

AVOIDING PLANNED DEFORESTATION AND DEGRADATION IN THE VALDIVIAN COASTAL RESERVE, CHILE

Document Prepared By

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Annex #	Documents
1	2011 Forest Biomass Inventory Results for Valdivian Coastal Reserve (MS Word) - Inventory analysis (MS Excel) - Measurement error analysis (MS Excel)
2	Inventario Forestal Empresas TNC. 2007.
3	2005 VCR Conservation Action Plan
4	2000 MOP Engineering Study Files:

	• Antecedents de Litacion • Pavimentos
5	Coastal Highway Road Map (Vialidad Map Of Carretera Costera)
6	2002/2003 and 2011 Classified Satellite Imagery and Accuracy Assessment • ANTECEDENTES PARA LA CERTIFICACIÓN DE ESTÁNDAR DE CARBONO VOLUNTARIO (MS Word) • Shape files of project boundary • Shape files of 2002/3 forest benchmark map • Shape files of 2011 forest benchmark map
7	2010 VCR Management Plan (English and Spanish versions)
8	CONAF permits – Venecia sector (Spanish and English)
9	CONAF permits – Chaihuin sector (Spanish and English)
10	VCR road APD analysis.xlsx
11	VCR Euc APD analysis.xls
12	additionality analysis VCR.xlsx
13	Non-permanence Risk Report for Avoiding Planned Deforestation in the Valdivian Coastal Reserve, Chile
14	risk analysis VCR.xlsx
15	PROTOCOLOS DE CAMPO PARA LA MEDICIÓN Y MONITOREO DE LA BIOMASA FORESTAL EN LA RESERVA COSTERA VALDIVIANA
16	VCR APD summing tables.xlsx

Note that the following documents reviewed by the VCS validation auditor are confidential and commercially sensitive:

- 1) "Footnote 14 - PSA between Bosques and WDC and Clarification"
- 2) "Footnote 14 - PSA Woodland - TNC"
- 3) "Footnote 14 - WDC Shares Assign to TNC 2003-1"
- 4) "Footnote 14 -WDC Agreement March 2011-1"
- 5) "Footnote 15 - Voluntary Carbon Offsets - chilean law memo"
- 6) "Footnote 21 - Memo, CMT 11 de Febrero 2004"
- 7) "Footnote 55 - Memo, Evaluacion CCCC del actuar de MOP referente al acuerdo de 2003"
- 8) "Financial projection - native forest restoration"

1 Project Details

1.1 Summary Description of the Project

The Valdivian Coastal Reserve (VCR) is located approximately 40 km southwest of Valdivia in Region XIV (formerly Region X), Chile (Figure 1.1). The VCR is situated in the Coastal Range of south-central Chile, in a

section known as the Cordillera Pelada. It is located at the northern extension of the temperate rainforest ecoregion, and represents one of the last large fragments of Valdivian Temperate Forest. The area is of significant ecological value, home to numerous endemic species and globally-significant ecosystems and vegetation, such as Olivillo coastal forest (*Aextoxicon punctatum*) and Alerce (*Fitzroya cupressoides*), the latter one of the world's largest and longest-lived tree species. Significant stores of carbon are sequestered in the VCR's native forests, with stocking levels estimated at over 800 metric tons of CO₂ equivalent per ha¹.



Figure 1.1. Location of the Valdivian Coastal Reserve

Prior to 2003, the property was owned and managed by an industrial timber company, Bosques S.A., that had been steadily converting native forest on the property to Eucalyptus plantations and coordinating with the Ministry of Public Works (MOP) and its agent the Chilean Army Corps of Engineers (CMT) on the construction of a coastal highway (Carretera Costera) traversing the property. When Bosques S.A. went bankrupt in 2003 due to financial mismanagement, the property became available for purchase, and in November 2003, The Nature Conservancy (TNC), recognizing its significant conservation value and imminent threats, acquired the property. In February 2012, TNC donated a portion of the property, consisting of approximately 9,453 ha, to the Government of Chile, to form part of Chile's new Alerce Costero National Park; as a result, the VCR is currently approximately 50,251 ha in size.

¹ Shoch, D. 2011 Forest biomass inventory results for the Valdivian Coastal Reserve. **ANNEX 1.**

TNC's decision to purchase the property was made after extensive analysis of conservation threats and priorities in the region² and also after identification of the potential of carbon credits generated through forest conservation activities in the region³ that could be explored as a revenue source to finance the acquisition and management of the property. Even after purchase of the VCR, carbon revenue remains critical to help finance the establishment of an endowment for long-term operations, and to help pay off the original acquisition costs, which were paid for through a loan from TNC's internal Land Purchase Fund, with no other immediate sources of finance to repay the entirety of the loan identified as of the project start date. Generous philanthropic donations from TNC donors, WWF and Conservation International, helped to partially offset but did not fully fund the original acquisition costs.

The acquisition of the property by TNC effectively stopped the ongoing conversion of native forest to Eucalyptus plantations, activities authorized through permits that conveyed to the new owner, and that were expected to be exercised by the most likely alternate buyer (i.e. another industrial timber company with management objectives similar to Bosques S.A.). The acquisition further leveraged the position of TNC to advocate against and ultimately contribute to stopping the construction of the coastal highway.

The acquisition of the VCR and subsequent conservation actions by TNC, including ongoing protection and management activities, constitute two VCS-eligible Reducing Emissions from Deforestation and Degradation (REDD) activities:

1. Avoiding Planned Deforestation (APD) by stopping construction of the coastal highway
2. Avoiding Planned Degradation (APD) by stopping conversion of native forest to Eucalyptus plantations

The two activities are combined under one project, the Avoiding Planned Deforestation and Degradation in the Valdivian Coastal Reserve Project. The total eligible project area is 1,273 ha, which is a subset of the larger VCR.

The fundamental objectives of the project are:

1. Protect threatened biodiversity by avoiding the planned deforestation of native rainforest.
2. Help to sustain and improve the well-being of rural and indigenous human communities surrounding the Reserve.
3. Protect forest carbon stocks over the long term.
4. Achieve sustainable long-term financing for the Reserve (and its potential future expansion through creation of a marine protected area) through carbon credit transactions. (Funds from any transaction will be used to help establish an endowment to fund long-term operational costs, which primarily consist of salaries for park guards and other staff, and to fund additional conservation activities within the Reserve.)
5. Demonstrate a successful private sector funding strategy for climate change mitigation.
6. Widely share lessons learned during project development, in order to build climate change mitigation capacity within the Chilean government and other institutions (i.e., Universidad Austral).
7. Test scientific methodologies for quantifying emissions avoided and other impacts.
8. Improve voluntary carbon market accounting standards.
9. Influence future climate change mitigation policies and laws through the development and use of rigorous standards in the voluntary carbon market.
10. Create a reference center at a partner institution (Universidad Austral) as part of a global REDD network. The reference center will serve both as a physical repository of information and as the host of an electronic web portal for relevant documentation. The center would connect Chilean REDD+ initiatives with those in Brazil, Indonesia and Mexico.

A schedule of project development and implementation milestones is listed in Table 1.1, below.

² 2002 land tenure study ("Final Report: Promoting Private Lands Conservation Investments in the Valdivian Coastal Range", TNC & WWF, February 2002.)

³ Jorge Gayoso & Bastienne Schlegel, Sept 2003, ESTUDIO DE LÍNEA DE BASE DE CARBONO: CARBONO EN BOSQUES NATIVOS, MATORRALES Y PRADERAS DE LA DÉCIMA REGIÓN DE CHILE, Universidad Austral de Chile.

Table 1.1. Schedule of project activities

Project activity	Date	Source/Notes
Project start date and start of the crediting period	4 November 2003	Date of acquisition of the VCR property by TNC
VCR forest inventory	2011	
Validation and first verification of the project	Anticipated 2012/2013	
Registration of the project	Anticipated 2012/2013	
End date of project crediting period	3 November 2023	

1.2 Sectoral Scope and Project Type

Project Scope 14: Agriculture, Forest and other Land Use (AFOLU)

Project Category: Reduction Emission from Deforestation and Degradation (REDD)

Type of Activity: Avoided Planned Deforestation (APD)

1.3 Project Proponent

The project will be financed and implemented by The Nature Conservancy. Roles and responsibilities of project proponents are elaborated in Table 1.2 below. All project proponents are listed in Table 1.2; and no other implementation partners exist.

Table 1.2. List of project proponents

Roles and Responsibility	Position/Personnel	Contact Details
Manage project validation, verification and registration, including hiring of contractors to assist in PD development, validation and verification; offset sales support and investor relations.	Sr. Business Advisor	The Nature Conservancy Forest Carbon Team 4245 North Fairfax Drive, Suite 100 Arlington, VA 22203-1606 (703) 841-4533
General management and oversight for the TNC program in Chile is based in Santiago. Core staff providing GIS, Science, Financial, Marketing, and Government Affairs support for the VCR are also based in Santiago.	1) <i>South Andes Director</i> 2) <i>Science Coordinator</i> 3) <i>GIS/Data Specialist</i> 4) <i>Country Representative</i> 5) <i>Associate Director of Development</i> 6) <i>Finance & Operations Manager</i>	The Nature Conservancy Marchant Pereira 367, Of 801 Providencia, Santiago, Chile
Day to day management of the VCR, including hiring of all staff, implementation of strategic plan, outreach to surrounding communities, tourism/education programs, park security and biological and carbon stock monitoring.	1) <i>Chile Conservation Manager (based in Santiago)</i> 2) <i>VCR Coordinator</i> 3) <i>Conservation Project Assistant</i> 4) <i>9 additional staff reporting to the Coordinator</i>	The Nature Conservancy Reserva Costera Valdiviana Chaihuin, Chile
Internal legal oversight and support; management of outside counsel.	<i>Senior Attorney</i>	The Nature Conservancy Rio de Janeiro, Brazil Tel via USA: (703) 841-5375

1.4 Other Entities Involved in the Project

Entity	Consultants based at Universidad de Austral, Chile
Role	1) Primary research and author of sections relating to biological and stakeholder impacts of the project. 2) Technical advisor and economic research. 3) Technical advisor and GIS/mapping.
Responsible	1) Trevor Walter 2) Miguel Carcamo 3) Aldo Farias
Address	Universidad de Austral, Valdivia, Chile
Contact	1) ecologue@gmail.com 2) miguelcarcamo@uach.cl 3) Aldo.farias@gmail.com

Entity	TerraCarbon LLC
Role	Technical lead on development of VCS PD
Responsible	David Shoch
Address	5901 N. Sheridan Road, Peoria, Illinois 61614 USA
Contact	David.shoch@terracarbon.com

Entity	SERVAL, Ltda. (Raul Troncozo)
Role	Implementation of 2011 biomass inventory, including management of field crews
Responsible	Nestor Juarez and Marcos Contreras
Address	Chile
Contact	nestorjuarez_60@yahoo.es mcontrerast@gmail.com

1.5 Project Start Date

The project start date is 4 November 2003, the date when The Nature Conservancy acquired the Valdivian Coastal Reserve property, which encompasses the project area. This was a critical event in stopping ongoing conversion of native forest to Eucalyptus plantations and stopping the construction of the Carretera Costera, already underway at the project start date and planned to traverse the VCR.

This change in ownership that took place on 4 November 2003 effectively changed the management priorities of the property owner from those of an industrial timber company (the previous owner and most likely alternative owner in the absence of the project), concerned with plantation timber production, to those of a conservation NGO. At this time, permitted forest conversion activities in the VCR ceased.

Although the road construction was a project of the Ministry of Public Works (MOP) and its agent responsible for construction, the Chilean Army Corps of Engineers (CMT), it was also dependent in part on the VCR landowner's advocacy for its construction and coordination with the MOP and CMT. It was in the interest of the previous landowner, Bosques S.A., and any alternate industrial forest owner, to lobby for and support the construction of the road to improve access for conversion and harvest activities, in particular to facilitate

access to southern Eucalyptus plantation for timber harvest. In fact, direct evidence of the previous coordination between Bosques and the MOP on the coastal highway construction is found in the 2000 engineering plan commissioned by the MOP (from an English translation of “Tramo 1-1 Section 06 Pavimentos”⁴):

“Traffic Demand

As noted above, the design life used was 10 years, the usual time when designing granular structures with surface asphalt treatments on their wearing course.

Traffic demand was determined based on the number of timber trucks, which are the only commercial vehicles of significant weight that are expected to use the road in the short term.

The information provided by Bosques S.A. indicates that once the road has been built, it is expected that 20 to 25 truckloads will be transported daily during the first few years, and that this number will double once wood processing plants are built in the area. The project for these plants considers their commissioning in 9 to 11 years, that is, beyond the design life horizon set for the surface treatment.

Considering that, at any rate, in addition to this traffic, the road will generate some minor traffic (construction materials and consumer supplies trucks and microbuses), we have included a 5% annual increase rate in the number of trucks.”

This coordination with the MOP further included access provided by the landowner to rock and sand for construction quarried locally from the property, and permission to route construction access roads through the property. When TNC acquired the property on 4 November 2003, all coordination with and support from the VCR property owner to the MOP toward facilitating the highway construction ceased⁵.

While there had been previous efforts by TNC and partner organizations, including WWF, to advocate for the cessation of construction of the Carretera Costera, the strength of this effort was critically enhanced when TNC acquired the VCR, permitting it to advocate from the stance of an engaged property owner and significant stakeholder in the region, ultimately leading to the abandonment of the highway project by the MOP. This marked an important turning point in the opposition effort, and hence is an appropriate start date for the avoided planned deforestation via stopping road construction project activity.

A chronology of events and actions leading up to the acquisition of the VCR by TNC is elaborated in Table 1.3 below.

Table 1.3. Chronology

Date	Action/event
February 2002	Land tenure study completed, identifying the VCR, then known as the “Bosques tract”, as the largest and most important tract to protect in Region X. As such, it became a conservation priority for TNC/WWF.
March 2003	Bosques S.A. is forced into bankruptcy by its lender. TNC begins in earnest to acquire VCR property to prevent its acquisition by another timber company.
3 November 2003	TNC acquires mortgages on the property from Fleet National Bank
4 November 2003	TNC, as mortgage holder, acquires VCR at public auction.

⁴ Empresas Intrat S.A. 2000. Estudio de Ingeniería Construcción y Mejoramiento Camino Costero Sur Sector : Chaihuín - Río Bueno - Estero Quihue Tramo : Chaihuín - Estero Dehui Km. 0,000 A Km. 53,200 Región : X. Contracted by República De Chile, Ministerio De Obras Públicas, Dirección General De Obras Públicas, Dirección De Vialidad, Departamento De Estudios. **ANNEX 4.**

⁵ In fact, shortly after acquisition, in February 2004, TNC refused to authorize a request from the CMT to access the quarry on the VCR property, as had been previously arranged with Bosques S.A. This action effectively cut off access to essential low cost construction materials.

1.6 Project Crediting Period

The project has a crediting period of 20 years. The start date of the crediting period is 4 November 2003 and the end date of the crediting period is 3 November 2023.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

As per VCS guidance on REDD projects (VCS AFOLU v3 3.1.9), ex ante estimates to determine project scale are provided for only the first 10-year baseline period, through November 2023 (Table 1.4). The project is beneath the threshold of mega projects, with less than 1,000,000 tCO₂e per year in anticipated emissions reductions generated.

Table 1.4. Ex ante estimates of net emission reductions (not including non-permanence risk buffer deduction).

Years	Estimated GHG emission Reductions or removals (tCO ₂ e)
2004	121,960.3
2005	136,422.5
2006	54,548.3
2007	51,902.4
2008	42,999.4
2009	30,862.5
2010	39,512.1
2011	41,627.4
2012	30,242.2
2013	31,462.9
Total estimated ERs	581,540
Total number of crediting years in first 10-year baseline period	10
Average annual ERs	58,154

* Hereafter, the year refers to the year at the end of the annual interval, hence 2004 represents the year from 4 November 2003 to 3 November 2004.

Project (Less than or equal to 1,000,000 tCO ₂ e per year)	X
Mega-project	

1.8 Description of the Project Activity

The project activity consists of the following main activities:

1. Acquisition of the VCR and establishment of protected status
2. Advocacy to stop construction of the Carretera Costera
3. Stopping conversion of native forest to Eucalyptus plantations

4. Ongoing protection and management activities

Acquisition of the VCR and establishment of protected status

Following acquisition of the project area (detailed above in Section 1.5), TNC either has already or has plans to put in place the following mechanisms to establish the protected status of the area and ensure permanence of the carbon stocks over the long term.

Table 1.5. Actions to establish the protected status of the VCR

Approach	Applicability and Status
Chile Nature Sanctuary Designation ⁶	The Nature Sanctuary status is a government designation that will elevate the property protection status. It is regulated by Chile's National Council of Natural Monuments, which requires, among other things, its prior approval for any private development projects on the property. It is the only protection designation in Chile's environmental legislation that allows private owners to retain their title to the land, while simultaneously ensuring its protection (Ley N°17.288 de 1970 sobre Monumento Nacionales; Ley 19.300 artículo 10). TNC intends to seek this designation for a portion of the Reserve, and if successful, it will pertain to a portion of the project area, within the Reserve. It will provide the Reserve with an official recognition of its benefit to environment, as a conservation site and an official layer of protection, with the Government designation. Development activities proposed by any future private landowner may be subject to additional requirements, such as submitting proposed activities for review to the Chile government's Environmental Assessment System (Sistema de Evaluación Ambiental.)
Adapted Version of the Encumbrance of a Civil Code Easement-Type Restriction (<i>servidumbre</i>)	TNC will seek an easement-type permanent restriction that constitutes a lien on the property's title to prohibit certain activities determined to be in conflict with conservation of the Reserve. This instrument is similar to appurtenant conservation easements in the United States. This easement would run with the land and be enforceable upon future owners, by the adjacent 'dominant estate' owner, as required with appurtenant easements, which would provide the dominant estate owner the right to enforce the easement. <u>As such, it is a permanent protection mechanism, which protects the land and carbon stocks, no matter who owns it.</u> The permanent conservation easement will (i) require all landowners to maintain the acquired land in accordance with specified conservation objectives; (ii) prohibit the sale or other transfer of the acquired land if any such transfer would adversely impact the conservation objectives underlying the initial purchase, including in liquidation scenarios. TNC is currently in the process of securing this easement, and anticipates this process to be complete in 2013.

⁶ Propuesta técnica Santuario Naturaleza Colun Rio Bueno-1.doc

Tourism Zone (<i>Zona de Interés Turístico – ZOIT</i>)	Some 739 hectares of the Reserve is under the designation as “ <i>Zona de Interés Turístico - ZOIT</i> ” (Tourism Zone). This designation has been granted by the Chilean Tourism Agency, Sernatur. This provides an additional type of protection to the Reserve, as the creation of ZOITs includes the acknowledgement by the government of the high importance of the natural resources of the area and the need to adopt measures to preserve and improve natural values of the site.
Submission of TNC Management Plan and Environmental Impact Study to Chile government for formal approval and enforcement of conservation purposes upon any future owner of the Reserve.	TNC has a Management Plan for the Reserve that has been entered into the public domain ⁷ . TNC will also formally submit this plan as part of an environmental impact study and seek formal government approval (<i>Resolución de Calificación Ambiental</i>) so that future owners of the Reserve will have to comply with this plan, and most importantly, potential conflicting infrastructure projects should respect this environmental authorization. TNC would submit the environmental impact study for formal government approval, as well as submit the Conservation Management Plan for approval under the Native Forest Law and its bylaw.

⁷ 2010 VCR Management Plan ANNEX 7

Advocacy to stop construction of the Carretera Costera

The start of the activity to stop construction of the coastal highway is marked by TNC's acquisition of the VCR in November 2003. Relevant antecedents to that and subsequent advocacy efforts by TNC deserve mention to provide full context of the road opposition.

During the military dictatorship of Augusto Pinochet (1973-1990) strategic planning of transportation infrastructure resulted in the development of several major highway projects, the most emblematic of which resulted in the construction of the 1,240 km Carretera Austral, linking Puerto Montt with Villa O'Higgins in Patagonia. While this route was developed due to the lack of a terrestrial connection to southern Chile, the Carretera Costera or Coastal Highway was projected to follow the entire coastline of Chile and provide an alternative to the main north-south national arterial (Ruta 5), eventually spanning 3,346 km of the country. The section proposed to run between Corral and Bahía Mansa, through the project area, was ordered built by decree of President Eduardo Frei Ruiz-Tagle to then Minister of Public Works (MOP) Ricardo Lagos in 1994⁸.

Following the Presidential Mandate, the MOP approved technical specifications for the road project and formed an agreement with the Chilean Army Corp of Engineers (Cuerpo Militar de Trabajo, CMT) to construct it as specified, starting in Corral. Construction began in 1995 and by 2000 the highway had arrived in Chaihuín from Corral. In November of 2002 via a government resolution (D.F.L. MOP N°1857), 105.8 ha were expropriated from the VCR's former owner, Bosques S.A., for the extension of the coastal highway south of Chaihuín. However, by then there was already strong opposition to the road project led by the Coalition for Conservation in the Coast Range (CCCC). The CCCC was formed by a variety of organizations from civil society including conservationists, scientists, professional organizations and indigenous groups, to increase the conservation value placed on the Coast Range, to develop new protected areas and to oppose threats to the landscape, the greatest of which was the construction of the Coastal Highway. Through the CCCC's negotiations with the government an agreement arose in January of 2003⁹ with the MOP (in participation with CONAF, CONAMA and the Regional Government), which resulted in a temporary suspension of construction activities pending revision of some design features aimed to reduce the footprint of the road, short of stopping construction outright.

In 2002, TNC and WWF completed a land tenure study¹⁰ of the project region (then Region X) to identify priority areas for private sector conservation. In conjunction with the land tenure study, TNC had held a workshop for the CCCC in order to elucidate private conservation possibilities and to relate their experience with private sector models applied in the US, to options available in Chile.

Though TNC never became a member of the CCCC, it took on a different and legally stronger role in the negotiations with the purchase of the VCR property in November 2003. As explained above under Project Start Date, the vested interest represented by the ownership of such a large area and clearly defined conservation objectives posed an important force in swaying the decision-making process of the MOP and the regional government. In this capacity, as an important land owner, TNC was invited to participate in the Technical and Legal Coordination Committee (CCTL)¹¹, established by the January 2003 agreement as a collaborative multilateral body to advise on the Coastal Highway, and its participation on the CCTL is an important part of the project activity. Intervention through this forum, and through periodic meetings with the MOP and regional authorities, will continue through project implementation.

Stopping conversion of native forest to Eucalyptus plantations

On acquisition of the VCR, TNC became the holder of a series of forest "substitution" permits approved by CONAF, allowing for conversion of native forest to Eucalyptus plantations in the project area. As part of the

⁸ Presidential Mandate, Frei Ruiz-Tagle, E., 1994. Proyecto "Camino Costero Sur" GAB. PRES N° 94/4360. Santiago, Chile.

⁹ MOP, CCCC, CONAMA, CONAF, Intendencia de Los Lagos, Bienes Nacionales, 2003. Protocolo de Acuerdo: Cooperación pública privada para la implementación de una ruta escénica de mínimo impacto y conservación de la biodiversidad en la Cordillera de la Costa: Rediseño de trazado y estándares de la Ruta Costera X región, y mecanismos para la creación de áreas silvestres protegidas. Valdivia, Chile.

¹⁰ 2002 land tenure study ("Final Report: Promoting Private Lands Conservation Investments in the Valdivian Coastal Range", TNC & WWF, February 2002.)

¹¹ CONAMA, 2004. Invitation to TNC to participate in the Technical and Legal Coordination Committee related to the agreement on the development of the Coastal Highway.

project activity and its larger conservation vision, TNC has elected to not exercise the permits and conserve the native forest.

The Nature Conservancy officially cancelled the legal permits to convert native forest to eucalyptus plantations by sending notice to CONAF at the end of 2004¹². Furthermore, the permits only permitted conversion from 2003 – 2007 (as projected in the baseline, Section 3), and the permits were not renewed; therefore they are no longer usable, even had they not been cancelled.

Ongoing protection and management activities

TNC developed a Conservation Plan in 2005 (Delgado 2005 – See Annex 3) and a Management Plan in 2010 (Delgado 2010 – See Annex 7) to effectively steward the area and to meet the objectives that had been proposed from the beginning of the project.

The 2010 Management Plan prepared by TNC articulates the following Vision for the Reserve:

“The Valdivian Coastal Reserve is an area of high conservation relevance, as it ensures a functional landscape and is home to an important biodiversity representation of Coastal Temperate Forests. It is a model of conservation and sustainable use of natural resources based on scientific and community support granting effective protection to the rich diversity of ecosystems, species and biological processes occurring in it.

Objective 1. Conserve biodiversity present within the Valdivian Coastal Reserve.

Objective 2. Implement conservation actions to connect natural sites of high ecological value adjacent to the VCR, to ensure a wider ecologically functional landscape.

Objective 3. Involve relevant stakeholders in conservation actions (the local community, study centers, Governmental institutions, local conservation organizations, etc.).

Objective 4. Develop activities that contribute to sustainable development both in the VCR and in adjacent local communities.

Objective 5. Generate and promote scientific, technical, biological and socio-cultural research activities to increase knowledge of the area and continually improve the Conservation and Management Plans.

Objective 6. Promote the protection and sustainable use of the Reserve’s marine and coastal ecosystems

As part of the Conservation Plan, the Reserve explicitly stated its objectives and conservation targets, identified the condition of the ecosystems within its limits, and evaluated the viability and threats to conservation of these objects. In order to carry out these actions effectively, the Reserve developed a system of zones that defined the necessities and priorities for each region within the Reserve. The initial design was updated, based on lessons learned, when the Reserve’s Management Plan was released in 2010.

Zoning the Reserve allowed TNC to limit the types of activities that would be conducted in each area and to permit long term planning in a dynamic, adaptive and iterative structure. The division of the Reserve into zones was based on biological ecological, human, and administrative criteria and facilitated more informed conservation of the Reserve. The resulting ten management zones identified were: the forest management zone, the cultural heritage zone, the livestock management zone, the silvo-pastoral zone, the intangible zone, the intensive use zone, the primitive zone, the passive restoration zone, the active restoration, and the low impact use zone.

Having identified the conditions of the ecosystems, specific conservation objects and delimited management areas as part of the baseline for the objective of conservation, the Reserve could begin to develop programs to meet the other objectives that had been set.

To meet the objectives of conservation and local development in the Reserve, a number of management programs have been developed which govern actions in the protected area, including the following:

¹² In July 2012, TNC confirmed from CONAF that the permits had been voluntarily cancelled, and CONAF acknowledged receipt of the voluntary cancellation with an official stamp. 5 July 2012 letter from TNC to CONAF; bears CONAF stamp of receipt 10 July 2012.

Administration program

The fundamental objective of this program is to ensure that the area objectives are met and that the implementation of the management plan and annual operational plan is carried out satisfactorily, and to ensure sufficient funding for the programs to operate effectively.

Monitoring and Research Program

This program is designed to identify, support and facilitate key areas of research that are necessary to improve the management of the protected area and the conservation of biological diversity and ecological processes in the area, and to develop specific biological and threat monitoring research, with the goal of obtaining information to improve the management of the Reserve.

Program for social participation and community development

The VCR is a protected area that is integrated with the surrounding communities. Thus, it aims to promote terrestrial and marine protection and support the conservation of globally significant biodiversity while contributing to local development and involving the surrounding communities in a mutually beneficial partnership.

The Reserve aims to promote participatory processes and community integration, creating opportunities for the development of economic activities that are compatible with the conservation of natural resources. Examples of these opportunities include tourism and sustainable harvesting of non-timber forest products and seafood. The opportunities and benefits generated by the Reserve, in coordination with local governments and public services, promote the area as an ecotourism destination and an area of sustainable production of high value certified products with declaration of origin.

Effective communication mechanisms, conflict management, and environmental education are strategies to involve communities with conservation activities. Additionally, the strengthening of local organizations and leadership training are part of this program.

Control and Monitoring Program

This program is designed to mitigate existing threats and minimize the emergence of new threats, contributing directly to protecting the biodiversity of the Reserve. It also aims to ensure the safety, both of the infrastructure, and of the visitors who use it.

Training Program

This program focuses on improving the knowledge and skills of the administration and park rangers at the reserve. Improving knowledge in the areas of administration, wildlife management, conservation and geographic information systems is highly relevant for the proper management of the area.

Environmental Education and Outreach Program

This program aims to educate visitors about the conditions and characteristics of the site, the available resources and the measures being taken for conservation of these resources. It also aims to provide experiences and knowledge about the conservation value of species and ecosystems in the area. The goal is for visitors to develop a greater sensitivity, appreciation and understanding of resources and the value of the area, and to encourage visitors and local people to have a smaller environmental impact in the Reserve.

The program is primarily aimed at visitors, as a way to minimize the environmental impact of tourist activities, but it is also directed toward the local community, for example, through education initiatives in local schools. Moreover, the program will develop environmental outreach programs oriented toward the public, locally and at a regional level, to convey the progress and scope of conservation within the Reserve.

Resource Management Program

This program includes activities of direct management of resources, in those areas designated especially for that purpose.

Program for Infrastructure and Equipment Maintenance

This program is geared toward the design, maintenance and implementation of necessary infrastructure for the various activities undertaken in the Reserve. All new construction must respect the traditional building styles outlined in the style and design manual created by the Education and Outreach Program. Given the nature of the activities, maintenance or construction tasks are carried out under strict rules of risk prevention using the appropriate equipment for fieldwork.

Forest Fire Prevention Program

A seasonal contract with a local fire brigade for Prevention and Combat of Forest Fires is established each summer season for a period of at least two months to supplement the Reserve's park guard staff in their fire prevention activities. This brigade consists of 12 firefighters, headquartered in Colún. This program is coordinated with the National Forest Corporation's (CONAF) Fire Control Program.

Ecotourism Program

The Reserve's scenic beauty, diversity of landscapes and link with local communities, make ecotourism a relevant option for the use of natural resources. In this context, the ecotourism program consists of a set of tourism activities which emphasize environmental sustainability, appreciation and understanding of the environment, with a key emphasis on the welfare of communities living in or adjacent to the protected area.

In connection with TNC's donation of a portion of the Reserve's property to expand the recently created Alerce Costero National Park, TNC and CONAF have signed a memorandum of understanding to develop a joint work plan to increase collaboration in management of these adjacent protected areas. The integrated public-private conservation effort will yield a unique partnership in Chile.

In addition to the management activities noted above, TNC conducts: supervisory staff visits to the Reserve at least two times a year, project activity reporting as part of quarterly operating unit progress reports, annual performance reviews for staff, and annual compliance training in Spanish.

1.9 Project Location

The project area of 1,273 ha is located within the larger VCR property, in Region XIV, Chile, south of the city of Valdivia. (At the time of TNC's acquisition of the property in 2003, the property was part of Region X, which was subsequently subdivided by the Chile government forming a new administrative Region XIV, which now contains the VCR). The project area was delineated, consulting engineering plans and permits, to align with areas designated for construction of the coastal highway and for "substitution" of native forest with plantations (detailed in Section 3 below).

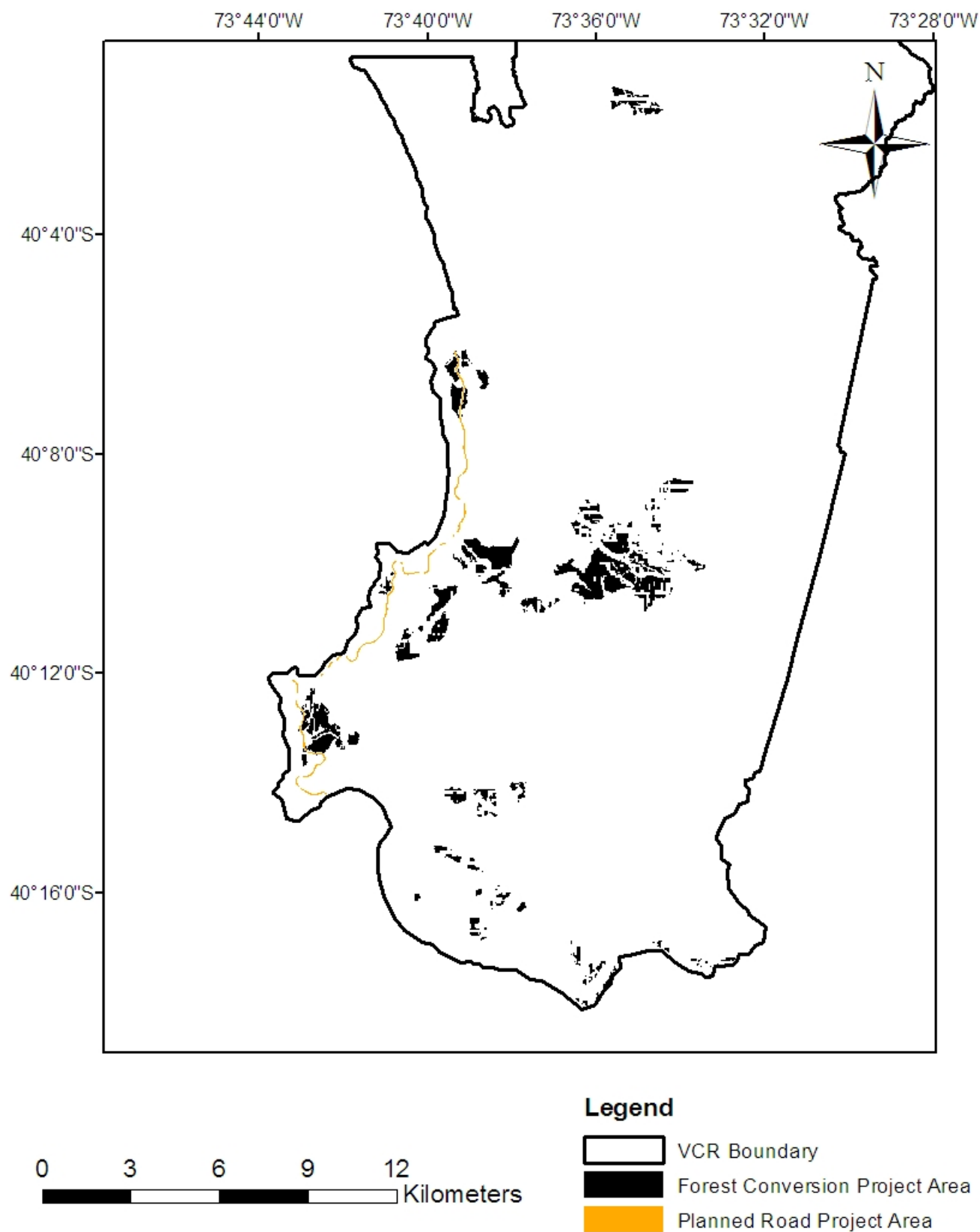


Figure 1.2. Project area for the two REDD APD activities within the VCR

VCS eligibility criteria (VCS AFOLU 4.2.5) were assessed consulting classified satellite imagery and aerial photographs.

“The project area shall meet an internationally accepted definition of forest, such as those based on UNFCCC host-country thresholds or FAO definitions, and shall qualify as forest for a minimum of 10 years before the project start date.”

Assessment of the project area at the time of project start was made applying classified Landsat imagery¹³ mosaicked for the years 2002 and 2003 (to achieve sufficient cloud-free coverage; the 2002 image (Enhanced thematic mapper+ February 1 2002) of the classification area (path/row 233/88) was 98.2% cloud free, the 2003 image (Enhanced thematic mapper+ February 20 2003) of the classification area (path/row 233/88) was 99.7% cloud free).

Forested conditions at the time of project start are demonstrated in Figures 1.3 and 1.4.

¹³ For the satellite imagery classification, a Minimum Mapping Unit of 0.81 ha (3 pixels * 3 pixels) was used, approximating the minimum area of forest of 0.5 ha as defined by the Chile Designated National Authority (DNA) under the CDM, Comisión Nacional del Medio Ambiente (CONAMA).

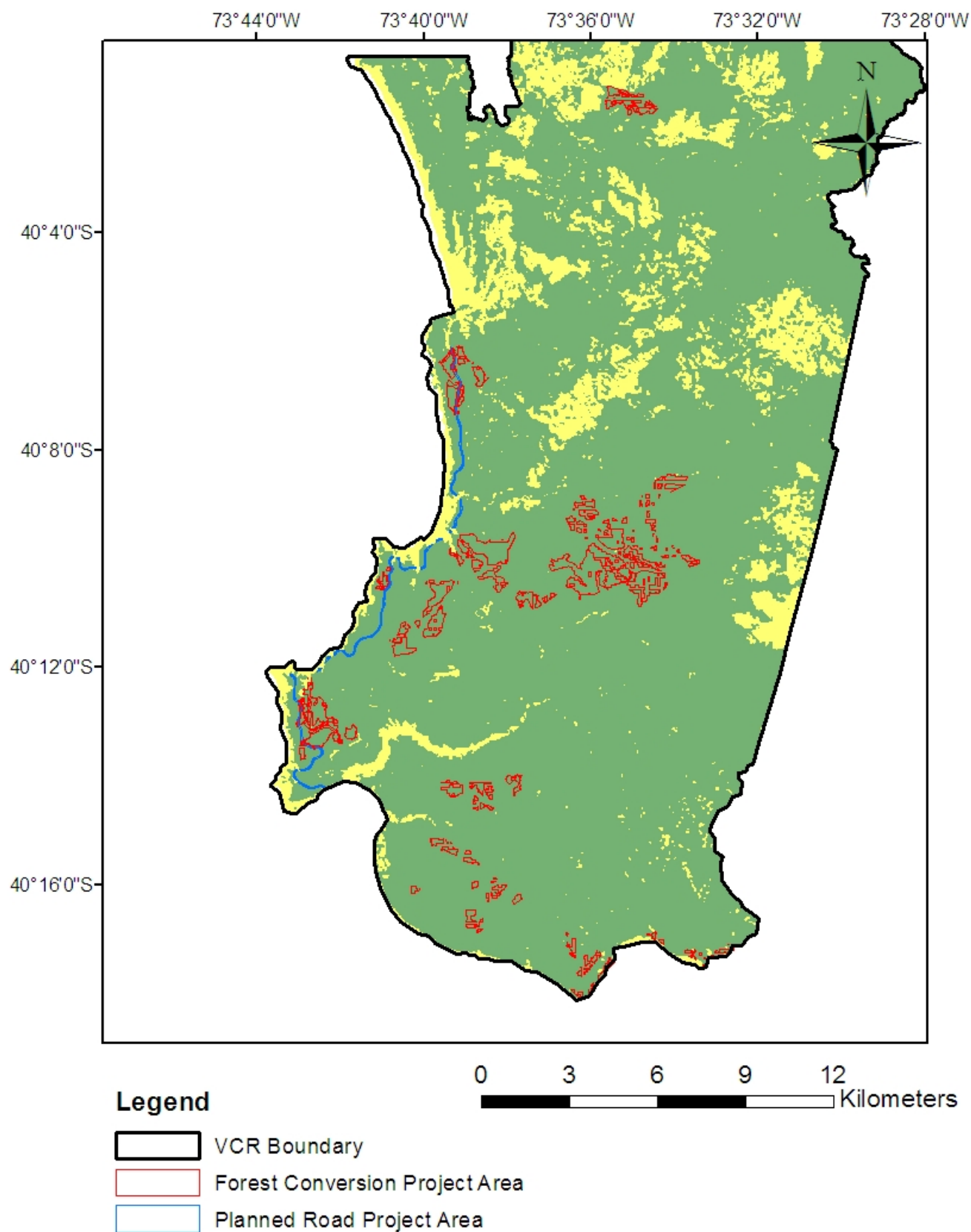


Figure 1.3. Demonstration that the project area was forest at the project start (classified 2002/2003 Landsat imagery; forest in green, non-forest in yellow)

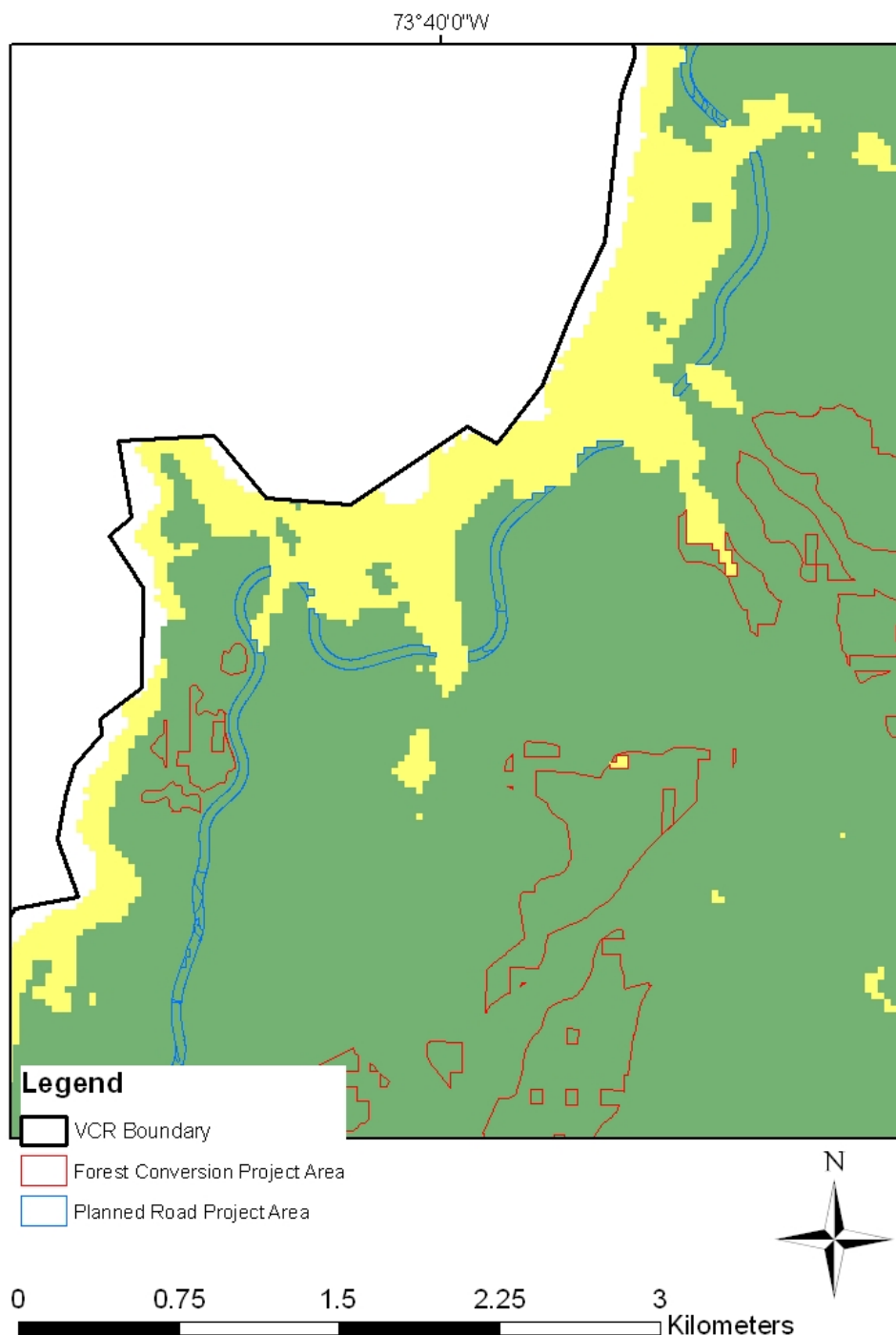


Figure 1.4. Detail from center of Figure 1.3 above, demonstration that the project area was forest at the project start (classified 2002/2003 Landsat imagery; forest in green, non-forest in yellow)

Note that all non-forest areas identified within the road clearance corridor and permitted forest substitution “rodales” were excluded from the eligible project area (Figure 1.4).

Compliance with VCS AFOLU Requirement 4.2.5 is further demonstrated by superimposing the project area on 1993 aerial photography (Figures 1.5, 1.6, 1.7 and 1.8). All Eucalyptus plantations in the road clearance corridor that were planted less than 10 years prior to the project start date (i.e. planted after 1993) were excluded from the project area, conforming with the VCS limitation on secondary forests, that they must be “...at least 10 years old ... at the start of the project” (VCS AFOLU 4.2.5).

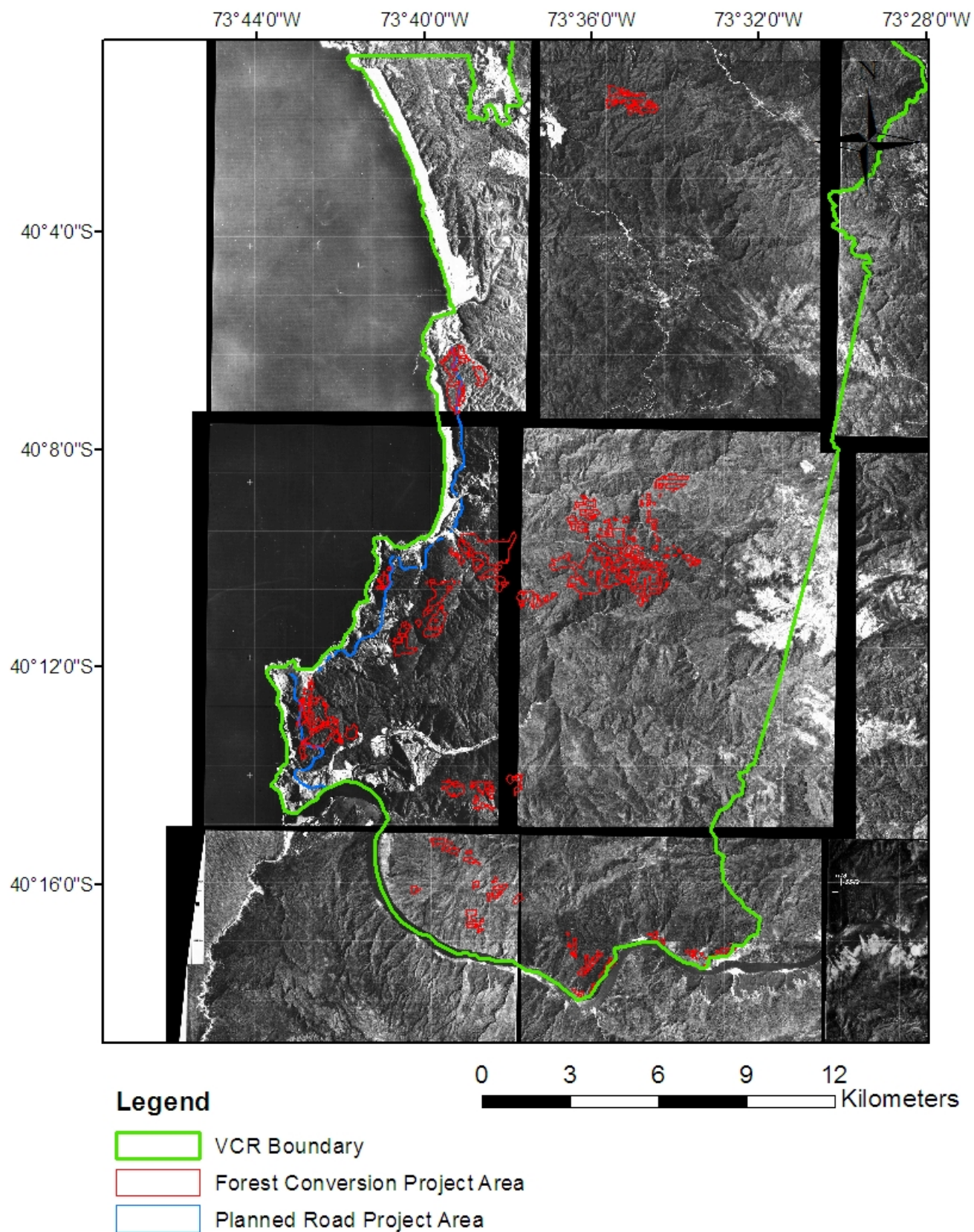


Figure 1.5. Demonstration that the project area was forest 10 years prior to the project start (1993 aerial photography)

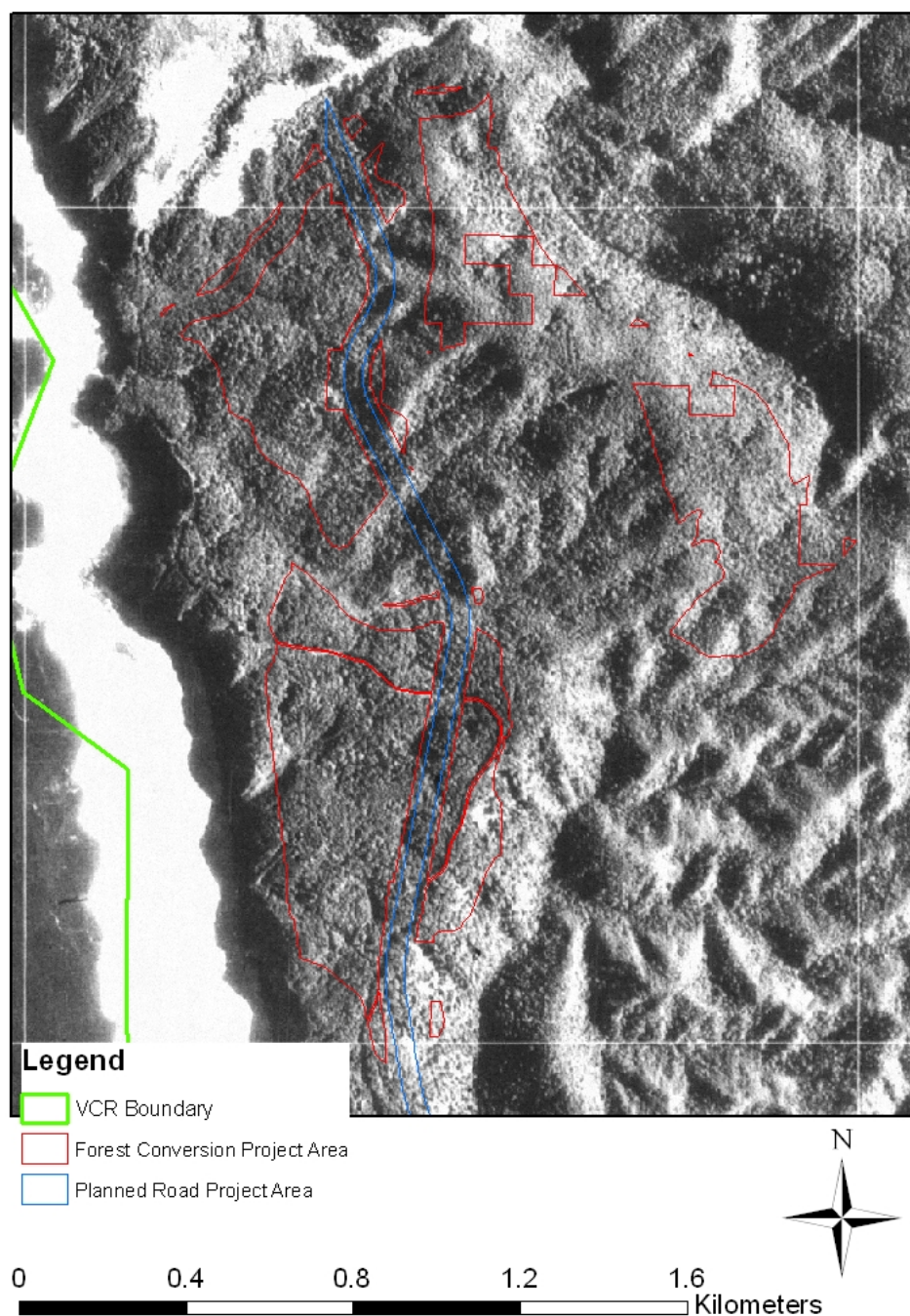


Figure 1.6. Detail from Figure 1.5 above, demonstration that the project area was forest 10 years prior to the project start, i.e. > 10 years old (1993 aerial photography)

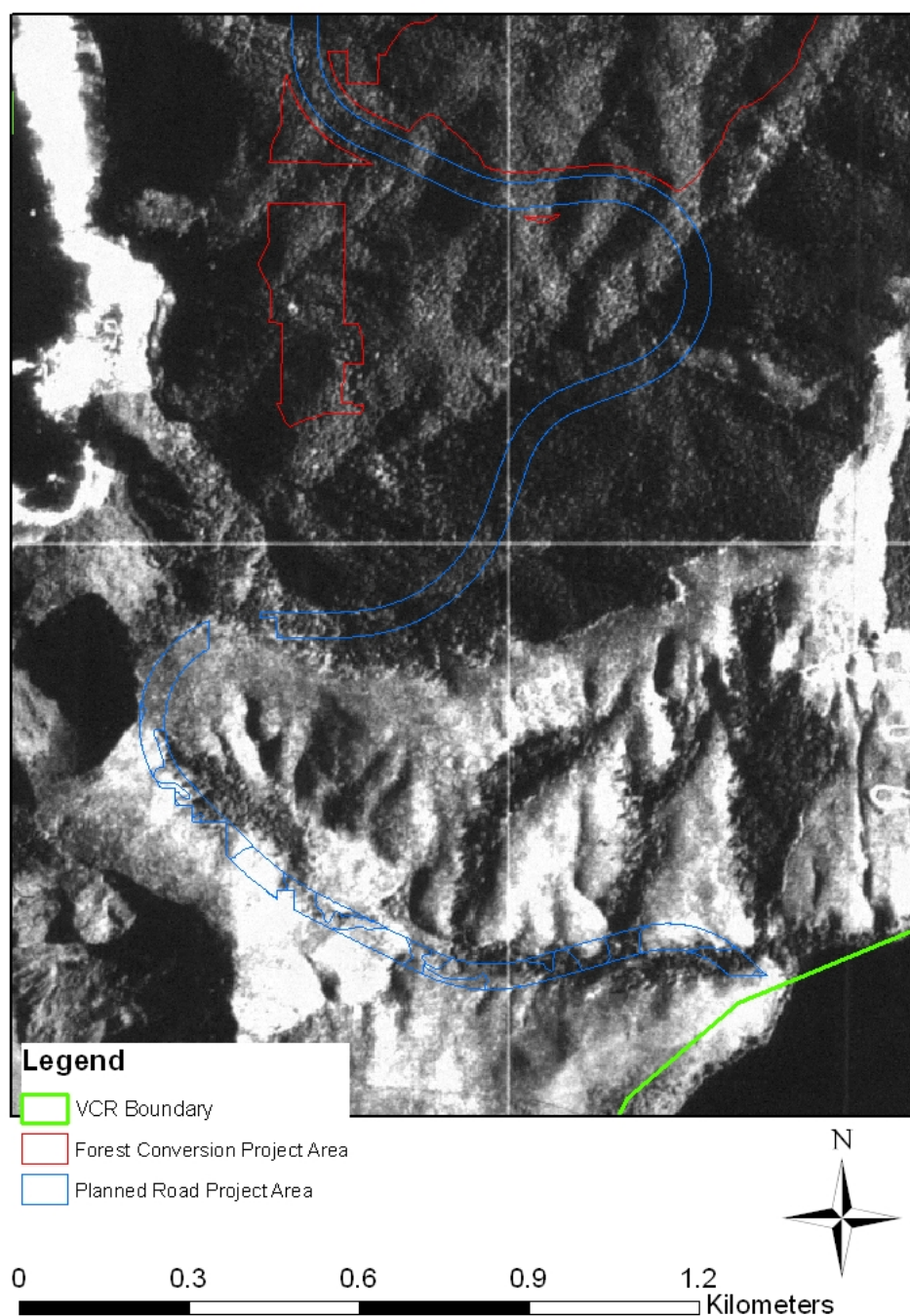


Figure 1.7. Detail: demonstration that the project area was forest 10 years prior to the project start (1993 aerial photography). Note in the road clearance corridor that bare areas without apparent vegetative cover in 1993 are newly-initiated Eucalyptus plantations (see Figure 1.8 below).

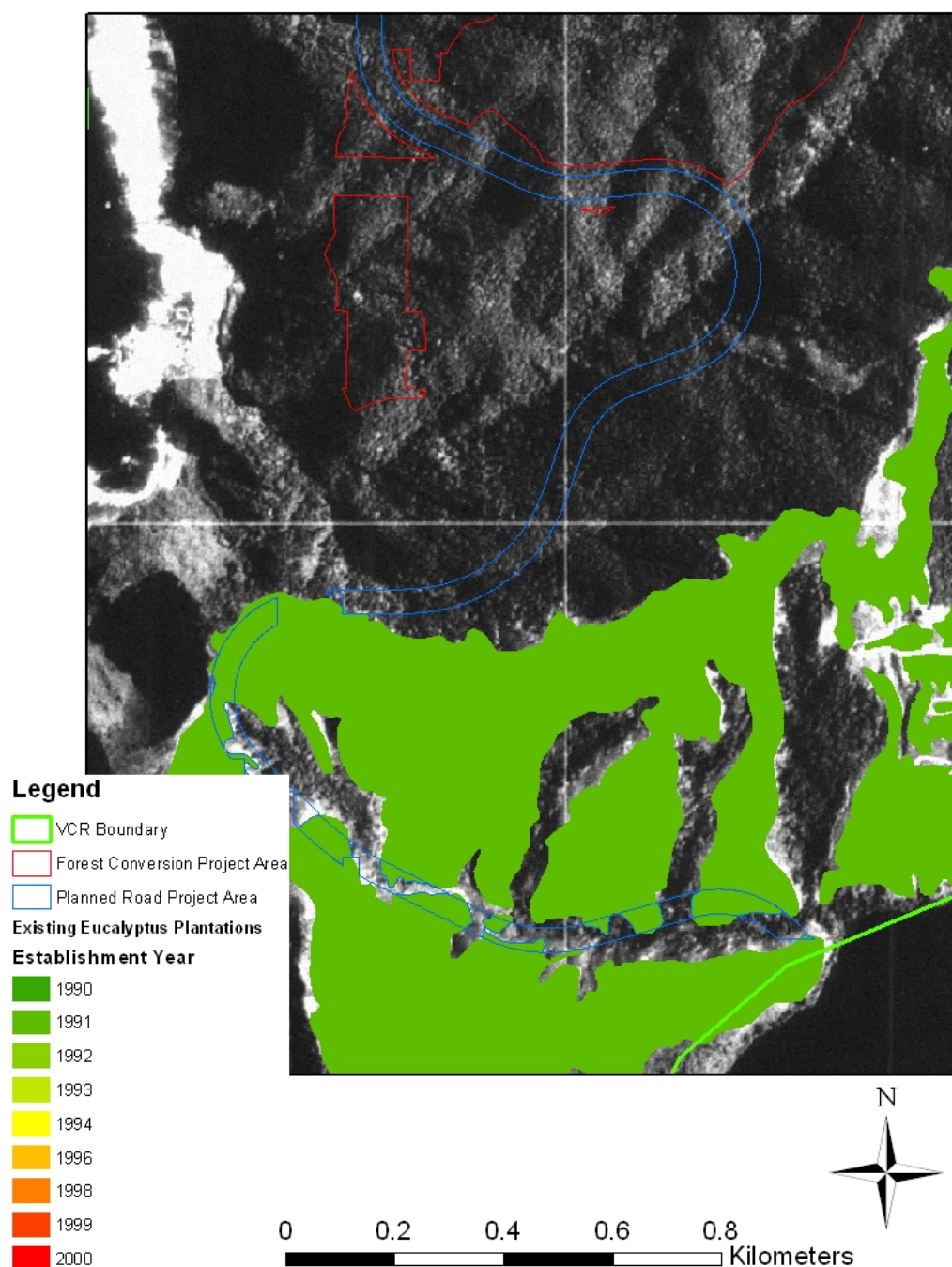


Figure 1.8. Detail: documentation that the bare areas without apparent vegetative cover in 1993 (as seen in Figure 1.7 above) are newly established Eucalyptus plantations. Here, the plantations evident in the road clearance corridor were established in 1991 (two years old at the time of the photograph) and thus 12 years old at the time of project start and eligible for inclusion in the REDD project area.

1.10 Conditions Prior to Project Initiation

Before its acquisition by TNC at the project start date, the project area property had been owned by Bosques S.A. Bosques S.A. had purchased the two parcels (commonly referred to as “Chaihuin” and “Venecia”) comprising the Reserve in November 1995 and July 1996, respectively. During its tenure as owner, Bosques S.A. conducted no harvests or management activities of any kind in the project area. The property has a long history of former owners. A French Countess, Marie Therese Lebaudy, inherited the Chaihuin property in 1922. The Lebaudy family did not develop the property, and was rarely present, and it was transferred through additional owners over time. The Venecia property had been owned by Estanislau Mizgier according to a 1932 deed. By 1988, both the Chaihuin and Venecia properties had been purchased by Terranova, a timber company, and passed through a series of corporate owners interested in legally developing its timber reserves: CAP S.A. in 1993, Invercap S.A. in 1994 and finally Bosques S.A. in 1995/6.

Prior to project start, the entire project area was forest, demonstrated above for the years 1993 and 2002/2003 (Figures 1.3, 1.4, 1.5, 1.6, 1.7 and 1.8). The forest is characterized as Valdivian Temperate Rainforest, with sub-types of coastal evergreen (“siempreverde”, including Olivillo forests) and *Nothofagus* (“coigue”) forests in the project area. A 2011 forest inventory of the project area encountered twenty-seven species, with the majority (59.4%) of basal area made up by the following four species: Mañio Hembra (*Podocarpus saligna*), Canelo (*Drimys winteri*), Tepa (*Laurelia philippiana*) and Luma (*Amomyrtus luma*). Relative basal areas by species are detailed in Table 1.6 below.

Table 1.6 Relative basal area of tree species encountered in the 2011 VCR forest inventory

Common name	Scientific name	Relative basal area
Mañio Hembra	<i>Podocarpus saligna</i>	19.0%
Canelo	<i>Drimys winteri</i>	14.3%
Tepa	<i>Laurelia philippiana</i>	14.0%
Luma	<i>Amomyrtus luma</i>	12.1%
Meli	<i>Amomyrtus meli</i>	6.7%
Trevo	<i>Dasyphyllum diancanthoides</i>	3.9%
Coigue	<i>Nothofagus dombeyi</i>	3.7%
Avellano	<i>Gevuina avellana</i>	3.7%
Ulmo	<i>Eucryphia cordifolia</i>	3.6%
Mañio Macho	<i>Podocarpus nubigena</i>	3.5%
Tepu	<i>Tepualia stipularis</i>	3.4%
Olivillo	<i>Aextoxicum punctatum</i>	3.3%
Coigue De Magallanes	<i>Nothofagus betuloides</i>	2.0%
Romerillo	<i>Sp?</i>	1.3%
Sauco Del Diablo	<i>Pseudopanax laetevirens (?)</i>	1.0%
Sauco	<i>Salix chilensis</i>	1.0%
Tineo	<i>Weinmannia trichosperma</i>	1.0%
Alerce	<i>Fitzroya cupressoides</i>	0.7%
Lingue	<i>Persea lingue</i>	0.4%
Radal	<i>Lomatia hirsute</i>	0.3%

Common name	Scientific name	Relative basal area
Palo Negro	<i>Sp?</i>	0.2%
Tiaca	<i>Caldcluvia paniculata</i>	0.2%
Arrayan	<i>Myrceugenella apiculata</i>	0.1%
Espino Negro	<i>Acacia caven</i>	0.1%
Picha Picha	<i>Myrceugenia planipes</i>	0.1%
Chacay	<i>Sp?</i>	0.1%
Meli - Sauco	<i>Sp?</i>	0.1%
Unidentified	<i>Spp?</i>	0.1%

While specific stand histories are not available for the project areas, in the VCR as a whole, some selective harvest had occurred up until 1944 (fuel wood for the Altos Hornos steel mill in operation in Corral from 1913-1944), but since then no significant harvests have taken place in the native forests of the VCR (excepting conversions to Eucalyptus plantations, which have not occurred in the project area). The forests in the project area are now characterized as mature, uneven-aged, forest.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project proponent, to the best of its knowledge, has complied with all relevant national laws, including labor laws, in the course of project implementation. No citation or notification of nonconformity to any legal statute has been received by the project proponent in relation to the project. The following summary is based on the project proponent's review of applicable local, state and national laws. The summary was conducted with the advice and assistance of outside counsel at the Chilean law firm, "Carey y Cia".

The project proponent is a non-profit organization validly incorporated according to the laws of the Columbia District, United States of America, and has been authorized to develop activities in Chile by the Ministry of Justice through Executive Decree No. 647/2003, which has been modified by Executive Decree No. 2734/2006 and Executive Decree No. 1139/2009.

The project proponent complies with the decrees already mentioned and with the following general laws: (i) Title XXXIII, First Book of the Chilean Civil Code, (ii) Law No. 20,500 on Non Profit Entities and Public Participation in Public Administration, (iii) the Labor Code, (iv) Law Decree No. 824/1974, on Income Tax.

The project proponent also complies with the following labor laws: (v) Law No. 16,744 on Labor Safety and Professional Illnesses, (vi) Law No. 19,728 on Unemployment Insurance, (vii) Law No. 20,123, Subcontracting Law, (viii) Law Decree No. 3,500 on Labor and Social Security Obligations, and Law No. 19,759 of 2001 that modifies the Labor Code to prohibit discriminatory practices in the hiring of employees.

Regarding environmental laws and regulations, the project is in full compliance with Law No. 19,300 Environmental Framework Law, Forest Law contained in Executive Decree No. 4363/1931, the Forestry Development Act contained in Law Decree No. 701/1974 and the Convention on Biological Diversity, which is a law of the Republic of Chile, as promulgated by Executive Decree No. 1969/1994.

1.12 Ownership and Other Programs

1.12.1 Right of Use

On 3 November 2003, The Nature Conservancy took title to the mortgages on the property held by Fleet National Bank, for a price of US \$6.375,000. Fleet Bank was the mortgage holder for the prior property owner, Bosques, S.A., which Fleet Bank had forced into bankruptcy in February 2003. The mortgages were titled to Woodlands Development Company, LLC, (WDC) a Delaware Corporation, which Fleet Bank owned 100% interest in. Through this transaction, TNC acquired 100% interest in the assets of WDC, which consisted solely of the mortgages on the property. On 4 November 2003, as mortgage holder, TNC prevailed at the public

bankruptcy auction in Santiago, Chile and took full fee title to the Bosques properties (now VCR), which consist of two adjacent parcels commonly referred to and titled as “Chaihuin” and “Venecia”. The titles remained in the name of WDC, LLC, which is wholly-owned and controlled by TNC. Therefore TNC owns full fee title to the VCR properties.¹⁴

In 2009, TNC contracted outside local legal counsel, Carey y Cia, to provide an opinion on TNC’s right to develop and sell carbon credits generated through TNC’s activities on the property. Their findings stated:

“4.2 Compatibility of TNC activities with the Political Constitution, environmental laws and policies

Voluntary carbon offsets neither are specially regulated nor have specific policies been set out to promote them as a tool to mitigate climate change effects. However, they are fully compatible with the Political Constitution, environmental laws, the policies, strategies and specific actions set forth in the National Action Plan on Climate Change, and the overall government’s standpoint on offsetting projects.

First, please note that the Political Constitution guarantees the freedom to undertake any commercial activity that complies with the applicable law and does not attempt against moral, good customs and national security. It also guarantees property rights only restricted by the limitations imposed for the protection of the environment and the social function of property that includes among other considerations the conservation of the environment.

In turn, the Law 19,300, Environmental Framework Law, regulates the right to live in a pollution-free environment, the protection of the environment, the preservation of nature and the conservation of the country’s environmental heritage. It defines the conservation of the environment as the rational use, and reparation if the case, of the components of the environment specially those that are unique, rare or representatives of the country’s environment heritage, with the aim of securing its permanence and regeneration capacity. Likewise, it establishes a national protected areas system administered by the State and the possibility to create private protected areas.

The National Action Plan on Climate Change establishes a general strategy regarding climate change mitigation based upon a low-carbon economy aimed at contributing to the country’s sustainable development and the world’s efforts to reduce carbon emissions.

As conclusion, in our opinion, TNC activities harmonize two interests constitutionally protected: the public interest in preserving nature and the private interest in undertaking economic activities. They are also compatible with national regulation and environmental policies on the matter.”¹⁵

1.12.2 Emissions Trading Programs and Other Binding Limits

Chile is a non-Annex I country under the UNFCCC and does not have any GHG reduction commitments under the Convention. No emission reductions generated by the project are or will be part of any regulatory scheme or emissions trading program.

1.12.3 Participation under Other GHG Programs

The project is not registered or seeking registration in any other GHG programs.

¹⁴ TNC title may be confirmed via the following: 1) “Purchase and Sale Agreement – Woodland - TNC”, 3 November 2003 (Fleet Bank sale of 100% of WDC assets to TNC), 2) “Deed Chaihuin”, 3) “Deed Venecia”, 4) “Explanatory Map of Chaihuin and Venecia Parcels in VCR”; 5) “PSA Clarification memo”, 6 November 2003; 6) “WDC Agreement March 2011”; 7) “WDC shares assign to TNC 2003”.

¹⁵ Memorandum October 16, 2009 to TNC from Felipe Leiva and Paulina Sandoval, Carey y Cia. Voluntary Carbon Offsets under Chilean Law

1.12.4 Other Forms of Environmental Credit

The project has not created any other form of environmental credits.

1.12.5 Projects Rejected by Other GHG Programs

TNC is not requesting registration of this project in any other GHG Programs nor has the project been rejected by any other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The project is not a grouped project.

Leakage Management

Throughout project implementation, TNC will continue to engage with the MOP and regional authorities, and in its capacity as member of the CCTL (explained in Section 1.8 above). TNC will advocate for low impact re-routing alternatives to the coastal highway, including improving existing route T470, which can satisfy transportation objectives while reducing environmental impacts.

While TNC has no influence over the industrial forest sector in Chile, the Native Forest Law (Law 20.283/2008) approved in December 2007, and put into effect in 2008, has effectively addressed leakage by stopping conversion of native forest to plantation activity. The law aims to protect native forests from indiscriminate logging and to promote sustainable forest management. Most importantly with regard to leakage from the project activity, the law prohibits the conversion of native forests to non-native plantations, except where existing permits had been previously issued and continue to be in effect (as in the baseline case of the project).

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

REDD Methodology framework:

VM0007 REDD Methodology Module, REDD Methodology Framework (REDD-MF), version 1.3

This project uses the following modules and tools:

Carbon pool modules:

CP-AB "VMD0001 Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools", version 1.0

CP-D "VMD0002 Estimation of carbon stocks in the dead-wood pool", version 1.0

CP-W "VMD0005 Estimation of carbon stocks in the long-term wood products pool", version 1.1

Baseline module:

BL-PL "VMD0006 Estimation of baseline carbon stock changes and greenhouse gas emissions from planned deforestation", version 1.1

Leakage modules:

LK-ASP "VMD0009 Estimation of emissions from activity shifting for avoided planned deforestation", version

1.1

LK-ME “VMD0011 Estimation of emissions from market-effects”, version 1.0. Mandatory where the process of deforestation involves timber harvesting for commercial markets

Monitoring module:

M-MON “VMD0015 Methods for monitoring of greenhouse gas emissions and removals”, version 2.1

Other modules:

X -STR “VMD0016 Methods for stratification of the project area”, version 1.0.

X-UNC “VMD0017 Estimation of uncertainty for REDD project activities”, version 1.0.

Tools:

T-ADD “VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities”, version 3.0.

“AFOLU Non-permanence Risk Tool”, version 3.1

T-SIG “Tool for testing significance of GHG emissions in A/R CDM project activities” – latest CDM-EB approved version

2.2 Applicability of Methodology

Table 2.1. VM0007 REDD Methodology applicability

Conditions of applicability of Methodology	Justification
General Conditions	
Land in the project area has qualified as forest at least 10 years before the project start date.	Land in the project area has qualified as forest for at least 10 years prior to the project start of 2003, demonstrated in section 1.9, with complete forest cover demonstrated for the years 2002/2003 and 1993.
The project area can include forested wetlands (such as bottomland forests, floodplain forests, mangrove forests) as long as they do not grow on peat. Peat shall be defined as organic soils with at least 65% organic matter and a minimum thickness of 50 cm ³ . If the project area includes a forested wetlands growing on peat (e.g. peat swamp forests), this methodology is not applicable.	The project area does not include any wetlands. Wetlands in the VCR are restricted to herbaceous wetlands along rivers.
Project proponents must be able to show control over the project area and ownership of carbon rights for the project area at the time of verification.	As shown in section 1.12, TNC has control of the project area and the ownership of the carbon credits.
Baseline deforestation and baseline forest degradation in the project area fall within one or more of the following categories: - Unplanned deforestation (VCS category AUDD); - Planned deforestation (VCS category APD); - Degradation through extraction of wood for fuel (fuel wood and charcoal production) (VCS category AUDD).	The project falls within the Planned Deforestation category. Official permits authorizing the baseline deforestation activities are referenced in Sections 2 and 3.
Baselines shall be renewed every 10 years after	Baseline will be renewed November 2013.

the start of the project except where triggers lead to a more frequent renewal.	
All land areas registered under the CDM or under any other carbon trading scheme (both voluntary and compliance-orientated) must be transparently reported and excluded from the project area. The exclusion of land in the project area from any other carbon trading scheme shall be monitored over time and reported in the monitoring reports.	No land areas within the project area are currently registered under the CDM or any other carbon trading scheme (neither voluntary nor compliance-based). The exclusion of land in the project area from any other carbon trading scheme shall be monitored over time and reported in the monitoring reports.
If land is not being converted to an alternative use but will be allowed to naturally regrowth (i.e. temporarily unstocked), this framework shall not be used.	In the baseline, forest is cleared in the project area and converted to land uses that preclude natural regrowth (Eucalyptus plantations under continuous management and a road right of way that will be maintained free of vegetation).
Leakage avoidance activities shall not include: - Agricultural lands that are flooded to increase production (e.g. paddy rice); - Intensifying livestock production through use of "feed-lots" and/or manure lagoons	Leakage avoidance activities do not include flooding agricultural lands or intensifying livestock production.
Specific Conditions for module BL-PL Planned Deforestation	
Conversion of forest lands to a deforested condition must be legally permitted.	Official permits authorizing the baseline forest conversion activities are referenced in Sections 2 and 3.
Documentation must be available to clearly demonstrate with credible evidence and documentation that indeed the land would have been converted to non-forest use if not for the REDD project.	Permissibility and intent to convert forest in the without project case are demonstrated and documented in detail in Sections 2 and 3.
Where, pre-project, unsustainable fuel wood collection is occurring within the project boundaries modules BL-DFW and LK-DFW shall be used to determine potential leakage	The project area is remote with limited access and there is no evidence of unsustainable fuel wood collection in the project area (further detailed in Section 3).

2.3 Project Boundary

Table 2.2. GHG emission sources and justifications for exclusion

Source	Gas	Included	Justification/ Explanation
Biomass burning	CO ₂	No	CO ₂ emissions are already considered in carbon stock changes.
	CH ₄	Yes	Conservative to exclude in the baseline. Will be monitored ex post.
	N ₂ O	Yes	
Fossil Fuel Combustion	CO ₂	No	Emissions from fossil fuel combustion are conservatively excluded – emissions from this source in the baseline, from fuel consumption in machinery and transport related to road construction and plantation establishment activities, far exceed those in the project case.
	CH ₄	No	
	N ₂ O	No	
Use of fertilizers	CO ₂	No	Conservative to exclude in the baseline. No fertilizer use is contemplated in the project case as part of leakage mitigation or any other activity.
	CH ₄	No	
	N ₂ O	No	

Table 2.3: Carbon pools

Carbon pools	Included / Excluded	Justification / Explanation of choice
Aboveground	Yes	Mandatory to include. Most significant carbon pool.
Belowground	Yes	Included and treated together with aboveground biomass for completeness to include whole tree (above- and belowground) biomass.
Dead Wood	Yes	Significant pool, particularly in cool temperate rainforests, such as those in the project area, where decomposition rates are slow.
Harvested Wood Products	Yes	Included because wood harvest, and transfer of a portion of forest carbon to storage in long-lived wood products, takes place in the baseline.
Litter	No	Generally not significant (representing <5% of total stocks) and conservatively omitted per methodology.
Soil Organic Carbon	No	As per the methodology, exclusion is always conservative.

2.4 Baseline Scenario

The project baseline scenario involves construction of the coastal highway and execution of existing permits to convert native forest to Eucalyptus plantations, resulting in 86 ha of deforestation and 1,187 ha of planned degradation in the project area, respectively. Both baseline activities are fully elaborated and substantiated in Section 3 below.

2.5 Additionality

Demonstration of consideration of carbon finance

Prior to March 2003 when TNC began in earnest to acquire the VCR, carbon credits were considered as a contributing source of finance for acquisition and management of the VCR. Although the proof of consideration of carbon finance is not a VCS requirement for projects with a 2003 start date, as a supplement to the required VCS additionality tests, the following evidence is provided to demonstrate the explicit consideration of carbon finance given by TNC in the context of the VCR acquisition:

June 2001: TNC proposal to US Department of Energy (which was later funded) for carbon baseline studies at a portfolio of then existing and potential project sites, specifically including the “Valdivian forest region of Chile”.

January 2003: Draft amendment to a contract with the Universidad Austral for work to prepare a report on the carbon baseline in Region X (which included the VCR project area at that time), Chile. Per TNC Chile Program Country Director, the purpose of the report was to establish a baseline for future use in carbon projects by TNC in Region X, within which the VCR, then known as the “Bosques tract”, had been previously identified as a TNC priority in a 2002 land tenure study completed by TNC and WWF (personal communication, Margo Burnham, 2003 TNC Chile Program Country Director), and the study was intended for use in developing offsets in the VCR (personal communication, Bill Stanley, 2003 TNC Global Climate Change Initiative Director).

September 2003: Universidad Austral report¹⁶ delivered to TNC. The report acknowledges TNC’s prevailing intent to develop carbon projects through forest conservation and restoration in Region X of Chile:

“The Nature Conservancy” (TNC) ha trabajado desde 1995 en el campo de la captura de carbono, desarrollando proyectos de protección, restauración y manejo de bosques en todo el continente americano a través de cooperación innovativa con empresas líderes del sector privado. En este sentido, TNC está desarrollando un estudio de factibilidad para establecer proyectos de protección y restauración de bosques en la décima Región de Chile, que signifiquen una reducción y captura de GEI que sean adicionales al negocio como común. Es por esto, que la primera prioridad es establecer el escenario de referencia o línea de base, ya que las reducciones de emisiones y captura de GEI que resultan de estos proyectos se miden al comparar el almacenamiento de C con proyecto, con el almacenamiento de C que se hubiera esperado sin proyecto.”

Following acquisition of the VCR in November 2003, pursuit of carbon finance was still relevant because the bridge loan which made the property acquisition possible (through TNC’s Land Purchase Fund) was as yet unpaid and with no immediate means of repayment, all the while accruing annual interest payments greater than \$200,000. As of the project start date, there was a funding gap of several million dollars that would be needed from unidentified sources to repay the bridge loan. The following evidence is provided to demonstrate the continuing consideration of carbon finance given by TNC in the context of the VCR acquisition post acquisition:

March 2004: Delivery of Neira report on carbon baseline in Region X. Neira, E., Romero, P. and A. Lara. 2004. Complementación del estudio para el diseño de una línea de base para captura de Carbono en la Xma Región de Chile. Instituto de Silvicultura, Universidad Austral de Chile.

2005: Delivery of Gonzalez report. González, P; Lara, A; Ganoso, J; Neira E; Romero P. Sotomayor, L. 2005. Comparison of Three Methods to Project Future Baseline Carbon Emissions in Temperate Rainforest, Curiñanco, Chile. Topical Report. U.S. Department of Energy, National Energy Technology Laboratory, Morgantown, WV USA. 32 p.

2006: Delivery of second Neira carbon study. Romero, Patricio; Neira, Eduardo; Lara, Antonio. Forest Cover and Carbon Changes in Coastal Temperate Rainforest, Chile. Universidad Austral de Chile.

September 2009: TNC commissioned Terracarbon for VCR carbon feasibility study, delivered January 2010. Shoch, D., Settelmyer, S. and J. Eaton. 2010. Forest Carbon Projects in the Valdivian Coastal Reserve, Chile. Feasibility Assessment.

¹⁶ Jorge Gayoso & Bastienne Schlegel, Sept 2003, ESTUDIO DE LÍNEA DE BASE DE CARBONO: CARBONO EN BOSQUES NATIVOS, MATORRALES Y PRADERAS DE LA DÉCIMA REGIÓN DE CHILE, Universidad Austral de Chile.

The steps described below are in accordance with the “Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities”, ver.3.

The entire Valdivian Coastal Reserve in its entirety is the relevant area for addressing additionality because the acquisition of the Reserve represents a single action under consideration by TNC at the project start date, of which stopping continued construction of the coastal highway and conversion of native forest to Eucalyptus plantations are parts but cannot be considered in isolation from the standpoint of TNC.

Step 1. Identification of alternative land use scenarios to the proposed VCS AFOLU project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity

In February 2003, approximately eight months prior to the project start date, the previous owner, Bosques S.A., was forced to file for bankruptcy by their lender, Fleet National Bank, and the VCR property became available for purchase at a future bankruptcy auction. It was widely known by Chilean forestry investors at that time, that the Bosques property, with its transferrable legal permits for further expansion of eucalyptus plantations, would be auctioned, in November 2003. The bankruptcy auction would award the property to the highest bidder. Under law, an offer could be made in cash or, alternatively, the holder of the mortgages could bid the face value of the debt associated with those mortgages. This mechanism essentially gave the mortgage holders first claim on their secured asset, up to the value of the mortgage. Thus, any investor would need to bid more than the face value of the mortgages in order to outbid the mortgage holder, which put the mortgage holder in a highly advantageous position at auction. As such, TNC’s imperative was to purchase the outstanding debt from Fleet Bank, at a discount from its face value, rather than bid against other commercial forestry companies at public auction.

When TNC contacted the property’s mortgage holder, Fleet Bank, about acquiring the property’s debt prior to public auction of the property, Fleet Bank’s representative informed TNC that a forestry investment group had already offered to purchase the debt, so as to later prevail in securing the property at auction along with the permits.¹⁷ This resulted in TNC being given only two days notice by Fleet Bank to deliver a “Letter of Intent” to purchase the debt, if a deal was to be considered with TNC, rather than the forestry investment group. TNC did so, offering to purchase the entirety of the secured debt, an offer that was then accepted by Fleet Bank. In bidding as the mortgage holder at the public auction, TNC was then able to prevail as the winning bidder and took ownership of the property.

Had TNC not purchased the debt from Fleet Bank, the debt would likely have been transferred to the forest management group who had already approached Fleet Bank, which would very likely have resulted in that company also submitting the prevailing bid at auction. Had that company not purchased the debt, or submitted the winning bid at auction, the value of the permits and their forest management potential, as evidenced by ongoing demand for eucalyptus at that time, suggest that only a commercial enterprise with the financial means to make such an expensive purchase and to carry out forestry operations would have been able to secure the property and maximize the value of its legal use.

Alternative land use scenarios identified here consider new owners with different land management objectives.

Alternative 1. A commercial forestry company acquires the property and implements CONAF permits/management plans to substitute native forest with Eucalyptus plantations and carry out sustained Eucalyptus plantation management, and to allow continued coastal highway construction by the MOP unopposed through the property. Note this is equivalent to continuation of the pre-project land-use (where ownership transfers via the Bosques bankruptcy to another similar commercial forestry company).

Alternative 2. TNC or another entity acquires and conserves the property (stopping highway construction and conversion of native forest to Eucalyptus plantations) without the activity being registered as a VCS AFOLU project.

Sub-step 1b. Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations.

Alternative 1.

¹⁷ Personal communication between Greg Fishbein, then Director (TNC), Carlos Fernandez, then Sr. Attorney (TNC) with Fleet Bank representative Jared Ward, 2003.

There are no laws that prevent Alternative 1 from taking place. The conversion of native forest to Eucalyptus plantations and ongoing management of Eucalyptus plantations on the property are explicitly allowed per the CONAF permits in place at the project start date, as listed in Table 3.11a (and which would transfer to the new property owner in Alternative 1):

Areas of permitted plantation establishment in this scenario further incorporate CONAF requirements concerning restrictions around steep slopes and riparian buffer areas (see Section 1) and so represent legally-permitted conversion and harvest activities as per CONAF regulations in effect at the project start date, and have been vetted with CONAF officials. (CONAF, January 2012, Valdivia)¹⁸.

Demonstration of legal permissibility for construction of the coastal highway is detailed in Section 2 by presidential mandate (1994) and resolution of the MOP (1995).

Alternative 2.

There are no laws that prevent the conservation of private property as in Alternative 2.

Sub-step 1c. Selection of the baseline scenario

As per the VCS Additionality tool (VT0001), the baseline scenario is selected and justified applying the methodology, module BL-PL, detailed in Section 3, and corresponds to Alternative 1 here.

Step 2. Investment analysis

It will be demonstrated below, that the project without carbon credits (alternative 2) is not financially attractive in comparison to the alternative use.

Sub-step 2a. Determine appropriate analysis method

As alternative 2 (project scenario) generates financial benefits beyond VCS-related income, related to philanthropic donations, the simple cost analysis cannot be used, and instead the investment comparison analysis method is applied.

Sub-step 2b. –Option II. Apply investment comparison analysis

The financial indicator to be used in the comparison is Net Present Value (NPV) assessed over a 20 year period (2003-2023). For Alternative 2, the NPV analysis uses a nominal discount rate of 4%, which was the TNC endowment interest rate paid to operating units as of the project start date.

For Alternative 1, a nominal discount rate of 5.125% is applied, which reflects a rate relevant to a large Chilean timber company (most likely alternative property buyer) in 2003. Specifically, referencing Arauco's U.S. Securities and Exchange Commission Form 20-F filing, in 2003 Arauco issued a \$300 million dollar, 10-year bond at 5.125%. Both Arauco and Masisa, characteristic of large industrial timber companies operating in Chile at around the project start date, had access to U.S. debt markets and generated a large part of their revenues in US\$ or indexed to US\$ as much of their timber produced at that time was exported to the U.S. and Asia.

Estimated annual cash flows incorporate a 3.1% inflation rate for expenses, and a 3.5% rate for salaries. Prices are assumed constant through the 20-year assessment period.

Financing proceeds to acquire the VCR, and any associated interest costs, are not included in the comparative analysis, as they are equal in both alternatives – any credible land use scenario must first involve acquisition of the property – and also because financing cash flows have an effective NPV of zero (the present value of future repayment of principal and interest equals the value of the financing proceeds).

Sub-step 2c. Calculation and comparison of financial indicator

Details and assumptions for Alternative 1 are provided below.

Cash in:

¹⁸ 5 July 2012 meeting at CONAF (Oficina Provincial Valdivia Dirección: Los Castaños 100, Isla Teja, Valdivia), Attending: Arnoldo Shibar (Director Regional Departamento Forestal, CONAF Región de Los Ríos), Miguel Cárcamo (Consultant for TNC), Liliana Pezoa (TNC).

Eucalyptus harvests: US\$43 per cubic meters; price of *E globulus* wood for pulp for export in 2003¹⁹. Harvests are scheduled in rotations of 15 years, referencing plantation establishment year and area data from Annex 2 “Inventario Forestal Empresas TNC. 2007. The Nature Conservancy.” Establishment of new plantations was derived from application of permits (as yet un-exercised in 2003) and CONAF restrictions, as detailed in Section 3. Growth projections were made applying the area-weighted average annual increment for the VCR *E globulus* plantations, as estimated from 2007 data, of 16.2 m3/ha/yr.

¹⁹ Boletines Estadísticos de INFOR: 1) INFOR. 1998. Monografía *Eucalyptus regnans*. Potencialidad de Especies y Sitios para una Diversificación Silvícola Nacional. 89 p.; 2) INFOR. 2002. Boletín de precios forestales. *Instituto Forestal*; 3) INFOR. 2004. *Eucalyptus nitens* en Chile: Economía y Mercado. 80 p. *Instituto Forestal*. Informe Técnico N 166

Table 2.4. Projected harvest schedule over 20 year assessment period for Alternative 1.

originally planted	ha	harvest m3	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1990	88	-	-	21,311	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21,311	-	-	-
1991	463	-	-	-	112,460	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112,460	-	-
1992	247	-	-	-	-	59,972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59,972	-
1993	176	-	-	-	-	-	42,817	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42,817
1994	167	-	-	-	-	-	-	40,605	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1998	819	-	-	-	-	-	-	-	-	-	-	198,896	-	-	-	-	-	-	-	-	-	-
1999	1,173	-	-	-	-	-	-	-	-	-	-	-	285,136	-	-	-	-	-	-	-	-	-
2000	269	-	-	-	-	-	-	-	-	-	-	-	-	65,343	-	-	-	-	-	-	-	-
2004	505	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	122,618	-	-	-	-
2005	662	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160,939	-	-	-
2006	176	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42,671	-	-
2007	205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49,694	-
2008	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23,693
	total m3	-	-	21,311	112,460	59,972	42,817	40,605	-	-	-	198,896	285,136	65,343	-	-	-	122,618	182,250	155,131	109,666	66,509

Value of land expropriated for continued construction of the Carretera Costera in 2003: US\$ 557,591 (=\$362,072,020 Chilean Pesos * 0.00154²⁰). Under Chile law, when the federal government expropriates private land, the landowner must be fairly compensated at fair market value. The law governing this process is Decreto Ley 2186, published 9 June 1978. At the time of TNC's acquisition of the Reserve in 2003, the government had already expropriated portions of the former landowner's holdings in the Reserve, in order to construct parts of the coastal highway. As evidenced by a decree of the Ministry of Public Works dated 29 October 2002 (Ministry of Public Works Decree N° 1857 of 2002), the Chilean government paid \$87,688,900 Chilean Pesos for Lot 1A, \$103,271,400 for Lot 4A, and \$12,729,650 for Lot 5A. Thus, the government paid \$203,689,950 Chilean Pesos in total for Lots 1A, 4A and 5A, which measure 428,090 (1A); 560,726 (4A); and 68,811 (5A) square meters, respectively, or 105.8 hectares in total. This equates to \$1,925,915 Chilean Pesos in compensation per hectare expropriated on lands adjacent and similar to the project area. The length of planned highway in the project area, (an area that had not already been expropriated), is 23.5 km. The government's right of way secured through expropriation for this section was to a width of 80 meters, so the total area to be expropriated was 188 hectares. Therefore, the estimated expropriation value of this land is \$362,072,020 CP in revenue (188 ha x \$1,925,915 CP/ha = \$362,072,020 CP)

Annual value in 2003 of contracts to supply rock and gravel to the CMT: US\$ 46,162 (=\$29,975,000 CP * 0.00154). In constructing the coastal highway, the CMT required access to rock and gravel, and they had been purchasing these construction materials from the prior landowner (Bosques S.A.), and extracting them from a pit on the prior landowner's property, near Huiro. As documented in minutes from a meeting that TNC and WWF representatives held with the CMT on 11 February 2004 (shortly after TNC acquired the property) (TNC, 2004)²¹, TNC was offered an opportunity to receive \$400 CP per cubic meter of sand and \$500 CP per cubic meter of rock in revenue, in exchange for the Army's continued access to rock and gravel within the Reserve for construction of the highway. These were the rates that had been paid to the prior landowner. As documented in the meeting minutes, the Army estimated that for a section of road from km 10 to km 22 (thus 12 km), the Army would require 225,000 cubic meters of sand and 38,000 cubic meters of rock, equivalent to a value of materials of \$9,083,333 CP per km constructed. At a rate of construction of 3.3 km per year (derived below in Section 3), the annual value of contracts to supply sand and rock is estimated at \$29,975,000 CP or US\$ 46,162. Demand for

²⁰ Exchange rate Nov 3 2003; <http://www.oanda.com/currency/converter/>

²¹ Notes from 11 February 2004 TNC meeting with Chilean Army.

materials is expected to last from project start through 2013 (from km 13.3 through km 47.4). It is worth noting that these construction materials would have been considerably more expensive for the CMT had they been obtained from areas further from the VCR, hence the property owner is in a unique position to secure these contracts. Furthermore, a property owner with commercial interests to improve access to facilitate timber harvests, as in Alternative 1, would be expected to enter into a contract that in the end facilitates construction of the highway. As further evidence of this foregone revenue, prior to the aforementioned meeting, MOP sent a proposal to TNC dated 10 February 2004, requesting cooperation with MOP-CMT in regard to provision of construction materials, with a signature page, already executed by MOP-CMT; TNC did not agree to sign the proposal.

Cash out:

Costs related to Eucalyptus establishment and management are detailed in Table 2.5 below.

Table 2.5 Eucalyptus establishment and management costs²²:

<i>Costs</i>	<i>US\$²³</i>	<i>Chilean pesos</i>	<i>units</i>	<i>year</i>
Site preparation	\$154	\$100,000	\$ /ha	initial establishment only
Plant material	\$146	\$95,000	\$ /ha	at year 0 (planting)
Weed control	\$139	\$90,000	\$ /ha	at year 0 (planting)
Fertilizer	\$69	\$45,000	\$ /ha	at year 0 (planting)
Fencing	\$62	\$40,000	\$ /ha	initial establishment only
Harvest and transport ²⁴	\$15	\$9,650	\$ /m3	harvest
Administration	\$23	\$15,000	\$ /ha/yr	annual

Details and assumptions for Alternative 2 are provided below.

Cash in:

Philanthropic donations are based on TNC accounting records for 2003-2011. Philanthropic funding of \$2.3 million between 2003 and 2011 included a \$1 million pledge from WWF and \$750,000 pledge from Conservation International, in addition to funding from individual donations. From 2013-2023, assumptions include annual philanthropic donations of \$100,000 per year through 2023 (to reflect reasonable assumptions at project start date), which is conservative (as it will produce a higher NPV) relative to actual donations from 2010-2012, which totaled \$0.

²² Boletines Estadísticos de INFOR: 1) INFOR. 1998. Monografía Eucalyptus regnans. Potencialidad de Especies y Sitios para una Diversificación Silvícola Nacional. 89 p.; 2) INFOR.(fencing costs): <http://biblioteca1.infor.cl:81/DataFiles/15439-2.pdf>; 3) INFOR. 2004. Eucalyptus nitens en Chile: Economía y Mercado. 80 p. *Instituto Forestal*. Informe Técnico N 166

²³ Converted to US\$ from Chilean pesos applying exchange rate from Nov 3 2003; <http://www.oanda.com/currency/converter/>

²⁴ Includes road maintenance, harvest, and transport (avg 75 km distance)

In Alternative 2 and the with-project scenario, some limited harvest of existing Eucalyptus, followed by restoration with native forest species, will be carried out on a pilot basis. The principle objective is to restore native forest, rather than to generate income from Eucalyptus harvest, and in fact this activity is conducted at a net cost to TNC (or any other entity that would focus on restoration objectives) because of the extensive reduced impact harvest precautions and cost of plant material and site preparations for the restoration. Conservatively, the contribution of this activity to overall finances is assumed to be zero in this analysis.

Cash out:

Management and operation costs in 2003-2011 are based on TNC accounting system files; management and operation costs in 2012 - 2023 are based on TNC spending plan.

Cost to develop the VCR Conservation Plan (Delgado 2005, TNC 2005) in 2005: US\$ 7,916 (= \$4,684,000 Chilean Pesos * 0.00169²⁵)

Results

Table 2.6. 20 year NPV analysis for Alternative 1. (See ANNEX 12 for full 20 year projection, which is not depicted below due to limited space).

Indicators	3.10%																					
nominal discount rate	5.11%																					
Cash out	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
		\$81,008	\$736,177	\$2,394,836	\$1,429,096	\$1,111,963	\$1,006,412	\$217,620	\$148,806	\$153,419	\$4,169,239	\$6,497,204	\$2,168,339	\$314,991	\$178,719	\$184,260	\$3,159,861	\$5,047,250	\$4,656,108	\$3,523,023	\$2,329,142	
	TOTAL CASH OUT	\$0	\$81,008	\$736,177	\$2,394,836	\$1,429,096	\$1,111,963	\$1,006,412	\$217,620	\$148,806	\$153,419	\$4,169,239	\$6,497,204	\$2,168,339	\$314,991	\$178,719	\$184,260	\$3,159,861	\$5,047,250	\$4,656,108	\$3,523,023	\$2,329,142
Cash in	Rock and sand contracts with CMT	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162	\$46,162										
	Value of expropriated land	\$557,591																				
	Eucalyptus harvests	\$0	\$924,902	\$4,880,781	\$2,602,802	\$1,858,240	\$1,762,270	\$0	\$0	\$0	\$8,632,065	\$12,374,911	\$2,895,873	\$0	\$0	\$0	\$5,321,613	\$7,909,650	\$6,732,694	\$4,759,500	\$2,886,495	
TOTAL CASH IN	\$625,753	\$46,162	\$924,902	\$4,926,963	\$2,648,966	\$1,908,432	\$1,768,432	\$46,162	\$46,162	\$46,162	\$8,678,227	\$12,374,911	\$2,895,873	\$0	\$0	\$0	\$5,321,613	\$7,909,650	\$6,732,694	\$4,759,500	\$2,886,495	
Net cash flow	\$625,753	\$46,162	\$843,894	\$2,532,107	\$1,219,868	\$792,468	\$862,020	\$17,542	\$102,646	\$102,742	\$4,508,987	\$5,877,707	\$2,895,873	\$0	\$0	\$0	\$2,161,713	\$2,862,400	\$2,083,392	\$1,236,357	\$557,353	
NPV	\$14,790,041																					

NPV: \$ 14,790,041 (discount rate: 5.125%)

For comparison, Álvarez y Sandoval (1999)²⁶ estimated NPV's in 12 year pulp rotations of *Eucalyptus nitens* from US\$2,767 to US\$3,046 per ha at a discount rate of 10%. The parameters used in this analysis yield an equivalent (i.e. excluding revenue from rock and sand contracts and expropriated lands, applying a 10% discount rate) of ~US\$2,400/ha NPV across all stands in the VCR, slightly less than the results of Álvarez y Sandoval, attributable to the shorter rotations and faster growth of *Eucalyptus nitens*.

Table 2.7. 20 year NPV analysis for Alternative 2. (See ANNEX 12 for full 20 year projection, which is not depicted below due to limited space).

²⁵ Exchange rate Jun 14 2005; <http://www.oanda.com/currency/converter/>)

²⁶ ÁLVAREZ, J.; SANDOVAL, E. 1999. Silvicultura Integrada en Eucalyptus nitens In: XII Silvotecnica. Realidad y Potencial del Eucalipto en Chile. 23 – 44 p.

Alternative 2 Valdivian Coastal Reserve project financial analysis

Inflation	3.5% for personnel expenses; 3.1% for other expenses											
nominal discount rate	4.00%											
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cash out	(a) management/operations		\$147,288	\$400,729	\$336,174	\$404,136	\$351,218	\$253,065	\$312,328	\$286,401	\$420,059	\$400,389
	(b) cost to create conservation Action Plan			\$7,916								
	TOTAL CASH OUT	\$0	\$147,288	\$408,645	\$336,174	\$404,136	\$351,218	\$253,065	\$312,328	\$286,401	\$420,059	\$400,389
Cash in	(c) Philanthropic donations	\$0	\$858,086	\$826,988	\$334,630	\$148,684	\$125,749	\$4,910	\$0	\$0	\$0	\$100,000
	TOTAL CASH IN	\$0	\$858,086	\$826,988	\$334,630	\$148,684	\$125,749	\$4,910	\$0	\$0	\$0	\$100,000
	Net cash flow	\$ -	\$ 710,798	\$ 418,343	\$ (1,544)	\$ (255,452)	\$ (225,469)	\$ (248,154)	\$ (312,328)	\$ (286,401)	\$ (420,059)	\$ (300,389)
	NPV	\$ (2,195,106)										

NPV: (Negative) \$ - 2,195,106 (discount rate: 4%)

Comparative NPV's for the two alternative land uses are presented in Table 2.8 below.

Table 2.8. Comparative NPVs for Alternatives 1 and 2.

Alternative	Scenario	NPV (US\$)
1.	Conversion of native forest and clearance for coastal highway	\$ 14,790,041
2.	Conservation of the project area	\$ - 2,195,106 (Negative)

As can be seen in the table above, Alternative 1 yields an NPV (US\$ 14,790,041) higher than Alternative 2, and therefore is demonstrated to be more financially competitive than the project activity without carbon revenues.

Sub-step 2d. Sensitivity analysis

The results of the financial comparison above are robust to reasonable variations in revenue and costs, borne out the in the sensitivity analysis below (Table 2.9).

Table 2.9. Sensitivity analysis

Alternative land use scenario	Base assumptions NPV (US\$)	Alt 1 prices ↓10% costs ↑10%, Alt 2 mgt costs ↓10% Revenue (2013-2023) ↑10% NPV (US\$)	Alt 1 prices ↓20% costs ↑20%, Alt 2 mgt costs ↓20% Revenue (2013-2023) ↑10% NPV (US\$)
1. Conversion of native forest and clearance for coastal highway	\$ 14,790,041	\$9,022,886	\$3,255,732
1. Conservation of the project area	\$ -2,195,106	\$ -1,641,078	\$ -1,087,049

In all cases, the NPV of Alternative 1 is substantially than the NPV of Alternative 2.

Result Step 2: As demonstrated above, the project without the financial benefits of carbon VCS is not financially competitive with reasonable alternative economic activities.

STEP 4 – COMMON PRACTICE

The project activity, Alternative 2 - conservation of the project area, cannot be considered common practice. As of the project start date in 2003, we were aware of no private protected areas of any significant area in existence within Chile.

More specifically, the cancellation of an approved permit to conduct forest “substitution” activities cannot be characterized as common practice in the region of the project. While it is not possible to assess the lack of follow through on existing permits on a case by case basis, there is ample evidence to demonstrate that the reverse - executing legal forest substitution permits - was common practice in the region around the time of the project start date. On the VCR property, the previous landowner, Bosques S.A., legally converted 1,871.1 ha of native forest to Eucalyptus plantations from 1998 to 1999, equivalent to a rate of 936 ha/yr by this landowner alone. In 2003, Wilson et al²⁷ considered conversion to plantations as one of the greatest deforestation threats faced by temperate rainforests in Chile. Wilson et al (2005) assessed the landscape dynamics of native forest conversion to plantations in the project region (Valdivia, Osorno and Llanquihue provinces of then Region X), and at the time of their study, ~200,000 ha of native forest had been converted to plantations in the region, most of this occurring since the mid-1970's with continuing incentives (subsidies and tax exemptions) provided by the Chilean government.

Regarding road construction, the MOP has a mandate from the government to expand road infrastructure throughout the country, with particular emphasis on the more remote regions like that of the project area, and ongoing expansion of roads by the MOP must thus be considered common practice as it continues to execute its mandate.

As demonstrated above, as of the project start date, expansion of plantation forestry and the regional highway network are common practice in the region, and thus prevention of these activities (i.e. the project activity, Alternative 2) cannot be considered the norm.

²⁷ Wilson, K, Newton, A, Echeverria, C, Weston, C. and M. Burgman, 2005. A vulnerability analysis of the temperate forests of south central Chile. Biological Conservation 122 (2005) 9–21 (paper submitted September 2003)

RESULT OF THE ADDITIONALITY ANALYSIS:

As demonstrated above, the project activity, without revenue from carbon credits, it is not the most financially attractive land use alternative, and it is not a common practice in the region. Therefore, the project is determined to be additional.

2.6 Methodology Deviations

The following deviations to methodology VM0007 were applied:

The rate of deforestation for the planned highway construction was based on historic construction rate for the same highway. Although a construction timetable was specified in the engineering plan, it was considered unrealistically aggressive compared to previous progress (explained further in Section 3.1). Although module BL-PL specifies that “where a valid verifiable plan exists for rate at which deforestation is projected to occur, this rate shall be used”, the project instead conservatively employs the observed historic construction rate of the constructed section of the same road (and same logistics and operations by the CMT as would take place in the baseline) to set the rate of deforestation for the planned highway construction.

Per module CP-AB, “measurements of initial stocks employed in the baseline must take place within ± 5 years of the project start date.” Native forest stocks in the VCR and project area were measured in a forest inventory taking place in 2010/2011, approximately 7 years after the 2003 project start date. While this represents a deviation from the methodology, application of stock estimates derived 7 years after the project start date logically aligns with the subsequent assumption in CP-AB and other pools modules in methodology VM0007 that “...stock estimates are valid in the baseline (i.e. treated as constant) for 10 years.” The assumption that stocks are roughly at steady state is considered valid because the native forests in the project area are mostly mature stands with no significant disturbance history (see also Section 1.10).

Estimation of mean forest biomass carbon stocks per unit area employs a method different from that detailed in VM0007 module CP-AB (where the inventory level mean is derived from plot level biomass per unit area estimates). The 2010/2011 forest carbon inventory, detailed in Annex 1, instead employed a double sampling approach producing independent estimates of live tree basal area (m^2/ha) and live tree biomass:basal area ratios (BBAR, expressed in $t\ C/m^2$), which were then combined to produce inventory level estimates of mean biomass per unit area. This sampling approach has been peer-reviewed (Avery and Burkhart 1994, Iles 2003, Marshall et al 2004²⁸) and is equally robust, and more efficient than, the more traditional approach outlined in VM0007 module CP-AB.

Tree biomass was estimated with measured diameter at breast height (dbh) as the sole independent variable, in alignment with the construction of the Gayoso et al (2002²⁹) allometric equation used, developed specifically for the project region and forest type. Although height is not included, height is correlated with dbh and is implicitly included in the model.

For monitoring potential for illegal degradation, module M-MON is employed. Because it is extremely sensitive to ask of community members explicit questions regarding timber harvest activities, instead of the participatory

²⁸ Avery, T.E. and H.E. Burkhart. 1994. Forest Measurements. Fourth Edition. McGraw Hill, Boston, Massachusetts, USA. 408 pp.

Iles, K. 2003. A Sampler of Inventory Topics. Kim Iles and Associates, Ltd.

Marshall, D., Iles, K., and J. Bell. 2004. Using a large-angle gauge to select trees for measurement in variable plot sampling. Canadian Journal of Forestry Resources 34: 840-845.

²⁹ Gayoso, J.; Guerra, J.; Alarcón, D. 2002. Contenido de carbono y funciones de biomasa en especies nativas y exóticas. Proyecto FONDEF D98I1076 Medición de la capacidad de captura de carbono en bosques de Chile y promoción en el mercado mundial. 157 p.

rural appraisal approach specified in module M-MON, involving direct interviews in communities surrounding the project area to evaluate potential for illegal degradation, an alternative approach was pursued involving consultation with local authorities responsible for tracking these activities (elaborated in Section 4).

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Baseline emissions are estimated applying module BL-PL (VMD0006) of Methodology VM0007.

3.1.1 Stopping construction of the coastal highway

Baseline emissions are calculated applying module BL-PL. In the baseline scenario, the agent of deforestation is the government of Chile Ministry of Public Works (MOP), with forest clearance directly carried out by the Chile Army Corps of Engineers (CMT).

Imminent threat of deforestation in the project area is demonstrated with the following evidence:

1. *Legal permissibility for deforestation* is demonstrated by:
 - Presidential Mandate, Frei Ruiz-Tagle, E., 1994. Proyecto "Camino Costero Sur" GAB. PRES N° 94/4360. Santiago, Chile to develop the Carretera Costera.
2. *Suitability of project area for conversion to alternative non-forest land use* is demonstrated by:
 - 2000 definitive engineering study for the Carretera Costera commissioned by the MOP: Empresas Intrat S.A. 2000. Estudio de Ingeniería Construcción y Mejoramiento Camino Costero Sur Sector : Chaihuín - Río Bueno - Estero Quihue Tramo : Chaihuín - Estero Dehui Km. 0,000 A Km. 53,200 Región : X. Contracted by República De Chile, Ministerio De Obras Públicas, Dirección General De Obras Públicas, Dirección De Vialidad, Departamento De Estudios.
3. *Evidence of likely transfer of ownership to baseline agent of deforestation or class of agent of deforestation must be demonstrated by one of the following forms of evidence originating prior to the date of all evidence on pursuit of carbon finance/consideration of REDD* is demonstrated by evidence that control of the project area would have been transferred to the baseline agent or class of agents in the absence of the project.

In the absence of the project, the government of Chile would have expropriated the lands along the road corridor, to a 60 - 80 meter width from the axis of the road; per the engineering plan (Empresas Intrat S.A. 2000),

"En cuanto a la expropiación, esta se ha definido con una faja de expropiación variable de 60 metros desde km. 0,260 hasta el km. 25,000, y de 80 metros del km. 25,000 hasta el km. 53,200."

The expropriation process is legally made possible under decree law No. 2186 Jun 9 1978. The government of Chile had already expropriated lands to km 23.9 (to Pichicolun Creek) as of the project start date, and would continue to do so following the MOP's expropriation plan, covering the entire project area (Figure 3.1).

ESTUDIO DE INGENIERIA CAMINO: COSTERO SUR SECTOR: CHAIHUIN-RIO BUENO-ESTERO QUIHUE TRAMO KM 0,000 A KM 48,45	REGION : X PROVINCIA : VALDIVIA-OSORNO COMUNA : CORRAL LA UNION	DESCRIPCION : PLANO DE UBICACION CUADRO DE EXPROPIACIONES SECTOR: RIO CHAIHUIN-RIO BUENO	 EXP 01 DE 35 AGOSTO 2001
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tegua

PLANO DE

CUADRO DE EXPROPIACIONES

LAMINAS	LORES	PROPIETARIOS	REQUERIMIENTOS		SUPERFICIES		ROL	COMUNA	DIRECCION	PROPIETARIO APARENTE	OBSERVACIONES
			DE Km.	A Km.	TERRENO	CONSTRUCION					
3 a la 7	1A	LENGUA SECURITY S.A.	0,0000	7,31334	426,286	66	112-18	CORRAL	HACIENDA CHARRIN		
7 a la 9	2A	VENISADO DE WALDAN	7,31336	16,01308	182,190	0	112-54	CORRAL	CHARRIN PUE		
9 a la 10	3A	FACTURING LEASING S.A.	16,01308	12,20995	154,571	0	530-63	LA UNION	FED CHARRIN LT A 2		
10 a la 17	4A	LENGUA SECURITY S.A.	12,20995	22,40200	560,726	0	112-18	CORRAL	HACIENDA CHARRIN		
17 a la 18	5A	INVERSIONES DE HUALIANO SA	22,40200	23,70703	68,811	0	530-42	LA UNION	HACIENDA VENEZA		
18 a la 23	6A	INVERSIONES DE HUALIANO SA	23,70703	30,32503	500,930	0	530-42	LA UNION	HACIENDA VENEZA		
23 a la 24	7	INVERSIONES DE HUALIANO SA	30,32503	31,88000	69,199	0	530-42	LA UNION	HACIENDA VENEZA		
23	8	ORCULO HUICOLLANO DE LA UNO	30,32503	30,77553	8,452	0	530-83	LA UNION	HUICOLLANO		
23	9	ORCULO HUICOLLANO DE LA UNO	30,77553	31,32657	12,435	0	530-83	LA UNION	HUICOLLANO		
24	10	ORCULO HUICOLLANO DE LA UNO	31,32657	32,80331	24,102	0	530-83	LA UNION	HUICOLLANO		
24 a la 25	11	INVERSIONES DE HUALIANO SA	32,80331	33,58777	22,054	0	530-42	LA UNION	HACIENDA VENEZA		
25 a la 26	12	INVERSIONES DE HUALIANO SA	33,58777	47,08000	1,142732	0	530-42	LA UNION	HACIENDA VENEZA		

MINISTERIO DE OBRAS PUBLICAS DIRECCION GENERAL DE OBRAS PUBLICAS DIRECCION DE VIALIDAD	EJECUCION DEL PROYECTO			APROBACION DEL PROYECTO	
	CONSEJERO	SECRETARIO	CONSULTOR	INTRA	
	JEFE DE PROYECTO	GERARDO CONEYERIA	CONSULTOR	A-M	
	INSPECTOR FISCAL	PABLO RACHO	CONSULTOR		

Figure 3.1. Ministerio de Obras Publicas expropriation plan for the project area

As historically, and in alignment with the construction process, which is carried out in successive tramos or sections of construction, expropriation would be done in a staggered process, until complete.

4. *If government approval is required for deforestation to occur, the intention to deforest within the project area must be demonstrated by evidence of recent approval from relevant government department (local to national) for conversion of forest to an alternative land use:*

- Presidential Mandate, Frei Ruiz-Tagle, E., 1994. Proyecto "Camino Costero Sur" GAB. PRES N° 94/4360. Santiago, Chile to develop the Carretera Costera.

5. *Intention to deforest is demonstrated by the following form of evidence originating prior to the date of all evidence on pursuit of carbon finance/consideration of REDD: [Where a specific baseline agent has been identified] a valid and verifiable land use management plan for deforesting the project area.*

The relevant land use management plan is the 2000 engineering study for the Carretera Costera commissioned by the MOP: Empresas Intrat S.A. 2000. Estudio de Ingeniería Construcción y Mejoramiento Camino Costero Sur Sector : Chaihuín - Río Bueno - Estero Quihue Tramo : Chaihuín - Estero Dehui Km. 0,000 A Km. 53,200 Región : X. Contracted by República De Chile, Ministerio De Obras Públicas, Dirección General De Obras Públicas, Dirección De Vialidad, Departamento De Estudios.

The earliest consideration of carbon finance by The Nature Conservancy with respect to the VCR project was in June 2001 with the US Department of Energy proposal for carbon baseline studies in the "Valdivian forest region of Chile" (detailed under Additionality section 2.5). The engineering plan, written in 2000, thus predates all consideration of carbon finance, and was already in implementation, to km 13, at the time of the project start date.

The rate of deforestation in the baseline was based on the observed historic construction rate of the northern stretch of the road from west of the Chaihuin bridge (km 0) to km 13.3, where construction stopped (Figure 3.2).

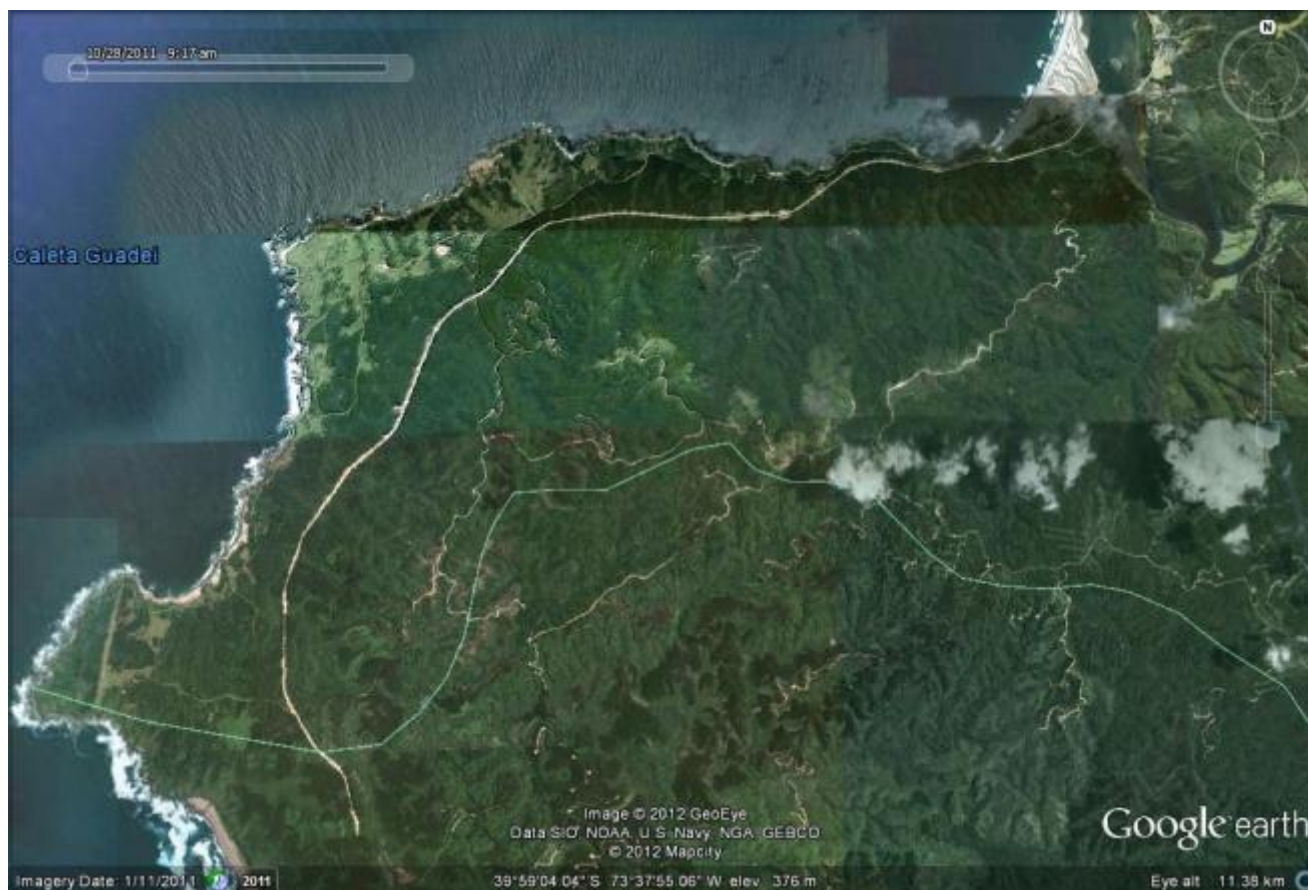


Figure 3.2. Satellite imagery from 28 Oct 2011, sourced from Google Earth.

This segment of the road was built over a four-year period from 2000 through 2003 (personal communication Carlos Herrera Garcia, MOP, Santiago 19 March 2012). Construction start and end dates are confirmed from assessment of historic Landsat imagery (Figures 3.3, 3.4, 3.5 and 3.6).



Figure 3.3. Landsat image from 23 Oct 1999, demonstrating that road construction had not yet commenced.

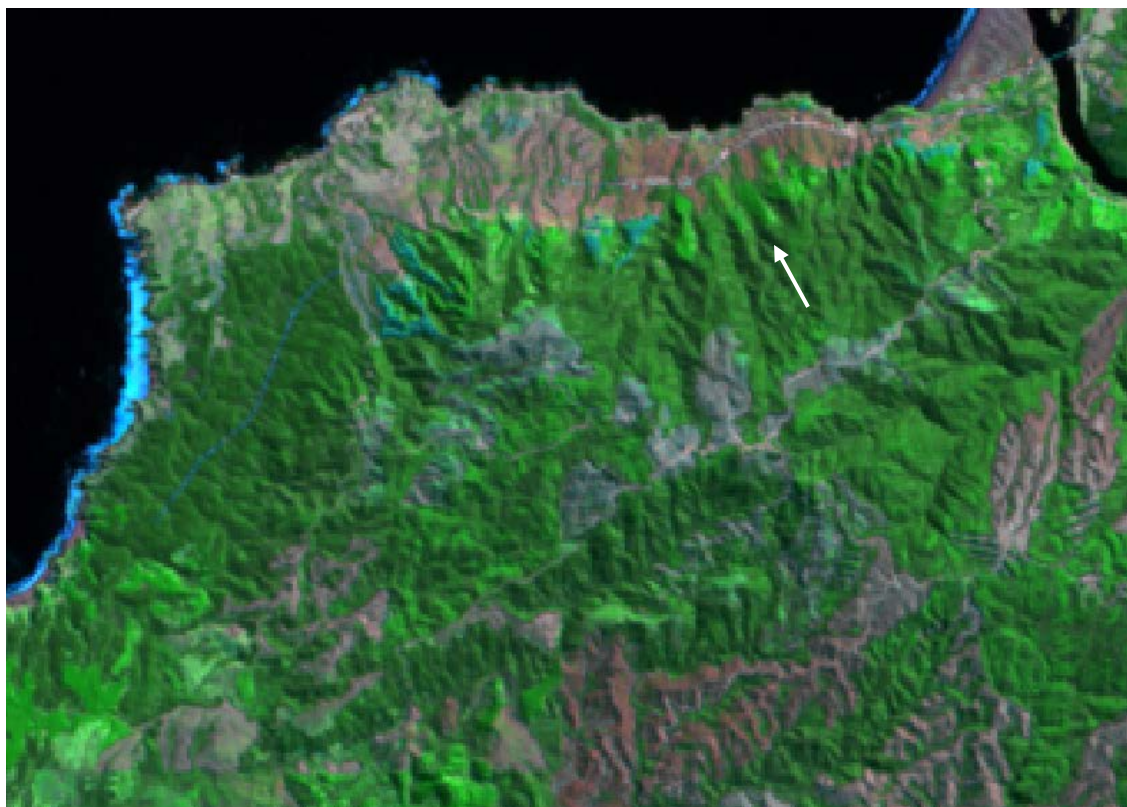


Figure 3.4. Landsat image from 31 March 2000, demonstrating that road construction was underway.



Figure 3.5. Landsat image from 20 February 2003, demonstrating road construction to km 10.

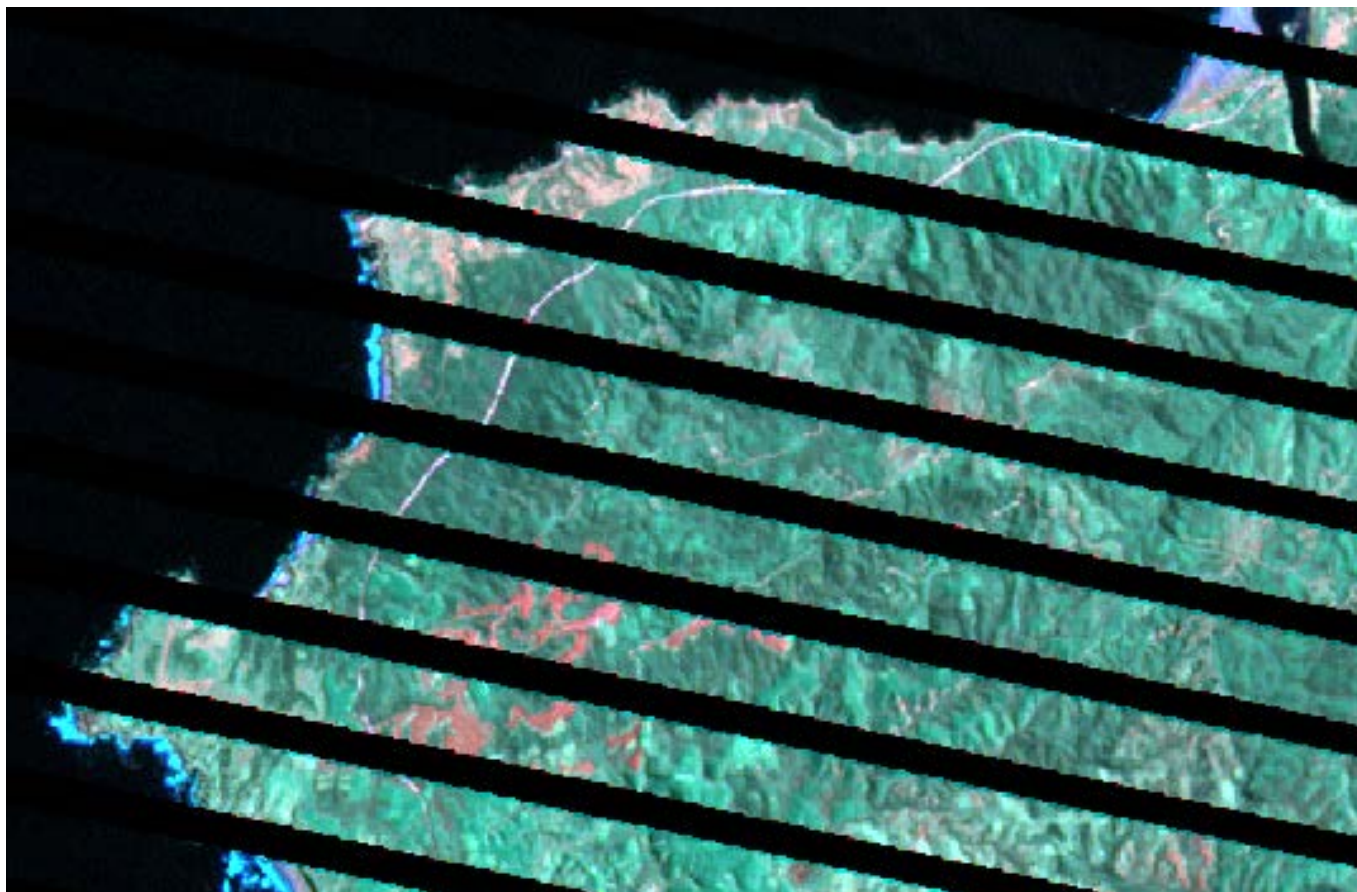


Figure 3.6. Landsat image from 9 February 2005, demonstrating road construction to km 13 (where construction stopped). Striping is due to scan line error.

Thus, the rate of deforestation (i.e. rate of construction) was 3.3 km per year (13.3 / 4 years). This rate of road construction is on the low end of typical rates of 3 to 7 km per year as explained in consultation with MOP and CMT personnel (personal communication Carlos Herrera Garcia, MOP, and Col. Andres Silva Vega, CMT, Santiago 19 March 2012). In fact, the rate as derived is conservative because construction was suspended for several months in 2003 as part of the process to intervene by the La Coalición para la Conservación de la Cordillera de la Costa (CCCC).

Methodology VM0007 module BL-PL states that “where a valid verifiable plan exists for rate at which deforestation is projected to occur, this rate shall be used”. The approved engineering plan and solicitation to contractors for the road specifies a construction timeline of 560 days (1.5 years) for the 53.2 km stretch of road from Chaihuín to Río Bueno,

“2.2.4 Plazo para la Ejecución de la Obra.

El plazo máximo para la ejecución de las obras será de 560 días corridos; contados en la forma señalada en el Art. 154 del R.C.O.P.”³⁰

³⁰ Empresas Intrat S.A. 2000. Estudio de Ingeniería Construcción y Mejoramiento Camino Costero Sur Sector : Chaihuín - Río Bueno - Estero Quihue Tramo : Chaihuín - Estero Dehui Km. 0,000 A Km. 53,200 Región : X. Contracted by República De Chile, Ministerio De Obras Públicas, Dirección General De Obras Públicas, Dirección De Vialidad, Departamento De Estudios. (See ANNEX 4)

Nonetheless, because this timetable is considered unrealistic, the project instead conservatively applies a construction rate of 3.3 km per year based on the observed historic rate of construction of the proximal stretch of road immediately north of the project area, as derived above.

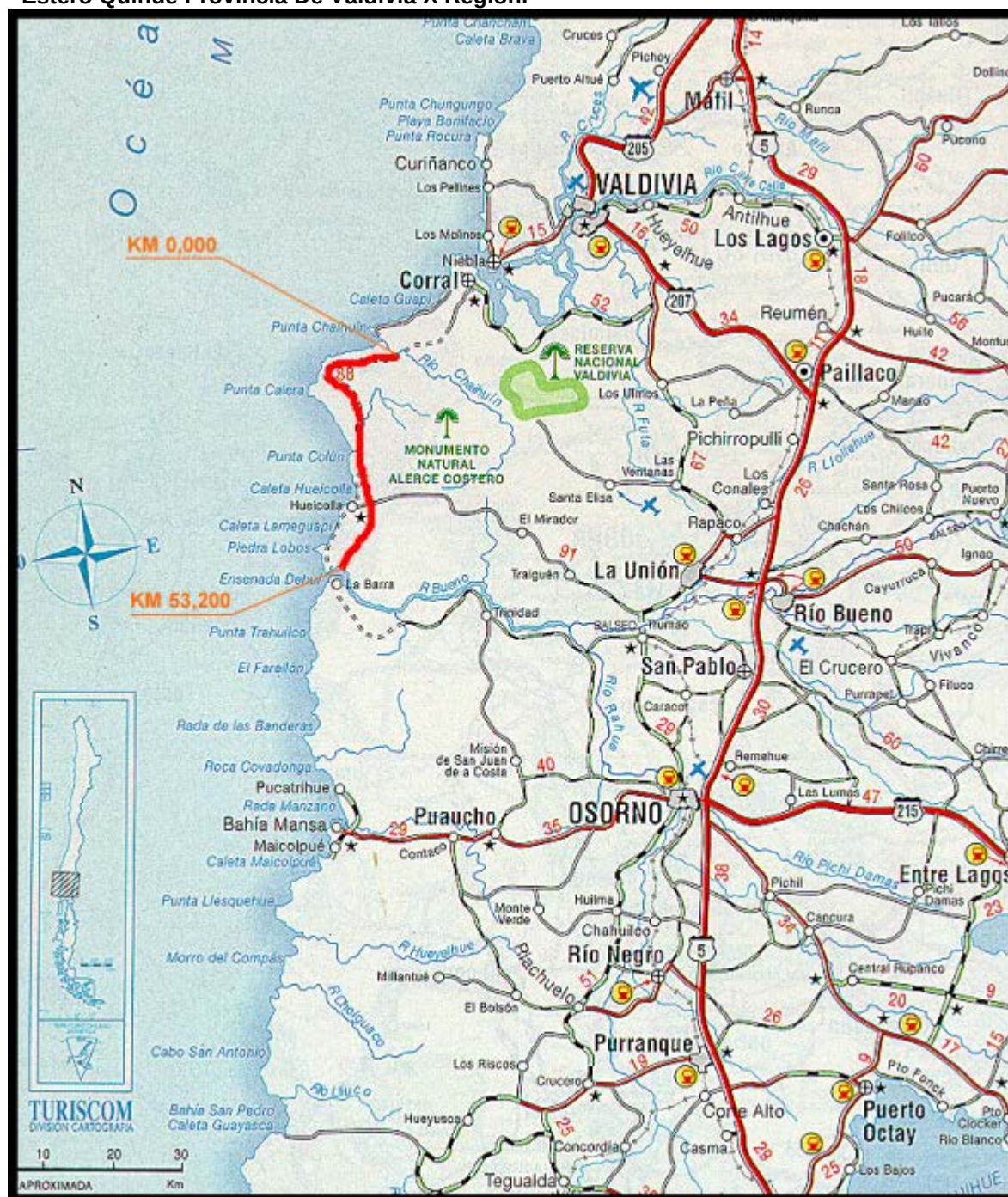
The project area is not under government control and is not zoned for deforestation, thus per BL-PL section 1.4,

“For all other planned deforestation areas (i.e. areas not both under government control and zoned for deforestation), $L-D_i$ shall be equal to 100%”,

likelihood of deforestation ($L-D_i$) is set at 1. Risk of abandonment of constructed roads is logically assumed to be equal to zero.

The area deforested via road construction in the baseline references the siting of the future road as specified in the approved construction plans (Empresas Intrat S.A. 2000, Figure 3.7).

Figure 3.7.³¹ Planned siting of the Carretera Costera, Plano De Ubicacion Sector Chaihuín - Río Bueno - Estero Quihue Provincia De Valdivia X Región.



For spatial projection purposes, the road was digitized from the official map of the Vialidad (**Annex 5**).

For the width of the road clearance area, the baseline projection referenced average actual width of cleared right of way on the constructed portion of the road from Chaihuín to km 13.3, as sampled and measured in the field in November 2010. Width of clearance was sampled systematically from south to north at points every

³¹ Empresas Intrat S.A. 2000. Estudio de Ingeniería Construcción y Mejoramiento Camino Costero Sur Sector : Chaihuín - Río Bueno - Estero Quihue Tramo : Chaihuín - Estero Dehui Km. 0,000 A Km. 53,200 Región : X. Contracted by República De Chile, Ministerio De Obras Públicas, Dirección General De Obras Públicas, Dirección De Vialidad, Departamento De Estudios. (See **ANNEX 4**)

500 meters, starting with a random start from km 13.3 (south end of the constructed road). Measurements are detailed in Table 3.1 below.

Table 3.1. Measurements of width of the constructed portion of the coastal highway from Chaihuin to km 13.3.

Sample point	Meters width of forest clearance	Notes
1	60	
2	51	
3	28	
4	40	
5	24	
6	37	
7	46	
8	49	
9	47	
10	50	
11	54	
12	48	
13	30	
14	24	
15	35	
16	27	
17	43	
18	84	
19	n/a	CMT operations base - not measured, as it was atypically wide (thus conservative not to include)
20	92	
21	36	
22	48	
23	29	
24	44	
25	n/a	not possible to measure due to presence of gorse
26	n/a	driveway of reserve - not measured, as it is atypically wide (thus conservative not to include)
	45	= average of 23 measured points

The average width of cleared area was 45 meters (22.5 m either side of the road axis), which is used as the width of the APD project area. In fact, the approved engineering plans specify a 60 to 80 meter right of way,

“En cuanto a la expropiación, esta se ha definido con una faja de expropiación variable de 60 metros desde km. 0,260 hasta el km. 25,000, y de 80 metros del km. 25,000 hasta el km. 53,200.”³²

³² p. 5 Empresas Intrat S.A. 2000. Estudio de Ingeniería Construcción y Mejoramiento Camino Costero Sur Sector : Chaihuín - Río Bueno - Estero Quihue Tramo : Chaihuín - Estero Dehui Km. 0,000 A Km. 53,200

which would correspond with the legally-permitted area of forest clearance (“faja fiscal” or right-of-way), while the 45 meters width as measured represents the likely area of forest clearance in practice.

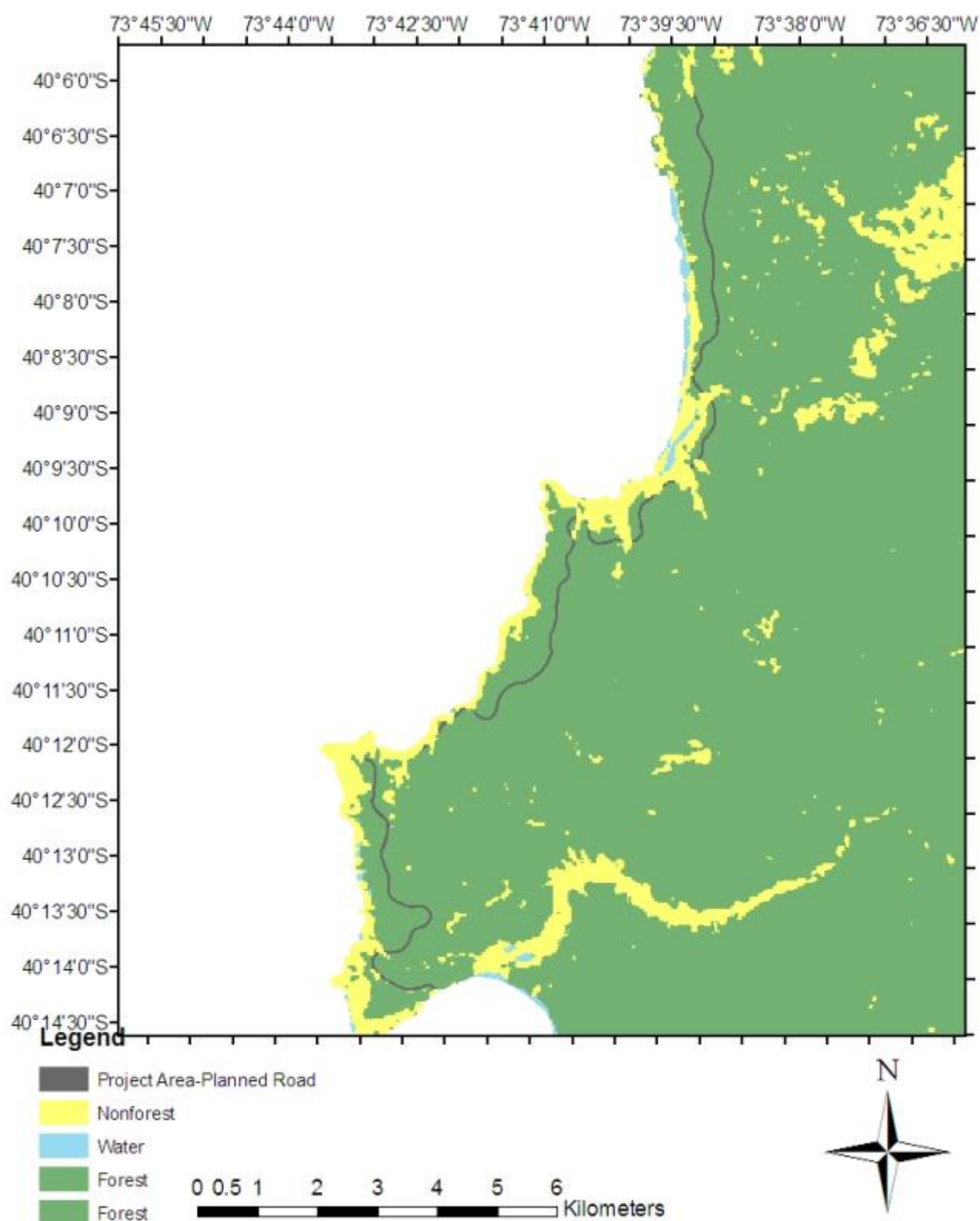


Figure 3.8 Project area of stopping highway construction APD activity

In the baseline, road construction and deforestation continues from km 13.3 starting at the project start date of 4 November 2003, and progresses at a rate of 3.3 km per year. Deforestation in the project area in the

baseline does not occur until road construction reaches the border of the project area at km 23.9, in project year 2006 (Table 3.2).

Table 3.2 Projected deforestation (in ha) due to highway construction in the first 10-year baseline period

Year	Native Forest	Plantation-1990	Plantation-1991	Plantation-1992	Total Planned Area Deforested (ha)
2004					0.0
2005					0.0
2006	21.97				22.0
2007			2.01		2.0
2008	9.24	1.00			10.2
2009	3.57	0.01			3.6
2010	14.74	0.10		6.74	21.6
2011	19.51	0.81			20.3
2012			3.45		3.5
2013	2.84				2.8
				<i>Total</i>	86.0

Table 3.3. Area in hectares deforested per year in the project area in the baseline.

Year	$D\%_{planned,i,t} * A_{planned,i}$ ha
2004	0.0
2005	0.0
2006	22.0
2007	2.0
2008	10.2
2009	3.6
2010	21.6
2011	20.3
2012	3.5
2013	2.8

Estimation of forest biomass stocks in native forest was made from direct inventory of the VCR in 2010/2011, including the project area, and is detailed in Annex 1 “Forest Biomass Inventory Results for Valdivian Coastal Reserve.” Average aboveground live tree biomass carbon, below-ground live tree biomass carbon and dead wood (standing and lying) is 610.4, 175.1 and 59.4 t CO₂e/ha, respectively.

Inventory level stock estimates by pool are summarized in the table below.

	t C/ha	t CO ₂ e/ha
Aboveground live tree	166.5	610.4
Belowground live tree	47.8	175.1

Standing dead wood	4.0	14.8
Lying dead wood	12.2	44.6
TOTAL	230.4	844.9

Estimation of forest biomass stocks in *Eucalyptus* plantations was made from direct inventory of commercial volumes (inside bark) of the VCR in 2007 (Table 3.4), including the project area, and is detailed in Annex 2 “Inventario Forestal Empresas TNC. 2007. The Nature Conservancy.” Note that plantations established post-2003 (i.e. less than 10 years old at project start date) were excluded from the project area to conform with VCS AFOLU REDD eligibility criteria (VCS AFOLU Requirements 4.2.5) (see Section 1).

To estimate carbon in aboveground biomass, we applied wood specific gravity of *E globulus* of 0.5 g/cm³ and a carbon fraction of dry biomass of 0.47 (per IPCC 2006GL). To convert stem biomass to total aboveground biomass we applied a factor of 1.74, referencing stem volume as 57.6% of total aboveground biomass for *E globulus* measured in the region in Chile³³. To estimate belowground root biomass we applied a root:shoot ratio of 0.2159 from the same study (Table 3.5). Dead wood was not surveyed in the 2007 inventory and is assumed to be zero in these intensively managed plantations subject to complete harvest.

Table 3.4. Commercial volume stocks for *Eucalyptus globulus* plantations in the VCR (calculated from Inventario Forestal Empresas TNC. 2007. The Nature Conservancy – Please see Annex 2 for more information).

Predio	Year planted	Rodal	included in project area?	Area (ha)	Commercial Vol (m3/ha)
Venecia	1990	9001	y	16.7	189.5
Venecia	1991	9101	y	71.2	221.0
Venecia	1991	9102	n	205.8	247.8
Venecia	1991	9103	y	122	266.0
Venecia	1991	9104	y	24.7	137.4
Venecia	1992	9201	n	29.9	187.8
Venecia	1992	9202	y	133.9	278.3
Venecia	1992	9203	n	44.4	393.7

Table 3.5. Above and belowground biomass stocks for *Eucalyptus globulus* plantations in the VCR (calculated from Inventario Forestal Empresas TNC. 2007. The Nature Conservancy).

Predio	Year planted	weighted average Commercial Vol (m3/ha)	weighted average AGB t CO2/ha	weighted average BGB t CO2/ha
Venecia	1990	189.5	284.1	61.3
Venecia	1991	242.1	363.0	78.4
Venecia	1992	289.9	434.7	93.8

In summary:

³³ Gayoso, J. 2008a. *Eucalyptus* sp. Resultados Proyecto FONDEF D98i1076

Strata	average AGB t CO2/ha	average BGB t CO2/ha	average dead wood t CO2/ha
Native forest	610.5	175.2	59.3
<i>E globulus</i> plantation est 1990	284.1	61.3	0
<i>E globulus</i> plantation est 1991	363.0	78.4	0
<i>E globulus</i> plantation est 1992	434.7	93.8	0

Stocks of belowground biomass and dead wood are emitted from the year of conversion/deforestation at a linear rate equal to 1/10 of the initial stock annually, for 10 years. Emissions from steady decay of these pools are elaborated in Tables 3.6 and 3.7 below.

Table 3.6 Emissions from steady decomposition of belowground biomass post deforestation.

	Belowground biomass deforested	Emissions t CO2									
Year of deforestation	t CO2	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2004	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	3848.8			384.9	384.9	384.9	384.9	384.9	384.9	384.9	384.9
2007	157.9				15.8	15.8	15.8	15.8	15.8	15.8	15.8
2008	1680.8					168.1	168.1	168.1	168.1	168.1	168.1
2009	625.2						62.5	62.5	62.5	62.5	62.5
2010	3219.5							321.9	321.9	321.9	321.9
2011	3467.1								346.7	346.7	346.7
2012	270.5									27.1	27.1
2013	497.8										49.8
	Total t CO2	0.0	0.0	384.9	400.7	568.7	631.3	953.2	1299.9	1327.0	1376.8

Table 3.7 Emissions from steady decomposition of dead wood post deforestation.

	Dead wood deforested	Emissions t CO2									
Year of deforestation	t CO2	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2004	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	1302.7			130.3	130.3	130.3	130.3	130.3	130.3	130.3	130.3
2007	0.0				0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	548.1					54.8	54.8	54.8	54.8	54.8	54.8
2009	211.5						21.2	21.2	21.2	21.2	21.2
2010	873.8							87.4	87.4	87.4	87.4
2011	1156.7								115.7	115.7	115.7
2012	0.0									0.0	0.0
2013	168.5										16.8
	Total t CO2	0.0	0.0	130.3	130.3	185.1	206.2	293.6	409.3	409.3	426.1

Carbon sequestered in long-lived wood products is calculated using module CP-W Option 1, Direct Volume Extraction Estimation, referencing volume estimates from the 2007 inventory of VCR Eucalyptus stands. One anticipated end use wood product class (paper and paper board, “p”) is extracted in the baseline. It is assumed that Eucalyptus wood would be recovered prior to road clearance operations, with the baseline agent industrial timber owner of the project area coordinating with the CMT’s activities, as did Bosques S.A. historically (see Section 1). Recovery of wood products only takes place in the Eucalyptus plantations – historic practices of Bosques S.A. on the property involved no recovery of wood from native tree species during the forest conversion process due to poor markets combined with long transport distances – wood from the native forest was cut and piled, and sometimes burned. Furthermore, the CMT is not equipped, nor is it part of their mandate, to carry out wood harvest from the areas they clear in the road right of way.

All parameters employed in calculations are summarized in Table 3.8 below. Parameters A and $V_{ex,p,j}$ follow the baseline clearance areas derived above and volumes derived from the 2007 inventory, respectively. Wood density applied, D_j , references the wood specific gravity of *E globulus* of 0.5 g/cm³ reported in the IPCC 2006GL. A default carbon fraction of biomass of 0.47 is applied for parameter CF (IPCC 2006GL).

Table 3.8. Assumptions used in calculations of the wood products pool.

Parameter	<i>E globulus</i> plantation est 1990	<i>E globulus</i> plantation est 1991	<i>E globulus</i> plantation est 1992
A (ha)	1.9	5.5	6.7
$V_{ex,p,j}$ (m ³)	363	1,323	1,953
D (t d.m. m ⁻³)	0.5	0.5	0.5
CF	0.47	0.47	0.47
$C_{XB,p}$ (t CO ₂ /ha)	163.3	208.6	249.8
WW_p	0.19	0.19	0.19
$C_{WP,i}$ (t CO ₂ /ha) = amount entering wood products pool at the time of conversion, deducting immediate emissions from wood waste	132.3	169.0	202.3

The amount of wood products entering the pool at the time of conversion/deforestation ($C_{WP,i}$) and that is expected to be emitted over a 100-year timeframe is calculated as $C_{WP,i} - C_{WP,i} * (1 - SLF_p) * (1 - Ofp)$. Default parameters are sourced from module C-WP and detailed below.

SLF_p	0.4
Ofp	0.6

Following the year of conversion/deforestation, the amount of wood products expected to be emitted over a 100-year timeframe, calculated as above, is decayed at a linear rate equal to 1/20 of the amount annually, for 20 years. Emissions from steady decay of the wood products pool are elaborated in Table 3.9 below.

Table 3.9. Emissions from steady oxidation of wood products post entry in the wood products pool.

	Amount entering wood products pool $C_{WP,i}$	Amount expected to be emitted over 100 years	Emissions t CO ₂								
year of conversion	t CO ₂	t CO ₂	2005	2006	2007	2008	2009	2010	2011	2012	2013
2004	0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	340.4	258.7				12.9	12.9	12.9	12.9	12.9	12.9
2008	132.3	100.6					5.0	5.0	5.0	5.0	5.0
2009	0.7	0.6						0.0	0.0	0.0	0.0
2010	1376.1	1045.8							52.3	52.3	52.3
2011	107.4	81.6								4.1	4.1
2012	583.0	443.1									22.2
2013	0.0	0.0									
		Total t CO ₂	0.0	0.0	0.0	12.9	18.0	18.0	70.3	74.4	96.5

Post deforestation carbon stocks in included pools is zero ($C_{BSL,post,i} = 0$), as no trees are retained on-site in the developed road corridor. Full baseline calculations, following module BL-PL, are detailed in Table 3.10 below.

Table 3.10. Calculations of project baseline, applying module BL-PL of methodology VM00

		tCO2/ha	tCO2/ha	tCO2/ha	tCO2/ha								
		610.5	284.1	363	434.7			forest C stocks	road right of way stocks	wood prod			including emissions from BGB, DW and WP pools
year	D%planned, t * Aplanned,i,t ha	Native (ha)	1990 (ha)	1991 (ha)	1992 (ha)	weighted average stock tCO2/ha	L-D _i	C _{BSL,i} tCO2e/ha	C _{BSL,post,i} tCO2e/ha	wtd avg C _{BSL,WP,i} tCO2e/ha	ΔC _{BSL,i} tCO2e/ha	GHG _B SL-E _{i,t} tCO2e	ΔC _{BSL,planned} tCO2e
2004	0.0	0.0	0.0	0.0	0.0	0.0	1	0.0	0	0.0	0.0	0	0
2005	0.0	0.0	0.0	0.0	0.0	0.0	1	0.0	0	0.0	0.0	0	0
2006	22.0	22.0	0.0	0.0	0.0	610.5	1	610.5	0	0.0	610.5	0	13,927
2007	2.0	0.0	0.0	2.0	0.0	363.0	1	363.0	0	169.0	194.0	0	922
2008	10.2	9.2	1.0	0.0	0.0	578.6	1	578.6	0	12.9	565.7	0	6,562
2009	3.6	3.6	0.0	0.0	0.0	610.0	1	610.0	0	0.2	609.8	0	3,034
2010	21.6	14.7	0.1	0.0	6.7	554.1	1	554.1	0	63.8	490.3	0	11,841
2011	20.3	19.5	0.8	0.0	0.0	597.5	1	597.5	0	5.3	592.2	0	13,811
2012	3.5	0.0	0.0	3.5	0.0	363.0	1	363.0	0	169.0	194.0	0	2,480
2013	2.8	2.8	0.0	0.0	0.0	610.5	1	610.5	0	0.0	610.5	0	3,634
total													56,210

3.1.2 *Stopping conversion of native forest to Eucalyptus plantations*

While the specific agent of planned degradation has not been identified, the class of agent has been identified, an industrial timber company, which is the most likely alternative buyer of the VCR and project area in the baseline. The previous owner, Bosques S.A., was an industrial timber company. The property is large (thus requiring significant financial resources, and consideration of revenue generation potential, to purchase), has demonstrated potential for Eucalyptus production, and conveys with government approved forest management plans and permits in place.

An immediate site-specific threat of planned degradation is demonstrated by the following evidence:

1. Legal permissibility for planned degradation is demonstrated by the CONAF-approved forest management plans and permits in effect at the project start date that specifically allow conversion of native forest to plantations, as listed in Table 3.11a:
2. Suitability of the project area for conversion to plantations is demonstrated in the management plans referenced above, and also in the proven potential for Eucalyptus production of the VCR property, yielding mean annual increments of commercial volumes of 16.2 m³/ha/year (see below). Existing and productive Eucalyptus plantations surround the project area (Figure 3.9). Furthermore, a large, modern pulp processing plant was under construction as of the project start date and opened in early 2004 in the nearby community of Valdivia, 100 km from the project areas, indicating expectations of supply from the project region and proximity of processing infrastructure to the project area. An older chip plant in nearby Corral had originally opened in 1993, and changed hands in 2001, and is still operating today.
3. Evidence of likely transfer of ownership to the class of agent of deforestation is demonstrated by the description of the public auction process provided above, in the Additionality section. Approximately eight months prior to the project start date, the previous owner, Bosques S.A., was forced to file for bankruptcy by their lender, Fleet Bank, and the VCR property became available for purchase at a future bankruptcy auction. It was widely known by Chilean forestry investors at that time, that the Bosques property, with its transferrable legal permits for further expansion of eucalyptus plantations, would be auctioned, in November 2003. The bankruptcy auction would award the property to the highest bidder. Under law, an offer could be made in cash or, alternatively, the holder of the mortgages could bid the face value of the debt associated with those mortgages. This mechanism essentially gave the mortgage holders first claim on their secured asset, up to the value of the mortgage. Thus, any investor would need to bid more than the face value of the mortgages in order to outbid the mortgage holder, which put the mortgage holder in a highly advantageous position at auction. Had TNC not purchased the debt from Fleet Bank, the debt would likely have been transferred to the timber company who had already approached Fleet Bank, which would very likely have resulted in that timber company also submitting the prevailing bid at auction. Even had they not submitted the winning bid at auction, the large size and value of the property suggest that only a commercial enterprise with the financial means to make such an expensive purchase and to carry out forestry operations would have been able to afford to purchase the property, and would have done so with the intent to use the permits.

As noted in the following section of the report, expectations of market participants around the time of the project start date were that eucalyptus export was anticipated to increase during the years following the project start date (which did in fact occur). See Table 3.12 and Figure 3.10.

4. Government approval is demonstrated by the authorization from CONAF for conversion of native forest to plantations (permits/management plans referenced above).
5. The intent to convert the forest is demonstrated by the forest management plans referenced above, approved in 1996, which originate prior to the date of all evidence on pursuit of carbon finance/consideration of REDD (earliest consideration June 2001; Section 2.4). The approved forest management plans are transferred on purchase of the property from seller to buyer³⁴, and any authorized harvest by the baseline agent will conform to the specifications of the plans. The ability to exercise the existing management plans, which conveys with the property, is a key component of the inherent value of the property driving the purchase decision of the baseline agent. Therefore, intent to deforest is most appropriately established referencing the management plans (constituting “a valid and verifiable land use management plan for deforesting the project area”).

³⁴ CONAF-approved management plans/permits previously held by Bosques S.A. conveyed to TNC in the project case (See ANNEX 8 and 9)

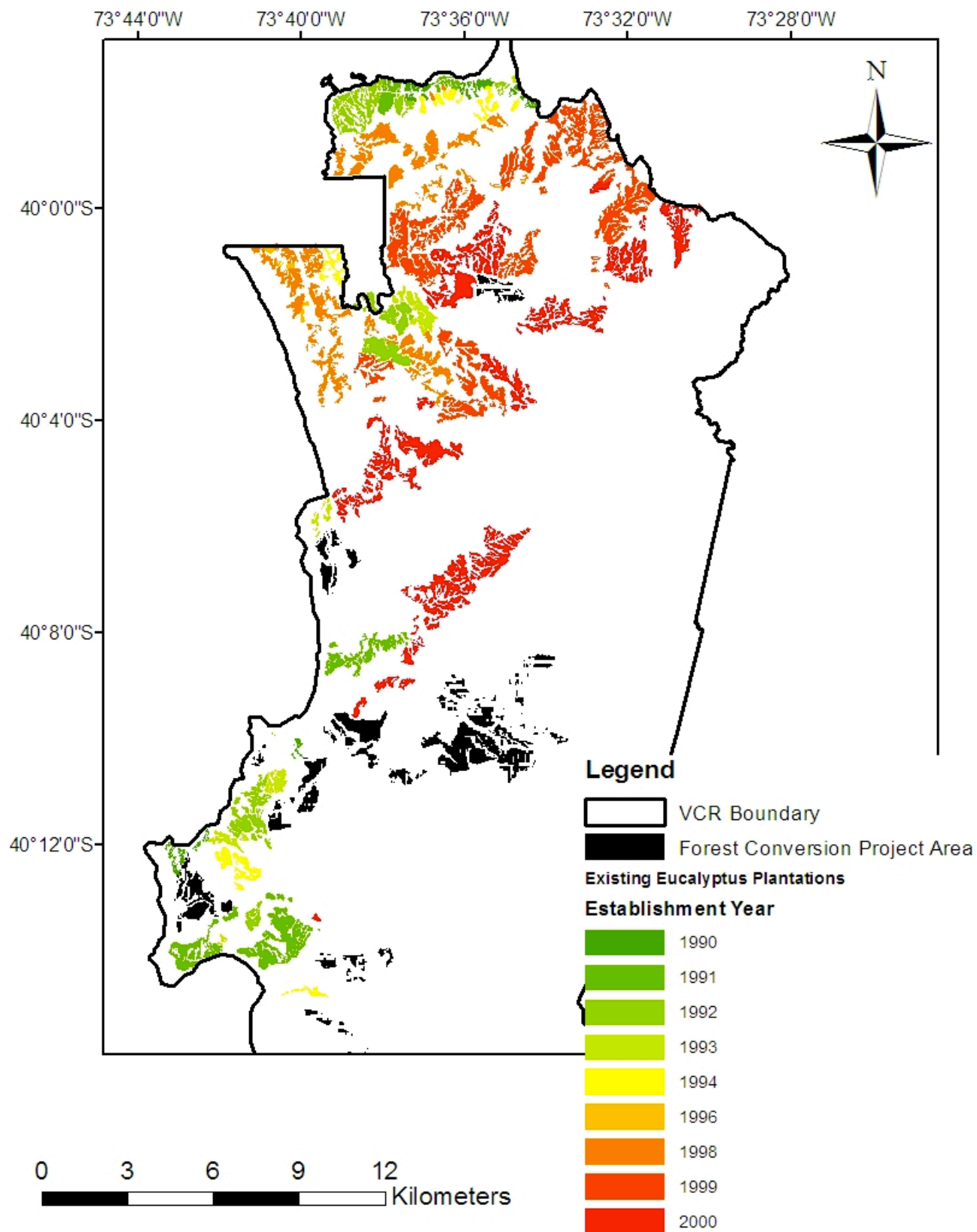


Figure 3.9. Map of the project area and other Eucalyptus plantations in the area.

The rate and area of conversion of native forest to plantations in the project area were derived from the forest management plans/permits referenced above (constituting a “valid and verifiable plan” per module BL-PL), which specify the areas (“rodales”) and years of establishment.

The final project area was determined through a GIS analysis. First, stand boundaries were digitized from CONAF paper maps. The gross area permitted for conversion to eucalyptus, as reflected in CONAFs paper permits listed below, was 1,835 ha. Once digitized, this area summed to 1,811 ha, the differences reflecting errors in the digitization process. In order to derive the final VCS project area, the following discounts were applied to the smaller, thus more conservative, digitized base permitted area of 1,811 ha.

Next a series of exclusions were delineated referencing CONAF harvest restrictions, VCS eligibility criteria and VM0007 methodology applicability conditions. These exclusions included:

- all areas within a 50 m buffer on permanent rivers,
- all areas within a 30 m buffer on temporary rivers,
- 2 m buffer around interior roads traversing stands,
- 100 m buffer around road between La Union and Hueicolla (per CONAF permit, to retain scenic value),
- 80 m width (+/- 40 meter from center line) of the planned costal highway,
- areas with slopes $\geq 30\%$,
- wetland areas (none present),
- any non-forested areas (e.g. all previously cut), and
- any area previously (and illegally) converted to Eucalyptus plantation.

Details of each exclusion, including GIS files and source information, and the process for delineating the project area through the aforementioned GIS analysis can be found in the project database (“Memo - VCR Revised Euc project area analysis 2013.01.30.doc”). After all exclusions were taken into account the eligible and allowable project area (1,187 ha) was 35% less than the paper permitted area (1,835 ha) (Table 3.11a).

Table 3.11a Final project area by forest stand.

Rodal/ Stand ID	Plantation Establishment Year ³⁵	Gross area per CONAF permits (ha)	Eligible and allowable cut area (ha) (VCS project area)
<i>Permit: Modificación de Plane de Manejo Programa de Corta o Explotación y Reforestación en Bosque Nativo Predio Chaihuín N 283518/V-8267, del 20 de Diciembre de 1999</i>			
R37	2004	84.0	49.3
<i>Permit: Certificado Actualización Plan de Manejo Forestación, Corta y Reforestación en Bosque Nativo Predio Venecia N 214291/V-4536, del 20 de Mayo de 1996</i>			
R528	2007	82.0	34.2
R529	2006	40.5	13.7
R530	2004	96.0	49.4
R531	2004	76.8	36.6
R532	2006	87.0	65.6
R533	2006	55.0	30.8

³⁵ Note that in Table 3.11b, establishment is assumed to occur at the end of the calendar year, which ascribes to the following project year, which extends from 4 November to 3 November. E.g. a plantation established in December 2003 is assigned to project year 2004.

R534	2005	88.0	76.0
R535	2003	24.0	10.3
<i>Permit: Certificado Actualización Plan de Manejo Programa de Corta o Explotacion y Reforestación en Bosque Nativo Predio Venecia N 218329/V-4718, del 14 de Agosto de 1996</i>			
R566	2003	85.0	57.5
R567	2003	37.0	26.6
R588	2004	42.0	27.0
R589	2004	113.0	95.3
R593	2003	150.0	135.5
R598	2003	116.0	83.4
R600	2003	32.0	23.4
R601	2003	34.0	26.5
R602	2003	58.0	36.7
R603	2004	93.0	66.5
R604	2003	94.0	75.6
R609	2004	31.0	18.7
R610	2004	51.0	35.2
R615	2004	31.0	14.1
R617	2004	18.0	4.1
R618	2004	32.0	10.8
R619	2004	35.0	16.3
R621	2004	29.0	16.6
R622	2004	43.0	21.5
R623	2004	28.0	15.1
R625	2004	50.0	14.9
Total Area (ha)		1835.3	1187.0

Table 3.11b. Project area (ha) converted in the baseline.

Year	$D\%_{\text{planned},i,t} * A_{\text{planned},i}$ ha
2004	475.4
2005	491.3
2006	76.0
2007	110.1
2008	34.2
2009	0.0
2010	0.0
2011	0.0
2012	0.0
2013	0.0

The likelihood of deforestation ($L-D_i$) is set to 100% as the project area is not “both under government control and zoned for deforestation” (per module BL-PL).

There is considered to be no risk of abandonment, as project areas converted to Eucalyptus plantations are expected to remain financially viable and in production in the baseline.

Near the time of the project start in 2004, INFOR (Forest Institute of Chile) projected significant increases in the volume of Eucalyptus harvested over the initial project baseline period (Table 3.12), reflecting production and market expectations at the time of the project start date.

Table 3.12 Projected volume of Eucalyptus in Chile in 2004. Data from INFOR³⁶

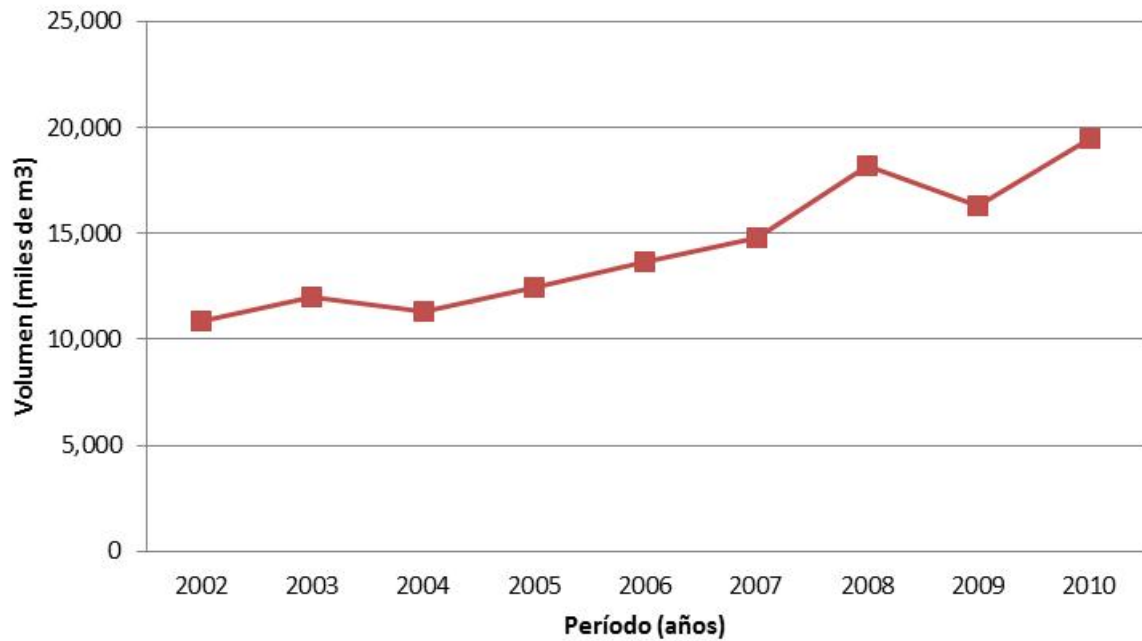
Period	E. globulus (thousands of m3/ year)	E. nitens (thousands of m3/ year)	Total (thousands of m3/ year)
2001 - 2002	2.8	1.8	4.7
2003 - 2004	2.5	2.2	4.7
2005 - 2006	4.5	1.6	6.1
2007 - 2008	4.6	2.7	7.4
2009 - 2010	3.8	3.7	7.5
2011 - 2012	7.6	2.2	9.8
2013 -2014	7.9	4.1	12.0
2015 - 2016	8.2	4.4	12.6

In fact, actual production (and demand) in Chile after the project start date exceeded expectations. Exported volumes, which represented 87% of domestic production over roughly the same period (see Section 3.3 below), almost doubled over the period 2002-2010 (Figure 3.10), reflecting increasing demand and continued viability of Eucalyptus wood production.

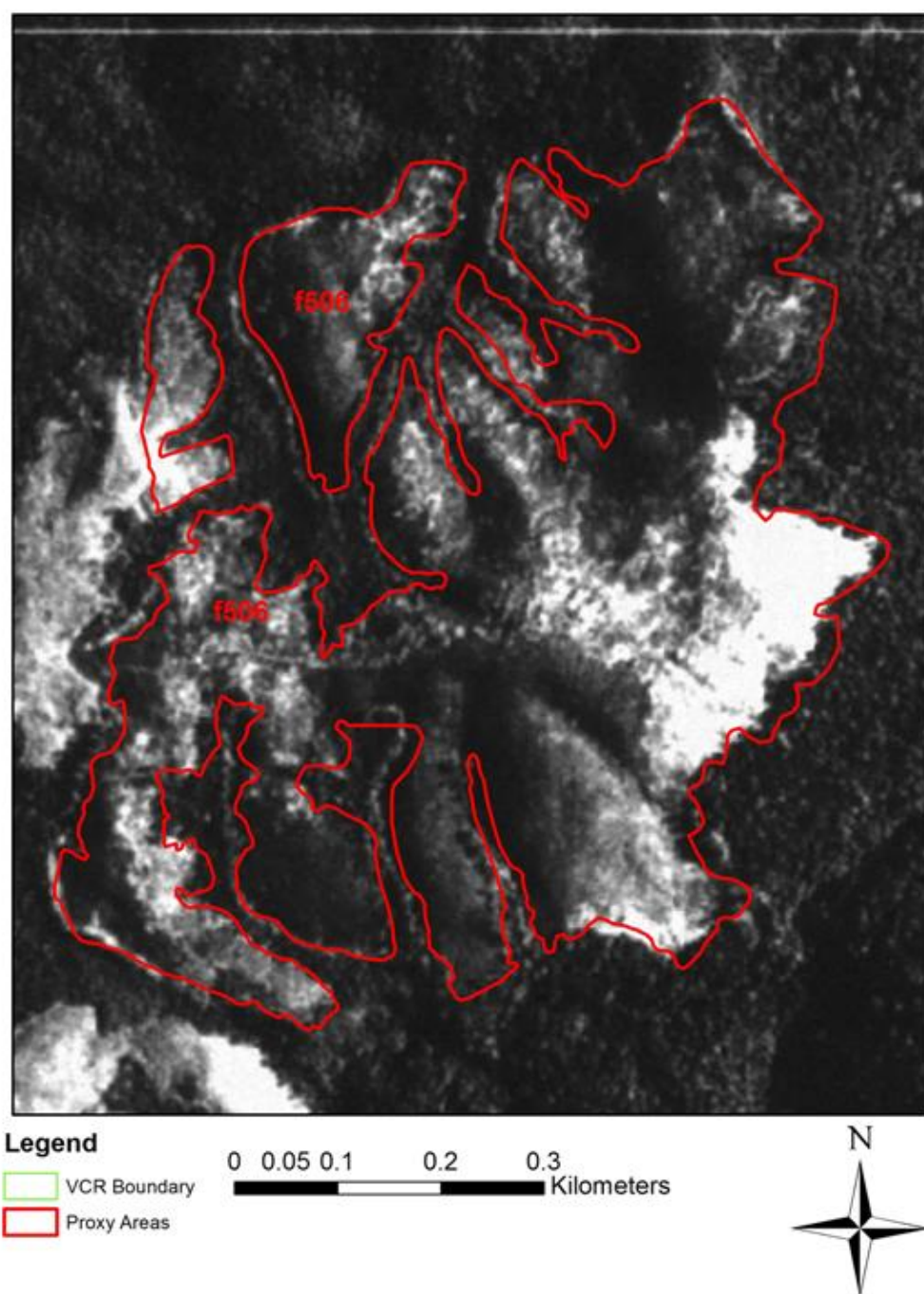
Figure 3.10. Volume (thousands of m3) of Eucalyptus exported from Chile during the initial baseline period (INFOR³⁷, 2011).

³⁶ INFOR. 2004. Eucalyptus nitens en Chile: Economía y Mercado. 80 p. Instituto Forestal.

³⁷ INFOR, 2011. Anuario Forestal 2011. Boletín estadístico N° 132. INFOR, Ministerio de Agricultura, Santiago de Chile.



To further assess potential risk of abandonment, an analysis of five proxy areas were chosen opportunistically from within the VCR as representative of the project area (established plantations stands f506 (planted in 1993), f508 (planted in 1993), f510 (planted in 1990), f514 (planted in 1991), f515 (planted in 1992), and f517 (planted in 1991)) was carried out using aerial photos from 1993 and 2004. Results demonstrate that none of these areas have been abandoned in the ten years prior to the project start date and all continued in a commercial plantation land use (illustrated for stand f506 in Figures 3.11 and 3.12).



Map of stand f506 overlying aerial photos from 1993.

Figure 3.11.

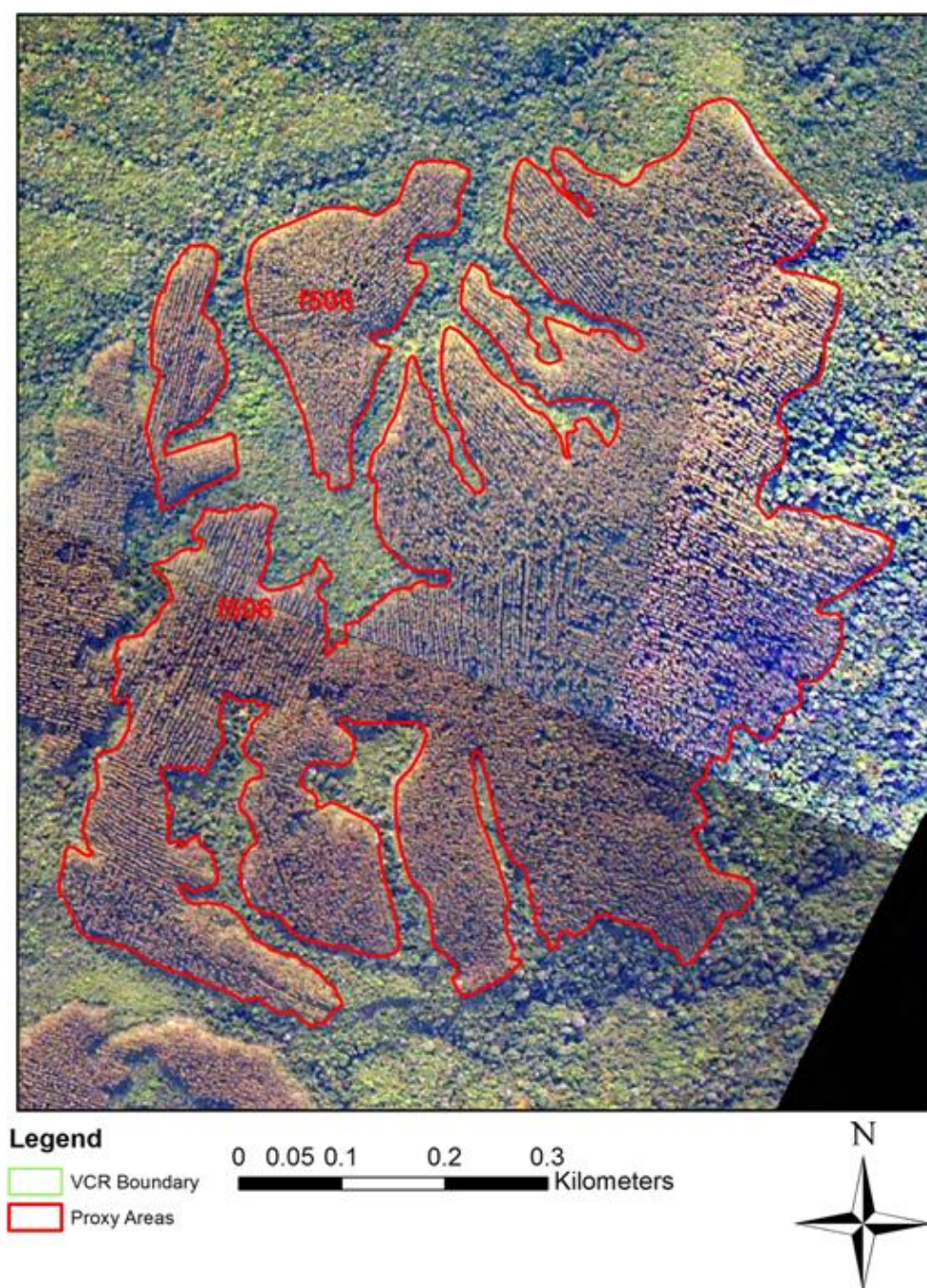


Figure 3.12. Map of stand f506 overlying aerial photos from 2004.

Estimation of forest biomass stocks in native forest was made from direct inventory of the VCR in 2010/2011, including the project area, and is detailed in **Annex 1** “Forest Biomass Inventory Results for Valdivian Coastal Reserve.” Average aboveground live tree biomass carbon, below-ground live tree biomass carbon and dead wood (standing and lying) are summarized in Table 3.13 below.

Table 3.13. Results of the VCR Native Forest Inventory.

Forest Component	VCR Forest (t C/ha)
Live Aboveground Biomass	166.5
Live Belowground Biomass	47.8
Standing Dead Wood	4.0
Lying Dead Wood	12.2
Total	230.4

Stocks of belowground biomass and dead wood are emitted from the year of conversion/deforestation at a linear rate equal to 1/10 of the initial stock annually, for 10 years. Emissions from steady decomposition of these pools are elaborated in Tables 3.14 and 3.15 below.

Table 3.14. Emissions from steady decomposition of belowground biomass post deforestation.

Year of Deforestation	Area Deforested-Native Forest (ha)	Belowground Biomass Stock (t CO2/ha)	Total Emissions from Belowground Biomass (t CO2)	Emissions (t CO2)									
				2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2004	475.4	175.2	83,268.7	8,326.9	8,326.9	8,326.9	8,326.9	8,326.9	8,326.9	8,326.9	8,326.9	8,326.9	8,326.9
2005	491.3	175.2	86,050.6		8,605.1	8,605.1	8,605.1	8,605.1	8,605.1	8,605.1	8,605.1	8,605.1	8,605.1
2006	76.0	175.2	13,313.2			1,331.3	1,331.3	1,331.3	1,331.3	1,331.3	1,331.3	1,331.3	1,331.3
2007	110.1	175.2	19,278.4				1,927.8	1,927.8	1,927.8	1,927.8	1,927.8	1,927.8	1,927.8
2008	34.2	175.2	5,998.6					599.9	599.9	599.9	599.9	599.9	599.9
2009	0.0	175.2	0.0						0.0	0.0	0.0	0.0	0.0
2010	0.0	175.2	0.0							0.0	0.0	0.0	0.0
2011	0.0	175.2	0.0								0.0	0.0	0.0
2012	0.0	175.2	0.0									0.0	0.0
2013	0.0	175.2	0.0										0.0
Total				8,326.9	16,931.9	18,263.3	20,191.1	20,791.0	20,791.0	20,791.0	20,791.0	20,791.0	20,791.0

Table 3.15. Emissions from steady decomposition of dead wood post deforestation.

Year of Deforestation	Area Deforested-Native Forest (ha)	Dead Wood Stock (t CO ₂ /ha)	Total Emissions from Dead Wood (t CO ₂)	Emissions (t CO ₂)									
				2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2004	475.4	59.3	28,186.9	2,818.7	2,818.7	2,818.7	2,818.7	2,818.7	2,818.7	2,818.7	2,818.7	2,818.7	2,818.7
2005	491.3	59.3	29,128.6		2,912.9	2,912.9	2,912.9	2,912.9	2,912.9	2,912.9	2,912.9	2,912.9	2,912.9
2006	76.0	59.3	4,506.6			450.7	450.7	450.7	450.7	450.7	450.7	450.7	450.7
2007	110.1	59.3	6,525.9				652.6	652.6	652.6	652.6	652.6	652.6	652.6
2008	34.2	59.3	2,030.6					203.1	203.1	203.1	203.1	203.1	203.1
2009	0.0	59.3	0.0						0.0	0.0	0.0	0.0	0.0
2010	0.0	59.3	0.0							0.0	0.0	0.0	0.0
2011	0.0	59.3	0.0								0.0	0.0	0.0
2012	0.0	59.3	0.0									0.0	0.0
2013	0.0	59.3	0.0										0.0
Total				2,818.7	5,731.5	6,182.2	6,834.8	7,037.8	7,037.8	7,037.8	7,037.8	7,037.8	7,037.8

Post-conversion, the project area will be *Eucalyptus globulus* plantations managed on 15-year rotations for pulp and chip production. Estimation of post-conversion carbon stocks were derived from data collected from *Eucalyptus* stands in the Valdivian Coastal Reserve as part of the “Inventario Forestal Empresas TNC”. Growth rates of *Eucalyptus globulus* were inferred from the most recent (2007) inventory, with an area-weighted average of 16.2 m³/ha/yr mean annual increment in growing stock on stands aged 6-17 years (Table 3.16 below).

Table 3.16. Stocks and growth rates for *Eucalyptus globulus* plantations in the VCR (calculated from Inventario Forestal Empresas TNC. 2007. The Nature Conservancy – Please see Annex 2 for more information).

Year established	Age in 2007	Area (ha)	Volume (m ³ /ha)	Mean annual increment (MAI) (m ³ /ha/yr)	Aboveground biomass (t C/ha)	MAI (tC/ha/yr)	Area-weighted MAI (m ³ /ha/yr)
1990	17	11.9	312.4	18.4	73.4	4.3	0.1
1990	17	23.4	108	6.4	25.4	1.5	0.1
1990	17	16.7	189.5	11.1	44.5	2.6	0.1
1991	16	8	124.8	7.8	29.3	1.8	0.0
1991	16	71.2	221	13.8	51.9	3.2	0.3
1991	16	205.8	247.4	15.5	58.1	3.6	1.1
1991	16	122	266	16.6	62.5	3.9	0.7
1991	16	24.7	137.4	8.6	32.3	2.0	0.1
1992	15	16.6	197.3	13.2	46.4	3.1	0.1
1992	15	4.3	231.4	15.4	54.4	3.6	0.0
1992	15	3	205.8	13.7	48.4	3.2	0.0
1992	15	8.9	246.5	16.4	57.9	3.9	0.1
1992	15	29.9	187.8	12.5	44.1	2.9	0.1
1992	15	133.9	278.3	18.6	65.4	4.4	0.9
1992	15	44.4	393.7	26.2	92.5	6.2	0.4
1993	14	38.5	295	21.1	69.3	5.0	0.3
1993	14	40.1	173.5	12.4	40.8	2.9	0.2
1993	14	20.1	144.5	10.3	34.0	2.4	0.1
1993	14	77.6	281.3	20.1	66.1	4.7	0.5
1994	13	26.6	276.2	21.2	64.9	5.0	0.2
1994	13	35	134.3	10.3	31.6	2.4	0.1
1994	13	26.2	261.1	20.1	61.4	4.7	0.2
1994	13	16.6	145.6	11.2	34.2	2.6	0.1
1994	13	24.2	180	13.8	42.3	3.3	0.1
1998	9	336.7	190.4	21.2	44.7	5.0	2.5
1998	9	58.8	53	5.9	12.5	1.4	0.1
1998	9	13.2	106.4	11.8	25.0	2.8	0.1
1998	9	6.6	331.6	36.8	77.9	8.7	0.1
1998	9	15	217.6	24.2	51.1	5.7	0.1
1998	9	71.3	214.2	23.8	50.3	5.6	0.6
1998	9	57.6	170.9	19.0	40.2	4.5	0.4

Year established	Age in 2007	Area (ha)	Volume (m ³ /ha)	Mean annual increment (MAI) (m ³ /ha/yr)	Aboveground biomass (t C/ha)	MAI (tC/ha/yr)	Area-weighted MAI (m ³ /ha/yr)
1999	8	86.1	77.8	9.7	18.3	2.3	0.3
1999	8	18.5	155	19.4	36.4	4.6	0.1
1999	8	460.4	135.5	16.9	31.8	4.0	2.7
1999	8	232.5	107.9	13.5	25.4	3.2	1.1
1999	8	49.7	118.1	14.8	27.8	3.5	0.3
1999	8	63.6	75	9.4	17.6	2.2	0.2
1999	8	91.4	140.5	17.6	33.0	4.1	0.6
2000	7	160.2	76.4	10.9	18.0	2.6	0.6
2000	7	34.3	133.7	19.1	31.4	4.5	0.2
2000	7	37.8	126.2	18.0	29.7	4.2	0.2
2001	6	19	55.4	9.2	13.0	2.2	0.1
2001	6	13.8	110.7	18.5	26.0	4.3	0.1
						Area-weighted MAI m ³ /ha/yr	16.2

Figure 3.13. Photo of a *Eucalyptus globulus* plantation in the VCR.



To estimate carbon in live aboveground biomass, we applied wood specific gravity of *Eucalyptus globulus* of 0.5 g/cm³ and a carbon fraction of dry biomass of 0.47 (per IPCC 2006GL). Further, a biomass expansion factor³⁸ of 1.74 for *Eucalyptus globulus* was used to convert commercial stem biomass to total aboveground biomass.

Mention should be made that in applying this as a long-term average we have not incorporated decreases in productivity due to nutrient depletion with successive rotations, and implicitly assume that these would be offset by application of fertilizer to maintain productivity under commercial management.

³⁸ Derived from Gayoso, J. 2008a. *Eucalyptus* sp. Resultados Proyecto FONDEF D98i1076

Belowground biomass was estimated by applying root: shoot ratio, 0.2159, for *Eucalyptus sp.* developed in Chile³⁹. Following each harvest, previously accrued stocks of belowground biomass are emitted from the year of harvest at a linear rate equal to 1/10 of the final stock annually, for 10 years.

Standing and lying dead wood is not common in managed stands in the project region, and hence biomass estimates for these pools are estimated as zero.

Wood products were also incorporated into the long-term average baseline post-conversion stocks, calculated using module CP-W Option 1, Direct Volume Extraction Estimation. Only one wood product class (paper and paper board, “p”) is extracted in the baseline. All parameters employed in calculations are summarized in Table 3.17, below. At each harvest, expected to occur at age 15, on average 243 m³ (16.2 * 15) of wood per ha would be extracted. Wood density applied, D_j , was derived from the IPCC⁴⁰. A default carbon fraction of biomass of 0.47 is applied for parameter CF (IPCC 2006GL). Parameter $C_{XB,p}$, t CO₂/ha sequestered in gross volume of timber extracted, is thus 209.4 t CO₂/ha at each harvest.

Table 3.17. Assumptions used in calculations of the wood products pool.

Parameter	Value	Units
D_j	0.5	t/ m3
CF_j	0.47	None
ty	(p) Paper and Paper Board	None
WWp	0.19	None
$SLFp$	0.4	None
Ofp	0.6	None

The amount of wood products entering the pool at the time of harvest ($C_{WP,i}$) is calculated as $C_{XB,p} * (1 - WWp)$, deducting immediate emissions from wood waste. The amount of wood products entering the pool at the time of harvest and that is expected to be emitted over a 100-year timeframe is calculated as $C_{WP,i} - C_{WP,i} * (1 - SLF_p) * (1 - Ofp)$.

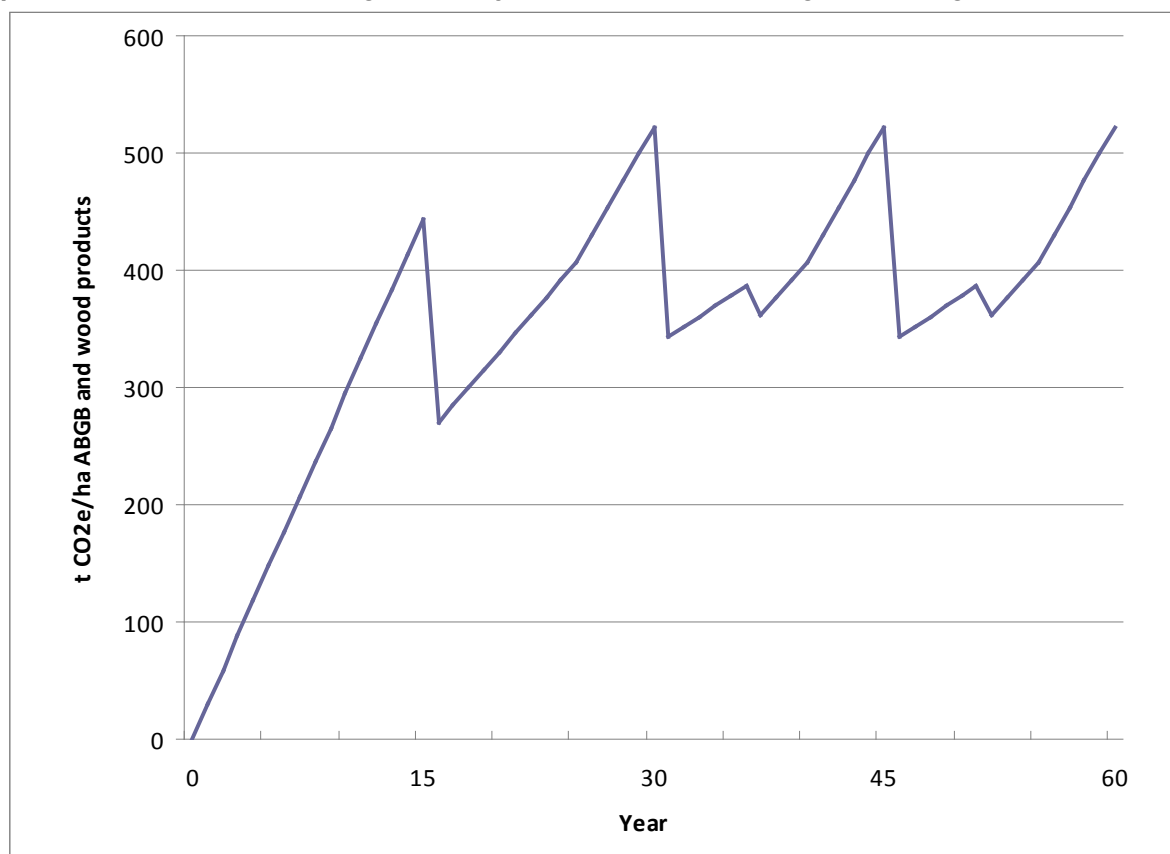
Following the year of conversion/deforestation, the amount of wood products expected to be emitted over a 100-year timeframe, calculated as above, is decayed at a linear rate equal to 1/20 of the amount annually, for 20 years.

Applying all of the above assumptions (Figure 3.14), time-weighted average (calculated over a 60-year period covering 4 harvests) stocks in above- and belowground biomass and wood products in *Eucalyptus globulus* plantations in the VCR managed on 15 year rotations is 358.7 t CO₂ equivalent per ha. Use of the long term average is in conformance with BL-PL guidelines whereby “stocks [which] are in a cycle the mean stock across the cycle shall be used” as the post deforestation carbon stock.

³⁹ Gayoso, J. 2008a. *Eucalyptus sp.* Resultados Proyecto FONDEF D98i1076

⁴⁰ IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Chapter 4 AFOLU (Agriculture, Forestry and Other Land-use).

Figure 3.14. Stocks in aboveground and belowground biomass and wood products in Eucalyptus plantations in the VCR managed on 15-year rotations. Time-weighted average is 358.7 t CO₂/ha.



No wood products are produced from the initial native forest conversion activity. Historic practices of Bosques S.A., the prior property owner, involved no recovery of wood from native tree species during the forest conversion process due to poor markets for native timber combined with long transport distances. Wood from the native forest was cut and piled and occasionally burned. The same constraints faced by Bosques S.A. apply to the baseline agent and thus no recovery of wood products is expected to result from conversion of native forest in the baseline (only from subsequent harvests of Eucalyptus, which is accounted in the estimate of long-term average post-conversion stocks derived above). Thus, the wood product parameter $C_{BSL,WP,I}$ is set to zero.

Full baseline calculations, following module BL-PL, are detailed in Table 3.18 below.

Table 3.18. Calculations of project baseline, applying module BL-PL of methodology VM0007.

Year	$D_{\text{planned},i,t}$ * $A_{\text{planned},i,t}$ ha	Native Forest (ha)	Weighted Average Stock tCO ₂ /ha	$L-D_i$	$C_{BSL,i}$ tCO ₂ e/ha	$C_{BSL,\text{post},i}$ tCO ₂ e/ha	$C_{BSL,\text{WP},i}$ tCO ₂ e/ha	$\Delta C_{BSL,i}$ tCO ₂ e/ha	GHG _{BSL-E,i,t} tCO ₂ e	$\Delta C_{BSL,\text{planned}}$ tCO ₂ e
2004	475.4	475.4	610.5	1	610.5	358.7	0.0	251.8	0	130,859
2005	491.3	491.3	610.5	1	610.5	358.7	0.0	251.8	0	146,376
2006	76.0	76.0	610.5	1	610.5	358.7	0.0	251.8	0	43,586
2007	110.1	110.1	610.5	1	610.5	358.7	0.0	251.8	0	54,742
2008	34.2	34.2	610.5	1	610.5	358.7	0.0	251.8	0	36,453
2009	0.0	0.0		1	0.0	358.7	0.0	-358.7	0	27,829
2010	0.0	0.0		1	0.0	358.7	0.0	-358.7	0	27,829
2011	0.0	0.0		1	0.0	358.7	0.0	-358.7	0	27,829
2012	0.0	0.0		1	0.0	358.7	0.0	-358.7	0	27,829
2013	0.0	0.0		1	0.0	358.7	0.0	-358.7	0	27,829
total	1,187.0	1,187.0								551,159

Note that emissions post 2008 result from ongoing decay of belowground biomass and dead wood post conversion events from 2008 prior.

3.1.3 Total project

Baseline emissions for the project as a whole, including both activities (stopping conversion of native forest to Eucalyptus plantations and stopping highway construction), are summed in Table 3.19 below.

Table 3.19. Total baseline emissions

Year	$\Delta C_{BSL,plannd, road}$ tCO ₂ e	$\Delta C_{BSL,plannd, Euc}$ tCO ₂ e	Total $\Delta C_{BSL,plannd}$ tCO ₂ e
2004	0	130,859	130,859
2005	0	146,376	146,376
2006	13,927	43,586	57,512
2007	922	54,742	55,664
2008	6,562	36,453	43,015
2009	3,034	27,829	30,863
2010	11,841	27,829	39,670
2011	13,811	27,829	41,640
2012	2,480	27,829	30,309
2013	3,634	27,829	31,463
Total	56,210	551,159	607,369

3.2 Project Emissions

Neither deforestation nor forest conversion activities are expected in the project area in the project scenario.

Emissions resulting from degradation due to illegal logging (parameter $\Delta C_{P,DegW}$) are assumed ex ante to be 0. Despite continuous monitoring activities in the field, no illegal logging activities have been observed in the VCR by park guards since October 2009 (and this was not in the carbon project area). Further, during three months of forest inventory fieldwork in 2010 and 2011 throughout the VCR, no indications of recent illegal logging were observed by field crews (some >20 year old cut stumps of cipres and alerce were observed).

Infractions of illegal logging in the region are few due to remote access and difficulty of transport and strong enforcement by CONAF (personal communication, CONAF personnel, Valdivia, December 2009). The project area in particular is remote with limited access by primary roads.

An assessment of potential for illegal logging to occur in the project area was carried out in 2012. Despite good relations between TNC and communities around the project area, it is extremely sensitive to ask of community members explicit questions regarding timber harvest activities. Thus instead of the participatory rural appraisal approach specified in methodology VM0007, involving direct interviews in communities surrounding the project area to evaluate potential for illegal degradation, an alternative approach was pursued involving consultation with local authorities responsible for tracking these activities.

In 2012, to assess the risk of illegal logging in the area in and around the project, records from the District Attorney's office (Fiscalia Regional) of the Ríos Region, detailing cases of illegal logging around the VCR, were obtained and reviewed, provided by Lorena Sandaña, executive director of the regional office; the District Attorney's office is where all reports of illegal logging by any enforcement body are collected. From 2005 to 2012, the office recorded 4 cases of illegal logging in and around the reserve: three along the end of the coastal highway (km 13.3, 10 km from the border of the project area with no connection by any existing access

route) and one outside the eastern border of the VCR. Only one of these incidents fell within the VCR itself (well outside the project area). The VCR's guards also confirm these records.

VCR staff indicates that it is unlikely that illegal logging would affect the project areas as they are all quite removed from the existing coastal highway (personal communication, Danilo Gonzalez, TNC, 2012). Nearly all project areas are in the southern section of the VCR, where there are few communities that might pose a risk in terms of illegal logging. Hueicolla and La Barra de Río Bueno are the only communities that lie in this area. Hueicolla is composed almost entirely of vacation homes and only a small number of caretakers inhabit the sector year round. The VCR management has dedicated a section of eucalyptus plantations to supply firewood to one family that provides food and lodging to guards and visitors to that area of the VCR. La Barra de Río Bueno is also a community composed primarily of vacation homes with caretakers, however the community is located to the south of the Río Bueno outside the reserve. Its location across the river significantly limits the risk of illegal logging in the VCR or project areas due to the logistical difficulties that are presented by transporting extractions across the river.

3.3 Leakage

Leakage is estimated applying methodology VM0007 modules LK-ASP and LK-ME.

3.3.1 Stopping construction of the coastal highway

Activity shifting leakage

No activity shifting leakage is expected in the project scenario, and is assumed ex ante to be equal to 0. Nor are any non-CO₂ greenhouse gas emissions from fertilizer use or biomass burning expected, thus parameters $GHG_{LK,E,i,t}$ and $\Delta C_{LK-AS,planned}$ are expected to be equal to zero throughout the baseline period.

Activity shifting leakage due to road construction by the MOP in a defined leakage zone, thus capturing any alternative routes to the Carretera Costera, will be monitored (see Section 4). Any deforestation resulting from construction or improvement of any alternate highways in the leakage zone by the MOP after the project start date will be monitored.

Market leakage

Market leakage is treating applying module LK-ME. In the baseline case, the following volumes of wood products would be extracted from *Eucalyptus globulus* plantations from the project area (Table 3.20 below). Commercial volumes are estimated from the 2007 inventory.

Table 3.20. Projected volumes of wood products extracted from *Eucalyptus globulus* plantations from the project area.

Year	Eucalyptus extracted m ³
2004	0
2005	0
2006	0
2007	488
2008	190

2009	1
2010	1,972
2011	154
2012	835
2013	0

In Chile, the majority of domestic timber production is destined for export, and thus not all of the extracted volumes in the baseline are subject to assessment as market leakage. As market leakage references decreased timber harvest for sale to national markets, as defined in module VMD0011 LK-ME of methodology VM0007 and aligned with VCS AFOLU guidance (see below), we first sought to determine the amount of domestic production of *Eucalyptus globulus* managed on pulp rotations that would be destined for domestic (not export) markets by consulting national forest statistics published by the Instituto Forestal (INFOR). Data were available for 2006 to 2011 (INFOR, 2006; INFOR 2008; INFOR, 2009; INFOR 2010; INFOR, 2011) and are presented in Table 3.21.

Table 3.21. Production data in thousands of cubic meters from INFOR for “Eucalyptus y otras especies”; within this category, in 2008 for example, *Eucalyptus spp* represented 97.1% of all volumes (INFOR 2009). Data consolidates all products, dominated by pulp and chips, which in 2009 for example represented 98% of production.

<i>Year</i>	<i>Domestic production (1000 m³)</i>	<i>Internal market (1000 m³)</i>	<i>External market (1000 m³)</i>	<i>Internal market (%)</i>	<i>Export market (%)</i>
2006	5,746	864	4,882	15%	85%
2007	8,364	1,108	7,257	13%	87%
2008	10,224	1,209	9,015	12%	88%
2009	9,553	1,073	8,481	11%	89%
2010	9,694	1,273	8,421	13%	87%
			<i>average</i>	<i>13%</i>	<i>87%</i>

FUENTE: (INFOR, 2006; INFOR 2008; INFOR, 2009; INFOR 2010; INFOR, 2011)⁴¹.

Average percent of domestic production sold to domestic markets from 2006-2010 was 13%, and thus, for calculations of market leakage, extracted volumes were multiplied by 13% to estimate the volume of timber harvest destined for sale to national markets (Table 3.22). This treatment conforms with guidance set out in VCS AFOLU Requirements section 4.6.5 “Leakage occurring outside the host country (international leakage) does not need to be quantified” and section 4.6.14 Table 3 “Where leakage is out of country [market leakage

⁴¹ INFOR, 2006. Estadísticas Forestales Chilenas 2006. Boletín estadístico N° 117. Ministerio de Agricultura. Santiago, Chile.
 INFOR, 2008. Anuario Forestal 2008. Boletín estadístico N° 121. Ministerio de Agricultura, INFOR. Santiago, Chile. 169 pag.
 INFOR, 2009. Anuario Forestal 2009. Boletín estadístico N° 125. Ministerio de Agricultura, INFOR. Santiago, Chile. 159 pag. Disponible en: <http://biblioteca1.infor.cl:81/openfile.asp?param=o%AD%88%92bi%95%88uf>
 INFOR, 2010. Anuario Forestal 2010. Boletín estadístico N° 128. Ministerio de Agricultura. Santiago, Chile.
 INFOR, 2011. Anuario Forestal 2011. Boletín estadístico N° 132. INFOR, Ministerio de Agricultura, Santiago de Chile.

discount factor equals] 0”, and reflected in module LK-ME “As per the VCS AFOLU requirements international market leakage is not considered.”

Table 3.22. Projected volumes of wood products extracted from *Eucalyptus globulus* plantations from the project area and entering domestic markets.

Year	Eucalyptus extracted m ³	% destined for national markets	Eucalyptus extracted that enters domestic markets m ³
2004	0.0	13%	0.0
2005	0.0	13%	0.0
2006	0.0	13%	0.0
2007	487.7	13%	62.9
2008	189.6	13%	24.4
2009	1.1	13%	0.1
2010	1,971.6	13%	254.2
2011	153.9	13%	19.8
2012	835.3	13%	107.7
2013	0.0	13%	0.0

All of the above estimated volumes of *Eucalyptus* extracted that enter domestic markets are potentially displaced, because no timber harvest takes place in the project area in the with-project scenario.

The market leakage factor, LF_{ME} , used is 0.4, where mean merchantable biomass as a proportion of total aboveground tree biomass in forests to which harvest would be displaced is equal to merchantable biomass as a proportion of total aboveground tree biomass within the project boundary. This value is justified because the commercial component of aboveground tree structure in the project area (*Eucalyptus globulus* plantations) will be nearly identical to areas where harvest could be displaced in Chile to make up for reduction in supply of *Eucalyptus globulus* wood (i.e. other *Eucalyptus globulus* plantations).

The value of parameter D_{mn} (mean wood density of commercially harvested species), 0.5; wood specific gravity of *E. globulus* reported in the IPCC 2006GL. A default carbon fraction of biomass of 0.47 is applied for parameter CF (IPCC 2006GL).

Parameters for calculation of market leakage from displaced timber production are summarized below.

Table 3.23. Parameters for calculation of market leakage

Parameter	Value	Source
D_{mn}	0.5	IPCC 2006GL
LF_{ME}	0.4	Justified above
CF	0.47	IPCC 2006GL
LDF	0.25	Default value for coniferous forests from methodology VM0007. Although Eucalypts are not conifers, their growth form is closer to conifers than deciduous or hardwood species, with a predominant stem (with bark)

		component representing 71% of aboveground biomass ⁴² , particularly in plantation grown settings as in the project area.
LIF	0.29	Default value from methodology VM0007

Calculations of market leakage from displaced timber production are summarized below and in Annex 12 ("VCR road APD analysis.xls"). Total leakage due to market effects from displaced timber production over the 10 year baseline period is 290.6 t CO₂ (Table 3.24)

Table 3.24. Market leakage calculation

Year	$V_{BSL,EX,t}$	$C_{BSL,XBT,i,t}$	$LK_{MarketEffects,timber,t}$
	m ³	t CO ₂	t CO ₂
2004	0.0	0	0.0
2005	0.0	0.0	0.0
2006	0.0	0.0	0.0
2007	62.9	97.4	38.9
2008	24.4	37.9	15.1
2009	0.1	0.2	0.1
2010	254.2	393.6	157.4
2011	19.8	30.7	12.3
2012	107.7	166.8	66.7
2013	0.0	0.0	0.0
		$AL_T = 726.5$	$LK_{MarketEffects,timber} = 290.6$

3.3.2 Stopping conversion of native forest to Eucalyptus plantations

Activity shifting leakage

Activity shifting leakage for this project activity applied VM0007 module LK-ASP, Part 2 where only the class of deforestation agent can be identified. The deforestation agent in the baseline case is an industrial forest company that steps in to purchase the project area and exercise the existing permits to convert native forest to Eucalyptus plantations. In this case, the exact identity of the agent is not known, however the class of agent is identified as a private industrial forest company.

The commodity displaced is Eucalyptus wood, precisely *Eucalyptus globulus* plantations for production of chips. *E globulus* is the most extensively planted Eucalyptus species in Chile⁴³.

In Chile, production of *E globulus* is concentrated in Regions V, VI, VII, VIII, IX, X and XIV (Table 3.25). This distribution reflects the area of adequate growing conditions for this species, as well as for other Eucalyptus species⁴⁴.

⁴² Gayoso, J. 2008a. Eucalyptus sp. Resultados Proyecto FONDEF D98i1076

⁴³ INFOR-Fondo de Desarrollo e Innovación. Establecimiento de Plantaciones Forestales. Eucalyptus sp. accessed at http://www.gestionforestal.cl:81/pt_02/plantaciones/map19-m.htm

⁴⁴ See also INFOR-Fondo de Desarrollo e Innovación. Establecimiento de Plantaciones Forestales. Eucalyptus sp. accessed at http://www.gestionforestal.cl:81/pt_02/plantaciones/map19-m.htm

Table 3.25. Area of *E globulus* production in Chile.⁴⁵

Region	Area of Eucalyptus globulus stands (ha)	Percent of Total Area
I de Tarapacá	0	0%
II de Antofagasta	0	0%
III de Atacama	38	0%
IV de Coquimbo	73	0%
V de Valparaíso	12,468	3%
VI de O'Higgins	16,868	4%
VII del Maule	22,146	6%
VIII del Bío-Bío	167,122	44%
IX de La Araucanía	94,527	25%
X de Los Lagos	16,965	4%
XI Aysen	0	0%
XII de Magallanes y Antártica	0	0%
Región Metropolitana de Santiago	1,319	0%
XIV de Los Ríos	45,485	12%
XV de Arica y Parinacota	4	0%

Within these regions, three principle land use classes, as identified by the Instituto Nacional de Estadísticas (INE), are available to potentially accommodate establishment of new plantations: praderas, matorrales and native forest (Table 3.26). Of these, only native forest qualifies as “forest” per the Chile DNA forest definition – both praderas and matorrales have < 25% cover of trees⁴⁶.

Table 3.26. Extent of native forest and wood lands in Region V, VI, VII, VIII, IX, X and XIV.⁴⁷

Region	Praderas (mejoradas y naturales)	Bosque nativo	Matorrales
Qualifies as forest	no	yes	no
Total Region V, VI, VII, VIII, IX, X and XIV (area, ha)	4,043,097	2,624,110	1,007,486
Total Region V, VI, VII, VIII, IX, X and XIV (area, %)	53%	34%	13%

As of 2007, the date closest to the project start date for which national area data by land use class were available, 34% of the area in Regions V, VI, VII, VIII, IX, X and XIV available for establishment of Eucalyptus globulus plantations was forest. Thus, parameter *PF*, proportion of available area for production of commodity (Eucalyptus pulp wood) that is currently forested, is set at 34%.

⁴⁵ Instituto Nacional de Estadísticas (INE). 2007. Censo Agropecuario 2007. Table 17.

http://www.ine.cl/canales/chile_estadistico/censos_agropecuarios/censo_agropecuario_07_comunas.php Accessed: 17 July 2012

⁴⁶ FAO 2005. Global Forest Resources Assessment. Chile Country Report.

⁴⁷ Instituto Nacional de Estadísticas (INE). 2007. Censo Agropecuario 2007. Table 2.

http://www.ine.cl/canales/chile_estadistico/censos_agropecuarios/censo_agropecuario_07_comunas.php Accessed: 17 July 2012

Productivity of *E globulus* in the project area can be defined on the basis of mean annual increment, referencing Annex 2 “Inventario Forestal Empresas TNC. 2007. The Nature Conservancy.” The area-weighted average annual increment for the VCR *E globulus* plantations, as measured in 2007, was 16.2 m³/ha/yr for stands 6-17 years old.

Assessing productivity of *E globulus* plantations in the project area relative to other areas in Chile, to which they could be displaced, is difficult given the lack of spatially explicit data on mean annual increment. Geldres and Schlatter⁴⁸, researchers of the Universidad Austral de Chile, in an assessment of *E globulus* plantations in the project region, consider the region on average to be marginal for this species, on the basis of climate, particularly cold winter temperatures:

“Los resultados obtenidos con Eucalyptus globulus en sitios promedio indican **que la especie está en una zona climática marginal** desde el punto de vista de la temperatura invernal.”

They estimated average 10-12 m³/ha/yr mean annual increment for stands aged 8-9 years, comparable to (though slightly lower than) increments assessed in the VCR. In contrast, and referencing Geldres and Schlatter’s results as “unfavorable”, Valencia and Cabrera⁴⁹, researchers at INFOR, characterize a mean annual increment of 20-30 m³/ha/yr as average to high productivity for *E globulus* in the south of Chile. Countrywide, INFOR (2003)⁵⁰ reports an average mean annual increment of *E globulus* of 25 m³/ha/yr. Both reported averages here of 20-25 m³/ha/yr exceed the observed area-weighted average annual increment for the VCR of 16.2 m³/ha/yr.

The contrast of growth potential between the project region and other *E globulus* -producing regions of Chile are borne out in measurements from plantation trials of *E globulus* across three regions of Chile. These plantations were initiated in 1998/99 as part of long-term trials developed for calibration of a *Eucalyptus globulus* growth yield model, and were sited to characterize “typical” (inasmuch as possible) conditions within the regions. Results of a 2008 study⁵¹ of these sites illustrates that mean annual increments from the project region site (formerly Region X), ranging from 11-20 m³/ha/yr (depending on treatments), were considerably less than those from sites in Regions IX and VIII, which ranged from 20-26 m³/ha/yr and 34-39 m³/ha/yr, respectively (Table 3.27).

Table 3.27. Estimated mean annual increments (m³/ha/yr) at 15 years of *E globulus* plantation trials (from Acevedo 2008).

	South (Region X)	Valle (Region IX)	Coast (Region VIII)
min	10.9	19.7	33.8
max	20.2	26.4	38.5

In Chile, Region VIII to the north of the project region is known for having the most productive sites for *E globulus* and other *Eucalyptus* species plantations, and consequently has the largest concentration of

⁴⁸ Geldres, E. and J. Schlatter. 2004. Crecimiento de las plantaciones de Eucalyptus globules sobre suelos rojo arcillosos de la provincia de Osorno, Décima Región. Bosques 25:95-101.

⁴⁹ Valencia Baier, Juan Carlos and Cabrera Pérramon, Jorge Armando . 2007. Análisis económico de opciones productivas para plantaciones de *Eucalyptus nitens* en el sur de Chile. Ciencia e Investigación Forestal, CIFOR, v.13:n1, pp.23-41 Accessed at: <http://biblioteca1.infor.cl:81/ficha.asp?param=o%AD%88%92bi%91%8Fm>

⁵⁰ INFOR. 2003. *Eucalyptus nitens*: La nueva estrella del sector forestal. Lignum. 67: 59-61p

⁵¹ Acevedo Meins, E.A. 2008. Efectos del Establecimiento en el Crecimiento y Rentabilidad de Plantaciones de Eucalyptus en el sur de Chile. Memoria para optar al título profesional de Ingeniero Forestal. Profesor Guía: Ing. Forestal, Dr. Gustavo Cruz Madariaga. Universidad De Chile, Facultad De Ciencias Forestales, Escuela De Ciencias Forestales, Departamento De Silvicultura. Santiago, Chile.

plantations in Chile⁵², 44% alone of the entire area dedicated to *E globulus* plantations in Chile as of 2007⁵³. Because Region VIII is widely acknowledged as having favorable conditions for *E globulus* growth, and as of 2007 still had over 1 million ha of potentially available land on which new plantations could be established⁵⁴, it would be expected to be a likely area within the country to which the baseline activity would be displaced, and hence would weight upwards the average productivity of new *E globulus* plantations in Chile sited outside of the project area.

Given that (1) the project region, though suitable for production of *E globulus*, is on the margin of its climatic tolerances and is surpassed in productivity by other regions in Chile, which have become more important in the production of this species, and (2) that observed mean annual increments in the VCR and project area are clearly lower than reported average mean annual increments for the species in Chile, we assign a parameter $LK_{CP-ME,C,I}$ of 0.2 (where average productivity of alternative lands is >15% more than the relevant strata in the project area).

Calculations of activity shifting leakage due to displacement of *E globulus* plantations establishment activities are detailed in Table 3.28. below. It is important to note that no activity shifting leakage occurs after project year 2007 (Nov 2006 to Nov 2007), due to the new Native Forest Law going into effect at the end of 2007. The Native Forest Law (Law 20.283/2008) prohibits conversion of native forests to non-native plantations, except in cases where pre-existing permits existed, as in the case of the project baseline.

Table 3.28. Activity shifting leakage calculations.

Year	$\Delta C_{BSL,planned}$ tCO ₂ e	PF	LK_{CP-ME}	$\Delta C_{LK-AS,planned}$
2004	130,858.7	0.3	0.2	8,898.4
2005	146,376.1	0.3	0.2	9,953.6
2006	43,585.5	0.3	0.2	2,963.8
2007	54,742.0	0.3	0.2	3,722.5
2008	0.0	0.0	0.0	-
2009	0.0	0.0	0.0	-
2010	0.0	0.0	0.0	-
2011	0.0	0.0	0.0	-
2012	0.0	0.0	0.0	-
2013	0.0	0.0	0.0	-

Market leakage

Market leakage is zero throughout the first 10-year baseline period, because commercial timber harvest is not affected by the project activity until 2019, the year in which the first plantations (established in project year 2004 of the baseline) would be harvested.

3.3.3 Total project

⁵² Bonilla, C.A., Bonomelli, C. and G. Urrutia.2002. Distribución espacial y temporal de la precipitación y la humedad del suelo en tres sitios forestales de la VIII Región de Chile. Agricultura Técnica (Chile) 62 (4): 541 - 554 (octubre-diciembre, 2002)

⁵³ Instituto Nacional de Estadísticas (INE). 2007. Censo Agropecuario 2007. Table 17

⁵⁴ Instituto Nacional de Estadísticas (INE). 2007. Censo Agropecuario 2007.

Leakage emissions for the project as a whole, including both activities (stopping conversion of native forest to Eucalyptus plantations and stopping highway construction), are summed in Table 3.29 below.

Table 3.29. Net greenhouse gas emissions due to leakage

Year	$\Delta C_{LK-AS,planned,road}$	$\Delta C_{LK-AS,planned,Euc}$	$\Delta C_{LK-ME,road}$	$\Delta C_{LK-ME,Euc}$	Total ΔC_{LK}
2004	0	8,898.39	0.0	0	8,898.39
2005	0	9,953.58	0.0	0	9,953.58
2006	0	2,963.82	0.0	0	2,963.82
2007	0	3,722.46	38.9	0	3,761.40
2008	0	-	15.1	0	15.14
2009	0	-	0.1	0	0.08
2010	0	-	157.4	0	157.44
2011	0	-	12.3	0	12.29
2012	0	-	66.7	0	66.70
2013	0	-	0.0	0	0.00
Total	0	25,538.2	290.6	-	25,828.84

3.4 Summary of GHG Emission Reductions and Removals

Uncertainty

Uncertainty was assessed applying module X-UNC.

Uncertainty in the baseline rate, parameter $Uncertainty_{BSL,RATE}$, is equal to zero. Per X-UNC, “Where an uncertainty value is not known or cannot be simply calculated, then a project must justify that it is using an indisputably conservative number and an uncertainty of 0% may be used for this component.” Uncertainty of 0% is applied to the rate of deforestation associated with road construction in the baseline, which cannot be calculated and has been clearly demonstrated to be conservative (VCS PD Section 3.1). Uncertainty in the baseline rate of deforestation associated with the conversion of native forest to plantations is also assumed to be zero “where the planned deforestation rate is based on actual deforestation plans” (per X-UNC), as it is for this component of the baseline, based on CONAF permits and management plans.

Total uncertainty in carbon stocks in native forest (parameter $Uncertainty_{BSL,SS}$) is equal to combined uncertainty of forest carbon pool stock estimates, calculated using propagation of errors (equation 4 of VM0007 module X-UNC). Parameter $Uncertainty_{BSL,SS}$ is thus calculated to be 8% at the 95% confidence level

(calculations detailed in VCS PD Annex 1 2011 Forest Biomass Inventory Results for Valdivia Coastal Reserve).

Results of overall uncertainty calculations are presented in the table below, and are applicable until forest carbon stock estimates (and precision) are revised after re-inventory before 2021.

Summary of uncertainty calculations.

X-UNC eq #	5	3	6	10	11
Parameter	$Uncertainty_{BSL, SS}$	$Uncertainty_{BSL, RATE}$	$Uncertainty_{BSL, t}$	$C_{REDD_ERROR, t}^*$	$Adjustment\ factor\ applied\ to\ C_{REDD, t}^*$
value	8%	0%	8%	8%	100%

Net emission reduction calculations for the project as a whole, including both activities (stopping conversion of native forest to Eucalyptus plantations and stopping highway construction) are summarized in Tables 3.30.

Table 3.30. Ex ante estimates of net emission reductions.

Years	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
2004	130,859	0	8,898.39	121,960.3
2005	146,376	0	9,953.58	136,422.5
2006	57,512	0	2,963.82	54,548.3
2007	55,664	0	3,761.40	51,902.4
2008	43,015	0	15.14	42,999.4
2009	30,863	0	0.08	30,862.5
2010	39,670	0	157.44	39,512.1
2011	41,640	0	12.29	41,627.4
2012	30,309	0	66.70	30,242.2
2013	31,463	0	0.00	31,462.9
Total	607,369	0	25,829	581,540

With non-permanence risk buffer deductions, estimated eligible VCU's are detailed in Table 3.31 below.

Table 3.31. Ex ante estimates of net emission reductions with non-permanence risk buffer deductions.

Years	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Risk buffer (%)	Deductions for AFOLU pooled buffer account	Estimated net GHG emission reductions or removals (tCO ₂ e)
2004	130,859	0	8,898	10.0%	13,086	108,874

2005	146,376	0	9,954	10.0%	14,638	121,785
2006	57,512	0	2,964	10.0%	5,751	48,797
2007	55,664	0	3,761	10.0%	5,566	46,336
2008	43,015	0	15	10.0%	4,301	38,698
2009	30,863	0	0	10.0%	3,086	27,776
2010	39,670	0	157	10.0%	3,967	35,545
2011	41,640	0	12	10.0%	4,164	37,463
2012	30,309	0	67	10.0%	3,031	27,211
2013	31,463	0	0	10.0%	3,146	28,317
Total	607,369	0	25,829		60,737	520,803

4 MONITORING

4.1 Data and Parameters Available at Validation

Details on data and parameters available at validation are provided below for:

Data Unit / Parameter:	$A_{planned,i}$
Data unit:	Ha
Description:	Total area of planned deforestation over the fixed baseline period for stratum i
Source of data:	Forest permits and engineering plans. Area determination detailed in PD Section 3.1.
Value applied:	Detailed in PD Section 3.1.
Justification of choice of data or description of measurement methods and procedures applied:	Detailed in PD Section 3.1.
Any comment:	

Data Unit / Parameter:	$D\%_{planned,i,t}$
Data unit:	% year ⁻¹
Description:	Projected annual proportion of land that will be deforested in stratum i at year t
Source of data:	Forest permits, engineering plans and remote sensing data. Rate determination detailed in PD Section 3.1.
Value applied:	Detailed in PD Section 3.1.

Justification of choice of data or description of measurement methods and procedures applied:	Detailed in PD Section 3.1.
Any comment:	

Data Unit / Parameter:	$L-D_i$
Data unit:	%
Description:	Likelihood of deforestation in stratum i
Source of data:	
Value applied:	100%
Justification of choice of data or description of measurement methods and procedures applied:	The likelihood of deforestation ($L-D_i$) is set to 100% as the project area is not “both under government control and zoned for deforestation” (per module BL-PL).
Any comment:	

Data Unit / Parameter:	$\Delta C_{BSL,planned}$
Data unit:	t CO ₂ -e
Description:	Net CO ₂ emissions in the baseline from planned deforestation
Source of data:	Derived in Section 3.1 of PD
Value applied:	Set at start of baseline period
Justification of choice of data or description of measurement methods and procedures applied:	Derived and justified in Section 3 of PD in which baseline is set
Any comment:	

Data Unit / Parameter:	LDF
Data unit:	t C m ⁻³
Description:	Logging damage factor for logging stratum z , in stratum i

Source of data:	VMD0011
Value applied:	0.25
Justification of choice of data or description of measurement methods and procedures applied:	Default value for coniferous forests from module VMD0011. Although Eucalypts are not conifers, their growth form is closer to conifers than deciduous or hardwood species, with a predominant stem (with bark) component representing 71% of aboveground biomass ⁵⁵ , particularly in plantation grown settings as in the project area.
Any comment:	

Data Unit / Parameter:	<i>LIF</i>
Data unit:	t C m ⁻³
Description:	Factor for calculating the emissions arising from the creation of logging infrastructure (roads, skid trails and decks) during logging operations per cubic meter extracted
Source of data:	VMD0011
Value applied:	0.29
Justification of choice of data or description of measurement methods and procedures applied:	Default value from methodology VM0007
Any comment:	

Data Unit / Parameter:	<i>CF</i>
Data unit:	t C t ⁻¹ d.m.
Description:	Carbon fraction of biomass
Source of data:	IPCC 2006GL
Value applied:	0.47
Justification of choice of data or description of measurement methods and procedures applied:	Global default
Any comment:	

Data Unit / Parameter:	<i>D</i>
Data unit:	t d.m.m ⁻³
Description:	Basic wood density of <i>Eucalyptus globulus</i>
Source of data:	IPCC 2006GL

⁵⁵ Gayoso, J. 2008a. Eucalyptus sp. Resultados Proyecto FONDEF D98i1076

Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied:	wood specific gravity of <i>E globulus</i> reported in the IPCC 2006GL
Any comment:	

Data Unit / Parameter:	D_{mn}
Data unit:	t d.m.m ⁻³
Description:	Mean wood density of commercially harvested species
Source of data:	IPCC 2006GL
Value applied:	0.5
Justification of choice of data or description of measurement methods and procedures applied:	wood specific gravity of <i>E globulus</i> reported in the IPCC 2006GL – only one species harvested in the project area
Any comment:	

Data Unit / Parameter:	WW_s
Data unit:	Dimension- less
Description:	Wood waste. The fraction immediately emitted through mill inefficiency by class of wood products
Source of data:	VMD005
Value applied:	0.19
Justification of choice of data or description of measurement methods and procedures applied:	Default value from VMD005
Any comment:	

Data Unit / Parameter:	SLF_s
Data unit:	Dimensionless
Description:	Fraction of wood products that will be emitted to the atmosphere within 5 years of timber harvest by class of wood products
Source of data:	VMD005
Value applied:	0.4
Justification of choice of data or description	Default value from VMD005

of measurement methods and procedures applied:	
Any comment:	

Data Unit / Parameter:	Ofs
Data unit:	Dimensionless
Description:	Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years of timber harvest by class of wood product s
Source of data:	VMD005
Value applied:	0.6
Justification of choice of data or description of measurement methods and procedures applied:	Default value from VMD005
Any comment:	

Data Unit / Parameter:	$NewR_{i,t}$
Data unit:	Ha
Description:	New calculated forest clearance in stratum i at time t by the baseline agent of the planned deforestation where no leakage is occurring
Source of data:	derived in Section 3 of PD
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied:	Fixed for the first baseline period, derived and justified in Section 3 of PD
Any comment:	This value applies to deforestation from area of deforestation from any highways constructed or improved in Region XIV, within the leakage zone, which is defined as the area bounded by 1) the coast on the west, 2) the existing north-south highway Rt. 5 on the east, 3) the coastline from the town of Corral to Rt 207 on the north, and 4) the Rio Bueno on the south (representing the southernmost border of the Reserve), by the MOP after the project start date.

Data Unit / Parameter:	LF_{ME}
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Data unit:	Dimensionless
Description:	Leakage factor for market effects calculations
Source of data:	VM0007; LK-ME
Value applied:	0.4
Justification of choice of data or description of measurement methods and procedures applied:	Default value where mean merchantable biomass as a proportion of total aboveground tree biomass in forests to which harvest would be displaced is equal to merchantable biomass as a proportion of total aboveground tree biomass within the project boundary. This value is justified because the commercial component of aboveground tree structure in the project area (<i>Eucalyptus globulus</i> plantations) will be nearly identical to areas where harvest could be displaced in Chile to make up for reduction in supply of <i>Eucalyptus globulus</i> wood (i.e. other <i>Eucalyptus globulus</i> plantations).
Any comment:	This value applies to market leakage calculations for timber harvests avoided in the project case in <i>Eucalyptus</i> plantations

Data Unit / Parameter:	$LK_{CP-ME,C,I}$
Data unit:	Dimensionless
Description:	Leakage factor for displacement of class of planned deforestation agents
Source of data:	VM0007; LK-ASP
Value applied:	0.2
Justification of choice of data or description of measurement methods and procedures applied:	Default value where average productivity of alternative lands is >15% more than the relevant strata in the project area. Justified in Section 3.
Any comment:	This value applies to activity shifting calculations for native forest to plantation conversion activities avoided in the project case

Data Unit / Parameter:	PF_c
Data unit:	Dimensionless
Description:	Proportion of available area for production of commodity c that is currently forested
Source of data:	Instituto Nacional de Estadísticas (INE). 2007. Censo Agropecuario 2007.
Value applied:	0.34
Justification of choice of data or description	Justified in Section 3.

of measurement methods and procedures applied:	
Any comment:	This value applies to activity shifting calculations for native forest to plantation conversion activities avoided in the project case

Data Unit / Parameter:	$COMF_i$
Data unit:	dimensionless
Description:	combustion factor for stratum i (vegetation type)
Source of data:	default values in Table 2.6 of IPCC, 2006 (Annex 2)
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied:	
Any comment:	

Data Unit / Parameter:	G_{gi}
Data unit:	g kg^{-1} dry matter burnt
Description:	Emission factor for stratum i for gas g ,

Source of data:	Defaults in Volume 4, Chapter 2, of the IPCC 2006 Inventory Guidelines in table 2.5 (Annex 2: emission factors for various types of burning for CH ₄ and N ₂ O).
Value applied:	
Justification of choice of data or description of measurement methods and procedures applied:	
Any comment:	

4.2 Data and Parameters Monitored

Details on data and parameters monitored are provided below.

Data Unit / Parameter:	$\Delta C_{P,Def,i,t}$
Data unit:	t CO ₂ -e
Description:	Net carbon stock change as a result of deforestation in the project case in the project area in stratum <i>i</i> at time <i>t</i>
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	First monitoring event in 2011. Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 3, VMD0015

Any comment:	
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Data Unit / Parameter:	$\Delta C_{P,DistPA,i,t}$
Data unit:	t CO ₂ -e
Description:	Net carbon stock change as a result of natural disturbance in the project case in the project area in stratum <i>i</i> at time <i>t</i>
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	First monitoring event in 2011. Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 20, VMD0015
Any comment:	

Data Unit / Parameter:	$A_{DefPA,u,i,t}$
Data unit:	Ha
Description:	Area of recorded deforestation in the project area stratum <i>i</i> converted to land use <i>u</i> at time <i>t</i>
Source of data:	Monitored at each monitoring/verification event through analysis of classified satellite imagery
Description of measurement methods and procedures to be applied:	<i>Data acquisition</i> To estimate the change of forest cover within the project area, the benchmark map generated at the previous monitoring event (or at project start November 2003 for the first monitoring event) will be compared with a newly-generated classified forest cover map for the monitoring date. The new forest cover map for the project area will comply with the following requirements. Base satellite imagery will cover the entire project area and will be from a single year, though it may include a mosaic of scenes over several months. Imagery will be 90% cloud free. To achieve 90% classified area, multiple scenes or portions of multiple scenes may be mosaicked. Where possible, areas that are continually clouded will be classified on the basis of other data sources

	(e.g. ground surveys in the year of interest, radar, over-flights or classified imagery from a year subsequent to the monitored year). <i>Pre-processing</i> Collected imagery will be prepared for processing and analysis to ensure that the imagery displays and overlays accurately. The following pre-processing tasks will be conducted and are detailed below: geo-referencing, cloud and shadow removal. Each scene will be pre-processed and classified separately, eliminating need for radiometric corrections or topographic normalization where scenes must be mosaicked together. <u>Geo-referencing:</u> For this procedure the November 2003 benchmark map will be used as a reference image from which all subsequent images will be geo-referenced. At least 7 control points will be established for the geo-reference procedure and the average geo-location error will not exceed 1 pixel. In the case that multiple images are mosaicked, a final image may be geo-referenced to ensure accurate location. In the case that imagery is obtained with geo-rectification conducted by the image producer or provider, secondary geo-referencing is not necessary. <u>Cloud and Shadow detection and removal:</u> Detection of clouds and shadows will be accomplished through visual inspection or combining automated cloud identification techniques and visual inspection. Minimum Mapping Unit (MMU) of 0.81 ha, corresponding to 3 pixels by 3 pixels Landsat resolution (90m by 90m) will be used throughout the duration of the project crediting period. <i>Interpretation and classification</i> In this step, the scenes are interpreted by applying a classification algorithm to identify forest and non-forest categories. A land use map with 2 categories (forest and non-forest) will be created to assess forest loss against the previous benchmark map. As mentioned above, each scene will be classified separately. The following guidelines will be taken into consideration for the imagery classification
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	process: Each scene will be classified separately using a hard classification method. The geospatial analyst performing the classification will take into consideration the variety of features in the scene and reference training sites representing a range of categories (from within forest and non-forest) sufficient to facilitate the identification of forested locations from locations with no forest. Where necessary, corrections to the classification will be made from visual interpretation of imagery. Once the classified map is produced, categories will be merged into two categories for change assessment: forest and non-forest. Following classification, classified scenes will then be joined to produce a final map that will be compared against the benchmark map. <i>Change detection</i> Post-classification change detection techniques will be implemented for identifying forest cover change. Basic cross-tabulation techniques will be used to identify changes from forest to non-forest. Area data from the two maps (benchmark map at beginning of monitoring interval and newly-generated map for current monitoring year) will be cross-tabulated to identify locations that change from forest to non-forest during the monitoring period, which represent deforestation in the actual with-project case. Transitions from forest to non-forest referable to anthropogenic deforestation (not natural disturbance) will be identified on the basis of auxiliary information including but not limited to high resolution satellite imagery, confirmation in the field and/or GIS layers (from which the likelihood of anthropogenic versus natural disturbance can be assessed, e.g. on the basis of remoteness or proclivity to disturbance, e.g. steep slopes).
Frequency of monitoring/recording:	First monitoring event in 2011. Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Landsat or other medium resolution satellite imagery, high-resolution imagery (e.g. SPOT or Rapideye imagery) for classification, improved remote sensing data sources to be used as they become available, GIS coverages, remote

	sensing classification and GIS software, GPS for geo-referencing ground truth points, forest cover benchmark map from end of previous monitoring interval.
QA/QC procedures to be applied:	All data sources and analytical procedures will be documented and archived. Accuracy of the classification will be assessed by comparing the classification with ground truth points or samples of high-resolution imagery (e.g. SPOT or Rapideye imagery). Any data collected from ground-truth points will be recorded (including GPS coordinates, identified land-use class) and archived. Any sample points of high resolution imagery used to assess classification accuracy will also be archived. Samples used to assess classification accuracy should be well-distributed throughout the project area (as far as is possible considering availability of high resolution imagery and/or logistics of acquiring ground truth data). Results of the accuracy assessment will be presented and analyzed in a matrix in the format elaborated in the example below, such that the following errors are presented: • Overall classification accuracy • Error of omission of each land-use category (forest and non-forest) • Error of commission of each land-use category (forest and non-forest) The classification will only be used in the forest cover change detection step if the overall classification accuracy, calculated as the total number of correct samples/ the total number of samples, is equal to or exceeds 90%.
Calculation method:	None
Any comment:	

Data Unit / Parameter:	$A_{DistPA,q,i,t}$
Data unit:	ha
Description:	Area impacted by natural disturbance in post-natural disturbance stratum q in stratum i , at time t
Source of data:	Monitored at each monitoring/verification event through analysis of classified satellite imagery
Description of measurement methods and	<i>Data acquisition</i> To estimate the change of forest cover within the

procedures to be applied:	project area, the benchmark map generated at the previous monitoring event (or at project start November 2003 for the first monitoring event) will be compared with a newly-generated classified forest cover map for the monitoring date. The new forest cover map for the project area will comply with the following requirements. Base satellite imagery will cover the entire project area and will be from a single year, though it may include a mosaic of scenes over several months. Imagery will be 90% cloud free. To achieve 90% classified area, multiple scenes or portions of multiple scenes may be mosaicked. Where possible, areas that are continually clouded will be classified on the basis of other data sources (e.g. ground surveys in the year of interest, radar, over-flights or classified imagery from a year subsequent to the monitored year). <i>Pre-processing</i> Collected imagery will be prepared for processing and analysis to ensure that the imagery displays and overlays accurately. The following pre-processing tasks will be conducted and are detailed below: geo-referencing, cloud and shadow removal. Each scene will be pre-processed and classified separately, eliminating need for radiometric corrections or topographic normalization where scenes must be mosaicked together. <u>Geo-referencing:</u> For this procedure the November 2003 benchmark map will be used as a reference image from which all subsequent images will be geo-referenced. At least 7 control points will be established for the geo-reference procedure and the average geo-location error will not exceed 1 pixel. In the case that multiple images are mosaicked, a final image may be geo-referenced to ensure accurate location. In the case that imagery is obtained with geo-rectification conducted by the image producer or provider, secondary geo-referencing is not necessary. <u>Cloud and Shadow detection and removal:</u> Detection of clouds and shadows will be accomplished through visual inspection or combining automated cloud identification techniques and visual
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	inspection. Minimum Mapping Unit (MMU) of 0.81 ha, corresponding to 3 pixels by 3 pixels Landsat resolution (90m by 90m) will be used throughout the duration of the project crediting period. <i>Interpretation and classification</i> In this step, the scenes are interpreted by applying a classification algorithm to identify forest and non-forest categories. A land use map with 2 categories (forest and non-forest) will be created to assess forest loss against the previous benchmark map. As mentioned above, each scene will be classified separately. The following guidelines will be taken into consideration for the imagery classification process: Each scene will be classified separately using a hard classification method. The geospatial analyst performing the classification will take into consideration the variety of features in the scene and reference training sites representing a range of categories (from within forest and non-forest) sufficient to facilitate the identification of forested locations from locations with no forest. Where necessary, corrections to the classification will be made from visual interpretation of imagery. Once the classified map is produced, categories will be merged into two categories for change assessment: forest and non-forest. Following classification, classified scenes will then be joined to produce a final map that will be compared against the benchmark map. <i>Change detection</i> Post-classification change detection techniques will be implemented for identifying forest cover change. Basic cross-tabulation techniques will be used to identify changes from forest to non-forest. Area data from the two maps (benchmark map at beginning of monitoring interval and newly-generated map for current monitoring year) will be cross-tabulated to identify locations that change from forest to non-forest during the monitoring period, which represent deforestation in the actual with-project case. Transitions from forest to non-forest referable to natural disturbance (not anthropogenic deforestation) will be identified on the basis of auxiliary information including but not limited to
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	high resolution satellite imagery, confirmation in the field and/or GIS layers (from which the likelihood of anthropogenic versus natural disturbance can be assessed, e.g. on the basis of remoteness or proclivity to disturbance, e.g. steep slopes).
Frequency of monitoring/recording:	First monitoring event in 2011. Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Landsat or other medium resolution satellite imagery, high-resolution imagery (e.g. SPOT or Rapideye imagery) for classification, GIS coverages, improved remote sensing data sources to be used as they become available, remote sensing classification and GIS software, GPS for geo-referencing ground truth points, forest cover benchmark map from end of previous monitoring interval.
QA/QC procedures to be applied:	All data sources and analytical procedures will be documented and archived. Accuracy of the classification will be assessed by comparing the classification with ground truth points or samples of high-resolution imagery (e.g. SPOT or Rapideye imagery). Any data collected from ground-truth points will be recorded (including GPS coordinates, identified land-use class) and archived. Any sample points of high resolution imagery used to assess classification accuracy will also be archived. Samples used to assess classification accuracy should be well-distributed throughout the project area (as far as is possible considering availability of high resolution imagery and/or logistics of acquiring ground truth data). Results of the accuracy assessment will be presented and analyzed in a matrix in the format elaborated in the example below, such that the following errors are presented: • Overall classification accuracy • Error of omission of each land-use category (forest and non-forest) • Error of commission of each land-use category (forest and non-forest) The classification will only be used in the forest cover change detection step if the overall classification accuracy, calculated as the total number of correct samples/ the total number of samples, is equal to or exceeds 90%.

Calculation method:	None
Any comment:	

Data Unit / Parameter:	$C_{BSL,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Description:	Carbon stock in all pools in the baseline case in stratum <i>i</i>
Source of data:	Estimated from forest carbon inventory
Description of measurement methods and procedures to be applied:	To re-assess forest carbon stocks, fifty (50) point samples (ten clusters of five points) will be randomly located in the project area and basal area measured (following field protocols in Annex 15) in 2021. Biomass will be estimated from basal area applying a Biomass:Basal Area Ratio (BBAR) of 2.87 (derived for the VCR in the 2011 inventory, Annex 1). Where the re-measured estimate of live above- and belowground forest biomass carbon is within the 90% confidence interval of the 2011 estimate, the 2011 stock estimate will continue to be used in the next 10 year period. If the re-measured estimate is outside (i.e., greater than or less than) the 90% confidence interval of the 2011 estimate, then the new stock estimate will be used in the next 10-year period.
Frequency of monitoring/recording:	Every ≤ 10 years. First measurement in 2011. Stock estimates will then be re-assessed at re-inventory on the first monitoring event subsequent to February 2021.
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	GPS Compass Flagging Rangefinder Wedge prisms Clinometer Diameter tape Machete Datasheets Pencils
QA/QC procedures to be applied:	The following steps will be taken to control for errors in field sampling and measurements and data analysis: 1. Field crews will be fully trained in all aspects of the field data collection prior to

	conducting formal sampling and measurements and adhere to field measurement protocols outlined in standard field operating procedures. Pilot sample points will be used for field training prior to initiating formal measurements to appraise field crews and identify and correct any errors in field measurements. Detailed standard procedures for all aspects of field measurement activities are provided in Annex 15: "PROTOCOLOS DE CAMPO PARA LA MEDICIÓN Y MONITOREO DE LA BIOMASA FORESTAL EN LA RESERVA COSTERA VALDIVIANA." Field crew leaders will be responsible for ensuring that field protocols are followed to ensure accurate and consistent measurement. Prism calibration will be verified prior to use. All borderline trees will be measured and assessed against prism plot radius factor, which will be standardized as distance to the center of the tree: diameter at breast height. To ensure accurate measurements, the height of diameter at breast height (1.3 m) will be periodically re-assessed by personnel during the course of the inventory. Field crews will have fine scale forest strata maps for use in the field to precisely interpret strata/forest boundaries and identify potential areas of plot overlap. 2. Following measurement, a consistency check of an opportunistic sample of 5 points will be re-measured to determine measurement error. Re-measurement for this purpose will be done by a different field crew. Measurement error will be assessed as 1/2 of the mean (absolute) percent difference between re-measured plot level biomass estimates (a valid assumption where teams are equally experienced and there are no systematic errors in measurement, which will also be appraised from the re-measurement results). Target measurement error is < 5%. During the course of implementation, field crews will be periodically apprised of measurement errors to assess progress. 3. Field measurement data will be recorded
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	on standard field data sheets included in "PROTOCOLOS DE CAMPO PARA LA MEDICIÓN Y MONITOREO DE LA BIOMASA FORESTAL EN LA RESERVA COSTERA VALDIVIANA." Data will be entered from field sheets to an electronic database. Checks will be run for unusual (high or low) values to identify and correct any errors in recorded field data or transcription. Personnel involved in data analysis will consult with personnel involved in measurement to clarify any ambiguities in recorded field data.
Calculation method:	Biomass will be estimated from diameter at breast height using allometric equations from Gayoso, J.; Guerra, J.; Alarcón, D. 2002. Contenido de carbono y funciones de biomasa en especies nativas y exóticas. Proyecto FONDEF D98I1076 Medición de la capacidad de captura de carbono en bosques de Chile y promoción en el mercado mundial. 157 p.
Any comment:	

Data Unit / Parameter:	$C_{P,Dist,q,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Description:	Carbon stock in pools in post-natural disturbance strata q in stratum i
Source of data:	Conservatively assumed to be zero
Description of measurement methods and procedures to be applied:	Not measured.
Frequency of monitoring/recording:	Not measured.
Value monitored:	0
Monitoring equipment:	Not measured.
QA/QC procedures to be applied:	Not measured.
Calculation method:	None
Any comment:	

Data Unit / Parameter:	$A_{DegW,i,t}$
Data unit:	ha
Description:	Area potentially impacted by degradation processes in stratum i

Source of data:	Delineated based on observations by VCR guard staff and consultation with the District Attorney's office (Fiscalia Regional) of the Ríos Region.
Description of measurement methods and procedures to be applied:	Monitored via periodic patrols throughout the VCR area, including the project area, by six TNC park rangers and through periodic consultation the District Attorney's office (Fiscalia Regional) of the Ríos Region. VCR staff patrol observations and consultations with local authorities will provide general indications on incidents and areas where illegal wood harvest (the main anticipated cause of degradation) has occurred or may be occurring in or near the project area. Patrols prioritize key access points/areas of activity, particularly in the areas of Colun, Chaihuin and the route from Hueicolla to La Union (Rts 470 and 80), the latter area in coordination with CONAF personnel posted at a permanent guard station at the national park near the reserve entrance. Notwithstanding the priority areas identified above, guard patrols are deployed according to continuous re-assessments of threats, which may change in nature and location seasonally. Monthly meetings of park guards are held to assess current threats and using a planning grid of the reserve, select priority 100 ha grid areas for patrols on the basis of accessibility and threats. Monthly, 4 grids, covering an area of 400 ha, are investigated. Guards carry out patrols on foot, on motorcycles and in pickup trucks. Twenty camera traps are also deployed in priority areas to aid in monitoring threats. When incidents are encountered, guards will record details regarding the incident on standardized forms, including the location using GPS. In the event that any potential of illegal logging in the project area is detected, the area indicated will be delineated by GPS and calculated using GIS software ($A_{DegW,i}$).
Frequency of monitoring/recording:	Park guard surveys are continuous throughout the crediting period. Consultations with the district attorney's office conducted every ≤ 2 years. First consultation conducted in 2012.
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Two-way radios, motorcycles, pick-up trucks, camera traps, GPS, standardized incident forms, GIS software.

QA/QC procedures to be applied:	Incident areas of potential degradation are confirmed and delineated in the field using GPS.
Calculation method:	None
Any comment:	

Data Unit / Parameter:	$C_{DegW,i,t}$
Data unit:	t CO ₂ -e
Description:	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum i at time t
Source of data:	Estimated from diameter measurements of cut stumps in sample plots
Description of measurement methods and procedures to be applied:	Temporary sample plots will be allocated and measured in the area of potential logging ($A_{DegW,i}$). Rectangular plots 10 meters by 1 kilometer (1 ha area) will be randomly or systematically allocated in the area, sufficient to produce a 1% sample of the area, and any recently-cut stumps or other indications of illegal harvest will be noted and recorded. Diameter at breast height, or diameter at height of cut, whichever is lower, of cut stumps will be measured. Where potential emissions as determined through this assessment are determined to be insignificant using tool T-SIG, no further monitoring will be conducted and emissions from illegal logging will be assumed to be zero. In the event that the sample plot assessment indicated that illegal logging is occurring in the area and is potentially significant, supplemental plots will be allocated systematically to achieve a 3% sample of the area. Biomass of trees cut and removed will be estimated from measured diameters (conservatively assuming that diameters of stumps cut below breast height are equivalent to diameter at breast height) applying allometric equations of Gayoso et al 2002 and otherwise maintain consistency with analytical procedures applied in the original 2011 inventory.
Frequency of monitoring/recording:	The more intensive 3% sample will be carried out once every 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area.
Value monitored:	Value of parameter is monitored and expected to

	vary over the crediting period
Monitoring equipment:	GPS Compass Flagging Rangefinder Diameter tape Machete Datasheets Pencils
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	Biomass will be estimated from diameter at breast height using allometric equations from Gayoso, J.; Guerra, J.; Alarcón, D. 2002. Contenido de carbono y funciones de biomasa en especies nativas y exóticas. Proyecto FONDEF D98I1076 Medición de la capacidad de captura de carbono en bosques de Chile y promoción en el mercado mundial. 157 p.
Any comment:	

Data Unit / Parameter:	AP_i
Data unit:	ha
Description:	Total area of degradation sample plots in stratum i
Source of data:	Calculated as 3% (minimally) of $A_{DegW,i,t}$
Description of measurement methods and procedures to be applied:	Calculated by summing the (slope corrected) area of sample plots measured in 3% sample of $A_{DegW,i,t}$.
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	None
QA/QC procedures to be applied:	Sample plot dimensions are measured in the field on plot establishment, and any corrections for slope made where slope exceeds 15%.
Calculation method:	Calculated by summing the (slope corrected) area of sample plots measured in 3% sample of $A_{DegW,i,t}$
Any comment:	

Data Unit / Parameter:	$\Delta C_{P,DegW,i,t}$
Data unit:	t CO ₂ -e
Description:	Net carbon stock changes as a result of degradation in stratum <i>i</i> in the project area at time <i>t</i>
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 8, VMD0015 Estimates of emissions will be annualized (to produce estimates in t CO ₂ -e per year) by dividing the emission for the monitoring interval by the number of years in the interval.
Any comment:	

Data Unit / Parameter:	$\Delta C_{LK-AS,planned}$
Data unit:	t CO ₂ -e
Description:	Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 1, VMD0009
Any comment:	

Data Unit / Parameter:	$A_{defLK,i,t}$
Data unit:	ha
Description:	The total area of deforestation by the baseline agent of the planned deforestation in stratum i at time, t
Source of data:	Monitored through investigation of MOP construction records or current road maps and remote imagery.
Description of measurement methods and procedures to be applied:	The area of this parameter is restricted to deforestation from any highways constructed or improved in Region XIV, within the leakage zone, which is defined as the area bounded by 1) the coast on the west, 2) the existing north-south highway Rt. 5 on the east, 3) the coastline from the town of Corral to Rt 207 on the north, and 4) the Rio Bueno on the south (representing the southernmost border of the Reserve), by the MOP after the project start date. First, new road construction meeting the criteria above will be identified by consulting MOP construction records and/or current road maps. In the event that new road construction meeting the leakage criteria is identified, area of deforestation along the road construction identified above will then be determined with remotely-sensed imagery.
Frequency of monitoring/recording:	Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Medium and/or high resolution satellite imagery, GIS software, improved remote sensing data sources to be used as they become available,
QA/QC procedures to be applied:	All data sources and analytical procedures will be documented and archived.
Calculation method:	Any activity shifting leakage identified for the monitoring interval will be annualized (to produce estimates of ha for each year) by dividing the area by the number of years in the period.
Any comment:	

Data Unit / Parameter:	$LKA_{planned,i,t}$
Data unit:	ha

Description:	The area of activity shifting leakage in stratum i at time t
Source of data:	Calculated as $NewR_{i,t} - A_{defLK,i,t}$
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 5, VMD0009
Any comment:	

Data Unit / Parameter:	$\Delta C_{BSL,i}$
Data unit:	t CO ₂ -e ha ⁻¹
Description:	Net carbon stock changes in all pools in baseline stratum i
Source of data:	Calculated from equation 1, VMD0006
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 1, VMD0006
Any comment:	

Data Unit / Parameter:	$LK_{MarketEffects,timber}$
Data unit:	t CO ₂
Description:	Total GHG emissions due to market- effects leakage through decreased timber harvest sold into domestic markets
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	Not applicable
Frequency of monitoring/recording:	Every ≤ 10 years
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Not applicable

QA/QC procedures to be applied:	Not applicable
Calculation method:	Equation 2, VMD0011
Any comment:	

Data Unit / Parameter:	$A_{burn,i,t}$
Data unit:	ha
Description:	Area burnt in stratum i at time t
Source of data:	CONAF fire database and analysis of remote sensing data
Description of measurement methods and procedures to be applied:	Consultation of CONAF fire database identifying incidence of fire followed by remote sensing analysis to delineate and quantify area. Incidence of burned areas in the project area will be monitored consulting the CONAF fire database. Where points of fire incidence are discovered, the area subject to fire will be delineated and quantified using remote sensing analysis.
Frequency of monitoring/recording:	Areas burnt shall be monitored at least every five years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value monitored:	Value of parameter is monitored and expected to vary over the crediting period
Monitoring equipment:	Medium and/or high resolution satellite imagery, GIS software, improved remote sensing data sources to be used as they become available,
QA/QC procedures to be applied:	All data sources and analytical procedures will be documented and archived. Remote sensing analysis will be conducted using visual interpretation by an image analyst with knowledge of local land cover and/or with the assistance of high resolution imagery.
Calculation method:	Any areas of burns identified for the monitoring interval will be annualized (to produce estimates of ha for each year) by dividing the area by the number of years in the period.
Any comment:	For estimation of biomass burning emissions using the module E-BB – calculated emissions from biomass burning will be incorporated in project accounting only where they are not determined to be insignificant applying T-SIG.

4.3 Description of the Monitoring Plan

4.3.1 Revision of the baseline

The baseline as outlined here in the Project Description is valid for 10 years from the project start date, through November 3, 2013, and will be revised on the first monitoring event subsequent to this date. Because the entire project area is deforested in the first 10-year baseline period, deforestation rate in the baseline for all subsequent baseline periods will be equal to zero.

4.3.2 Monitoring of actual carbon stock changes and greenhouse gas emissions

The project area is made up of mostly mature temperate rainforest either at steady state or accruing biomass at very slow rates (i.e. unlikely to be significant within the timeframe of the project crediting period). For accounting purposes the project assumes stable stocks and no measurement or accounting of growth is conducted, as permitted in the methodology monitoring module VMD0015, hence $\Delta C_{P,Enh,i,t}$ is set to 0.

Monitoring of actual emissions in the project area focuses on:

- Emissions due to deforestation and natural disturbance
- Emissions due to biomass burning Emissions due to illegal degradation

Procedures and responsibilities for monitoring each of the above sources of emissions are detailed below.

Emissions due to deforestation and natural disturbance

Forest cover change due to deforestation and natural disturbance is monitored through periodic assessment of classified satellite imagery covering the project area. Emissions ($\Delta C_{P,Def,i,t}$ and $\Delta C_{P,DistPA,i,t}$ for deforestation and natural disturbance, respectively) are estimated by multiplying area of forest loss detected ($A_{DefPA,u,i,t}$ and $A_{DistPA,q,i,t}$, for deforestation and natural disturbance, respectively) by average forest carbon stock per unit area (conservatively assuming $\Delta C_{P,Dist,q,i,t}$ and $\Delta C_{Pools,Def,u,i,t} = C_{BSL,i}$). Stock estimates from the initial field inventory completed in 2011, are valid for 10 years (per VM0007), minimally through 2021. Stock estimates will be re-assessed at re-inventory on the first monitoring event subsequent to February 2021.

Monitoring changes in forest cover

The project boundary, as set in the PD, will serve as the initial “forest cover benchmark map” against which changes in forest cover will be assessed over the interval of the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting period. For subsequent monitoring periods, change in forest cover will be assessed against the preceding classified forest cover map marking the beginning of the monitoring interval.

Data collection and analysis to determine forest cover change at each monitoring event will follow the procedures detailed below. The resulting classified image is compared with the preceding classified image (forest cover benchmark map marking the start of the monitoring interval) to detect forest cover change over the monitoring interval, and subsequently becomes the updated forest cover benchmark map for the next monitoring interval. Thus, the forest benchmark map is updated at each monitoring event. All changes in forest cover detected for the monitoring interval will be annualized (to produce estimates of ha for each year) by dividing the area by the number of years in the period.

For each monitoring/verification date, satellite imagery for that year will be acquired and interpreted to produce a classified forest cover map in which forest and non-forest are distinguished. Consistent with the original

2002/2003 imagery from which the eligible project area was set, a Minimum Mapping Unit (MMU) of 0.81 ha, corresponding to 3 pixels by 3 pixels Landsat resolution (90m by 90m) will be used throughout the duration of the project crediting period.

The forest cover benchmark map (Figure 4.1) establishes the initial extent and location of forest and non-forest at the beginning of the crediting period and the first verification interval.

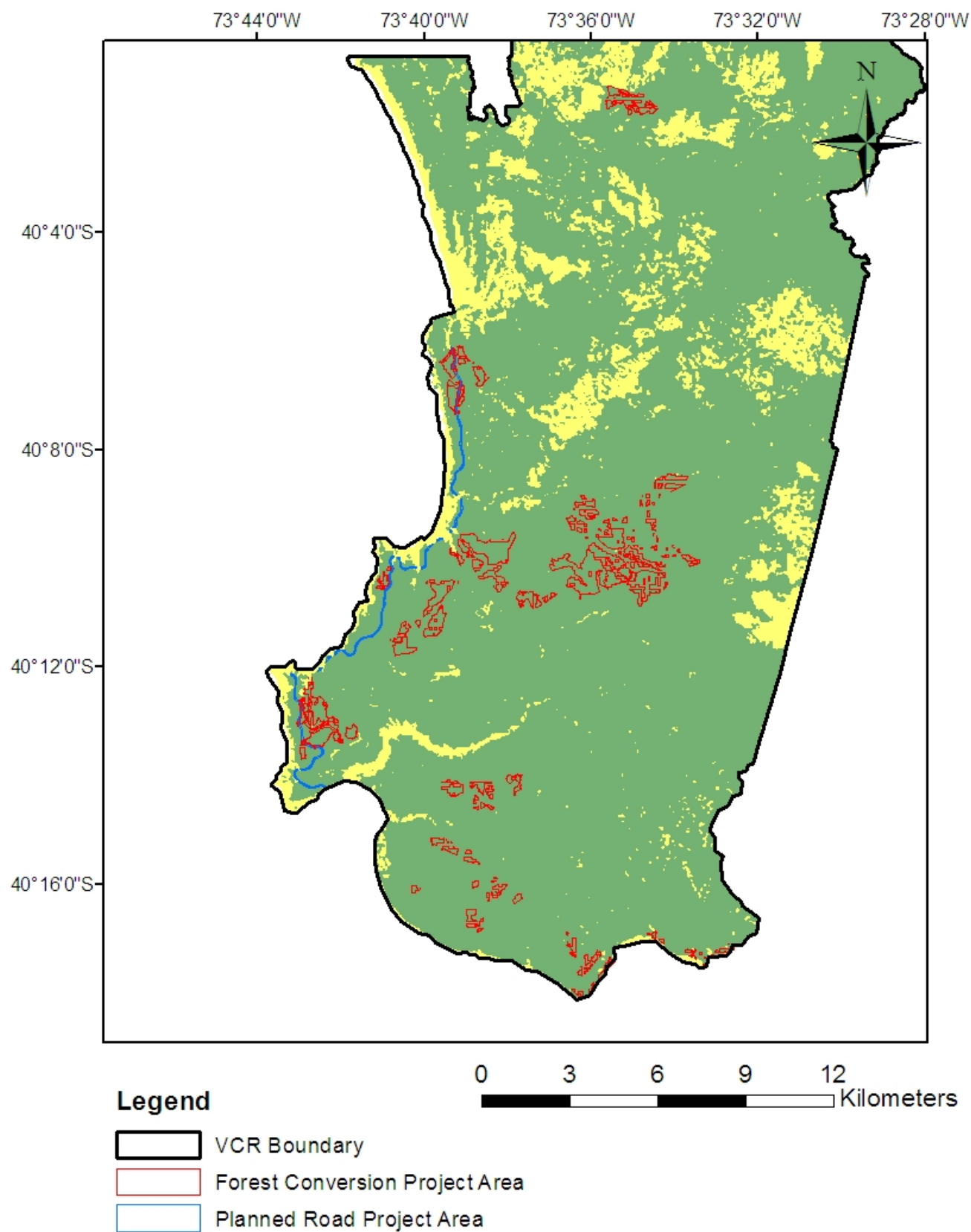


Figure 4.1. Forest cover benchmark map for project area, classified Landsat imagery 2002/2003 (forest in green, non-forest in yellow).

Data acquisition

To estimate the change of forest cover within the project area, the benchmark map generated at the previous monitoring event (or at project start November 2003 for the first monitoring event) will be compared with a newly-generated classified forest cover map for the monitoring date. The new forest cover map for the project area will comply with the following requirements.

Base satellite imagery will cover the entire project area and will be from a single year, though it may include a mosaic of scenes over several months.

Imagery will be 90% cloud free. To achieve 90% classified area, multiple scenes or portions of multiple scenes may be mosaicked. Where possible, areas that are continually clouded will be classified on the basis of other data sources (e.g. ground surveys in the year of interest, radar, over-flights or classified imagery from a year subsequent to the monitored year).

Pre-processing

Collected imagery will be prepared for processing and analysis to ensure that the imagery displays and overlays accurately. The following pre-processing tasks will be conducted and are detailed below: geo-referencing, cloud and shadow removal. Each scene will be pre-processed and classified separately, eliminating need for radiometric corrections or topographic normalization where scenes must be mosaicked together.

Geo-referencing

For this procedure the November 2003 benchmark map will be used as a reference image from which all subsequent images will be geo-referenced. At least 7 control points will be established for the geo-reference procedure and the average geo-location error will not exceed 1 pixel. In the case that multiple images are mosaicked, a final image may be geo-referenced to ensure accurate location. In the case that imagery is obtained with geo-rectification conducted by the image producer or provider, secondary geo-referencing is not necessary.

Cloud and Shadow detection and removal

Detection of clouds and shadows will be accomplished through visual inspection or combining automated cloud identification techniques and visual inspection.

Interpretation and classification

In this step, the scenes are interpreted by applying a classification algorithm to identify forest and non-forest categories. A land use map with 2 categories (forest and non-forest) will be created to assess forest loss against the previous benchmark map. As mentioned above, each scene will be classified separately.

The following guidelines will be taken into consideration for the imagery classification process:

Each scene will be classified separately using a hard classification method. The geospatial analyst performing the classification will take into consideration the variety of features in the scene and reference training sites representing a range of categories (from within forest and non-forest) sufficient to facilitate the identification of forested locations from locations with no forest. Where necessary, corrections to the classification will be made from visual interpretation of imagery. Once the classified map is produced, categories will be merged into two categories for change assessment: forest and non-forest.

Following classification, classified scenes will then be joined to produce a final map that will be compared against the benchmark map.

Change detection

Post-classification change detection techniques will be implemented for identifying forest cover change. Basic cross-tabulation techniques will be used to identify changes from forest to non-forest. Area data from the two maps (benchmark map at beginning of monitoring interval and newly-generated map for current monitoring year) will be cross-tabulated to identify locations that change from forest to non-forest during the monitoring period, which represent deforestation in the actual with-project case.

Quality Assurance/Quality Control

To ensure consistency and quality results, spatial analysts carrying out the imagery processing, interpretation, and change detection procedures will strictly adhere to the steps detailed above. All data sources and analytical procedures will be documented and archived (detailed under data archiving below).

Accuracy of the classification will be assessed by comparing the classification with ground truth points or samples of high-resolution imagery (e.g. SPOT or Rapideye imagery). Any data collected from ground-truth points will be recorded (including GPS coordinates, identified land-use class) and archived. Any sample points of high resolution imagery used to assess classification accuracy will also be archived. Samples used to assess classification accuracy should be well-distributed throughout the project area (as far as is possible considering availability of high resolution imagery and/or logistics of acquiring ground truth data).

Results of the accuracy assessment will be presented and analyzed in a matrix in the format elaborated in the example below, such that the following errors are presented:

- Overall classification accuracy
- Error of omission of each land-use category (forest and non-forest)
- Error of commission of each land-use category (forest and non-forest)

Land-use class as determined from ground-truth points	Classification		Total	Accuracy (%) <i>User's accuracy</i> (# correct/ row total)	Error of Commission (%)
	Forest	Non-forest			
Forest (100)	95	5	100	95.0	5.0
Non-forest (100)	9	91	100	91.0	9.0
Total	104	96	200		
Accuracy (%) Producer's accuracy (# correct/ column total)	91.3	94.8			
Error of Omission (%)	8.7	5.2			

The classification will only be used in the forest cover change detection step if the overall classification accuracy, calculated as the total number of correct samples/ the total number of samples, is equal to or exceeds 90%.

Data Archiving

All data sources and processing, classification and change detection procedures will be documented and stored in a dedicated long-term electronic archive maintained by TNC at its office in Chaihuin, with a backup file at its office in Valdivia.

Information related to monitoring deforestation maintained in the archive will include:

- Base (raw) imagery used (specifying type, source, resolution, imagery date, acquisition date)
- Any cartographic data used to geo-reference the image (source, base data)
- Data used for training classification, if supervised
- Definition of land cover classes assessed
- Documentation of software type and procedures applied (including all pre-processing steps and corrections, spectral bands used in final classifications, and classification methodologies and algorithms applied)
- Classified images
- Data used in accuracy assessment - ground-truth points (including GPS coordinates, identified land-use class) and/or sample points of high resolution imagery
- Accuracy assessment matrix with minimally the following errors presented: overall classification accuracy, error of omission of each land-use category (forest and non-forest), and error of commission of each land-use category (forest and non-forest)

Data archived will be maintained through at least two years beyond the end of the project crediting period, through November 2025. Given the extended time frame and the pace of production of updated versions of software and new hardware for storing data, electronic files will be updated periodically or converted to a format accessible to future software applications, as needed.

Updating forest carbon stock estimates

Forest carbon stock estimates used to calculate emissions from deforestation and natural disturbance will use estimates derived from field measurements less than or equal to 10 years old. In the event that any deforestation is discovered in the project area, forest carbon stock estimates older than 10 years will be updated where deforestation is detected. Initial above- and belowground biomass and dead wood stock estimates from the 2011 inventory are valid and treated as constant through 2021, after which they will be re-estimated from new field measurements. Stock estimates will be re-assessed at re-inventory on the first monitoring event subsequent to February 2021.

To re-assess forest carbon stocks, fifty (50) point samples (ten clusters of five points) will be randomly located in the project area and basal area measured (following field protocols in Annex 15) in 2021. Biomass will be estimated from basal area applying a Biomass:Basal Area Ratio (BBAR) of 2.87 (derived for the VCR in the 2011 inventory, Annex 1). Where the re-measured estimate of live above- and belowground forest biomass carbon is within the 90% confidence interval of the 2011 estimate, the 2011 stock estimate will continue to be used in the next 10 year period. If the re-measured estimate is outside (i.e., greater than or less than) the 90% confidence interval of the 2011 estimate, then the new stock estimate will be used in the next 10-year period.

Quality Assurance /Quality Control and Data Archiving Procedures

The following steps will be taken to control for errors in field sampling and measurements and data analysis:

4. Field crews will be fully trained in all aspects of the field data collection prior to conducting formal sampling and measurements and adhere to field measurement protocols outlined in standard field operating procedures. Pilot sample points will be used for field training prior to initiating formal measurements to appraise field crews and identify and correct any errors in field measurements. Detailed standard procedures for all aspects of field measurement activities are provided in Annex 15:

“PROTOCOLOS DE CAMPO PARA LA MEDICIÓN Y MONITOREO DE LA BIOMASA FORESTAL EN LA RESERVA COSTERA VALDIVIANA.” Field crew leaders will be responsible for ensuring that field protocols are followed to ensure accurate and consistent measurement. Prism calibration will be verified prior to use. All borderline trees will be measured and assessed against prism plot radius factor, which will be standardized as distance to the center of the tree: diameter at breast height. To ensure accurate measurements, the height of diameter at breast height (1.3 m) will be periodically re-assessed by personnel during the course of the inventory. Field crews will have fine scale forest strata maps for use in the field to precisely interpret strata/forest boundaries and identify potential areas of plot overlap.

5. Following measurement, a consistency check of an opportunistic sample of 5 points will be re-measured to determine measurement error. Re-measurement for this purpose will be done by a different field crew. Measurement error will be assessed as 1/2 of the mean (absolute) percent difference between re-measured plot level biomass estimates (a valid assumption where teams are equally experienced and there are no systematic errors in measurement, which will also be appraised from the re-measurement results). Target measurement error is < 5%. During the course of implementation, field crews will be periodically apprised of measurement errors to assess progress.
6. Field measurement data will be recorded on standard field data sheets included in “PROTOCOLOS DE CAMPO PARA LA MEDICIÓN Y MONITOREO DE LA BIOMASA FORESTAL EN LA RESERVA COSTERA VALDIVIANA.” Data will be entered from field sheets to an electronic database. Checks will be run for unusual (high or low) values to identify and correct any errors in recorded field data or transcription. Personnel involved in data analysis will consult with personnel involved in measurement to clarify any ambiguities in recorded field data.
7. Data archiving: On each return from the field, field data sheets will be photocopied and originals archived with the TNC office in Chaihuin, with duplicate copies stored at the TNC office in Valdivia. The electronic database of all field measurements will be housed in the dedicated long-term electronic archive maintained on the TNC server at its office in Valdivia. The electronic database will also archive GIS coverages detailing forest and strata boundaries and plot locations.

Emissions due to biomass burning

Incidence of burned areas in the project area will be monitored consulting the CONAF fire database. Where points of fire incidence are discovered, the area subject to fire will be delineated and quantified using the same remote sensing analysis detailed above, using visual interpretation by an image analyst with knowledge of the land cover and/or with the assistance of high resolution imagery. Burned areas will be maintained as a separate category to calculate parameter $A_{burn,i,t}$ and for estimation of biomass burning emissions using the module E-BB – calculated emissions from biomass burning will be incorporated in project accounting only where they are not determined to be insignificant applying T-SIG.

Emissions due to illegal degradation

Because it is extremely sensitive to ask of community members explicit questions regarding timber harvest activities, precluding direct interviews with communities potentially carrying out these activities, potential for illegal degradation will instead be monitored via periodic patrols throughout the VCR area, including the project area, by six TNC park rangers and through periodic consultation the District Attorney's office (Fiscalia Regional) of the Ríos Region; the District Attorney's office is where all reports of illegal logging by any enforcement body are collected. Consultations will be conducted at least every 2 years, starting in 2012. VCR staff patrol observations and consultations with local authorities will provide general indications on incidents and areas where illegal wood harvest has occurred or may be occurring in or near the project area.

Rangers typically work ten-day shifts, with five days off for rest, with the exception of the coordinator and manager of community development work Monday through Friday. The VCR administrator meets annually with the ranger team to develop annual work plan based on the VCR management plan. The coordinator,

according to the annual work plan provides that each ranger activities must meet during their shift and ensures that these are met. Rangers' responsibilities include control and monitoring, forest fire prevention, environmental education, monitoring threats, wildlife monitoring, and community development. The primary operations center for the park rangers is in Chaihuin, but a new base will be established in the upcoming summer, in Hueicolla, allowing the rangers to more easily and frequently monitor activities in the southern portion of the Reserve. Patrols prioritize key access points/areas of activity, particularly in the areas of Colun, Chaihuin and the route from Hueicolla to La Union (Rts 470 and 80), the latter area in coordination with CONAF personnel posted at a permanent guard station at the national park near the reserve entrance. Notwithstanding the priority areas identified above, guard patrols are deployed according to continuous re-assessments of threats, which may change in nature and location seasonally. Monthly meetings of park guards are held to assess current threats and using a planning grid of the reserve, select priority 100 ha grid areas for patrols on the basis of accessibility and threats. Monthly, 4 grids, covering an area of 400 ha, are investigated. Guards carry out patrols on foot, on motorcycles and in pickup trucks. Twenty camera traps are also deployed in priority areas to aid in monitoring threats. When incidents are encountered, guards will record details regarding the incident on standardized forms, including the location using GPS. In the case of illegal logging encountered, guards will specify the species and volume (cubic meters) extracted, and whether there was any contact with the persons involved. While in the field, guards maintain radio contact with the reserve administration office in Chaihuin, to which incidents are also relayed immediately by radio.

In the event that any potential of illegal logging in the project area is detected, the area indicated will be delineated ($A_{DegW,i}$) and temporary sample plots will be allocated and measured in the area. Rectangular plots 10 meters by 1 kilometer (1 ha area) will be randomly or systematically allocated in the area, sufficient to produce a 1% sample of the area, and any recently-cut stumps or other indications of illegal harvest will be noted and recorded. Diameter at breast height, or diameter at height of cut, whichever is lower, of cut stumps will be measured. Where potential emissions as determined through this assessment are determined to be insignificant using tool T-SIG, no further monitoring will be conducted and emissions from illegal logging will be assumed to be zero.

In the event that the sample plot assessment indicated that illegal logging is occurring in the area and is potentially significant, supplemental plots will be allocated systematically to achieve a 3% sample of the area. Biomass will be estimated from measured diameters (conservatively assuming that diameters of stumps cut below breast height are equivalent to diameter at breast height) applying allometric equations of Gayoso et al 2002 and otherwise maintain consistency with analytical procedures applied in the original 2011 inventory. Emissions due to illegal logging ($\dot{A}C_{P,DegW,i,t}$) are estimated by multiplying area ($A_{DegW,i}$) by average biomass carbon of trees cut and removed per unit area ($C_{DegW,i,t} / AP_i$).

The more intensive 3% sample will be carried out once every 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area to produce an estimate of emissions resulting from illegal logging ($\dot{A}C_{P,DegW,i}$). Estimates of emissions will be annualized (to produce estimates in t CO₂-e per year) by dividing the emission for the monitoring interval by the number of years in the interval.

4.3.3 Monitoring of leakage carbon stock changes and greenhouse gas emissions

Two sources of leakage will be monitored: activity shifting leakage and market leakage.

Activity-shifting leakage

Activity shifting leakage due to displaced road construction

Activity shifting leakage due to road construction by the MOP will be monitored in a defined leakage zone, thus capturing any alternative routes to the Carretera Costera. The effective baseline rate for this corridor is set to

zero, and hence any deforestation resulting from road construction meeting the criteria defined below will be treated as leakage.

The parameter *NewR*, new calculated planned forest clearance by the baseline agent where no leakage is occurring, is set to zero. The Carretera Costera was intended to be a major highway for scenic and commercial purposes, generally running from north to south through the Reserve, though with some east-west variation in direction, to account for topography and connection of existing points of habitation and local roads. As such, the defined leakage zone is intended to capture deforestation resulting within an area where an alternative highway could be constructed after the project start date. Parameter *NewR*, and parameter A_{defLK} , monitored area of planned deforestation by the baseline agent, are further specified to refer to deforestation from any highways in Region XIV within the leakage zone, which is defined as the area bounded by 1) the coast on the west, 2) the existing north-south highway Rt. 5 on the east, 3) the coastline from the town of Corral to Rt 207 on the north, and 4) the Rio Bueno on the south (representing the southernmost border of the Reserve), by the MOP after the project start date. (Figure 4.2).

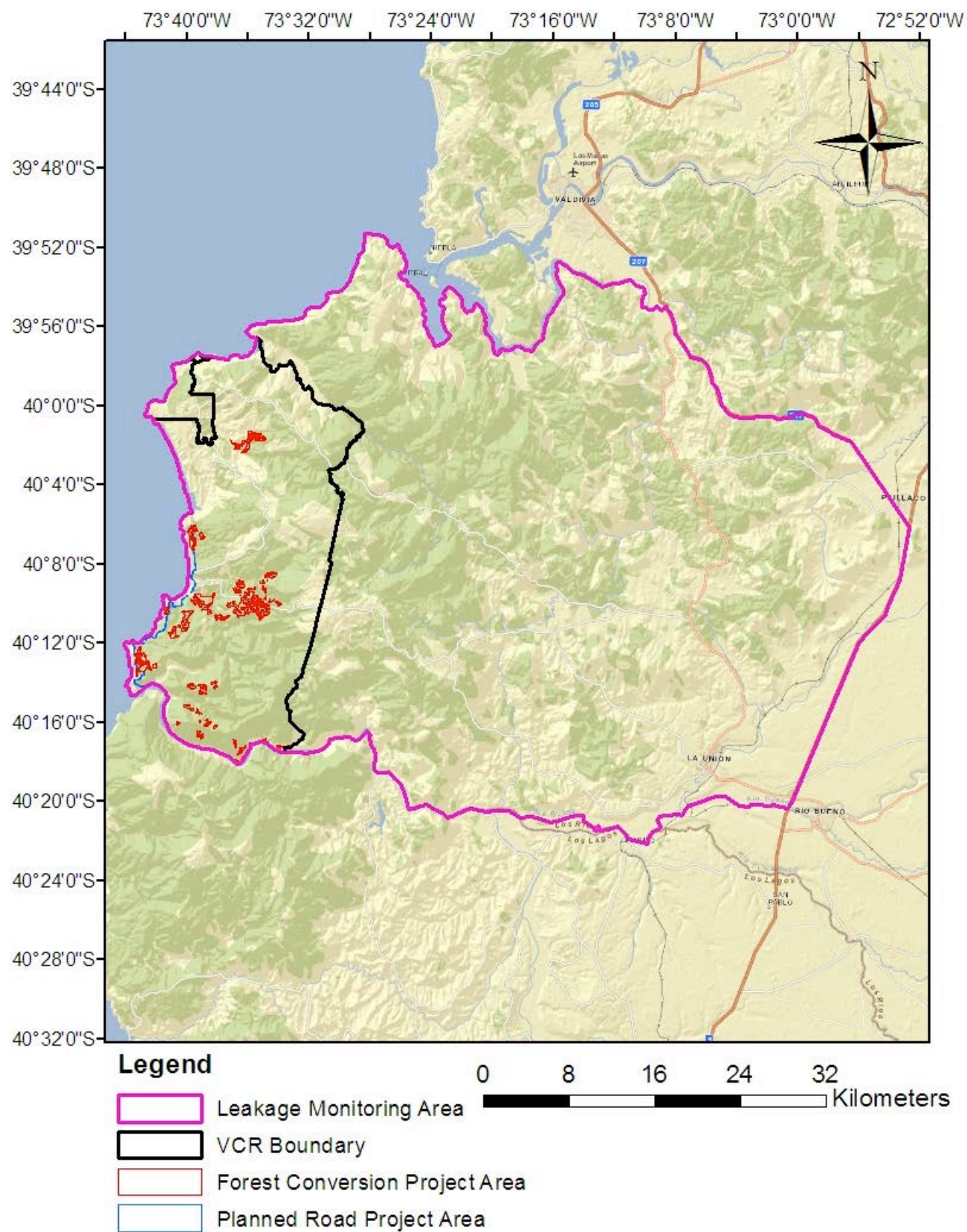


Figure 4.2. Leakage zone in which deforestation resulting from new road construction/improvement by the MOP is monitored.

New road construction meeting the criteria detailed above will be identified by consulting MOP construction records and/or current road maps.

Area of deforestation along the road construction identified above will be determined with remotely-sensed imagery. When using remotely-sensed imagery, imagery that is freely available and accessible using Google Earth will be used preferentially when it is available. When it is unavailable, other remotely sensed imagery will be acquired for analysis.

Any activity shifting leakage identified for the monitoring interval will be annualized (to produce estimates of ha for each year) by dividing the area by the number of years in the period.

Activity shifting due to displaced road construction will be tracked and calculated using the table below. For monitoring, because $NewR$, is set to zero, thus $LKA_{planned}$, area of activity shifting leakage, is equal to A_{defLK} .

Year	$NewR_{i,t}$ (ha) *	$A_{defLK,i,t}$ (ha) *	$LKA_{planned,i,t}$ (ha) *
2004	0		
2005	0		
2006	0		
2007	0		
2008	0		
2009	0		
2010	0		
2011	0		
2012	0		
2013	0		

* area of deforestation from any highways constructed or improved by the MOP after the project start date within the leakage zone, which is defined as the area bounded by 1) the coast on the west, 2) the existing north-south highway Rt. 5 on the east, 3) the coastline from the town of Corral to Rt 207 on the north, and 4) the Rio Bueno on the south (representing the southernmost border of the Reserve).

Activity shifting leakage due to displaced forest conversion activities

Activity shifting leakage due to displacement of *E globulus* plantation establishment activities will be assessed per the table below (derived in Section 3) from project start date through 2007. No activity shifting leakage occurs after project year 2007 (Nov 2006 to Nov 2007), due to the new Native Forest Law going into effect at the end of 2007; Native Forest Law (Law 20.283/2008).

	$\Delta C_{BSL, planned}$ tCO ₂ e	PF	LK_{CP-ME}	$\Delta C_{LK-AS,planned}$ (t CO ₂)
2004	130,858.7	0.3	0.2	8,898.4
2005	146,376.1	0.3	0.2	9,953.6
2006	43,585.5	0.3	0.2	2,963.8

2007	54,742.0	0.3	0.2	3,722.5
2008	0.0	0.0	0.0	-
2009	0.0	0.0	0.0	-
2010	0.0	0.0	0.0	-
2011	0.0	0.0	0.0	-
2012	0.0	0.0	0.0	-
2013	0.0	0.0	0.0	-

Market leakage

Market leakage from displaced timber production within the road clearance area will be assessed per the table below (derived in Section 3).

Year	$V_{BSL,EX,t}$	$C_{BSL,XBT,i,t}$	$LK_{MarketEffects,timber,t}$
	m^3	$t\ CO_2$	$t\ CO_2$
2004	0.0	0	0.0
2005	0.0	0.0	0.0
2006	0.0	0.0	0.0
2007	62.9	97.4	38.9
2008	24.4	37.9	15.1
2009	0.1	0.2	0.1
2010	254.2	393.6	157.4
2011	19.8	30.7	12.3
2012	107.7	166.8	66.7
2013	0.0	0.0	0.0
		$AL_T = 726.5$	$LK_{MarketEffects,timber} = 290.6$

No market leakage occurs as a result of the stop conversion to plantations activity until 2019, the year of the first commercial wood harvest potentially displaced by the project. Market leakage for this component will be estimated (for subsequent accounting in monitoring dates from 2019 to 2023) at baseline renewal in 2013.

Total leakage for the project as a whole, including both activities (stopping conversion of native forest to Eucalyptus plantations and stopping highway construction) will be summed using the Table below.

Year	$\Delta C_{LK-AS,planned,road}$	$\Delta C_{LK-AS,planned,Euc}$	$\Delta C_{LK-ME,road}$	$\Delta C_{LK-ME,Euc}$	ΔC_{LK}
2004		8,898.39	0.0	0.0	

2005		9,953.58	0.0	0.0	
2006		2,963.82	0.0	0.0	
2007		3,722.46	38.9	0.0	
2008		-	15.1	0.0	
2009		-	0.1	0.0	
2010		-	157.4	0.0	
2011		-	12.3	0.0	
2012		-	66.7	0.0	
2013		-	0.0	0.0	

4.4.4 Estimation of ex-post net carbon stock changes and greenhouse gas emissions.

Estimates of GHG credits eligible for issuance as VCU's for the project as a whole, including both activities (stopping conversion of native forest to Eucalyptus plantations and stopping highway construction), will be calculated entering data into the table format below, where

Estimated GHG emission reduction credits =

Baseline emissions, fixed for 10 years at validation *minus*

Project emissions *minus*

Leakage *minus*

Non-permanence Risk Buffer withholding (calculated as a percent of net change in carbon stocks prior to deduction of leakage)

Years	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Risk buffer (%)	Deductions for AFOLU pooled buffer account (tCO2e)	GHG credits eligible for issuance as VCUs (tCO2e)
2004	130,859			10%		
2005	146,376			10%		
2006	57,512			10%		
2007	55,664			10%		
2008	43,015			10%		
2009	30,863			10%		
2010	39,670			10%		
2011	41,640			10%		
2012	30,309			10%		
2013	31,463			10%		

4.4.5 Organization and Responsibilities

Responsibility for carrying out future monitoring resides within TNC's Chile chapter, lead by the S. Andes Director, though implementation of monitoring activities will be delegated to staff within the Reserve. TNC

Chile staff have expertise in the areas of biological monitoring, forest engineering and Geographic Information Systems, but will contract with external experts as required, in the area of forest biometrics, remote sensing, and the like. Biomass inventory may be contracted to external experts and field crews, should this be required. See Table 1.2 for more detail.

5 ENVIRONMENTAL IMPACT

The project activities have had and will continue to have a significant positive impact on preservation of the biodiversity and provision of ecosystem services within the project area, relative to the baseline case. Destruction of native forest in the baseline scenario would have negatively affected not only the native tree and plant species, but also a host of animal communities that dwell within or migrate through the Valdivian forests, some of which are globally rare. Furthermore, the project activities have had a positive impact on freshwater ecosystems, relative to the baseline, in that eucalyptus plantation establishment results in an unnaturally pronounced draw on natural freshwater systems relative to native forest. And following harvest of eucalyptus, negative impacts on aboveground freshwater systems result through siltation from erosion, a concern that has been eliminated through TNC's implementation of the project activities. The environmental impacts of the project, relative to the baseline are explored more fully in the section that follows.

The VCR is located in the Cordillera Pelada, a very important landscape in terms of conservation at multiple scales. According to Ramirez and San Martin (2005)⁵⁶, the Cordillera Pelada contains one of the last continuous fragments of native coastal forest in good condition. According to World Resource Institute (Neira et al., 2002)⁵⁷, it is considered a "frontier forest", whose relatively large size enhances the viability of existing populations of species. The Cordillera Pelada, where the Valdivian Coastal Reserve is located, is recognized as a high priority conservation area by numerous organizations and publications, including Red Book CONAF Priority Sites (Muñoz et al., 1996)⁵⁸, the Vision of the Biodiversity of WWF (WWF et al., 2000)⁵⁹, Regional Biodiversity Strategy of the National Environment Commission (CONAMA) (CONAMA, 2002)⁶⁰, Silviculture Institute of the Universidad Austral de Chile (Lara et al., 2002)⁶¹ and Conservation International, through their identification of the area as a "Hot Spot" called the "Chilean Winter Rainfall - Valdivian Forest" (<http://www.biodiversityhotspots.org>) (Farias et al., 2004)⁶².

The VCR itself is characterized by a series of unique formations created by the steep slopes of the coastal mountain range, which reach down to the Pacific Ocean and the rivers that flow into it. Within the Reserve, there are terrestrial, freshwater and coastal marine ecosystems of great biological importance with native flora and fauna of national and global significance (Veit 1994⁶³, Armesto et al 1997⁶⁴, Veit and Garleff 1995⁶⁵, Villagran et al. 1997⁶⁶, Farias and Tecklin 2003⁶⁷).

⁵⁶ Ramirez, C., San Martin, C. 2005. Asociaciones vegetales de la Cordillera de la Costa de la Región de los Lagos. En Smith-Ramirez, C., Armesto, J., Valdovinos, C. (eds) 2005. Historia, biodiversidad y ecología de los bosques costeros de Chile. Editorial Universitaria, Chile.

⁵⁷ Neira, E., Verscheure, H., Revenga, C. 2002. Chile's frontier forests: conserving a global treasure. CAB International, London. Pp.55.

⁵⁸ Muñoz, M. Núñez, H., Yáñez, J. 1996. Libro Rojo de los sitios prioritarios para la conservación de la Biodiversidad biológica en Chile. Corporación Nacional Forestal.

⁵⁹ WWF et al. 2000. A conservation assessment and biodiversity vision for the Valdivian ecoregion. Available online at: http://chile.panda.org/sala_redaccion/publicaciones/?144962/Resumen-vision-para-la-biodiversidad-de-la-Ecorregion-de-los-Bosques-Templados-Lluviosos-de-Chile-y-Argentina

⁶⁰ CONAMA. 2002. Propuesta regional para la conservación y utilización sostenible de la biodiversidad, décima Región de los Lagos.

⁶¹ Lara, A., Neira, E., Echeverría, C., 2002. Levantamiento de una base de datos para la implementación piloto de sistema de información para el manejo sustentable de los recursos naturales renovables y la conservación de la biodiversidad en la X región de los lagos.

⁶² Farias A., Tecklin, D., Plischoff, P. 2004. Análisis del avance hasta la fecha en la definición de las áreas prioritarias para la conservación de la biodiversidad en la Región de los Lagos. Documento N° 8 Serie de Publicaciones WWF Chile Programa Ecoregión Valdiviana

⁶³ Veit, H. 1994. Estratigrafía de capas sedimentarias y suelos correspondientes en el centro – sur de Chile. Revista Chilena de Historia Natural 67: 395 – 403.

⁶⁴ Armesto, J., Villagrán, C., Arroyo, M.K. (eds.). 1997. Ecología de los bosques nativos. Editorial Universitaria, Universidad de Chile, Santiago.

The Reserve hosts important riverine systems, portions of which were degraded under prior ownership by poor plantation management practices and due to the construction of the bridge crossing the Chaihuín River by the Chilean Army as part of the Coastal Highway construction. The Chaihuín River is still recovering from the high sediment loading of the estuarine zone from the construction of the bridge, which had a negative impact on Shoe Mussels (*Choromytilus chorus*), which are harvested by locals as an important part of their economy. Sedimentation affected these mussel populations as well as other species that the community relies upon.

Similarly, the community of Huiro relies on the water quality of the Colún River where community members harvest shellfish. Prior to the project start date, this area had been impaired at times by high sediment loading from clearcutting and burning of native forest during the establishment of eucalyptus plantations. Both Chaihuín and the Cadillal communities rely on the Chaihuín watershed for drinking water, and Huiro is also supplied with water from small coastal watersheds within the Reserve. Following the project start date, Chaihuín entered into an agreement with the Reserve to develop a Rural Potable Water system (APR), to be facilitated by TNC's donation of 0.5 ha and water rights to the community.

The Reserve constitutes one of the last relatively intact forest fragments along the Valdivian Coastal Mountain Range; 60% of the Reserve is primary forest (Farías and Tecklin 2003), giving it high ecological value. The VCR is home to 77 species of mammals, birds, reptiles, amphibians and fish. This group includes endemic and endangered species, such as the huillín or river otter (*Lontra provocax*), the pudú (*Pudu puda*), the mountain monkey (*Dromiciops gliroides*) the Magellanic woodpecker (*Campephilus magellanicus*), the guiña cat (*Leopardus = Oncifelis guigna*), Darwin's frog (*Rhinoderma darwini*) and the Valdivian toad (*Alsodes valdiviensis*) (Muñoz et al., 2005b)⁶⁸. Restricted endemic species such as the freshwater crustacean *Aegla hueicollensis* have been identified in the Huieicolla river watershed (Jara 2005)⁶⁹. The great diversity and endemism of this area are explained by its status as a glacial relic (Armesto et al., 1996)⁷⁰.

The Reserve also contains unique globally significant ecosystems and vegetation, such as Olivillo coastal forest (*Aextoxicon punctatum*) and Alerce forest (*Fitzroya cupressoides*)—the latter being the second oldest living tree species, with lifespans that can exceed 3,600 years. Also within the Reserve are extensive *Nothofagus* forest areas that conserve a high diversity of endemic flora and fauna.

Noteworthy is also the coastal shrub land or *matorral* consisting of *patagua marina* (*Griselinia jodinifolia*) and Quila (*Chusquea quila*) which forms a vegetation band of varying width between altitudes of 3 to 10 meters a.s.l. and can reach heights of up to 4 meters (Ramirez and San Martin 2005). In addition, coastal forests include Coigüe and Chilean myrtle trees.

Specific native forest communities and species that would have been negatively impacted in the baseline scenario, are described below.

⁶⁵ Veit, H., Garleff, K. 1995. Evolución del paisaje cuaternario y los suelos en Chile central-sur: 29-49. En Armesto, J., Villagrán, C., Arroyo, M.K. (eds.). 1997. Ecología de los bosques nativos. Editorial universitaria, Universidad de Chile, Santiago.

⁶⁶ Villagrán, C., Moreno, P., Villa, R. 1997. Antecedentes palinológicos acerca de la historia cuaternaria de los bosques chilenos. 51 - 65. En Armesto, J., Villagrán, C., Arroyo, M.K. (eds.). 1997. Ecología de los bosques nativos. Editorial Universitaria, Universidad de Chile, Santiago.

⁶⁷ Farías A., Tecklin, D. 2003. Caracterización preliminar de los predios Chaihuín y Venecia, Cordillera de la Costa, Décima Región. Documento nº6, Serie de publicaciones WWF Chile. Programa Ecoregión Valdiviana.

⁶⁸ Muñoz-Pedrerros, A., Gil, C., Rutherford, P., Heuestein, E., Barriento, M., Sanchez, P., Sanhueza, R., Guíñez, B., Contreras, P., Navarrete, M., 2005b. Caracterización y zonificación de la Cordillera Pelada. Informe Final. Centro de Estudios Agrarias y Ambientales CEA, Valdivia, Chile. 362 p.

⁶⁹ Jara, C. 2005. Crustáceos del Género *Aegla* (Decapoda: Anomura) en la Cordillera de la Costa: su importancia para la conservación de la biodiversidad de aguas Continentales en Chile. En Smith-Ramirez, C., Armesto, J., Valdovinos, C. 2005. Historia, biodiversidad y ecología de los bosques costeros de Chile. Editorial Universitaria, Chile.

⁷⁰ Armesto, J., Villagrán, C., Aravena, J., Perez, C., Parker, G., 1996 Bosques templados de la cordillera de la costa. En: Armesto, J., Villagrán, C., Kalin, M., eds., 1996. Ecología de los bosques nativos de Chile. Santiago, Chile: Editorial Universitaria.

Amphibian Communities:

The Valdivian forests of the Cordillera Pelada host an important wealth of native amphibians, many of them facing conservation challenges associated with different environments and forest types. The native amphibian community in the Cordillera Pelada consists of seven representative genera: *Rhinoderma*, *Pleurodema*, *Eupsophus*, *Batrachyla*, *Alsodes*, *Caudiverbera* and *Hylorina*, of which the last two are monotypic (Delgado 2005⁷¹, Mendez et al. 2005⁷²). Most of them live amongst forest floor debris and rotting logs (Mendez et al. 2005). However, *Alsodes monticola* and *Caudiverbera caudiverbera* are associated with water bodies. *Rhinoderma darwini* and *Batrachyla antartandica* habitats are associated more closely with mosses and lentic waters (Mendez et al. 2005).

In recent studies in the Cordillera Pelada, including part of the Valdivian Coastal Reserve, 13 species of native amphibians have been found (Delgado 2005⁷³, Muñoz et al. 2005⁷⁴, Mendez et al. 2005), these being; *Eupsophus calcaratus*, *Eupsophus vertebralis*, *Eupsophus roseus*, *Eupsophus migueli*, *Rhinoderma darwini*, *Hylorina sylvatica*, *Alsodes valdiviensis*, *Alsodes monticola*, *Pleurodema thaul*, *Batrachyla taeniata*, *Batrachyla leptopus*, *Batrachyla antartandica* and *Caudiverbera caudiverbera*.

From these studies it is possible to establish that the Olivillo forest community is made up of six species: *Batrachyla taeniata*, *Eupsophus calcaratus*, *Eupsophus vertebralis*, *Rhinoderma darwini*, *Hylorina sylvatica* and *Batrachyla leptopus* (Muñoz et al. 2005, Méndez 2005, C. Cuevas 2005 pers. comm.). The Chilean toad (*Caudiverbera caudiverbera*) is associated with bodies of water with reeds, which in the VCR are near the southern boundary by the Carimahuida River and possibly in some areas of the Chaihuín River.

Although all species in this community have a very high biological value, some of them are of special conservation value, such as those acting as indicators of environmental impacts or those that are highly endemic. Darwin's Frog (*R. darwini*), an amphibian which is very sensitive to environmental change and which exhibits a form of parental care unique amongst frogs, protects its eggs in the male's mouth. Furthermore, this frog is endemic to temperate forests and has been considered an endangered species by the IUCN (Glade 1993⁷⁵, Nuñez et al 1997⁷⁶, Crump 2002⁷⁷, Ortiz and Ibarra 2005⁷⁸, Crump and Veloso 2005⁷⁹). Equally special is the *Alsodes valdiviensis*, a restricted endemic amphibian, only found in the Cordillera Pelada at higher elevations of the VCR (Formas et al. 2002⁸⁰).

⁷¹ Delgado, C., 2005. Plan de Conservación, Reserva Costera Valdiviana. The Nature Conservancy.

⁷² Mendez, M., Soto, E., Torres-Perez, F., Veloso, A. 2005. Anfios y reptiles delos bosques de la cordillera de la costa (X Región de Chile), En Smith-Ramirez, C., Armesto, J., Valdovinos, C. 2005. Historia, biodiversidad y ecología de los bosques costeros de Chile. Editorial Universitaria, Chile.441-451.

⁷³ Delgado, C., 2005. Plan de Conservación, Reserva Costera Valdiviana. The Nature Conservancy.

⁷⁴ Muñoz-Pedrerros, A., Gil, C., Heuestein, E., Sanchez, P., Guíñez, B., Contreras, P., Sepulveda, M., Navarrete, M., Delgado, C., Farias, A., Steffen, W., Jara, C., Jaramillo, J., Woelfl, S., Arriagada, R., Godoy, M., Mera, R. 2005a. Evaluación de la biodiversidad: En las alternativas de construcción de la carretera de la costa en el tramo Chaihuín – Hueicolla. Informe Final CEA. WWF, Valdivia, Chile. 218 p.

⁷⁵ Glade, A. 1993. Libro rojo de los vertebrados de Chile. Corporación Nacional Forestal, Santiago.

⁷⁶ Nuñez, H, Maldonado, V., Perez, R. 1997. Reunión de trabajo con especialistas en herpetología para categorización de especies según estado de Conservación. Noticiario mensual Museo de Historia Natural, Chile 329:12-19.

⁷⁷ Crump, M.L. 2002. Natural History of darwin's frog, *Rhinoderma darwini*. Herpetological Natural History 9(1), 21-30.

⁷⁸ Ortiz, J., Ibarra, H. 2005. Anfios y reptiles de la cordillera de Nahuelbuta. En Smith-Ramirez, C., Armesto, J., Valdovinos, C. (eds) 2005. Historia, Biología y ecología de los bosques costeros de Chile. 427-451.

⁷⁹ Crump, M.L., Veloso, A., 2005. El aporte de observaciones de terreno y del análisis genético para la conservación de *Rhinoderma darwini*. En; Smith, C., Armesto, J., Valdovinos, C., (eds) Historia, Biología y ecología de los bosques costeros de Chile. 452 – 455.

⁸⁰ Formas, R., Cuevas, C., Brieva, L. 2002. A new species of alsodes from cerro mirador, from cordillera pelada, southern Chile. Proceedings of the biological society of Washington 115(4): 708-719.

Mammal Communities:

Pudu (*Pudu puda*)

The Pudu (*Pudu puda*) is the smallest of the South American deer species and is endemic to the temperate forests of Chile and Argentina. Its distribution in Chile ranges from the Maule region (35 ° 10 'S) to the Straits of Magellan (Redford and Eisenberg 1992⁸¹, Quintana et al. 2000⁸²).

This species inhabits densely forested areas and is associated with the dark, humid understory, at altitudes from sea level to 1000 or 1700 meters above sea level (Redford & Eisenberg 1992, Delgado 2005⁸³, Eldridge et al. 1987⁸⁴, Quintana et al. 2000). It is mainly solitary and when it does form groups, these consist of a maximum of three individuals (Quintana et al. 2000). Different studies have described Pudu habitat as native forest with low levels of disturbance and dense undergrowth (Rau 2005 pers. comm.). Pudus have also been reported in areas of greater disturbance, exhibiting different habits, i.e. visiting grazing lands and plantations of mature exotic species that have dense undergrowth, even areas dominated by blackberry (Jiménez 1994⁸⁵, 1995, Bello 2003⁸⁶, Rau 2005 pers. comm.). However, the presence of native forests with dense native understory definitely constitutes a better habitat. The conservation status of Pudu is listed as Vulnerable in the Red Book of Chilean Vertebrates (Glade 1993) and according to the Deer Specialist Group of the IUCN (2002). It is also to be found in Appendix I of CITES. The main threat to this species is the degradation of the native forest that makes up their main habitat.

In the VCR, the Pudu is found at altitudes between 0 and 800 meters above sea level. It is associated with mature forests, saplings and dense thickets, restricted to areas with slopes of less than 40 degrees (Delgado 2005 Cit. Bello 2005 pers. comm.⁸⁷). Within the Reserve, both pudu and Lutra are studied and periodically monitored, which will help with their conservation.

Guiña (*Leopardus = Oncifelis guigna*)

Among other small mammals, birds and insects, the Guiña cat to a certain degree preys upon the Pudu and has been found throughout lesser disturbed areas of the Reserve. Radio telemetry has been used to map home ranges of this species within the Reserve and indicates that there are likely to be at least 30 individuals within this habitat (Sepulveda, 2012 pers. comm.).

Bird Communities:

The Reserve hosts a large avian community including several species recognized by the IUCN as vulnerable: Magellanic Woodpecker (*Campephilus magellanicus*) and Torcaza (*Columba araucana*). Other avian species found within the native forests of the Reserve include Black Necked Swan (*Cygnus melancoryphus*), which is locally threatened, the Chilean Gavián (*Accipiter chilensis*) listed in Appendix II of CITES, and the near-threatened Rufous-tailed Hawk (*Buteo ventralis*).

Coastal Olivillo Forest:

The coastal forest is dominated by evergreen Olivillo (*Aextoxicon punctatum*) that are commonly found in lower segments of the Coastal Mountain Range, between sea level and 300-500 meters above sea level (Perez and

⁸¹ Redford, K.H., Eisenberg, J.F.. 1992. Mammals of the neotropics. The southern cone: Argentina, Uruguay, Paraguay, Chile. Universidad de Chicago Press, Chicago, Illinois.

⁸² Quintana V., Yáñez, J., Valdebenito, M. 2000. Orden Carnívora. Pp 155-187, En Muñoz-Pedrerros, A., Yáñez, J. (Eds.), Mamíferos de Chile. Ediciones CEA, Valdivia Chile. 464pp.

⁸³ Delgado, C., 2005. Plan de Conservación, Reserva Costera Valdiviana. The Nature Conservancy.

⁸⁴ Eldridge W.D., Macnamara, M.M., Pacheco, N.V. 1987. Activity patterns and habitat utilization of pudus (*Pudu puda*) in south-central Chile. Pp. 352-370, in Wemmer CM (Ed) Biology and management of the Cervidae. Smithsonian Institution Press, Washington, DC.

⁸⁵ Jiménez, J. 1994. Respuesta de pudús (*Pudu puda*) a perturbaciones humanas en bosques lluviosos templados neotropicales. Proyecto de tesis doctoral. Departamento de pesquerías y vida silvestre, Universidad Estatal de UTA. 18 p.

⁸⁶ Bello, M. 2003. Ecología del Pudú (*Pudu puda*, Molina 1782) y su valor como especie focal, en la Provincia de Valdivia, Ecorregión Valdiviana. Tesis, Escuela de Medicina Veterinaria, Universidad Católica de Temuco, Temuco, Chile. 102 p.

⁸⁷ Delgado, C., 2005. Plan de Conservación, Reserva Costera Valdiviana. The Nature Conservancy. pp173.

Villagran 1994⁸⁸, Aravena 1991⁸⁹, Armesto et al. 1997, Trecaman 2002⁹⁰, Muñoz et al. 2005). Within these evergreen multi-stratified forests, a wealth of species are found (Ramírez and San Martín 2005).

The coastal Olivillo are distributed along the Chilean coast from 30 to 43 ° S. Olivillo is an endemic species of the temperate forests of Chile and Argentina and houses the greatest species richness in the Valdivian Forest of vascular and nonvascular species (Ramírez et al. 1976⁹¹, Smith et al. 2005⁹²). Other species present in the canopy of the Olivillo forests are Tepa (*Laureliopsis philipiana*) and Luma (*Amomyrtus luma*), as well as Valdivian Patagua (*Myrceugenia planipes*), Chilean Myrtle or Arrayán (*Luma apiculata*) and Meli (*Amomyrtus meli*). One of the most noticeable features of this forest type is the richness and abundance of epiphytes and vine species, including more than 15 species of ferns of the genus *Hymenophyllum*, a species of bromeliad (*Fascicularia bicolor*), three species of Quilineja (*Luzuriaga sp*), two species of climbing vines (*Hydrangaea serratifolia*, *Elytropis chilensis*) and three species of epiphytes of the family Gesneriaceae (*Asteranthera ovata*, *Mitraria coccinea*, *Sarmienta repens*) (Aravena 1991, Armesto et al. 1997). Studies conducted in the VCR on flora, which included flora sampling stations in the Coastal Olivillo forests, recorded 90 plant species (Muñoz et al. 2005). These findings serve to reinforce the ecological importance of this forest, which have been protected by the carbon project.

Despite their uniqueness and ecological importance, Olivillo Coastal Forests are poorly represented in the forested areas of SNASPE, and are protected only in the National Park Fray Jorge and the Chiloé National Park. In the VCR, Olivillo Forest is located along a coastal strip that extends from 5 to about 300 meters above sea level.

Coastal evergreen forest:

Evergreen forest is located between 40 ° 30 'and 47 ° S, below 1000 meters above sea level in the Andes Mountain Range and from 38 ° 30 'to 47 ° S in the Coastal Mountain Range on the western slopes (Donoso 1981⁹³, Vergara and Reyes 2000⁹⁴). It covers an area of approximately 4,148,904.8 hectares, representing 30.9% of the total native forest area of the country (CONAF et al. 1999, 2000⁹⁵ and Vergara and Reyes 2000, Vergara et al. 2000). Of this area, 34.3% is protected in SNASPE. However, these conservation efforts focus primarily on the Andes Mountain Range. Coastal evergreen forest in the continental Coastal Mountain Range is only under official protection in the Alerce Costero National Park, covering 24,694.21 hectares. The VCR has an additional 32,953 hectares of Coastal evergreen forest (excluding Coastal Olivillo forest), which represents three times the area currently under official protection in the mountains of the mainland coast.

These forests grow in areas with high rainfall, with approximately 2000 - 5000 mm of precipitation per year. The temperature at which this forest develops varies from a minimum monthly average 8 - 9 ° C in the north of its distribution and 5 - 6 ° C in the south to a maximum monthly average of 15 ° at the northern and 11 ° at the southern limit of its distribution.

⁸⁸ Perez, C., Villagran, C. 1994. Influencia del clima en el cambio florístico, vegetacional, y edáfico en los bosques de olivillo costero (*Aetoxicon punctatum*) de la cordillera de la Costa de Chile: implicancias biogeográficas. Revista Chilena de Historia Natural 67:77-88.

⁸⁹ Aravena, J.C. 1991. Análisis de la estructura y la flora de los bosques de Chiloé continental e insular. Tesis, magíster, Facultad de ciencias, Universidad de Chile.

⁹⁰ Trecaman, H. 2002. Comparación de la producción de agua entre un bosque de la subasociación Olivillo (*Aetoxiconetum*) y una plantación de *Pinus radiata* en la zona de Valdivia.

⁹¹ Ramírez, C., Steubing, L., Alberdi, M. 1976. La familia Hymenophyllaceae (Pteridophyta) en el fundo San Martín, Valdivia, Chile. I. Taxonomía y ecología. Medio Ambiente 2: 21 – 28.

⁹² Smith-Ramírez, C., Armesto, J., Valdovinos, C. 2005. Historia, biodiversidad y ecología de los bosques costeros de Chile. Editorial Universitaria, Chile.

⁹³ Donoso, C. 1981. Tipos forestales de los bosques nativos de Chile. Corporación Nacional Forestal y Organización de las Naciones Unidas para la Agricultura y la Alimentación. Documento de Trabajo No 38.

⁹⁴ Vergara, C., Reyes, R. 2000. Análisis socioeconómico de la Ecoregión Valdiviana, subsector forestal.

⁹⁵ CONAF, CONAMA, Universidad Austral De Chile, Pontificia Universidad Católica De Chile, Universidad Católica De Temuco. 1999. Catastro y evaluación de los recursos vegetacionales nativos de Chile. Informe regional X Región. 137 p.

Typical species present in these forests are generally *Nothofagus* associations with other evergreen species, although some areas have pure Chiloé Coigüe forests and Magallanes Coigüe forests (Donoso, 1981). This forest type has a latitudinal, longitudinal and altitude variation common to all species types, among which are: Tapa (*Laurelia philippiana*), Luma (*Amomyrtus luma*), Canelo (*Drimys winteri*), Tineo (*Weinmannia trichosperma*) and Tiaca (*Cladocuvia paniculata*) in the intermediate and higher layers; Quila (*Chusquea quila*) Tepú (*Tepualia stipularis*), Picha (*Myrceugenia planipes*) and other Myrtaceae in the shrub layer. At ground level, herbaceous species dominate, such as *Nertera granadensis*, *Luzuriaga* spp. and Medallita, Botellita and Estrellita of the family Gesneriaceae, as well as mosses and ferns found near the bases of trees (Donoso 1981).

The Tapa-Tineo-Mañío Forest (*Laureliopso-Weinmanniaetum-trichosperma*) covers an area of 12,339 hectares of the Reserve and is situated between 500 and 800 meters above sea level, being strongly associated with high humidity zones due to continuous fog condensation. It is an evergreen forest type with trees reaching heights of up to 45 m. The upper stratum is dominated by Tapa (*Laureliopsis philippiana*), Tineo (*Weinmannia trichosperma*) and Female Mañío or Prince Albert's Yew (*Saxegothaea conspicuosa*). It is characterized by a high abundance of climbers, the most characteristic being Quila (*Chusquea quila*), Helm (*Griselinia ruscifolia*), Pehueldén (*Hydrangea serratifolia*) and Elder (*Pseudopanax laetevirens*). The soil is usually covered with mosses, hygrophilous herbs and hepatica. The trunks are covered with layers of epiphytes (*Fascicularia bicolor* and *Hymenophyllum* species) and mosses of the genus *Weymouthia* (Donoso et al. 1984⁹⁶, Ramirez and San Martin 2005).

The Chiloé Coigüe Forest (*Nothofagetum nitidae*) is located above altitudes of 800 meters. This forest is dominated by evergreen *Nothofagus nitida* and generally has a lower species diversity than Tapa-Tineo-Mañío forests (Ramirez and San Martin 2005). However, Canelo (*Drimys winteri*) and Mañío Macho (*Podocarpus nubigena*) are commonly found in these forests. The shrub layer is dominated by Taique (*Desfontainia spinosa*), Pitrilla (*Myrceugenia chrysocarpa*) and Murta (*Ugni candollei*). Among the climbers are Quila (*C. quila*) and Voqui liana (*Capsidium valdivianum*). The herbaceous layer is poor, although it is possible to find mosses, hepatica and some hygrophilous herbs, although less abundant than in Tapa-Tineo-Mañío Forests (Ramirez and San Martin 2005).

The Notro Canelo Forest is a stage of Tapa Tineo-Mañío forest regeneration, because after disturbance regrowth is characterized by very abundant Canelo and Notro (*Embothrium coccineum*) (Donoso et al. 1990⁹⁷). In the VCR, this forest is mainly present between 100 and 500 meters above sea level and covers an area of 13,069 hectares. Different studies have indicated the presence in these forests of various species, the most emblematic of these are Puma (*Puma concolor*), guíña or Kodkod (*Leopardus* = *Leopardus* = *Oncifelis guigna*), Grey fox and Andean fox (*P. griseus*, *P. culpaeus*), Pudu (*Pudu puda*), various species of rodents (*Irenomys tarsalis*, *Abrotrix longipillis*, *Geoxus valdivianus*, *Loxodontomys micropus*), Monito del monte (*Dromiciops gliroides*), the Chilean shrew opossum (*Rhyncholestes raphanurus*), Magellanic and Striped woodpeckers (*Campephilus magellanicus*, *Picoides lignarius*), the Rufous-legged Owl (*Strix rufipes*), toads and frogs (*Batrachyla leptopus*, *B. taeniata*, *Eupsophus roseus*, *E. vertebralis*, *E. calcaratus*, *E. migueli* and *Alsodes monticola*), and reptiles such as the Chilean Slender Snake (*Tachymenis chilensis*), the Painted Tree Lizard (*Liolaemus pictus*) and the Thin Tree Lizard (*L. tenuis*).

Evidence of erosion may be found in portions of the road network within the Reserve, and it is possible that this erosion may have a corresponding negative impact on water quality. However, these potentially negative impacts are mitigated by the following positive aspects of the current road network condition, relative to the baseline (the baseline being road conditions as they would have existed under continued ownership by an industrial timber company):

- Many of the roads within the Reserve are no longer used, and vegetation has taken over these roads, providing more stability to the surface, more water retention, and less erosion than would have occurred in the baseline where primitive forest roads would have been maintained to a degree sufficient for transportation by 4-wheel drive vehicles. Currently, 68% of the road network that existed as of the project start date is no longer being used, and vegetation is overtaking these areas; 347 km

⁹⁶ Donoso, C., Grez, R., Escobar, B., Real, P. 1984. Estructura y dinámica de bosque del tipo forestal siempreverde en un sector de Chiloé insular. Bosque 5(2): 82 – 104.

⁹⁷ Donoso, C., Sandoval, R., Grez, R. 1990. Silvicultura de *Fitzroya cupressoides* ¿ficción o realidad?. Bosque 11: 57 – 67.

of roads are now unused out of a total of 510 km of roads in the Reserve that were in place as of the project start date.

- Funds received through the future sale of carbon credits would make it possible to undertake the repair of some of conditions that are causing erosion in the roads that are still in use.
- A portion of the roads (13 km) within the Reserve were recently improved in conjunction with a native forest restoration pilot project, and these roads were designed to meet FSC standards, a significant improvement over the baseline scenario.

6 STAKEHOLDER COMMENTS

Prior to the acquisition of the Reserve, Margo Burnham (TNC), David Tecklin (WWF), and Francisco ("Pancho") Solis (with Coalition for Coastal Range Conservation at the project start date, and now employed with TNC) briefed key stakeholders in the communities about the potential acquisition, listened to their concerns, and shaped the project design to address various interests and perspectives.

Following the establishment of the VCR, meetings were held during the months of October and November 2004 with the following groups and individuals: the *Comunidad Indígena Antillanca*, the *Huiro Indigenous Community*, and all holders of life estates (including those in Chaihuín and Cadillal). The goals and purposes of the Reserve were explained in these meetings, and participants were invited to bring forward any concerns or interests they might have relating to the development of the Reserve.

Following those initial consultations with communities in 2003 and 2004, a number of concrete steps have been taken to address stakeholder concerns that were initially identified, or that have arisen in the years since TNC's acquisition. The table below indicates the projects that TNC has participated in or developed in conjunction with the communities.

Community	Organization	Relation to the VCR	Year
Huape	Junta de Vecinos (Neighbor's association)	Technical support for participation with WWF and TNC in the UNDP-SSP.	2006-2008
		Technical support for Developing a solid waste management project financed by CONAMA and in conjunction with the Neighbor's Associations of Chaihuín and Huiro.	2009
	Agrupación Campesina AGRUCAMP	Associated with the Neighbor's Association in the UNDP-SSP project.	2006-2008
	Centro de Padres y apoderados (Parent's Association)	Associated with the Neighbor's Association in the UNDP-SSP project.	2006-2008
		Environmental education workshops as school	2009-2010
		Firewood supplied for the school	2008-2010
	Agrupación Lafken Mapu	Connection to the Chilemprende program and support in developing a proposal for building the Pesca Sur restaurant	2007-2008
Chaihuín	Neighbor's Association	Technical support for Developing a solid waste management project financed by CONAMA and in conjunction with the Neighbor's Associations of Huape and Huiro.	2009
		Supplied prizes for fundraising campaign	2005-2010
		Provided concession of picnic area along tourist beach within the VCR free of charge	2006-2007
	Fishermen's Union	Technical support for participation with WWF and TNC in the UNDP-SSP.	2006-2008

		Connection to the Chilemprende program and support in developing a proposal for building sanitary service at campground	2007-2008
		Supplied wood for repairs to boathouse	2008-2009
		Financed legalization of the Chaihuín cove concession	2010- In progress
		Agreement with the Chaihuín Fishermen's Union, Conservacion Marina and VCR to begin a trial project of sustainable management of marine resources, Chaihuín Sector C.	2011-In progress
	Parent's Group	Environmental education workshops for school kids	2009-2010
		Supplied firewood for the school	2008-2010
		Supplied prizes for fundraising campaign	2005-2011
	Tourism Restaurant (Fondo Marino)	Requests catering services for important events at the VCR	2005-Current
	Agrup. De mujeres productoras de hortalizas	Supplied prizes for fundraising campaign	2005-2011
	We Llanca Milla Indigenous Community	Supplied prizes for fundraising campaign	2010-2011
		Supplied wood to build a booth to sell typical foods of the zone.	2009-2010
		Provided concession of picnic area along tourist beach within the VCR free of charge	2012
	Chaihuín Rural Water System Committee	Technical support for participation with WWF and TNC in the UNDP-SSP.	2009-2011
		Donated water rights and land to build rural water supply system for Chaihuín.	2009-In progress
	Agrup. Adulto Mayor	Supplied prizes for fundraising campaign	2006-2010
	Agrup. Productiva PRODESAL	Supplied wood to repair and build greenhouses for members	2008-2010
		Agreement to build local produce stand at the Reserve's picnic site.	2010
		Provided concession of picnic area along tourist beach within the VCR free of charge	2010-2011
	Comité de Defensa del Río Chaihuín	Supplied wood for construction.	
	Alerce Costero Artist's Group	Assisted in legally registering the group	2009
		Incorporated members in the FONDART project developed by the VCR to identify and publicize local artists around the Reserve.	2009-2010
		Provided concession of picnic area along tourist beach within the VCR free of charge	2008-2009

	Community Guides Association	Agreement to collaborate in the care and monitoring of the Reserve and the provision of office space and infrastructure for the guides (computers, radio etc.), training and exclusivity in guiding "Los Alerces" trail.	2009 to present
		Assisted in legally registering the group	2010
Huiro	Neighbor's Association	Technical support for Developing a solid waste management project financed by CONAMA and in conjunction with the Neighbor's Associations of Huape and Chaihuín.	2009
		Supplied gravel to improve roads	2005-2011
		Supplied prizes for fundraising campaign	2005-2010
	Fishermen's Union	Funded the legalization of Huiro Cove concession administrated in conjunction with the Indigenous Fishermen's Association of Huiro.	2010- In progress
	Indigenous Fishermen's Association	Technical support for participation with WWF and TNC in the UNDP-SSP.	2009-2011
		Collaborative agreement for the Colún sector	2009- In progress
		Funded the legalization of Huiro Cove concession administrated in conjunction with the Huiro Fishermen's Union.	2010- In progress
	Antillanca Indigenous Community	Responding to requests for the donation of two sites to the community: one for a cemetery and the other for a family wishing to relocate from within the Reserve, to a parcel near the Huiro community. Note that although TNC legally subdivided land to provide a parcel for the cemetery, the Huiro community recently determined that they no longer wish to have the cemetery parcel, so the land will remain with TNC.	2004-In progress
	Parent's Group	Environmental Education for School Kids	2006-2011
		Supplied firewood for school	2007-2011
		Supplied prizes for fundraising campaign	2006-2010
	Kutralhue Artist's Association	Technical support for participation with WWF and TNC in the UNDP-SSP.	2006-2008
		Connection to the Chilemprende program and technical support in the development of a proposal of a local restaurant project	2007-2008
Cadillal	Comité Adelanto Cadillal Bajo	Support in requesting legal titles of land for residents along the border of the new National Park	2009-2011
	Comité Adelanto Cadillal Alto	Radio communication agreement	2008 to present
		Support in requesting legal titles of land for residents along the border of the new National Park	2009-2011
	Comité de Turismo Rural	Support in publicizing organization and coordinating tourism	2008 to present

	CADITUR		
Other Organizations	Cooperativa Campesina Los Liles	Technical support for participation with WWF and TNC in the UNDP-SSP.	2006-2008
	Fishermen's Union of el Piojo Cove, Niebla	Funded the legalization of Lamehuaape Cove concession administrated in conjunction with the Cooperativa de Pescadores de Osorno.	2010- In progress
	Cooperativa de Pescadores de Osorno COOPEMAR	Funded the legalization of Lamehuaape Cove concession administrated in conjunction with the Fishermen's Union of el Piojo cove, Niebla.	2010- In progress

Furthermore, since acquiring the Reserve properties in 2003, TNC has successfully incorporated local communities, scientific researchers, companies, and local, regional and national government entities into the conservation project.

From direct employment as park guards to seeking Chilean government support for community development initiatives, TNC has sought to integrate local communities into the strategic development of activities at the Reserve. In addition, TNC has formed a strategic partnership with Universidad Austral to support scientific research at the Reserve with regard to specific species, water and watershed management, and forestry, among other areas.

Economic development is also a cornerstone of Project activities. For many years, the Reserve has been at the heart of a nascent eco-tourism industry in the area. And TNC is also partnering with local fishermen to promote sustainable fishing practices and a marine protected area off the coast. In each instance, these activities seek to reinforce the role of conservation in local and regional economic development.

In the same way, TNC is an active participant in government initiatives in the area. TNC helped to promote the creation of the Alerce Costero National Park and donated 9,453 hectares of land to expand it. TNC is also working in partnership with CONAF to create a regional fund for sustainable activities near protected areas.

All of these activities are reflected in the core values of the Project and were included in its Management Plan that was created in collaboration with local area stakeholders.

In order to involve local stakeholders and aid in the sustainable development of the area around the Reserve, early on the administration identified the need for a social program to connect with local communities and provide for the development of a positive relationship with its neighbors. In 2000, an initial program formed under the direction and support of WWF who had been articulating the social connection with conservation in the communities of the region since before the purchase of the Reserve. The program was based on the need to coordinate with communities for the success of conservation and to help direct rural development in sustainable ways that would reduce anthropic pressure on the environment and to improve the quality of life of the people living within it.

In late 2004, TNC hired a staff member specifically to guide this aspect of its program and to advocate for the communities' development with outside organizations including government institutions. This activity was not only intended to increase the quality of life of the local communities and to promote the conservation of biodiversity, but to gain new allies that will work together towards mutual benefit.

This position facilitated outreach activities and the assistance in the development of projects to create sustainable businesses around tourism and rural development. The position brought a face to the Reserve and a point person to receive questions, comments or complaints from the communities. The development of both the Conservation and Management Plans considered the experience, opinion and historical territorial use that the communities had in relation to the landscape and specifically the Reserve.

Even though less than a decade has passed since the Reserve was established, TNC's participation in local economic development has created ecotourism benefits and possibilities for green development. This role has also served as an important engine for development, linking the communities to outside resources. A clear

example of this is the Regional Government's recognition of the area as an important site to focus resources related to conservation and tourism.

Beginning in March 2012 meetings were organized with the community organizations from Huape, Chaihuín, Cadillal and Huiro to present an opportunity for them to evaluate their relationship with the Reserve and request their participation in the development of a social impact assessment of project. Initial meetings were held with community leaders; these were followed by requests to participate in regular meetings of the community organizations, in order to further develop the social impact assessment methodology.