Patagonia’s Potential
Climate change mitigation in the private conservation context: A feasibility study for the Patagonia Sur Foundation
The Patagonia Sur Workshop Group

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Executive Summary

Nearly 18% of global greenhouse gas emissions result from deforestation and degradation of forested lands, and policies to promote conservation have been identified by the United Nations Framework Convention on Climate Change (UNFCCC) to be part of the solution. Reducing Emissions from Deforestation and Forest Degradation (REDD) is a mitigation strategy that emphasizes aligning forest protection with development strategies and providing economic incentives for developing nations to preserve threatened forests and reduce carbon emissions. Under REDD, governments develop national strategies for pertinent issues such as land-use planning, carbon accounting, and stakeholder engagement.

REDD remains in development and its implementation framework continues to evolve at all levels, from regional to global, with many stakeholders attempting to determine the feasibility of and best practices for participation in REDD projects.

One of those actors is the Patagonia Sur Foundation, a nonprofit organization that promotes conservation and sustainable social and economic development in Chile’s Patagonia region. The Foundation is affiliated with a for-profit company, Patagonia Sur LLC, which owns land in Patagonia. This report focuses on answering the question: Should the Foundation pursue a REDD project in Southern Chile?

Answering this question required a systematic and comprehensive analysis, which included extensive literature research, numerous interviews with experts, analysis of Chilean national policy, and GIS mapping of the region and ongoing developments. Coupling available information with a thorough analysis, the Workshop team determined that a REDD project on Patagonia Sur’s properties is not feasible under the known current conditions. This conclusion stems from our analysis in four overarching areas: 1) Patagonia’s forests, and the threats they may face, 2) Technical feasibility, which refers to certification methods for reducing emissions, 3) Economic feasibility, using an established REDD project cost/benefit model, and 4) REDD policy mechanisms, both nationally and internationally.

Findings
1. Forests and Threats:
We conducted technical environmental analysis to estimate forest cover and carbon stocks, identifying Patagonia Sur’s Melimoyu property as the most feasible prospect for a REDD project. However, our research on the threats to this region brought the team to the conclusion that “threats,” as defined under the REDD framework, are not, as of yet, evident on Patagonia Sur’s properties to the degree that would warrant the current development of a REDD project.

2. Technical feasibility:
There are five existing Verified Carbon Standard REDD methodologies that cater to different forest and threat types. Of these, our team identified two methodologies that may be the closest, though not perfect, fit for Patagonia Sur’s lands. It is likely that the client may have to modify either of these methodologies or design a new methodology to fit its purpose.

3. Economic modeling of a project:
Using an economic model template used by industry practitioners, we determined that a REDD project is currently infeasible economically for Patagonia Sur. The economic model resulted in a negative Net Present Value (NPV) of greater than $350,000. The negative NPV is primarily a result
of large startup costs, and recurring implementation costs, which far outweigh the revenue obtained from the sale of carbon credits. To arrive at a positive NPV, any one, or a combination, of the following things need to happen – a substantial increase in the area of forestland under threat, an increase in the deforestation/degradation rate, or an increase in carbon price.

4. Institutional feasibility: REDD policy mechanisms
On the international front, it is unclear when and how REDD credits will be recognized by the compliance carbon markets. On the national front, while Chile has recently begun developing a REDD strategy with assistance from the World Bank, and is considering a bill to create conservation easements like those found in the US, it remains to be seen if and when these developments will bear fruit.

Recommendations: Get Ready For REDD
We recommend that Patagonia Sur Foundation and Patagonia Sur LLC ready themselves for REDD now because the conditions that drive a REDD project are dynamic and changing: Threats could emerge and intensify on existing lands; Policy mechanisms governing REDD could evolve and better facilitate future projects; and/or increases in carbon prices and/or Patagonia Sur’s landholdings, could also improve the economics of the project.

For this reason, we encourage our client to expand or develop: 1) a strategy of environmental data collection and monitoring, 2) institutional and community partnership building, and 3) legislative and policy tracking, to ensure the right implementation of REDD, under the right conditions and at the right moment. We provide specific recommendations within these activity areas, with the belief that following them will better position Patagonia Sur to ensure the continued stewardship of their properties, as these recommendations would benefit not only a future REDD project, but also the organization’s general conservation efforts.
Introduction

The Project and the Workshop Team
The Patagonia Sur Foundation, which supports the work of Patagonia Sur LLC while fulfilling its own mission of promoting sustainable ecological and social development, asked the Columbia Workshop team to complete a feasibility study for REDD. This report addresses the following question: “Should the Patagonia Sur Foundation pursue a REDD project in Southern Chile?” This feasibility study is intended as a first step towards adding REDD projects to the conservation and economic development efforts that dovetail with climate change mitigation.

The Team is part of the Workshop in Applied Policy Analysis, the capstone project of the Master in Public Administration in Environmental Science and Policy Program at Columbia University’s School of International and Public Affairs. Twelve Master’s students completed the primary and secondary research through interviews with 13 experts, review of extensive secondary documentation, analysis that included developing economic feasibility scenarios, and production of this report and the accompanying program briefings over 12 weeks in Spring 2012. Included within this team were forestry and climate change experts, two of whom are Chilean, with experience both in the field and at the policy level, as well as individuals with expertise in economics, finance, public policy, and the environmental and biological sciences.

About the Client: The Patagonia Sur Foundation
The Patagonia Sur Foundation, a United States-based 501(c)(3) nonprofit organization established in 2007, aims to promote conservation and sustainable social and economic development in Chile’s Patagonia region. In working towards this goal, the Foundation works closely with its Chilean counterpart, Fundación SNP Patagonia Sur, to engage in educational initiatives to teach English and encourage environmental awareness in schools and communities, the promotion, conservation, and enhancement of ecologically sensitive and unique areas, and the facilitation of local community engagement in sustainable development in the region and long-term regional planning.

The Foundation is also closely affiliated with Patagonia Sur, LLC, a for-profit venture that invests in and protects properties in Patagonia. Patagonia Sur LLC’s business model seeks to find a financially beneficial way to conserve land. Sources of revenue including limited development, a membership-based eco-tourism club, eco-brokerage services, and carbon offset sales. Patagonia Sur, LLC, owns land in Chile’s Los Lagos and Aysen (X and XI) regions where REDD would potentially be instituted. Currently, Patagonia Sur LLC operates carbon-offset projects as part of an overall strategy to engage in climate change mitigation, land conservation and sustainable development (Fundacion Patagonia Sur).

Patagonia Sur’s Properties
Patagonia Sur owns six land parcels in Chilean Patagonia. Extending 2,700 miles north to south, Chile is divided into fifteen administrative regions. Patagonia Sur’s six properties - Lago Espolón (near Futaleufú), Valle California (near Palena), Melimoyu, Los Leones, Jeinimeni and Tortel - are located in Chile’s X (10th or Lakes Region) and XI Regions (11th or Aysén Region), and each has unique characteristics.
**Lago Espolón**
The smallest of the properties with a surface area of 109 hectares, Lago Espolón is located adjacent to the 30,000-acre Futaleafú National Reserve, one of the most diverse wildlife sanctuaries in Chile (Patagonia Sur LLC). This property is primarily made up of intact forest cover.

**Valle California**
A river valley near the Argentine border, Valle California is the second-largest property with a surface area of 3,091 hectares (Patagonia Sur LLC). Recent reforestation and afforestation efforts have increased the forest cover in this area, as the land was historically subject to overgrazing by cattle and other animals (INFOR).
Melimoyu
Located adjacent to a bay at the base of Mt. Melimoyu, is the largest property with a surface area of 16,000 hectares. This property has the highest percentage and amount of forested land of any of the properties, and while little data exists about historical land use, the area is largely unpopulated and is still mostly in its natural undisturbed state.

Los Leones
A 609-hectare glacier-filled valley abutting the deepest and second largest lake in South America (Lago General Carrera), is one of the best-known and readily accessible glacial valleys in all of Chilean Patagonia.

Jeinimeni
This property has a surface area of 1,435 hectares and is located at the convergence of two rivers. Wide-open fertile lowlands that are punctuated by small pockets of native forest and rock formations characterize this property.

Tortel
With a surface area of 1,458 hectares, Tortel is located on a fjord at the foot of Steffens Glacier and features riverbanks and glaciers (Patagonia Sur LLC).
Important Terms

**Afforestation:** The establishment of a wooded forested area in what was previously a different ecosystem without forests.

**Deforestation:** The destruction and alteration of vegetation in what was historically a forested area.

**Forest Degradation:** The alteration of a forested ecosystem that compromises the quality and/or function of historical ecosystem integrity.

**Frontier Forests:** Forest tracts that are relatively unaltered from their natural, historical state, and still maintain “natural” aspects of biodiversity and ecological significance.

**Hectares:** A metric unit comparable to 100 square meters or approximately 2.5 acres

**Magellanic Forests:** Cool, dry, subpolar forests also found in Chile and Argentina, characterized by sparser vegetation types than Valdivian forests,

**Plantations:** Human-made, human-maintained vegetation, usually used for commercial purposes.

**RED:** Projects that reduce emissions solely from reducing deforestation.

**REDD:** Projects that reduce emissions from deforestation and forest degradation

**REDD+:** Projects that reduce emissions from deforestation and degradation coupled with enhancing carbon stocks through sustainable forest management.

**Temperate Forests:** Forests located in moderate, seasonal climatic zones.

**UN-REDD:** United Nations Program on Reducing Emissions from Deforestation and Forest Degradation, the international REDD program authority.

**UNFCCC:** United Nations Framework Convention on Climate Change

**Valdivian Forests:** Temperate rainforest ecoregion located in Chile and Argentina, characterized by mixed, broadleaf vegetation and displaying extraordinary endemism in its species.
Part 1

Background and Important Concepts
REDD: What is it, and how does it work?

At the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP)’s thirteenth session in Bali, parties adopted agreements to create Reducing Emissions from Deforestation and Forest Degradation (REDD). REDD is a climate change mitigation strategy that emphasizes aligning forest protection with development strategies to address the approximately 18% of global greenhouse gas emissions resulting from deforestation (Angelsen). In December 2007, the UNFCCC’s COP established guidance for a pilot phase of REDD until 2012 to work on issues such as developing procedures for measuring and validating emissions reductions (Miles and Kapos).

REDD offers an opportunity for developing and developed nations to partner together to benefit the global climate system. It seeks to generate economic incentives for developing nations to preserve forests and their carbon storage services. Under REDD, governments will develop national strategies for pertinent issues such as land-use planning, carbon accounting, and stakeholder engagement (Phelps, Webb, and Agrawal). However, it is important to note that REDD remains in development; the REDD policy and implementation frameworks continue to evolve through discussions at all levels, from the regional to global, as experiences from pilot programs are taken into account. In September 2008, the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) was created to help developing countries prepare for participation in a future REDD mechanism (UN-REDD Programme). The UN-REDD Programme is currently working with 42 partner countries, with 16 receiving financial support for national activities (UN-REDD Programme, “National Programmes”).

The REDD Framework
To be recognized as a REDD project, a forest conservation project must meet requirements in four areas: 1) the scope of activities eligible as emissions reduction credits; 2) the reference level at which emissions reductions can be measured; 3) the financial aspects of the program with regard to sources of funding, the current market, and incentives; and 4) the distribution of monetary benefits to various stakeholders (Parker and Mitchell).

Scope: RED, REDD, REDD+
REDD’s objective focuses on emissions reductions. A fully comprehensive approach incorporates the prevention of deforestation and forest degradation as well as conservation, sustainable management, and enhancement of
forest carbon stocks in developing nations (K. R. Miller). As such, there are different scopes of activities aimed at achieving emissions reductions - while our focus was on REDD, we also refer to RED and REDD+ in this report (Parker and Mitchell). RED projects lower emissions solely from reducing deforestation. REDD lowers emissions by reducing deforestation and degradation. Finally, REDD+ refers to projects that take a three-pronged approach of reducing emissions from deforestation, degradation, and enhancing carbon stocks through sustainable forest management.

Reference Level
The scope involves the development of the second requirement for a REDD project: a reference level for measuring emissions reduction. The key objective of a reference level is to validate the impact and/or progress of a REDD initiative. Reference levels allow for evaluation and determination of rewards for a given initiative, and have implications for climate mitigation effectiveness, cost efficiency, and distribution of REDD funds among countries and projects (Angelsen). Reference level takes into account the scale of the project (sub national, national or global level), as well as the time period and type of information used to develop the baseline (historical, historical adjusted, or project) (Parker and Mitchell). A number of techniques, including analysis of satellite images of an area, use of remote sensing, and creation of regression models, are utilized to predict and track deforestation (Salgado; Alarcon, Soffia).

Additionality, Leakage and Permanence
An important component of REDD validation is establishing the additionality of the project, or proving that the emission reductions would not have occurred otherwise. Other considerations include leakage and permanence, which influence the impact and authenticity of a given initiative. Leakage refers to changes in greenhouse gas (GHG) emissions occurring beyond a project’s boundaries (Forest Carbon Partnership Facility). Permanence requires ensuring the long-term persistence of a given carbon...
pool and its stocks to validate the carbon credits produced (Parker and Mitchell).

Financing
The third component of the framework is financing, which includes the sources of funding or revenue used to incentivize emissions reductions under REDD. Three UN agencies - United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), and the Food and Agriculture Organization (FAO) – have worked together to establish a multi-donor trust fund that allow resources to be pooled to fund REDD projects (UN-REDD Programme, “Climate Funds Update”). Donors currently include UN organizations and member nations as well as non-governmental organizations. Existing bilateral arrangements between UN REDD, the Forest Carbon Partnership Facility (FCPF), and Forest Investment Program (FIP) have set aside approximately $900 million US for REDD+ activities (UN-REDD Programme Blog). Norway has been and continues to be the UN REDD Programme’s largest donor, committing a minimum of $40 million US for 2011 to 2012. The UN-REDD Programme has pledged $133 million to support country-driven REDD+ readiness activities and to support project implementation in nine countries and 13 other observer nations (UN-REDD Programme, “Climate Funds Update”).

Currently, Chile is not on the approved list as a receiving country. The FCPF, of which Chile is a participant, has pledged $221 million to support capacity building in 37 countries and to test implementation through pilot programs (“Map | Forest Carbon Partnership”). Beyond obtaining funding, there are other critical aspects of REDD projects. For instance, it is also necessary to assess a project’s capacity to sell the service provided, such as carbon credits, receive payments, monitor and enforce conservation, as well as manage and engage (Dillon).

Distribution of Revenue
The last portion of the framework determines how financial incentives are distributed to countries or regions – or as would likely be the case with our client, a private entity - with standing forests and low deforestation rates that might not directly benefit from an emissions-based approach to REDD. One option is implementing a redistribution mechanism which seeks to avoid international leakage and addresses equity concerns within the REDD mechanism where rewards are solely based on one’s emissions reductions (Parker and Mitchell). Another option is to have an additional mechanism or create a “stabilization fund” that would use funding to address these concerns in countries with high forest cover and low rates of deforestation (Parker and Mitchell). As with the financing requirement, this project did not focus on the revenue distribution aspect of a potential REDD project, which is to say, we did not investigate the feasibility or possible options for financing a project.

Carbon Markets
Understanding the financing of REDD projects requires an understanding of relevant markets and their respective carbon prices. Two types of carbon markets have been created for developing countries: the formal or regulatory market and the voluntary market. The formal market was created under the Kyoto protocol of the UNFCCC with the objective to help developed countries (Annex 1 countries) achieve their mandatory emission reductions. The Clean Development Mechanism (CDM) is an environmental investment and credit scheme that allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries (UNFCCC). These projects generate certified emission reduction credits, which can be purchased and used by industrialized nations to meet their own emission reduction targets (CDM). In addition to reducing emissions, CDM projects aim to promote sustainable development in the host country. The CDM considers different types of projects that reduce GHG emissions; regarding forest management, CDM considers Afforestation and Reforestation projects (A/R CDM). Although complete methodologies have been developed for these initiatives, projects related with degradation and deforestation avoidance (REDD projects) are not considered in this scheme.

A/R CDM projects have been hard to implement due to the complex process of developing approved methodologies and additionality
tools. However, even with approved methodologies, the main obstacle for these projects has been the European Union’s (EU’s) decision to exclude forestry credits from the EU Emissions Trading Scheme (ETS), which is the majority holder of the overall carbon market at present. This exclusion was due to the EU’s differing priorities for climate policy related with poverty alleviation and the involvement of local communities. There were also concerns that carbon removal by forests – or forest sinks – may be only temporary and that forest plantations – particularly monocultures – can contribute to the deforestation of other species and lead to loss of biodiversity and other environmental impacts (Food and Agriculture Organization). For these reasons, forest related projects have low levels of importance in the regulatory markets.

In voluntary markets, forest-related projects have been more successful, contributing significantly to credits available in these schemes. Voluntary markets have emerged as a result of organizations and individuals voluntarily deciding to offset their own emissions. Between the formal and involuntary markets, the requirements to certify carbon offsets are more comprehensive and stringent for the formal market. This means that greater financial investment is necessary to develop processes to reduce emissions as well as to certify the carbon offsets produced.

**Carbon Ownership and Difficulties Associated with Carbon Trading**

The main objective of REDD+ is to sustainably manage forests with the aim of storing more carbon while preventing the release of carbon that is already stored (LaVina and Lynch). With the REDD+ mechanism, the individuals and institutions responsible for maintaining and storing carbon in forests are potentially eligible for financial compensation through carbon market trading or payment for environmental services (LaVina and Lynch). As such, there are legal concerns regarding carbon rights and ownership. Most countries have not developed clear policies and regulations for carbon ownership, which makes participation in carbon trading more difficult (Eckford). The technical difficulties associated with measuring carbon and the limited number of approved REDD methodologies also makes carbon trading more challenging (Eckford). Despite this, the amount of credits in transactions has been increasing every year (Schneck et al.). Credit buyers include public sector institutions, emitters of greenhouse gases, private companies with corporate social responsibility initiatives, as well as NGOs and individuals (Schneck et al.). A recent survey from EcoSecurities indicates that voluntary buyers are willing to pay a premium for offset projects that provide additional social benefits (EcoSecurities).
Any Chilean REDD project would be built within the country’s existing policy structures. The Chilean government, unlike many other areas targeted by REDD, already has strong, well-defined regulations in regards to forestry conservation. These institutions, which are relevant to Patagonia Sur’s potential REDD projects, are described within this section:

**Forestry Laws**

Forest policy in Chile is currently comprised of three main pieces of legislation:

1. **Forest Development Law (D.L.) 701**: Decreed in 1974, D.L. 701 aimed to reduce native forest exploitation and led to the rapid growth of intensely developed plantations, which are “forest stands established by planting and/or seeding in the process of afforestation or reforestation” (Food and Agriculture Organization). Plantations now provide over 90% of industrial wood consumed (INFOR). D.L. 701 regulated, incentivized, and promoted the establishment of plantations. In this way, the Law encouraged afforestation by creating incentives for conserving soil with improved forest management practices. However, these incentives in the law disproportionately benefited large industries, resulting in the displacement of small landowners. To counter this effect, in 1998 D.L. 701 was modified to better engage small landowners and to encourage forestation in fragile and damaged soils.

2. **The Chilean Environmental Law, Law nº19300** (O’Ryan, Diaz, and S. Miller): Enacted in 1994, this Law established the basic principles for Chilean environmental legislation, the instruments of environmental management, and the legal framework for coordinating and facilitating environmental decision making. An important component of this law is that it requires companies to conduct impact studies of future projects that may affect the environment. With regard to forestry, any projects that involve forest development or exploitation at an industrial level within areas of concern, such as fragile soils and native forests, are subject to evaluation. The Law also established the creation of private protected areas.

3. **Law 20.283, Native Forest Recovery and Forestry**: Promulgated in 2009, Law 20.283 allocates US $8 million for forest conservation, recovery, and sustainable management projects each year. As part of this allocation, the law requires proof of conservation and protection of native forests
with all timber harvesting projects, including technical justification of cutting methods used and inclusion of measures to protect soils, water quality and quantity, and biodiversity (“Chile R-PIN Revised Annex 2”).

Land Ownership Institutions in Chile

The Chilean government owns 3.9 million hectares, which are designated Wild Protected Areas. However, much of Chile’s forestland – including plantations and native forests – is privately held. Most native forests are also privately held, with a significant proportion belonging to small and medium scale owners, generally described with land area less than 20,000 hectares, as in the case with our client (Vasquez).

There are two legal tools with regard to land ownership that are applicable for conservation efforts:

1. **Servidumbre Ecologica:** A contract, defined in the civil code, between two parties with ownership of two different lands. In this agreement, the owner of the “servant” land agrees to maintain some characteristics of his property that could benefit the owner of the other property. To ensure this, the owner of he servant land is legally prohibited from carrying out certain activities. Servidumbres protect the land from actions of their current or future owners but not from third parties (such as hunter or timber collectors). There is no legal requirement for a monitoring or management plan (Comité Nacional Pro Defensa de la Fauna y Flora Amigos de la Tierra).

2. **Derecho Real de Conservación (Conservation Easement Right):** This is a proposed law that would be the equivalent of a conservation easement, where landowners would voluntarily designate their land, either partially or completely, to a conservation objective. A contract would be signed between the landowner and a public or private entity that would help finance, support, and monitor a management plan. The contract would include obligations and restrictions for both parties involved, which would be binding for a set time period (ASI Conserva Chile). In March 2012, the Lower House of Congress’s Commission on Constitution, Legislation, and Justice in Chile passed the Derecho Real de Conservación bill. It has now been forwarded to the Chilean Senate.

REDD Institutions

Chile is currently an “observing” member of REDD, and its national structure for REDD is in early stages of development (Latorre). Presently, the Ministry of Agriculture is working on REDD+, with input from the Ministry of Environment and the Conservation of Biological Diversity (CBD) and the UNFCCC. Several initiatives are being pursued, including a Global Environment Facility project for carbon stock monitoring within the REDD context, a World Bank fund for the development of a REDD+ strategy, and a national plan of action for biodiversity and climate change.

Previously, Chile made a submission on land use, land-use change and forestry reporting under the Kyoto Protocol in June 2009 (Miles). Along with Mexico, Chile argued in a submission to the Conference of the Parties, Thirteenth session (COP13) in 2007 that countries should be able to engage in REDD through a national or project-based approach, emphasizing the importance of private sector involvement and payment of credits to projects regardless of national targets. These features will likely be reflected in their eventual national REDD strategies. Additionally, Chile was accepted into the Forest Carbon Partnership Facility (FCPF) in March 2009 and the Coalition for Rainforest Nations in 2005 (Miles).

Forest Carbon Partnership Facility

The FCPF is a global partnership that helps tropical and subtropical forest countries develop the systems and policies necessary for REDD, and provides them with performance-based payments for emission reductions (Miles; Forest Carbon Partnership Facility). The FCPF demonstrates how REDD can be applied nationally, complementing UNFCCC negotiations. The FCPF has developed a framework and processes for REDD readiness, which helps countries prepare for potential future financial incentives. This involves developing reference
scenarios and monitoring systems and establishing REDD national management arrangements while ensuring the inclusion of national stakeholders.

The FCPF’s governance includes a 28-member Participants Committee elected by REDD country participants and financial contributors, six Observers nominated by forest-dependent indigenous peoples and other forest dwellers, non-governmental organizations and international groups, as well as the World Bank. A variety of financial contributors – national governments, non-governmental organizations, and corporations – have pledged approximately $447 million to the FCPF. Of this, $215 million will be designated to the Carbon Fund, which will provide payments for verified emission reductions from REDD programs in countries that have achieved or progressed considerably towards REDD readiness.

At present, 37 REDD countries have been selected to join the partnership. Chile first submitted an FCPF R-PIN, which is used by the Participants Committee to select countries for inclusion, in 2008. The World Bank approved this in 2009 with the resolution PC/2/2009/1, with possible funding being dependent on the provisioning of additional funds besides that of the FCPF (Forest Carbon Partnership Facility, “The Implications of Adopting Resolution PC3/2009/4”). Resources to support this initiative did not materialize, and the document was suspended until 2010, when the document was revisited. In June 2011, Chile submitted an updated R-PIN, which provided an overview of Chile’s interest in the program, land-use patterns, causes of deforestation, stakeholder consultation, and potential institutional arrangements for addressing REDD. This document serves as a basis for Chile’s national REDD strategy (Sartori et al.).
General Status of Chilean Forests

The World Wildlife Fund has designated Chilean forests as one of the Global 200 ecoregions, in recognition of their ecological value and vulnerability to threats (Olson and Dinerstein). The forests, which house nearly 4,000 vascular plant species, have high levels of endemic biodiversity and house many endangered species (World Wildlife Fund; Center for Applied Biodiversity Science at Conservation International). Chile holds approximately one-third of the world’s remaining frontier temperate forests with 16 million hectares (CONAF). Of this, 13.4 million is native forest, while the remaining 2.6 million hectares are plantations of primarily pine and eucalyptus (CONAF). Approximately 25% of native forests are designated as part of the National State Protected Area System (SNASPE), which protects these areas against deforestation (Sartori et al.). Currently, Chile loses an average of 27,000 hectares of forest cover each year (Bergh and Promis).

Of particular importance are Chile’s frontier forests, which are tracts of mature forests or dense timberline forests at least 5,000 hectares in size that are intact or minimally altered (Neira, Verscheure, and Revenga). Many frontier forests are found in areas with steep slopes or at high altitudes, rendering them especially sensitive to human disturbance (Neira, Verscheure, and Revenga). Frontier and other Chilean forests are threatened by numerous factors, including overgrazing, invasive species, forest fires, development, and urbanization, which contribute to the destruction and degradation of these ecosystems (Neira, Verscheure, and Revenga).

The Timber Industry in Chile
The Chilean economy is based upon several large, extractive industries, one of which is timber. Over the past 30 years, the timber industry in Chile has undergone tremendous growth; exports increased from US$40 million in 1970 to US$5.9 billion in 2010, and currently timber and other wood products account for 3% of Chile’s gross domestic product (INFOR, “Productividad y Diversificación De Plantaciones Forestales”). This increase in production is partly due to the proliferation of plantations of exotic species, such as pine and eucalyptus, which have high growth rates and offer homogeneous quality and volume (Schegel). Plantation species provide 98% of the materials for products such as timber, paper, and cellulose. In contrast, native forests do not have significant recognized commercial value, since they are mainly utilized in a decentralized manner to provide firewood and other products. Development policies for the forestry sector in the 1970’s resulted in a large proportion of forest property being held by large industries, which has resulted in economic, social, and environmental consequences (Schegel).
This study was conducted using a range of research methods. Literature and data reviews were carried out and used to form the basis of knowledge presented in Part I of this report. The team also reviewed the elements of a feasibility study to ensure that our research methods authentically informed our research questions and analysis, and critically examined the necessary components and questions that such an analysis would include. The team posed the following questions, and many others, in scoping and targeting its work: What components are necessary for our specific feasibility analysis? What information about these areas is available? Given that this analysis is being undertaken from a remote location, how can the research most effectively be conducted?

We approached the research and analysis from several viewpoints. From an environmental perspective, we sought to determine the conditions on and needs of the client’s properties, as well as carbon storage potential. We considered REDD in the client’s organizational and technical context. Finally, we sought to investigate the social and policy perspective of a REDD project in this area.

Our research methods were mainly threefold: a) literature and data reviews; b) interviews with Patagonia Sur Foundation and Patagonia Sur LLC staff, Chilean policy officials, community members, and environmental experts as well as REDD program professionals; and c) technical analysis including GIS, carbon, and economic modeling. To complete this feasibility study in three months, we worked concurrently in six teams. Three research teams investigated the current environmental, technical, and policy contexts. Three Analysis Teams worked to apply and contextualize data and findings. In addition to this report, we have also compiled a complete “library” of secondary data from our literature review and research.¹

¹This “library” of documents and interviews are intended only as background materials for our client Patagonia Sur Foundation. They are not intended for publication or use in other research endeavors.
Local Findings
5.1 Our Focus: Patagonia Sur's Properties

Patagonia Sur LLC owns six different properties in Patagonia, a largely rural and relatively sparsely populated region renowned for its beauty, diversity, and highly natural state. The total surface area of the properties is approximately 22,700 hectares located within the Aysén Region and the Lakes Region. These lands are spread amongst three ecosystem regions (D. Olson and Dinerstein; D. M. Olson et al.): Valdivian temperate rainforest, Patagonian steppe, and Magellanic subpolar forest (see Table 1). While Valdivian and Magellanic forests are both temperate broadleaf and mixed forests, they vary in terms of the exact species that they contain as well as in their carbon sequestration potential. Below are our estimates of the forest cover on these properties.

Figure 3: Relative Size and Forest Cover of Patagonia Sur's Properties
5.2 Ecological Survey Results

We identified three main determinants of project feasibility:

1. The amount of forest cover as well as the type of vegetation present, since species composition determines the existing carbon stock as well as sequestration rates
2. Logistical considerations, such as road access and availability of facilities
3. The kinds of threats driving deforestation or degradation in each area

Using these criteria we were able to eliminate properties unsuitable for a REDD project. We found that Jeinimeni and Los Leones Valley lack large tracts of forests, making the applicability of REDD less feasible in these areas. Valle California was previously degraded and is now being reforested. Since REDD’s scope covers deforestation and degradation and not reforestation, this property is also ineligible. The last property that we were able to rule out was Tortel. This property lacks extensive forest cover, but more importantly is difficult to access logistically. Eliminating these four properties left Lago Espolón and Melimoyu. Due to Lago Espolón’s relatively small size (109 hectares), we eliminated this area as well. We decided to focus on Melimoyu due to the fact that 85% of its surface area has forest cover and the property has a relatively large area. Melimoyu is comprised of several primary forest types including Lenga, Simpreverde, and Ciprés de las Guaytecas forests (see Table 2).

Table 1: Patagonia Sur’s Properties

<table>
<thead>
<tr>
<th>PSF Land</th>
<th>Surface (ha)</th>
<th>Region</th>
<th>Province</th>
<th>Ecoregion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lago Espolón</td>
<td>109</td>
<td>Los Lagos</td>
<td>Palena</td>
<td></td>
<td>Characterized by extraordinary endemism and great antiquity of biogeographic relationships. Close phylogenetic relationships dating back to early Tertiary. Threats of degradation are significant. Actions to restore ecology and preservation are needed.¹</td>
</tr>
<tr>
<td>Valle California</td>
<td>3,091</td>
<td>Los Lagos</td>
<td>Palena</td>
<td>Valdivian Temperate Rainforest</td>
<td>This ecoregion is cool and dry and floristically poor. The fauna has similar components to Valdivian but it is varied. High mountain peaks, ice fields and fjords are present which provides for endemic animal and plant species.²</td>
</tr>
<tr>
<td>Melimoyu</td>
<td>16,000</td>
<td>Aysén</td>
<td>Aysén</td>
<td>Magellanic Subpolar Forests</td>
<td></td>
</tr>
<tr>
<td>Los Leones Valley</td>
<td>609</td>
<td>Aysén</td>
<td>General Carrera</td>
<td></td>
<td>Contains desert scrubs and year round frosts with high levels of endemism in both plants and animals.³</td>
</tr>
<tr>
<td>Steffens (Tortel)</td>
<td>1,458</td>
<td>Aysén</td>
<td>Capitán Prat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeinimeni</td>
<td>1,435</td>
<td>Aysén</td>
<td>General Carrera</td>
<td>Patagonian Steppe</td>
<td></td>
</tr>
</tbody>
</table>

5.3 Carbon Stock Estimates
To inform the process of investigating REDD’s potential within Patagonia Sur’s current properties, we prepared a rough estimate of the carbon stored in its forests. The client and our own GIS analyses provided the information that the following estimates are based on. It is important to note that carbon stocks are highly variable depending on the type (species, composition, and structure) and condition (conservation or degradation) of the forest at hand. Research has found that the total amount of carbon stored varies between 150 to 540 tons per hectare depending on the ecosystem type, such as savannas to tropical and temperate forests (Ajtay, Ketner, and Duvigneaud). Currently, the IPCC uses default values based on forest type, and the IPCC estimation of the carbon

Table 2: Forest Types Present in Melimoyu

<table>
<thead>
<tr>
<th>Forest Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenga</td>
<td><em>Nothofagus pumilio (Lenga)</em> and <em>Nothofagus antartica (Ñire)</em> are the two Chilean Nothofagus, or southern beech, species. The Lenga forest type has three subtypes, as follows:</td>
</tr>
<tr>
<td></td>
<td>1. Stunted <em>N. pumilio</em> forests or <em>Krummholz</em>, where the restrictive environmental conditions where <em>N. pumilio</em> grows as the timberline in its northern distribution determines that it does not reach a tree-like form but rather a stunted, crawling shape. This subtype sometimes limits to lower elevations with the normal <em>N. pumilio</em> forests, another subtype.</td>
</tr>
<tr>
<td></td>
<td>2. Pure <em>N. pumilio</em> forests: this is the usual <em>N. pumilio</em> forest dominating most of continental landscape of Chile south of 47°. These are typically uneven-aged forests, but comprised by single small-sized even-aged stands.</td>
</tr>
<tr>
<td></td>
<td>3. Mixed <em>N. pumilio-N. dombeyi</em> forest: refers to <em>N. pumilio-N. dombeyi</em> forests below elevations were <em>N. pumilio</em> grows as pure forests, especially between 37° and 40°30’ S, or to <em>N. pumilio-N. betuloides</em> forests south of this latitude, in transitional areas with the Coihue de Magallanes (<em>N. betuloides</em>) forest type.</td>
</tr>
<tr>
<td>Siempre-verde (Evergreen)</td>
<td>One main characteristic of this forest type is that it is only comprised of evergreen species, most broadleaved trees. This is the richest forest type in Chile, and a forest stand is usually comprised of at 10 to 20 tree species. Although tree composition is similar within the Valdivian rainforests (through 43°S Lat.), the coastal forests usually lack <em>Nothofagus</em> due to the apparent absence of large-scale disturbances in the this region, as compared with the Andes that are constantly subjected to this type of disturbances that allow recruitment of the shade-intolerant <em>N. dombeyi</em>.</td>
</tr>
<tr>
<td>Guaytecas Cypress</td>
<td>This forest type grows from 39°50’ in both Cordilleras and the central depression, but in its northern distribution it is usually present as small discrete stands in the so-called “Mallines” that correspond to concave areas were small stream water is temporarily stored. However, the main distribution of this forest type is in flat lands at mid and high elevations of the Costal Cordillera of the Chiloe Island, and along the islands of the Archipelago through 54°20’S. Species associated to <em>P. uviferum</em> do not vary much along its distribution, which is due to the restrictive conditions where this species grows. In the northern part of the distribution the main tree associates are <em>N. nitida</em> and <em>P. nubigena</em>; in the southern part <em>N. betuloides</em> and <em>D. winteri</em> are more common companions. <em>Tepualia stipularis</em> is common throughout.</td>
</tr>
</tbody>
</table>

stock in South American temperate forests is 50.54 to 214.27 tons per hectare for temperate oceanic forests, and 22.46 to 193.54 tons per hectare for old growth temperate mountain forests (See Table 3) (IPCC).

**Table 3: IPCC Estimation Ranges for Carbon Stocks of Temperate South American Forests**

<table>
<thead>
<tr>
<th>Forest</th>
<th>Above-Ground Biomass in Forests (ton d.m.)</th>
<th>Carbon Fraction (tonne c/ton d.m.) (^1)</th>
<th>Carbon Stock Above-Ground (tC/ha)</th>
<th>Ratio of Below-Ground Biomass to Above-Ground Biomass (R) (^2)</th>
<th>Carbon stock estimation (tC/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperate oceanic forest, South America</td>
<td>180 (90-310)</td>
<td>0.48</td>
<td>86.4 (43.2-148.8)</td>
<td>0.24 (0.17-0.44)</td>
<td>107.14 (50.54-214.27)</td>
</tr>
<tr>
<td>Temperate mountain Systems, South America</td>
<td>50 (20-110)</td>
<td>0.48</td>
<td>24 (9.6-52.8)</td>
<td>0.24 (0.17-0.44)</td>
<td>29.76 (11.23 – 76.03)</td>
</tr>
<tr>
<td>Temperate mountain Systems, South America</td>
<td>130 (40-280)</td>
<td>0.48</td>
<td>62.4 (19.2-134.4)</td>
<td>0.24 (0.17-0.44)</td>
<td>77.38 (22.46-193.54)</td>
</tr>
</tbody>
</table>

Source: (IPCC)

Carbon is stored not only in trees themselves (stems, stumps, branches, bark, seeds, and foliage), but also in other pools within the forest ecosystem. According to Ajtay, Ketner, and Duvigneaud, temperate forest carbon is distributed as follows: living vegetal biomass (66%), dead vegetal material (2.4%), litter (4.4%), animals (0.03%), and soil itself. As such, the quantities denoted in Table 3 should be increased accordingly to account for the other pools.

**Chilean Forest Carbon Stocks: Valdivian and Magellanic Forests**

Studies done in Chile show that total carbon stock for Valdivian evergreen old growth stands reaches 606.80 tons per hectare (Keith, Mackey, and Lindenmayer; Gayoso). However, there is variation in forest carbon stocks in different regions of Chile. Schlegel (2001), measured the same forest type composition (Valdivian evergreen forests) in two different locations: between latitudes 39°49’ y 40°36’ south, and 200 to 880 meters above the sea level. According Schlegel (2001), the amount of carbon stored per hectare in Chilean forests is higher than that of other Northern Hemisphere tropical and temperate forests. In addition, other studies have demonstrated the contribution of carbon stock from other forest pools, such as understory vegetation. According to Torres (2001), carbon stored the dense understory of coastal Valdivian temperate forests can reach 1.2 tons of carbon per hectare (Torres).

Despite the lack of specific studies of carbon pools and flux within Patagonia Sur forests, these data allow for carbon storage amounts to be extrapolated. Table 4 shows a conservative estimation of carbon stock in Melimoyu’s forests, using the estimated 85% cover, which gives a forest area of approximately 13,600 hectares. It is important to note that this is a very preliminary estimate that
does not include field information, which reduces the accuracy level. Furthermore, it does not consider other carbon pools such as litter, soil, and dead organic matter.

Table 4: Preliminary Estimation of Carbon Stocks in Melimoyu Forests

<table>
<thead>
<tr>
<th>Melimoyu’s forests (forest type, structure, canopy coverage)</th>
<th>Surface (ha)</th>
<th>Carbon stock range (tC/ha)</th>
<th>Minimum Total Carbon Stock (tC)</th>
<th>Maximum Total Carbon Stock (tC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprés de las Guaytecas - Stunted forest (50-75%)</td>
<td>98</td>
<td>80 - 100</td>
<td>7,865</td>
<td>9,831</td>
</tr>
<tr>
<td>Lenga- Stunted forest (&gt;75%)</td>
<td>72</td>
<td>32 - 40</td>
<td>2,292</td>
<td>2,864</td>
</tr>
<tr>
<td>Lenga- Stunted forest (50-75%)</td>
<td>1,309</td>
<td>24 - 32</td>
<td>31,421</td>
<td>41,894</td>
</tr>
<tr>
<td>Lenga-Stunted forest (25-50%)</td>
<td>19</td>
<td>16 - 24</td>
<td>296</td>
<td>445</td>
</tr>
<tr>
<td>Siempreverde - Second-growth forest (&gt;75%)</td>
<td>173</td>
<td>100 - 122</td>
<td>17,331</td>
<td>21,144</td>
</tr>
<tr>
<td>Siempreverde - First Growth Native Forest (&gt;75%)</td>
<td>5,230</td>
<td>151 - 182</td>
<td>789,684</td>
<td>951,805</td>
</tr>
<tr>
<td>Siempreverde - First Growth Native Forest (50-75%)</td>
<td>3,694</td>
<td>121 - 151</td>
<td>446,944</td>
<td>557,757</td>
</tr>
<tr>
<td>Siempreverde - Stunted forest (&gt;75%)</td>
<td>1,331</td>
<td>100 - 122</td>
<td>133,129</td>
<td>162,417</td>
</tr>
<tr>
<td>Siempreverde - Stunted forest (50-75%)</td>
<td>1,689</td>
<td>80 - 100</td>
<td>135,137</td>
<td>168,921</td>
</tr>
<tr>
<td>Siempreverde -Stunted forest (25-50%)</td>
<td>152</td>
<td>60 - 80</td>
<td>9,108</td>
<td>12,144</td>
</tr>
<tr>
<td><strong>Total (above-ground carbon stock)</strong></td>
<td><strong>1,573,207</strong></td>
<td></td>
<td><strong>1,929,222</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total including below-ground factor (R=0.24)</strong></td>
<td><strong>1,950,776</strong></td>
<td></td>
<td><strong>2,392,235</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Carbon Stock Ranges for Selected Chilean Forest Types

<table>
<thead>
<tr>
<th>Forest (by type and structure)</th>
<th>Carbon Stock (tC/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenga – First growth forest</td>
<td>122 – 212</td>
</tr>
<tr>
<td>Lenga – Secondary growth forest</td>
<td>16 – 40</td>
</tr>
<tr>
<td>Siempreverde- First growth forest</td>
<td>91 – 182</td>
</tr>
<tr>
<td>Siempreverde - Second growth forest</td>
<td>60 - 122</td>
</tr>
<tr>
<td>Coigue de Magallanes - First growth forest</td>
<td>122-212</td>
</tr>
<tr>
<td>Coigue de Magallanes - Second growth forest</td>
<td>11 – 69</td>
</tr>
</tbody>
</table>

One of the most important prerequisites to REDD project qualification is proving the existence of a substantial threat(s) to the land under consideration (Parker and Mitchell). In fact, after the forest itself, the existence of a quantifiable threat to the forest is the most essential project requirement. Establishing a threat is the basis for the claim that, if the area is not protected by REDD, the land will suffer deforestation or degradation. Threats can be established by quantifying historic deforestation or degradation activities or by demonstrating the existence of a future threat, with examples including planned roads and/or zoning changes that may result in land use changes (Parker and Mitchell). Determining and establishing threats to the forest is essential to creating a baseline scenario to compare carbon stock and emissions levels. In areas with high forest cover and low deforestation rates, such as Melimoyu, crediting would need to be based on a demonstrated future threat, not just past activity (Holloway and Giandomenico).

**Threats identified**

In our research, we identified a variety of possible threats and assessed the degree to which they posed any danger to Melimoyu. At this time, based on the available information, none of the following threats is substantial enough to validate a REDD project. It is important to understand that the region is currently experiencing a natural recovery of its native forests (Yankovic). However, the nature of these threats is dynamic, and therefore, we have framed our analysis in terms of both current and future threats to monitor.

The threats are examined from those of greatest to least concern: 1) mining industrial presence, 2) salmon farming, 3) Infrastructure, such as roads, 4) public works projects, 5) population growth and development, and 6) forest fires.

1. **Mining industrial presence**

According to information from the National Service of Geology and Mining of Chile, there are mining concessions within Patagonia Sur’s Melimoyu property (Sernageomin). However, the report is not explicit in describing the degree of exploration interest for the concessions on the Melimoyu lands. Chilean laws that govern land tenure and specifically govern the separation of mineral rights from the land property rights. The Constitution of the Republic of Chile, Article 19, nº 24 states that, "The State has absolute, exclusive, inalienable and imprescriptible domain over all mines...despite the ownership held by individuals or body corporates over the land in which the above should be contained" (Constitution of the Republic of Chile).
Concessions for exploration or exploitation can be established by the state company, Codelco, or by private companies. They are granted permits to explore for minerals under property owned by the state, citizens, or private corporations. In the event of an exploratory concession resulting in a finding that there is a significant presence of minerals to acquire, the private mining firm can explore or extract the natural resource.

The law determines what is subject to exploration or exploitation, and that these concessions should be established by court decision that obligates the property owner to follow court order. The law also affords the President of the Republic the authority to terminate concessions if deemed important to national security. With this framework, it is important to understand that concessions can be formed to explore for minerals under the Melimoyu lands, and these rights have primary standing regardless of land ownership or other current legal protections.

Therefore, mining is considered a potential future threat due to its potential impact on the permanence of conservation efforts for the native forest. Due to the fact that the impact from mining would depend on the surface area affected by each concession and the specific activities involved, this is an assessment that we are unable to make with the available information.

Additionally, the abundance of peat in Melimoyu requires consideration of mining interests. Melimoyu is a mosaic of forest and peat lands, which make up approximately one-third of the property. Peat is a carbon intensive fuel source, and when harvested, vast quantities of carbon could be released into the atmosphere. In Chile, the extraction of peat is governed under the mining code. While it is believed that the landowner – in this case Patagonia Sur - has rights to above ground mining resources, this has not been established with certainty.

2. Aquaculture - Salmon farming

Chile is currently the second largest aquaculture producer of salmon in the world, and in general the industry has undergone tremendous growth since its beginnings in the 1980s (Science Daily). After a 2007 outbreak of infectious salmon anemia (ISA) killed millions of salmon and devastated production, Chile’s production of Atlantic and Coho salmon and trout have been recovering. Production of these fish peaked in 2008 at approximately 700,000 metric tons; in 2010 production was 429,000 metric tons as the industry recovered. With new rules requiring certain distances between farms and fallow periods, ISA has largely been managed and the industry is determined to once again increase output. For instance, Chile has goals to increase its production of Atlantic salmon from 120,000 tons in 2010 to 300,000 tons by 2013 (Thomson).

After the ISA outbreak, the salmon farming industry turned to expanding into southern waters, which were pristine and virus free. In the Aysen region, 1,500 requests for new salmon
concessions are currently under review (Patagon Journal). Environmental problems associated with salmon farming include loss of biodiversity in bottom-dwelling organisms, changes in the properties of sediments, as well as increased nutrient and pollutant inputs (Leon-Munoz et al.). Although concerns about the environmental impacts of salmon farming are focused on aquatic ecosystems, growth of the industry in the area could threaten the native forest, as an increased number of concessions would lead to a greater number of people living in the area, and potentially increased development pressure. Currently, there are five farms in operation with seven concessions, and at this point, there is minimal impact on the forest. The industry currently transports salmon out of the area via boats and planes (Leon-Munoz et al.). While this may be in part because road transportation is not a currently a viable option in Melimoyu, regardless, the government appears to be focusing on enhancing connectivity by improving its existing piers and airfields (Plan Conectividad Austral).

We believe this threat, while not posing an immediate forest degradation risk, is particularly dynamic in nature; the level of risk to the overall area could rapidly expand or create new (and REDD-relevant) threats related to degradation or expanded development. Regardless of its impact upon REDD feasibility, it is important to note that substantial degradation of the aquatic environment could greatly harm the overall natural value of the area.

3. Road infrastructure

Our team believes that one of the potentially critical threats to Melimoyu’s forests would be the construction of roads either in close proximity to or through the property. A road was planned many years ago to connect Melimoyu with Raul Marin Balmaceda. This road would cut directly through Patagonia Sur’s property (Tepper). The road itself would not deforest a significant portion of the land, but there is concern over the indirect consequences of its presence. If constructed, the road’s presence could accelerate development and lead to the intensification of all the threats discussed, in particular land fragmentation; this would then require a new assessment of the threats to the property for qualification as a REDD project. However, due to the low population density in the Melimoyu area, there appears to be little incentive to build the costly road. Therefore, the long-standing plan may not pose a significant threat in the foreseeable future.

A different road, planned to connect Melimoyu to the Carretera Austral, which is the main road through Chile’s austral territories, was partially constructed around 1986 by the military government. However, the project was abandoned due to rugged terrain, high cost, and emergence of other government priorities. While it remains a planned government project, it currently has neither financing nor priority (Yankovic). Yet, since the plan is still documented, it constitutes a potential threat to the forest.

4. Public works projects

In the Chilean Winter Rainfall-Valdivian Forests region, the construction of highways and hydroelectric complexes are important threats to native ecosystems (Plan Conectividad Austral). The Environmental and Social Baseline study for the Melimoyu properties similarly identified hydropower development as a potential threat to the region (INFOR, Baseline Study, Reforestation Project in Degraded Lands in the California Valley, Municipality of Palena, Los Lagos Region). The Aysén Hydroelectric Complex consists of five dams in Region XI, two on the Baker River and three on the Pascua River, with a high-voltage direct current to be built between Aysén and Santiago to feed the Sistema Interconectado Central, which is the main power grid in Chile (Doman et al.).
Mining concessions are often used to hold land that the transmission lines are planned to cross through. Therefore, by tracing them it has been established that the transmission lines are unlikely to pass through the Melimoyu property (Orizola). The improbability of transmission lines passing through Melimoyu is compounded by the natural rugged layout of the land. The steep and hilly terrain of the area makes mobilization and construction difficult (Orizola). Nevertheless, this project should be monitored.

**Figure 4: Potential threats to Melimoyu lands**
5. Population and development
Currently, a small population of approximately ten families reside near the Melimoyu property (Landea). Due to the low number of people and types of activities, which include firewood gathering and limited rearing of livestock, these families probably have minimal impact on the land. Livestock species include sheep, oxen, horses, and goats, but in general, cattle ranching, which has been a major driver of deforestation elsewhere, is very rare in this area (Yankovic). Since families obtain their wood from public (CONAF) lands in the region, Patagonia Sur’s lands are perhaps not as vulnerable to this activity as they would be in other regions (Yancovic). Similarly, although poorly planned and implemented tourism facilities are another common threat that can result in unsustainable development, Patagonia Sur’s oversight of this activity within its properties makes it less of a concern (Tepper).

6. Forest fires
Local history indicates that the first settlers attempted to convert land in the area for cattle ranching through the use of forest fires. Yet, due to the humidity of the forests and the kinds of vegetation present, the fires were difficult to spread. The exception to this low fire risk is following a quila bloom. Quila is a perennial bamboo that grows in the humid temperate forests of Chile and Argentina. Every 15 years, large extensions of land are covered by quila (quila bloom or quila flowering). After this period, the quila dries, and the risk of forest fires increases. The small number of settlers currently living in the area, and the lack of interest in pursuing agricultural activities, render forest fires less of a threat (Yankovic). The available data leads us to believe that overall, forest fires are an identifiable, yet likely not imminent, minor threat.

Baseline, Permanence, and Leakage in the Patagonian Context
Determining and quantifying present and future threats is necessary to establish a baseline. However, as previously stated, a historical deforestation or degradation rate does not exist for Melimoyu. Therefore, quantification of future threats to the native forest, such as the construction of roads and/or mining concessions, and a method to address such threats are required to establish the baseline and project scenarios.

Two other factors of concern are permanence and leakage. As previously described, the influence of the mining sector threatens the permanence of potential REDD projects in Chile. Additionally, to establish permanence, it must be determined how the activities of a REDD project would protect the native forest against relevant threats to ensure its conservation and avoid degradation. With leakage, elimination of the road plan would not pose a risk; however, a change in the route of the road would result in a land use change outside Patagonia Sur’s lands. Construction plans for the road connecting Melimoyu to Raul Marin Balmaceda could be revised so the proposed path goes around, rather than through, the Melimoyu property - creating a leakage concern. Alternatively, plans for the road could be cancelled, eliminating the baseline risk and risk of leakage. Leakage could also be an issue if the mining concessions are removed, as the mining and/or exploration could move to another property.
The technical feasibility of a REDD project is greatly influenced by the availability of a certified methodology suited to the project. Although our environmental research did not identify any imminent threats to Patagonia Sur’s properties, methodological feasibility is relevant because the nature of these threats are dynamic; in the Patagonian context, it is still important to understand the available methodologies.

The Verified Carbon Standard Methodology
The Verified Carbon Standard (VCS) is a leading GHG crediting program in the voluntary market. Carbon offsets approved by VCS are registered and traded as Voluntary Carbon Units (VCUs) in voluntary over-the-counter offset markets. Each VCU represents GHG emission reductions of 1 metric ton of CO₂ (Verified Carbon Standard).

Jointly launched in 2007 by The Climate Group, the International Emissions Trading Association, the World Economic Forum, and the World Business Council for Sustainable Development, this standard was updated yearly for the first two years and every two years after that. Effective March 8, 2011, all projects should comply with the latest VCS Version (Version 3) requirements.

VCS is considered one of the few premium voluntary standards available in the market. It is used in more than 600 projects worldwide, ranging from forest conservation to renewable energy, mining, manufacturing and waste disposal. The VCS program relies on four pillars: VCS Standard, Methodologies, Validation & Verification, and Registry System. These pillars aim to ensure that projects using VCS meet all project-level assurances required by this methodology. Figure 5 outlines these pillars.

VCS and REDD
Although there are several third-party certification schemes that can be used to verify voluntary emission reduction projects, we focused on VCS because it is one of the most well-established and stable methodologies available. At the time of writing, VCS had approved eleven Agriculture, Forestry and Land Use methodologies, of which five are applicable to REDD projects (see Table 6). VCS approved its first REDD methodology in August 2010 and issued its first REDD carbon credits in February 2011.

Apart from VCS, two other third-party carbon certification systems - Plan Vivo and American Carbon Registry - also have approved REDD methodologies and issued REDD-related carbon credits. However, VCS remains the leading third-party certification system in the voluntary carbon market – making up 34% market share of VERs traded in the over-the-counter market in 2010. Over 90% of VCS forestry credits were from REDD activities (Shoch, Eaton, and Settelmyer).
Applicability of VCS REDD Methodologies for Patagonia Sur’s Properties

As the threats faced by Patagonia Sur’s properties are likely to be degradation and deforestation-related, we chose to exclude REDD methodologies VM0004, VM0009, and VM00015, which do not take into account degradation, from further consideration. Moreover, VM0004 and VM0009 relate to tropical forests, which are not present in Patagonia Sur’s lands.

The two existing VCS methodologies that relate to activities that avoid unplanned deforestation and degradation (AUDD) are VM0006 and VM0007. It is also important to note that VCS further classifies AUDD projects on the basis of the spatial configuration in which deforestation takes place (Shoch, Eaton, and Settelmyer). Mosaic configuration refers to deforestation or degradation that occurs in a scattered, patchwork-like pattern, typically as a result of local agents living in the immediate vicinity of a forest that is easily accessible from across the landscape (e.g. human populations and associated agriculture activities), whereas frontier configuration refers to deforestation

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Table 6: VCS Agriculture, Forestry and Land Use Methodologies

<table>
<thead>
<tr>
<th>Methodology ID</th>
<th>Methodology description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM0004</td>
<td>Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests, v1.0</td>
</tr>
<tr>
<td>VM0006</td>
<td>Methodology for Carbon Accounting in Project Activities that Reduce Emissions from Mosaic Deforestation and Degradation, v1.0</td>
</tr>
<tr>
<td>VM0007</td>
<td>REDD Methodology Modules (REDD-MF), v1.1</td>
</tr>
<tr>
<td>VM0009</td>
<td>Methodology for Avoided Mosaic Deforestation of Tropical Forests, v1.1</td>
</tr>
<tr>
<td>VM0015</td>
<td>Methodology for Avoided Unplanned Deforestation, v1.0</td>
</tr>
</tbody>
</table>

---

Figure 5: The Four Pillars of VCS
Source: Verified Carbon Standard
tion or degradation that occurs as discrete “fronts,” which progress steadily across a large area of intact forest (Shoch, Eaton, and Settelmyer).

Below is a brief description of the two methodologies that may represent the closest fit for a REDD project in Patagonia Sur lands in the future, given the threat agents previously identified.

**VM0006—Methodology for Carbon Accounting in Project Activities that Reduce Emissions from Mosaic Deforestation and Degradation, v1.0**

This methodology applies to projects that aim to avoid unplanned deforestation and forest degradation in a mosaic configuration. Through this methodology, deforestation and/or degradation can be reduced by strengthening land-tenure status, developing sustainable forest and land use management plans, protecting forest through patrolling of forests and forest boundaries, capacity building, preventing fire and introducing fuel-efficient wood-stoves and mosquito nets for livestock (Verified Carbon Standard, “VM0006 - Methodology for Carbon Accounting in Project Activities That Reduce Emissions from Mosaic Deforestation and Degradation, V1.0”).

VM0006 is typically used in projects where forests are threatened by activities such as land conversion of forest into crop-land or pasture-land for small-scale farming, land use change due to human settlements, logging of timber for commercial or local use, forest fires and fuel-wood collection of charcoal production (Shoch, Eaton, and Settelmyer).

**VM0007—REDD Methodology Modules**

This methodology provides a series of modules for reducing emissions from deforestation, and is applicable to projects in which forested lands would be deforested or degraded if the project did not take place. The methodology includes a module for project activities to reduce emissions from forest degradation caused by extraction of wood for fuel, but no modules are included for activities to reduce emissions from forest degradation caused by illegal harvesting of trees for timber (Verified Carbon Standard, “VM0007 - REDD Methodology Modules (REDD-MF), V1.1”). Additionally, restrictions are evident within VM0007 to delineate a project area that is void of Peat swamp or wetlands. Therefore, the peatland in Melimoyu would make application of this methodology difficult.

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**Case Study: Noel Kempff Mercado National Park REDD Project, Bolivia**

Although it was eventually certified under CDM, this project was used by VCS to exemplify many of the necessary conditions for REDD development. At over 642,500 hectares, this collaborative project between the Nature Conservancy, an international energy company, and a local NGO, addresses a broad set of issues such as biodiversity conservation, ecosystem services, and deforestation reduction (Conserve Online). This project incorporated both the purchase of surrounding land parcels to buffer against illegal logging and the purchase of the logging concessions on the original parcels to further mitigate threats. The importance of this case is seen within the discussion over the *Servidumbre Ecológica* and the question of whether such a contract negates the threat level. The adjacent parcels were purchased to utilize natural boundaries for buffer advantages (in this case surrounding rivers) and the land that no longer was threatened due to the purchase of logging concessions was not available for gaining credits. Relevance for such a project in Melimoyu under VCS would be: 1) certain methodologies will only certify existing land holdings and cannot be modified later to subsume additional lands purchased after certification, “geographic boundaries are fixed and cannot change over the life of the project,” 2) the relevance of a *Servidumbre Ecológica* contract or the potential *Derecho Real de Conservacion* warrants further consideration, and 3) no two projects or certifications can be on the same parcel, meaning any property already contracted to provide offsets would not be applicable for VCS certification (The Nature Conservancy).
Project developers also have the option of developing new methodologies if current methodologies do not fully address their needs. The VCS Methodology Approval Process (MAP) will assess and independently validate any newly proposed methodologies to ensure they meet the requirements of the four VCS pillars. It is important to note that this option is costly and requires significant time and resource commitment, but is encouraged if no suitable methodology exists.

**Unavailable Data**
Although VCS methodologies exist which specifically deal with forest degradation, there is insufficient information at this juncture regarding levels of degradation and deforestation threats as well as remote sensing data to build baseline scenarios in order to accurately determine the applicability of VM0006 and VM0007 (or any other existing methodology) to Patagonia Sur’s properties.

Photo Credit: Rafaela Landea
Although no imminent threats to Melimoyu were identified over the course of this research, we decided to conduct a simulation exercise in order to assess what the economic feasibility of a REDD project would be if threats did exist.

In determining the economic feasibility of a REDD project, the associated costs must be analyzed. Transactional costs include the costs of quantifying existing carbon stocks, measuring and monitoring changes in carbon stocks (including the monitoring of leakage), external verification of monitoring results, the preparation and external validation of project documentation, and potential registration fees (Eco Securities). Implementation costs are highly variable and context-specific. Cost factors for underlying activities may include the enforcement of forestry and land-use regulations, improved forest management, intensified agricultural production, enhanced land use and infrastructure planning, and local and national capacity building (Ecosur).

The economic model determines the monetary value of executing a REDD project based on carbon crediting. For our purposes, we adapted the SocialCarbon, Climate, Community and Biodiversity Alliance (CCBA) REDD economic feasibility tool to form a conceptual model for Patagonia Sur’s property in Melimoyu (Verified Carbon Standard, “VCS Agriculture, Forestry, Land Use Methodologies”).

It should be understood that this is a model only, and that its results are estimates; it is intended to provide an overview of the requirements and steps to consider when estimating potential economic returns of a REDD project.

The model is broken into two components: 1) Emissions Reduction; and 2) Financial Analysis. Detailed below is the information required and the assumptions behind the various input values used in the economic modeling to determine the net present value (NPV) of the REDD project on Patagonia Sur’s property in Melimoyu.
### Table 7: Model Inputs, Value and Description

<table>
<thead>
<tr>
<th>Input</th>
<th>Value</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total project area (hectares)</strong>: area of measured carbon stocks and greenhouse gas emissions.</td>
<td><strong>13,600</strong></td>
<td>85% of the 16,000 hectares of Melimoyu's surface area is native forests.</td>
</tr>
<tr>
<td><strong>Baseline deforestation rate (%/yr)</strong>: estimated average deforestation rate if the project is not implemented.</td>
<td><strong>0.10%</strong></td>
<td>Melimoyu's deforestation rate is based on literature review of the environmental components. It is less than 10.42 ha/yr or 0.07% and increased it to 0.10% to include estimated degradation.</td>
</tr>
<tr>
<td><strong>Projected deforestation rate for the first 5 years of project implementation (%/yr)</strong>: projected average deforestation rate during the first five years of project activities.</td>
<td><strong>0.00%</strong></td>
<td>No deforestation value based on an assumption that a project would completely eliminate the low levels of deforestation.</td>
</tr>
<tr>
<td><strong>Projected deforestation rate after 5th year of project implementation (%/yr)</strong>: projected average deforestation rate after the first five years of project activities until the end of the life of the project.</td>
<td><strong>0.00%</strong></td>
<td>No deforestation value based on an assumption that a project would completely eliminate the low levels of deforestation.</td>
</tr>
<tr>
<td><strong>Average carbon stock in intact forest in the project area (tCO2eq/ha)</strong>: May include above ground, below ground, and dead carbon pools.</td>
<td><strong>200</strong></td>
<td>Melimoyu total carbon stock (13,600 ha) = 1,950,776 - 2,392,235 tC. Melimoyu carbon per hectare = 143 - 176 tC/ha. These data don’t consider C stock in soil, dead material, understory and litter (ca 35% additional). If we want to consider those pools, we should multiply by 1.35, then Melimoyu carbon per hectare = 193 - 232 tC/ha. Use 200 tCO2eq/ha as a moderately conservative estimate.</td>
</tr>
<tr>
<td><strong>Average carbon stock of land after conversion (tCO2eq/ha)</strong>: the carbon stock of the land after it is deforested and converted to other use.</td>
<td><strong>0</strong></td>
<td>Includes an assessment of the same pools as above, and the assumption that deforested land would not have remaining carbon stock.</td>
</tr>
<tr>
<td><strong>Project Lifetime (years)</strong>: the period during which emissions reductions will be monitored.</td>
<td><strong>40</strong></td>
<td>Based on the standard length of other projects.</td>
</tr>
<tr>
<td><strong>Non-permanence buffer (%)</strong>: % of credits generated that must be deposited in a fund used to insure against non-permanence. This is a requirement of certification schemes like the Voluntary Carbon Standard.</td>
<td><strong>30%</strong></td>
<td>The buffer amount depends on an assessment of project risk. The Agriculture Forestry and Other Land Use’s (AFOLU’s) Non-Permanence Risk Tool provides risk analysis tool that is used to determine the buffer area. <em>Please see Appendix A for full assumptions.</em></td>
</tr>
</tbody>
</table>
2. Financial Analysis

a. Financial Assumptions

Table 8: Financial Assumptions

<table>
<thead>
<tr>
<th>Input</th>
<th>Value</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale Price of credits ($)</td>
<td>$5.00</td>
<td>Based on the current range of carbon prices at 15 cents to $10.</td>
</tr>
<tr>
<td>Brokerage fee (%)</td>
<td>7.50%</td>
<td>From example model</td>
</tr>
<tr>
<td>Registration ($/tCO2e)</td>
<td>$0.05</td>
<td>From example model</td>
</tr>
<tr>
<td>Certification fee ($/tCO2e)</td>
<td>$0.03</td>
<td>From example model</td>
</tr>
<tr>
<td>Sales Tax (if applicable) (%)</td>
<td>0.00%</td>
<td>Standard Rate</td>
</tr>
<tr>
<td>Tax on net income (if applicable)</td>
<td>18.50%</td>
<td>Standard Rate</td>
</tr>
</tbody>
</table>

b. Project Cycle Costs

All of the figures below were estimated by comparing the fixed start up and implementation costs of other projects, specifically an initiative in Brazil. The workshop team consulted with a consultant for CINCS, an asset management company that offers ways to create and monetize carbon offsets and credits for land use projects. The consultant's knowledge and work experience influenced our estimated costs for the economic model based on a specific early operational initiative in Brazil. For example, the PDD cost was estimated to be a relatively standard and fixed cost that was less dependent on project size; the validation/verification costs were recommended by the consultant as the likely range, and we used our own knowledge about Melimoyu's smaller economy-of-scale to adjust the estimate by one-third.

Table 9: Carbon Project Costs

<table>
<thead>
<tr>
<th>Carbon Project Cycle Costs¹</th>
<th>Startup costs year 0</th>
<th>Costs every year</th>
<th>Costs every 5-6 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>REDD Investment - Project Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Design Document (PDD)</td>
<td>-$200,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation (Audit PDD)</td>
<td>-$20,000</td>
<td>-$10,000</td>
<td></td>
</tr>
<tr>
<td>Activities to reduce deforestation</td>
<td>-$5,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental monitoring</td>
<td>-$10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social monitoring</td>
<td>-$10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon stock monitoring and modeling adjustment</td>
<td>-$60,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification (Audit monitoring reports)</td>
<td>-$14,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration fees</td>
<td>-$654</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certification fees</td>
<td>-$392</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brokerage fees</td>
<td>-$4,904</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project Cycle Costs</td>
<td>-$220,000</td>
<td>-$5,000</td>
<td>-$109,950</td>
</tr>
</tbody>
</table>

¹Refer to Appendix B for full cost assumptions.
c. Estimated Project Totals

The final project value gave a negative net present value (NPV) of approximately $359,000. The emissions reduction is very minor. Even if Patagonia Sur doubles the size of the land holdings around Melimoyu, due to the low degradation and deforestation rate, the NPV would still be negative. Since this model was estimated based on many assumptions and best estimates, the results should be considered cautiously; however, the model provides the basic concepts and information required for model development. It was determined that the main driver of the negative NPV was the large start up and implementation costs and the small size of the project area with low deforestation.

Tables 10 and 11 demonstrate our sensitivity analysis for this NPV for larger project areas, varied discount rates, three different carbon prices, and different deforestation rates. Currently optimistic carbon prices of $5 and over are evaluated.

**Table 10. Sensitivity Analysis for NPV Assuming 0.1% Deforestation Rate**

<table>
<thead>
<tr>
<th>Land Area (ha)</th>
<th>Carbon Price</th>
<th>7%</th>
<th>10%</th>
<th>13%</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
<td>$5</td>
<td>-$308,560</td>
<td>-$285,710</td>
<td>-$272,144</td>
</tr>
<tr>
<td></td>
<td>$7</td>
<td>-$235,788</td>
<td>-$235,391</td>
<td>-$235,101</td>
</tr>
<tr>
<td></td>
<td>$10</td>
<td>-$126,945</td>
<td>-$160,017</td>
<td>-$179,572</td>
</tr>
<tr>
<td>50,000</td>
<td>$5</td>
<td>-$189,737</td>
<td>-$203,474</td>
<td>-$211,568</td>
</tr>
<tr>
<td></td>
<td>$7</td>
<td>-$68,800</td>
<td>-$119,724</td>
<td>-$149,870</td>
</tr>
<tr>
<td></td>
<td>$10</td>
<td>$112,605</td>
<td>$5,900</td>
<td>$57,322</td>
</tr>
<tr>
<td>100,000</td>
<td>$5</td>
<td>$106,797</td>
<td>$1,944</td>
<td>-$60,189</td>
</tr>
<tr>
<td></td>
<td>$7</td>
<td>$348,670</td>
<td>$169,443</td>
<td>$63,208</td>
</tr>
<tr>
<td></td>
<td>$10</td>
<td>$711,480</td>
<td>$420,691</td>
<td>$248,303</td>
</tr>
</tbody>
</table>
The project value is dependent on a high carbon price, low interest rate, and higher deforestation rates. The net value is only positive at a land area of 50,000 and greater if the price is above $10 and interest rate is at or below 10%. At the 13% discount interest rate and price of $5, a positive financial return requires 100,000 hectares. For future land purposes, targeting larger parcels of land areas with quantifiable threats would be key to pursuing a REDD project.

Table 11: Sensitivity Analysis For NPV, Assuming 0.3% Deforestation Rate

<table>
<thead>
<tr>
<th>Land Area (ha)</th>
<th>Carbon Price</th>
<th>Interest rate 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>50,000</td>
<td>$5</td>
<td>$196,182</td>
</tr>
<tr>
<td></td>
<td>$7</td>
<td>$442,869</td>
</tr>
<tr>
<td></td>
<td>$10</td>
<td>$812,901</td>
</tr>
<tr>
<td>100,000</td>
<td>$5</td>
<td>$801,254</td>
</tr>
<tr>
<td></td>
<td>$7</td>
<td>$1,294,630</td>
</tr>
<tr>
<td></td>
<td>$10</td>
<td>$2,034,692</td>
</tr>
</tbody>
</table>

Sources for Tables 10 and 11*: “Dow Jones LATixx Chile Government Peso Bond Index Fact Sheet”; “Dow Jones LATixx Chile Corporate Bond Dur 9+ UF Index Fact Sheet”; “Dow Jones LATixx Chile Fixed Income Index Fact Sheet”

*Index rates were used to estimate appropriate discount rates for the economic model and sensitivity analysis.
After examining different indicators of REDD readiness, our team has concluded that Chile’s governmental institutions do not appear to be fully prepared for REDD. On the international front, although Chile is member of UN-REDD, it is currently an observer nation, so it does not receive financial support (UN-REDD Programme, “National Programmes”). At the national level, Chile is developing its national strategy for REDD projects, but it remains in draft form and may not be finalized for some time. A national strategy is a policy framework that seeks to identify drivers of deforestation and a method to reward activities that reduce these factors (The Forestry Commission of Ghana). National strategies have been identified as potential contributors to successful REDD projects, since having a national strategy can help avoid problems with leakage while ensuring permanence and reliable monitoring, reporting, and verification (Phelps, Webb, and Agrawal). Chile has emphasized alternative conservation efforts, for instance its recent partnership with Switzerland to develop a forestry based mitigation project, which will likely be part of the Nationally Appropriate Mitigation Action (NAMA).

Regardless, international climate change negotiations for mandatory carbon markets have not as yet focused on including REDD (UNEP). As a result, carbon offset transactions related to REDD activities can only be successful in voluntary markets. This will remain the case until the UNFCCC agrees upon and implements an international REDD mechanism. Once this occurs, initiatives will have support from government funds and/or tradable credits. Despite existing uncertainties, Chile has submitted an R-PIN, an initial preparation document that provides an outline of the current country context, and REDD-relevant organizations, institutions and sectors, to the FCPF to prepare for a possible REDD scheme in the future (The Forestry Commission of Ghana). Currently, there is little interest in pursuing REDD projects in southern Chile, due to the low rates of deforestation in the region. Instead, the principal problem is forest degradation, which is more difficult to measure and prove, and thus, complicates the pursuit of a REDD project.

INFOR, a forest institute within the Chilean Ministry of Agriculture, is proposing a new system for conducting inventories of Chilean forest ecosystems that would be periodically updated, but it not yet available. Additionally, CONAF - Chilean’s National Forest Corporation, a government agency that is part of Chile’s Agriculture Ministry - and INFOR have not agreed on the implementation of and distribution of responsibilities for this potential new tool for gathering information.
The Servidumbre Ecologica- Chile’s Current Conservation Easement and REDD

While similar in function to US conservation easements, Chilean servidumbre ecologicas vary according to the parties involved, and as such, the strength and conditions of the agreement vary. We do not have specific legal knowledge of the servidumbre ecologica contracts that may or may not apply to Patagonia Sur’s properties. The organization has been proactively shaping these agreements, but the team has not specifically determined the extent or nature of the agreements. Even if each property is protected, the relevance of servidumbre ecologicas to REDD in Patagonia is uncertain. The progress, extent, and type of the agreements determine how effectively the land is conserved. Relevant questions that may affect this issue are: Who are the main parties? Are any of the agreements made with mining companies or the government, or with other private landowners (and if so, what were the specific terms of the agreement)? A party that already is protected or reinforced by Chilean laws and institutions (case law or legal precedents, legal rights such as eminent domain), such as the Chilean government or a mining company, could likely enact a lasting agreement. But our team believes that because there is no designated, external third authority, if a party does not have the legal power to enforce the full intent of the servidumbre ecologica could form a less lasting and less effective agreement than a full, formal conservation easement law. As such, we do not believe that the existence of the agreement precludes a REDD project with certainty.
Project Recommendations
Our analysis of the available data led us to conclude that under current known conditions, a REDD project in Patagonia Sur properties is not feasible.

The main factor contributing to this conclusion was the lack of evidence showing imminent and significant degradation or deforestation threats.

However, the wide range of threats—however negligible they may currently be—as well as the nascent stage of several supportive Chilean policies, and the rapid observed changes occurring in the carbon market, lead us to believe that a REDD project could become feasible in the medium to long-term future.

One example of progress being made, but still lacking certainty and finality, is the Derecho Real de Conservación; if this legislation were to pass, there may be greater promise for conservation rights. However, this bill is not yet a law, and it is still unclear how it would incentivize landowners to conserve their forests. Additionally, the Chilean government does not prioritize REDD, largely because of the perceived current low deforestation rates nationally and the lack of data regarding degradation. As such, in addition to the current lack of threats, we cannot sufficiently establish a favorable condition for REDD.

The “in progress, yet uncertain” diagnosis also applies to the findings regarding REDD certification methods. Assuming that a combination of valid threats emerges, technical hurdles remain. While the available environmental data was insufficient to determine with certainty whether existing VCS methodologies would be applicable, we believe that they would not be, and that Patagonia Sur would need to either modify an existing methodology or create a new one.

Crediting for REDD is a fairly recent development for VCS and other third-party certification schemes, and there has been a proliferation of new REDD methodologies. Yet, very often these methodologies are developed with specific projects in mind. While there are currently two VCS REDD methodologies that attempt to address both degradation and deforestation, neither was designed with Chilean temperate for-
ests and specific threats in mind. Moreover, some of the first REDD methodologies were developed through the VCS Methodology Approval Process, so in the future, if potential threats are developed, Patagonia Sur should consider either pursuing a new methodology or altering an existing methodology to be appropriate for the specific conditions of their forest lands.

Using a methodology of suboptimal fit could result in the underestimation of the total emissions avoided or/and higher costs due to onerous requirements, thus undermining the economic prospect of a REDD project.

Additionally, our economic model highlines the challenges a current REDD project would face, as well as highlighting components that could contribute to an economically successful project. The small land area and low threat levels, combined with uncertainty of carbon prices and costs associated with project development, resulted in a wide range of net present values when these factors were varied. The results suggest that even if threats and an appropriate VCS methodology do exist, Patagonia Sur should consider what effects project boundary changes – that is, the acquisition and combination of lands – might have on economic efficacy before pursuing a future REDD project.

Although we do not believe a REDD project would be feasible at the current time, we must emphasize that Patagonia Sur ought to prepare for REDD, given the potential of development resulting from mining concessions, salmon farms, and road construction. The environmental, economic, technical, and policy findings we present are dynamic and changing; therefore we have provided several recommendations for how Patagonia Sur may re-evaluate feasibility going forward.
Further Recommendations

Based on our findings and research, our team provides a number of recommendations that we believe would greatly improve Patagonia Sur’s ability to implement a REDD project, should conditions become appropriate. Furthermore, we believe that these recommendations, in addition to being essential to the preparation for a REDD project, also support other activities or goals of the Patagonia Sur Foundation as well as those of Patagonia Sur LLC.

We encourage our client to expand or develop: 1) a strategy of environmental data collection and monitoring, 2) institutional and community partnership building, and 3) legislative and policy tracking, to ensure the right implementation of REDD, under the appropriate conditions. The goals and methods of the following recommendations are interdependent. For example, the threats we have identified can, to varying degrees, be monitored “on paper,” (a product of institutional or government activities) and/or via “on the ground” monitoring (through physical and geographical means). Thus, the determination of threats is a consideration reflected within each recommendation. In outlining our recommendations for addressing threats, it is important to note that our team worked under various assumptions. These assumptions were based on interviews and historical information as well as on the likelihood of each threat occurring or increasing in the future. The relative significance of each threat is likely to change over time.

A REDD project could become feasible in the medium to long-term future.

Recommendation 1: Expand or develop a strategy of environmental data collection and monitoring

This recommendation stems from the information limitations we encountered, and highlights the importance of environmental and forest carbon data to any REDD feasibility analysis. There was a stated acknowledgement from the client that these isolated, biologically diverse areas have not been researched to the desired extent; we consider this lack of information to be a main hindrance in the pursuit of further carbon credit projects. If the Patagonia Sur Foundation hopes to pursue a REDD project—or any other carbon credit project—it
If Patagonia Sur hopes to pursue a REDD project, it will need more data about its lands.

will need more data about its lands. There are two main reasons why information is needed: to identify and quantify threats that may or may not exist, and to more accurately estimate the amount of carbon sequestered on Patagonia Sur forests. Within this project, we were able to create new environmental data-based analyses regarding Patagonia Sur’s forest threats and carbon stocks using a variety of integrated research methods such as GIS and satellite imaging. In these areas, we believe Patagonia Sur should continue to expand its own data collection and management.

Whether through internal capacity increases, increased focus on research partnerships (such as the proposed Melimoyu Environmental Research Institute or MERI) and community education, and/or advocacy for public programs to collect data, the Foundation should increase the level of environmental data available for this region. Without improved information gathering capacity, we believe the Foundation will be unable to further prepare for or assess the applicability of a REDD project on its properties.

With regard to the main threats identified in our research, we propose specific information-gathering and monitoring activities be undertaken. The threat monitoring proposed below consists of both technical tasks requiring a high level of expertise, and activities that could be accomplished through various community outreach and education programs like those currently undertaken by the Foundation.

1.1 Carbon stock valuation
In order to better determine forest carbon storage, overall ecological research and sampling within the sites of interest must occur. Our team utilized a basic framework to derive carbon storage estimates, but more in-depth and substantiated information is necessary to quantify both the threats and the carbon storage potential.

1.2 Collaborate with community experts and environmental specialists
The Patagonia Sur Foundation and Patagonia Sur LLC have made extraordinary contacts and partnerships with the scientific and local Chilean community, but expanding information gathering activities and ecological research would improve understanding of these forests and carbon stock valuation. Methodologies have been developed for measuring the carbon stock and carbon stock potential of Chilean forests, and Patagonia Sur could investigate utilizing them within its properties (Schlegel et al, 2000; Locatelli and Leonard, 2001).

1.3 Increase outreach to the local Melimoyu community
By continuing to engage the local community, the Foundation can form partnerships to help achieve objectives related to understanding and mitigating threats to the forests. This could be an asset to the Foundation’s work; in practice many REDD projects have relied on local communities to provide an extra aspect of enforcement from illegal loggers, first responders in the case of wildfire, or for providing long-standing observation data to gauge the vitality of the surrounding ecosystem and forests. While a thorough survey of the specific topics and programs covered by the Foundation’s community education projects was not undertaken in this study, local community members or student interns could address many threat monitoring activities. This includes education that empowers locals to recognize and report forest fires, invasive species, trespassing, and other indicators about which the Foundation would need to be aware. Education projects teaching the basics of walking transects, and counting trees/recognizing species, could greatly increase the Foundation’s position of preparedness for REDD (and its ability to determine a threat that would justify the cost of undertaking further official baseline studies).

We must stress that these methods of data gathering are less scientifically rigorous, and therefore, are not a replacement for more in-depth scientific assessments by experts or con-
ultants. But the importance of this kind of local data and monitoring is shown in this example: In our research, the leader of the Wildlife Conservation Society's Chilean initiatives revealed that one of the unexpected results of a professionally-conducted REDD feasibility study was that the number of beavers (an invasive species) in the area posed a major justifiable threat (Saavedra). We believe that an increased focus on education and data gathering about factors that impact and threaten forests is an important step, and one that reinforces the overall goals and purpose of the Foundation.

1.4 Increase technical capabilities
A baseline data set of environmental conditions for the local area is necessary, and would require either satellite derived spatial data or a direct ecological sampling of the lands. With a better knowledge of different aspects of the land, determining and quantifying threats will be easier with future resampling. As such, technical data should include the extent and density of tree cover and the variety of flora species present in the Valdivian Forests. Furthermore, data regarding terrestrial biodiversity, the land area within the coastal watershed, and the composition of the Coastal Peat Swamp forests should assist in the determination of the necessity for adapting an existing or creating a new methodology for a REDD project.

1.5 Conduct a pilot study on a selected property to gain a better understanding of Patagonia Sur properties and maximize profitable conservation opportunities.
Should the conditions for a REDD project become favorable, Patagonia Sur should select, based on criteria provided through this report, an area to be used as a pilot study area. The goal of the pilot project would be to gain a clearer understanding of their properties while putting themselves in a better position to take advantage of future profitable conservation opportunities. Knowledge and experience gained from this pilot study could then be transferred to other areas, adjusting for differences between and within the properties. The pilot study would aid Patagonia Sur in filling in some of the information gaps that have been previously mentioned in the report, such as more specific information on the levels of each type of vegetation present in the Valdivian and Magellanic forests on the properties, and their carbon sequestration potential.

Much of the criteria mentioned in the environmental and economic analysis portions of the report can be applied to determining which area would be best suited for the pilot study. The area should support scalability, meaning that the framework for studying it could be applicable to other areas, as well, providing the most useful information for environmental and economic feasibility analyses for future conservation activities. We recommend using Melimoyu as the pilot case, as this area has the most significant tracts of forest and most likely threats of forest degradation.

"Local community members or student interns could address many threat monitoring activities"
The pilot study of Melimoyu could also be used as an opportunity to further work with the local community. Members of the local population could be employed in jobs that involve surveying the vegetation of the area and assisting expert analysts in the beginning (less technical) stages of carbon storage measurement. The Foundation could assist with these activities by engaging the community members and providing them with necessary training.

**Recommendation 2: Expand or develop partnerships with organizations and the community for policy monitoring.**

Patagonia Sur should consider specific areas of focus and goals in its organizational and community relations, as the progression of governmental and policy-driven threats will need to be monitored. In addition, there are a number of specific partnerships that, if strengthened, will help Patagonia Sur anticipate and influence REDD policy in the country.

Some of our study's minor identified threats (existing population development pressures and public works projects) can be monitored mainly through increased governmental relations, as recommended elsewhere in this section (to track proposed projects, such as the siting of transmissions lines for the Aysén Hydroelectric Complex).

We also recommend that the Foundation expand its community awareness and education arm to include nearby locals, as well as policy makers and business leaders. In doing so, the Foundation can build a network that involves stakeholders at all levels to help identify and address conservation threats.

Furthermore, we believe that an opportunity exists for the Foundation and Patagonia Sur LLC to continue to collaborate with and build partnerships within relevant governance agencies and local communities. As threats change, and development increases, the client could play a key role in establishing partnerships between developers, conservation interests, and government. The Ministry of Agriculture (responsible for policies pertaining to natural resources conservation and climate change) and the Ministry of Environment (in charge of developing Chile's REDD national framework

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**Case Study: Boden Creek, Belize**

The Boden Creek Ecological Preserve Carbon Project in Belize is quite similar to Melimoyu: it has significant forest area and is adjacent to a marine sanctuary, and is private conservation land under operation as an ecosystem lodge and resort. This project, relatively small in scale at 5,211 hectares, has low levels of current deforestation and degradation. A large threat was considered imminent due to the immediate presence of large-scale agriculture bordering the property. The project developers rationalized that without crediting emissions reductions through REDD, the owners would have become financially insolvent—and become forced to sell the property, leading to immediate land use change for both agriculture and near-shore aquaculture.

Another rationale for the immediate imperilment is the “proxy” measurement used from both base historical land use and the overarching deforestation factor of Belize. This status is notable as, in comparison, Chile has much lower deforestation rates than Belize, and as such, there is a greater need for Patagonia Sur to show immediate threats or in the absence of currently defined deforestation data utilize an approximate measurement. This data would have to originate from research on the historic to current land use alteration of the local area. Another relevant detail from this case is that the ownership of the emissions revenue, and the responsibility to maintain the land, belong to the owning entity of the land, Boden Creek Ecological Preserve, and thus are separate from the ecotourism operations and profit driven entity “Belize Lodge and Excursions.”

Finally, this case shows that even legally protected conservation land can be used for REDD, if a convincing case can be made for the likely future impact of a land ownership change (Markit Group Limited).
and forest management related policies) are key. Specifically, the Foundation could consider reaching out to the Office of Climate Change within the Environment Ministry, and the Office of Studies in Agriculture Policies (ODEPA) and National Forest Corporation (CONAF) within the Agriculture Ministry. To highlight the interrelated nature of our recommendations, improved forest data showing quantifiable threats would undoubtedly support efforts to build the case for institutional REDD support.

Should the Foundation wish to influence national policy development, it could consider working through the regional office of the Environment Ministry, given that these offices may be more receptive to views and feedback from entities based in their jurisdictions. By demonstrating genuine interest in forest conservation and showcasing success stories, the Foundation could develop a strong and credible voice in influencing REDD and other national forest conservation policy developments.

Recommendation 3: Expand or develop legislative and policy tracking
We have identified a number of policy, methodology, and institutional measures that will need to be monitored, and to some extent actively researched, in order for Patagonia Sur to be prepared for a potential REDD project. Most urgent of these are those pertaining to institutionally driven threats.

Threats Requiring Tracking
Our findings related to mining concessions under Melimoyu show the importance of identifying issues that need further monitoring. Patagonia Sur should monitor and research the progress of, and legal status relating to, mining concessions. These legal concessions could impact the permanence aspect of any project. Should the holders of the mining concessions underneath Melimoyu decide to explore, it could prove nearly impossible to stop them. Furthermore, Patagonia Sur should confirm that peat mining rights on their properties belong to them, to determine if peat mining can be eliminated as a potential threat. If the Foundation can prove that the peat could be extracted by another party, then this could be the basis for a REDD project.

If passed, the *Derecho Real de Conservación* could be both a legal and conservation innovation for Chile, and as such the Foundation may wish to work with the regional office to demonstrate how *Derecho Real de Conservación* and carbon crediting could be a powerful combination in conserving Chilean forests. Moreover, the Foundation could take the opportunity to tap into regional government funding through a National Fund for Regional Development grant for novel and meaningful forest conservation projects. Another avenue to build a strong voice would be with the NGO *Asi Conserva Chile*, of which the Foundation is a member. Finally, the Foundation may also wish to work the political route through Congressmen and the Inter-Ministerial Committee on Climate Change to profile and gain support for its work.

Patagonia Sur should also monitor government activities related to the planned and proposed roads connecting Melimoyu to the Carretera Austral and with Raul Marin Balmaceda. Our findings and interviews related to this planned road infrastructure indicated that currently, government has given low priority to, and has
not allocated funding to these projects. However, they remain viable projects that could be resumed in the future.

Currently there are five salmon farms in the Melimoyu area that minimally impact the forest, but there are active concessions for a few others with a number more under review. The continued growth of the salmon industry in Chile, particularly the expansion of activities into southern waters, could be a driver of land use change in the region. An increased number of concessions would lead to a larger population in Melimoyu, which would likely have a greater impact on the lands. If the number of concessions issued continues to increase—potentially creating a “ripple effect” of infrastructure and population pressures—the potential for a REDD project in Melimoyu would likely increase. For this reason, the Foundation should closely monitor these concessions.

**Monitoring and investigating VCS Methodologies**

Specific VCS REDD methodologies should also be monitored by Patagonia Sur because of the likelihood that any REDD project would require modifying existing or developing new methodologies to suit local conditions. The potential threats faced by Patagonia Sur’s properties in the foreseeable future would likely be degradation and deforestation-related, as indicated in the findings section of this report. The two existing VCS methodologies identified as the closest match to Patagonia Sur land conditions, based on the research and analysis conducted, are VM0006 and VM0007, both of which relate to activities that avoid unplanned deforestation and degradation.

However, although the aforementioned methodologies appear to be the most appropriate, there are information gaps at this juncture regarding the levels and agents of degradation and deforestation threats, and carbon stock densities in Patagonia Sur forests. There is also a lack of sufficient remote sensing data to build baseline scenarios, and these uncertainties make it difficult to accurately determine the applicability of VM0006 and VM0007 (or any other existing methodology) to Patagonia Sur’s properties at this point in time.

Should the Foundation decide to pursue a REDD project in the future, these information gaps will need to be addressed. In addition, the Foundation will need to reassess the suggested methodologies as well as any new methodologies that may be developed in the meantime to determine if, at that point, the REDD project meets the required criteria for applicability of any of them. Our assessment of methodologies and REDD cases provides a baseline for this understanding, but this area will need to be revisited.

Therefore, going forward, Patagonia Sur should attempt to gather some of the data that it is currently lacking in order to conduct a more thorough and accurate assessment of the existing methodologies in the context of its lands and forests. Once this information is available, the client may wish to survey the existing methodologies in approximately 24-36 months and determine whether any of them can be used or modified to suit their needs, or instead, if the development of a new methodology is necessary.

**National and international REDD developments requiring monitoring**

REDD related policies at the international and Chilean national levels are in an early development phase, and changes and developments could potentially affect the technical and economic feasibility of any future REDD project. At the UNFCCC, negotiations to include degradation and deforestation into the international climate change framework are still under way. In the voluntary market, there is a recent proliferation of REDD methodologies and carbon offsets. At the national level, Chile, with the assistance from the World Bank, has recently begun consideration of a national REDD strategy. Although the Foundation is unlikely to be able to influence the pace of any of these developments, these are nonetheless significant moving pieces that Patagonia Sur should anticipate and monitor closely with the view to calibrating its internal actions to ensure the feasibility of and maximize the return on any possible future REDD project.
The findings and recommendations presented in this report have surveyed the main issues that impact the feasibility of a REDD project if implemented by Patagonia Sur in Southern Chile. It is our hope that we have made the key considerations of such a project more clear for our client and communicated the chief concerns that any actors interested in a local application of REDD would need to examine.

The process has stimulated a number of discussions within our team, demonstrating the complex nature of this project. Given that Patagonia Sur’s conservation strategy has been to acquire native, pristine land where they believe little to no threat to conservation exists, and then ensure this situation remains (Orizola, Alejandro), it is unsurprising that imminent threats to land either do not exist or are exceedingly difficult to quantify, at least within the confines of our study. Whether the fact that these lands are currently protected would essentially remove the need for REDD was a key consideration throughout our study, and ultimately we feel that greater environmental data and information will be the answer to this question. Our contextual application of various REDD cases indicates that even private conservation land has been the site of projects, as long as a verifiable case was made that doing otherwise would endanger the forest.

We also struggled with the fundamental question of whether a strategy other than REDD might be more effective in the short term. For example, reforestation and afforestation efforts similar to those made in Valle California could be well-suited approaches, as Patagonia Sur has experience with and knowledge of those activities. Pursuit of afforestation or reforestation could be accompanied by greater policy support and revenue generation potential. But in any case, strategies to improve data gathering and management would benefit any type of conservation.

The Workshop team hopes that the findings and analyses in this report will be used to further conservation in Patagonia, whatever the eventual form this strategy should take. REDD itself was designed as a strategy to reduce emissions; climate change is a global problem and requires a global solution. The policy, technical, and economic findings that we have noted are dynamic and changing, and the team believes that preparing for future opportunities to pursue REDD would undoubtedly be a significant positive step towards a sustainable future.
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Appendix A

Economic Analysis: Non-permanence risk tool for buffer area

The buffer tool is broken into three considerations: internal risk, external risk and natural risk:

- **Internal risk**: project management, financial viability, opportunity costs, and project longevity.
- **External risk**: land tenure, community engagement, and political risk
- **Natural risk**: fire, pest and disease outbreak, and extreme weather

All of the risks are evaluated and the following approach is taken in these steps:

1. A prescribed quantitative value is given based on likelihood, historic events, remote censoring, and data collection.
2. A total value is added up for each section upon determining values for each subcategory.
3. All sections are totaled to determine overall risk.
4. The value is converted into a percentage to show the buffer percentage.
5. This percentage is multiplied by the net change in carbon stock.

A fully developed a risk assessment was unfeasible for this model due to the constraints of limited available data and time: thus, we assumed a minimal risk for this project based on our acquired knowledge of the characteristics, environmental and social factors of the region. We made the assumption that Melimoyu is low risk due to the small population (internal risk), low historical occurrence of natural fires (natural risk), and low political disturbance (external).

Based on the tool, a minimum value for each of the 3 sections is 10; therefore, we gave this value to the internal risk, external risk, and natural risk. This 30-point figure is then converted into a percentage, concluding that the buffer percentage is 30%.
## Appendix B

### Economic Analysis: Cost Assumptions for Melimoyu

<table>
<thead>
<tr>
<th>Activities and Costs for a ~125,000 hectare project in Brazil (~10x Melimoyu project)</th>
<th>Cost used for Melimoyu</th>
<th>Rationale</th>
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<td>PDD Development</td>
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<td>phase 2 start-up</td>
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<td><strong>Yearly Operating Costs</strong></td>
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<td>Fuel, rent, etc. for monitoring team</td>
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