and shrub variety of this species was considered for a long time a serious problem for land exploitation, especially when firewood demand started to decrease because of new fuels, like gas, in the Andean Patagonian region (Berón, 1999). Nowadays multiple direct and indirect benefits from "ñire" forests' are better known and valuated. They are called environmental or ecosystem's services, among which we find soil fixation (erosion control), hydrologic balance regulation, habitat/shelter for flora and fauna, CO_2 sequestration and contribution to biodiversity (Costanza *et al*., 1997). These factors together with the possibility to develop new agroforestry techniques that increase economic yield demand new knowledge and better use of this vast resource in the mountainous Chubut region.

I.1.1. "Ñire" forest and its current uses are characterized

Description: Resource characterization as well as the knowledge of traditional uses will be major instruments for planning activities aimed to acquire a rational and sustainable use of these areas.

V.1.1.1. "Ñire" forest is zoned according to structure types

Description: Knowledge of forest structure is an issue of great importance to an appropriate management, given that it has a direct incidence on features such as: kind and amount of fauna which use this forests as shelter, firewood volume that this forest can produce, presence of herbaceous understory, fire risk. Following structure classification is suggested:

Table 8: Suggested "ñire" forest structures

Pure "ñire"
High or tree-variety (h >7m)
Medium (h 2-7m)
Shrub-variety (h <2m)
Mixed formations
High "ñire" with "ciprés de la cordillera"
Medium-height "ñire" with bamboo (*Chusquea culeou*)
Medium-height "ñire" with "laura" (*Schinus patagonicus*), "radal" (*Lomatia hirsuta*) and "retamo" (*Diostea juncea*)

Satisfaction of the verifier: Structure-based zoning of "ñire" forests through the analysis of air photographs, satellite pictures and field survey.

V.1.1.2. Nire forest renewal is ensured and its enrichment with other native species is favored

Description: Seed regeneration is very rare, surely conditioned by ecological-climatic factors of limited temporal occurrence, thus resulting of great importance vegetative reproduction (Prémoli, 1991; Avaria, 1999). Domestic cattle munching has a strong negative impact on sprouts. Hares have also a strong incidence and it has been demonstrated that in winter 90% of their feces' dry-weight is composed of "ñire" litter (Bran *et al*., 1999).

Satisfaction of the verifier: Determination of animal load per hectare and division in pasture-grounds which can be left for regeneration, with total cattle exclusion within a period not shorter than ten years.

This way young sprouts can be allowed to grow far from cattle teeth, thus contributing to mitigate the over maturity of over pastured "ñirantales" ("ñire" forests). Another renewal alternative is plantation, for despite its low germinative power sprouts respond quite well in field plantation, existing recordings of success from 95% with tinned plants and 63% with bare-rooted plants. These values were obtained in sites with precipitations close to 1000 mm/year in the region of Coyhaique, Chile (Hansen, 1999). "Ciprés de la cordillera", being a very tolerant species, finds an ideal microsite for its establishment within "ñire" forest understory. This process which happens naturally in some sites, can be catalyzed to enhance in the long term the economic returns of these areas without producing important ecological alterations. It may be added that these activities will be framed within the Law of Promotion of Forest Activities in the chapter *Native Forest Enrichment*. When inspecting their application the current regulations for the assessment of this type of forest activities will be used.

V.1.1.3. Appropriate treatments for lowering forest fire danger and helping access to the area to allow the control activities are conducted

Description: "Ñire" forests are doubtless forest fire high-risk areas. Control tasks are usually extremely hard, because of vertical and horizontal structural continuity, difficulty to remove fuel material and mainly to this forest species' high calorific potential. A high percentage of the total area affected by fires within Chubut Province is related to this species. Some landowners and settlers use fire to clear out shrub "ñire" variety with diverse results depending on the area where this technique is used, but generally results are very poor (Lloyd, 1999). Often, and due to a bad post-fire pasture management, "ñire" forests have shifted into degraded areas, colonized by "acaena" (*Acaena sp.*), a species of null forage value, with the subsequent economic and ecological drawback.

Satisfaction of the verifier: Removal of felled material in order to establish fire line stripes, fulfilling the necessary requisites of width, length per hectare and adequate maintenance tasks for each particular case.

The removal of felled wooden material and the pruning of dead branches will be considered not only as a fire-risk-decrease activity but also as an income-generation by selling firewood. Some cartography will also be necessary with topography and vegetation to show distribution of fire lines and types of access.

V.1.1.4.Use of "ñire" forests understory is planned promoting a quali-quantitative forage enhancement for domestic cattle

Description: Forage Cover Index (INCOFO, see Annex II) (Somlo *et al*., 1995) can be used to assess the fields' receptive capacity thus determining the animal load and the area's rotation period. Forage will have to be adapted to the current dry material production, with a use factor lower than 50%. Such system will enable a 90% higher dry-matter production for the second year, therefore almost doubling the number of animals. Forage period will have to be no longer than six months within each ground.

Satisfaction of the verifier: Determination of the carrying capacity according to INCOFO values. Promotion of park setting, with density values of 500 to 700 stems/ha, and understory cleaning (complementing verifier 1.1.3) in order to create a park-like environment.

V.1.1.5. Firewood and other forest products' supply is quantified

Description: From a technical viewpoint "ñire" forests volume measurement is not an easy task. However, and provided that firewood as well as posts, rods and sticks are part of the main 'commercial' "ñire" products, their quantification is very important to plan the land ownership exploitation.

Satisfaction of the verifier: Volume for firewood, posts, rods and sticks and other forest products.

Annex II: Glossary of terms

Criterion: It is defined as a "principle or standard by means of which something is assessed". A criterion may be seen as a principle of second order, one which adds practicability and meaning to a previous principle, without being itself a direct yield or performance measure. Criteria are intermediate points where the information given by the indicators can be integrated, and where an interpretable determination or assessment is formed. Meanwhile, principles are the integration's final goal (CIFOR, 1999).

Indicator: It is any variable or component belonging to the forest ecosystem or to relevant management uses considered to infer the resource's use sustainability. Indicating means pointing out something, making it known, showing or being a sign/signal or symptom of, express/manifest the presence of. Indicators should lead to a "singular significant message". This "singular message" is called information. It represents the addition of one or more data items with established relationships (CIFOR, 1999).

Verifier: These are the data or the information which improve an indicator's specificity or assessment ease. It is the fourth level of specificity. Verifiers provide specific details which indicate or reflect the desired condition of an indicator. They add significance, precision and usually site specificity as well. They can also be defined as necessary procedures to determine the satisfaction of conditions postulated by the related indicator (CIFOR, 1999).

Multiple use: This term refers to the use of renewable and non-renewable natural resources in order to get from them a set of certain goods and services, mainly water, wood, wildlife, forage and outdoors recreation, which satisfy the population's economic, social and cultural needs by means of such one proper concept as it is a management of such resources that takes harm to a minimum (in terms of biological sustainability) especially considering soils and natural nutrient cycles (underlined words are a summarized definition of the concept) (Carabelli *et al.*, 2000).

Implementation: It is the execution of an action. The step from *normative planning* (what should be done) to the *operational planning* (what will be done) is usually a great challenge. Some of the important obstacles affecting implementation are: 1) the possibility to treat or solve problems, 2) lack of clarity about goals, 3) weak commitment of those responsible for the implementation, 4) low resources availability to reach the goals, 5) inadequate access to information, 6) mistaken assumptions on cause-effect relations, 7) wrong implementation dynamics and 8) different styles due to cultural variations (Mitchell, 1999).

Landscape: it is a territorial system composed of co-related natural and anthropogenic items (Sandner, 1991). Thus, landscape units are natural units which are or have been influenced by human society and then can be considered as a syntheses of nature and land use, having distinctive characters that enable their identification (Martínez Carretero and Roig, 1992).

Landscape pattern*:* Within a forest landscape this term refers to the spatial configuration and tree-group size, composed of different species and age classes. The concept can also be applied to different land exploitation systems (U.S. Forest Service, 1997).

Forest fragmentation*:* it refers to the subdivision of formerly continuous forests into different-size patches isolated from each other by modified environment types (Haila, 1995).

Carrying capacity: According to the World Tourism Organization it is "a threshold level of tourist development or recreation activity beyond which environment starts to get degraded (environmental carrying capacity), the infrastructure involved starts to get saturated (physical carrying capacity) or the tourist's holiday-enjoying experience starts to get lowered (socio-cultural carrying capacity)" (Buchinger, 1996). The carrying capacity is a function of: the amount of natural resources in a certain place, the use-tolerance of these resources, the number of visitors, the use type, the infrastructure's design and the use visitors do of it, the tourists' attitudes and behavior and those of the ones who are in charge of the area management. Determining the carrying capacity is not an easy task and it has a close correspondence with the determination of environmental, physical and socio-cultural impact. It must be considered as a planning tool that gives support -and also requires- management decisions (Cifuentes, 1992).

Forage cover index *(INCOFO):* it is calculated as the summation of **100%** of the desirable species cover -*Holcus lanatus, Poa pratensis, Elimus sp., Carex sp.* and *Trifolium repens*, among others, which are important components of herbivores' diet (Manacorda *et al*., 1996)- **50 %** of medium-quality forage species (*Berberis spp., Chusquea culeou, Discaria chacaya, Maytenus boaria, Nothofagus antártica*, among others) and **0%** of undesired species (A*caena sp.*, "neneo" *Mulinum spinosum*, "rosa mosqueta" *Rosa eglanteria*, *Vulpia sp., Rumex sp*., among others). The following reference values from INCOFO can be used: a) Forest with a minimum intervention (dense): 12-22%, b) Forest with light extraction: 49%, c) park-setting: 37-86% (depending on thinning degree).
Approximate values of "ñire" understory's biomass production, expressed as dry woody matter, gramineous and broadleaved herbs, after a two-year closure are the following (Bonvissuto and Manacorda, 1999): a) Park-setting: 1300-3800 kgDM (dry matter)/ha., b) Forest with light thinning: 1300-2500 kgDM/ha., c) Forest with a minimum intervention: 700-2400 kgDM/ha., d) Sectors lacking tree cover: 660-1500 kgDM/ha (in the first year of closure). These last values can be associated with the previous INCOFO's ones –the parameters were surveyed in sites of annual average temperature close to 9 Cº and annual average precipitation of 1000mm-.

Description of parameters in table 7: water pureness *(Source:* OSN-AGOSBA-SIHN, 1994)

Ph*:* in water courses pH is regulated basically by the bicarbonate buffer system. This system may be affected in its regulation capacity when pollution agents get into the water.

Dissolved oxygen: quantity of dissolved oxygen is always considered as one of the main water-quality criterion. Its presence is a major condition for plant and animal aquatic-life forms, for besides it prevents putrid anaerobic decomposition of organic matter.

Biochemical oxygen demand: it is the oxygen quantity necessary for decomposing organic matter through aerobic biochemical activity. It is essentially a study which measures the oxygen amounts used by bacteria in their development, taking organic matter as food. This determination's practical value is the transcription into numbers of this natural phenomenon.

Chlorides: this parameter has a high relationship with water pollution, given that high concentrations of chlorides are found in animals' urine.

Nitrogen: it may appear in different forms: *ammoniacal Nitrogen* is common in vegetal or animal wastes decomposition and in fertilizers used by man. Thus a concentration higher than normal is an indicator of pollution. *Nitrate* is mostly supplied by human wastes, plants transform these nitrates into organic nitrogen and so a high concentration of nitrates stimulate their growth, consequently enabling their possible excessive growth and subsequent dam eutrofication. Finally concentration of ion *nitrite* indicates active biological processes influenced by organic pollution

Total coliforms and colifaecals: they are indicators of faecal pollution degree.

Detergents and pesticides: this is another parameter indicating anthropic pollution degree.

Turbidness-smell-colour: these are parameters of easy measurement indicating in a quick and expedite way water quality levels.