CORDILLERA AZUL NATIONAL PARK REDD PROJECT

Document Prepared By
Centro de Conservación, Investigación y Manejo de Areas Naturales – Cordillera Azul
Lima, Peru
under a Total Management Contract with
The National Service of State National Protected Areas - SERNANP
and
with technical assistance from
The Field Museum
Chicago, USA
and
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1. PROJECT DETAILS

1.1 Summary Description of the Project

Cordillera Azul National Park (PNCAZ) REDD Project protects a large, intact expanse of lower-montane forest remaining in Peru. PNCAZ is the easternmost outlier of the Andes at this latitude and covers portions of seven provinces in four departments in Peru: San Martín, Ucayali, Huánuco, and Loreto. The project area is 1,351,963.85 hectares within the boundaries of PNCAZ owned by the government of Peru, by order of its designation as a national park. The park's buffer zone was officially recognized by the Peruvian government in a Supreme Decree establishing the park. In 2007 the buffer zone was expanded by legislation, resulting in an area of 2,301,117.24 hectares.

Each mountain range in the park is a separate, uplifted block of mostly Jurassic and Cretaceous strata, which predominate in the northeastern Peruvian Andes south of the Marañon River. Most of these tilted blocks are oriented north and south, but some curve to run east and west. A distinctive geological feature, the Vivian formation consists of rows of flat, sloping triangles of rock up to 7 km broad at the base and 4 km along the ridge resembling giant zigzags. They are well developed and almost perfectly symmetrical in two areas of the park.

The possibility of non-contacted indigenous people from the Cacataibo group living in the southeast region of the park led to the establishment of a "strict protection zone" (Zona de Protección Estricta in Spanish) in the region that permits zero outside entry. Until these people come out of their own volition and request contact, the region remains closed to all entry or use.

There are no organized human communities within the project area. The one known dweller inside the park – a cattle rancher – does not have legal land tenure but has an agreement with SERNANP and CIMA allowing him to remain on his land. He violated this agreement shortly before the project began. The ranch is discussed further in Section 1.10.4.

The total population in the districts around and including the park in 2008 was 321,000. This population has access to the park for subsistence hunting and fishing. The population in the actual buffer zone is estimated at 180,000, with the remaining population residing beyond the buffer zone. Most of the park-neighboring communities are on the west, along the Huallaga valley. Most Huallaga residents are *mestizo*. The only officially recognized indigenous population on the Huallaga side (with land titles as a "native community") is a small Quechua-Lamista community in the district of Chazuta. The Ucayali region on the park's eastern side differs dramatically from the west. The population is sparse and predominantly indigenous—principally Shipibo, with some Piro/Yine and Kakataibo groups—each group conserving its cultural identity and mother language.

The project area includes intact forests from the lowlands (at 300 meters) to mountain peaks (at 2,400 meters) and protects an eastern outlier of the Andes that has been isolated sufficiently long for massive speciation to occur. Scientists who conducted the Rapid Biological Inventory led by The Field Museum in 2000 estimated a total of 4000 – 6000 plant species in the park, with at least 12 probably new to science. (Alverson *et al*. 2001) In their three weeks in the field, the scientists observed 71 large mammal species including bush dogs, spectacled bears, 10 species of primates, and enormous herds of white-lipped peccaries. Bird diversity is extremely high, with more than 590 species already registered for the park and actual species richness probably exceeding 800 species. During the inventory, 58 species of amphibians and 26 of reptiles were registered, but these numbers are low because the inventory was conducted during the dry season when few species are calling and active. Inventories to date have confirmed 150 species of fish with total richness expected to be greater than 250 species.

The project area consists of 1,351,963.85 hectares within the park that belongs to the national government of Peru. Upon its formation in 2002, Centro de Conservación, Investigación, y Manejo de Áreas Naturales– Cordillera Azul (CIMA) voluntarily signed an agreement with the Peruvian government to support the management of the park. The agreement was renewed for one-to-two year terms until August 8, 2008 when CIMA and the Peruvian government signed a 20-year, full management contract. The 2008 management contract includes legal authorization for CIMA to use revenues from the sale of carbon credits from avoided deforestation for park activities for the 20-year term. CIMA is the only NGO with a contract with the Peruvian government for full management of the entire national park and buffer zone. CIMA and PNCAZ receive no or extremely limited funds from the government of Peru per the terms of the management contract, which further differentiates PNCAZ from other Peruvian national parks.

As a result of a funding crisis in 2007, CIMA and its technical advisor, The Field Museum, sought a more sustainable source of funding than the foundation and USAID funding that they had been receiving to date for park protection and land-use management activities. The two organizations decided to pursue a REDD project for PNCAZ because no alternative, sustainable financing was available and CIMA would have to cease all protection and management activities in the park and buffer zone. Two protocols were identified to develop and monitor the project: Verified Carbon Standard (VCS) and the Community, Climate and Biodiversity (CCB) protocol. Under VCS, the project is using VM0007 REDD Methodology Modules (REDD-MF) for unplanned frontier deforestation for carbon stock and avoided emissions assessment. The signing of the 20-year management contract in 2008 served as the start of the carbon project.

The project's primary objective is to prevent deforestation in PNCAZ by focusing on three main types of project activities:

- Protecting the park.
- Building local capacity for sustainable land use and improving the quality of life in the buffer zone communities.
- Strengthening relationships with local, regional and national government agencies.

All project activities support these goals.

1.2 Sectoral Scope and Project Type

The project falls under Sectoral Scope 14, Agriculture, Forestry and Other Land Use. It is an unplanned frontier deforestation REDD project and is not a grouped project.

1.3 Project Proponent (CCB: G4.1, G4.2, G4.3, G4.4, G4.6, G4.7)

Project Proponent: Centro de Conservación, Investigación y Manejo de Áreas Naturales – Cordillera Azul (CIMA-Cordillera Azul)
Contact: Patricia I. Fernández-Dávila M.
Address: Calle José Gabriel Chariarse 420, San Antonio, Miraflores, Lima 18, Perú
Telephone Number: +51 1 2412291
Email Address: pfernandezdavila@cima.org.pe
Responsibilities: Coordinate and oversee all project activities including interactions with national, regional and local governments, communications and relationships with buffer zone communities, input and review of project documentation, data collection and project monitoring and mapping

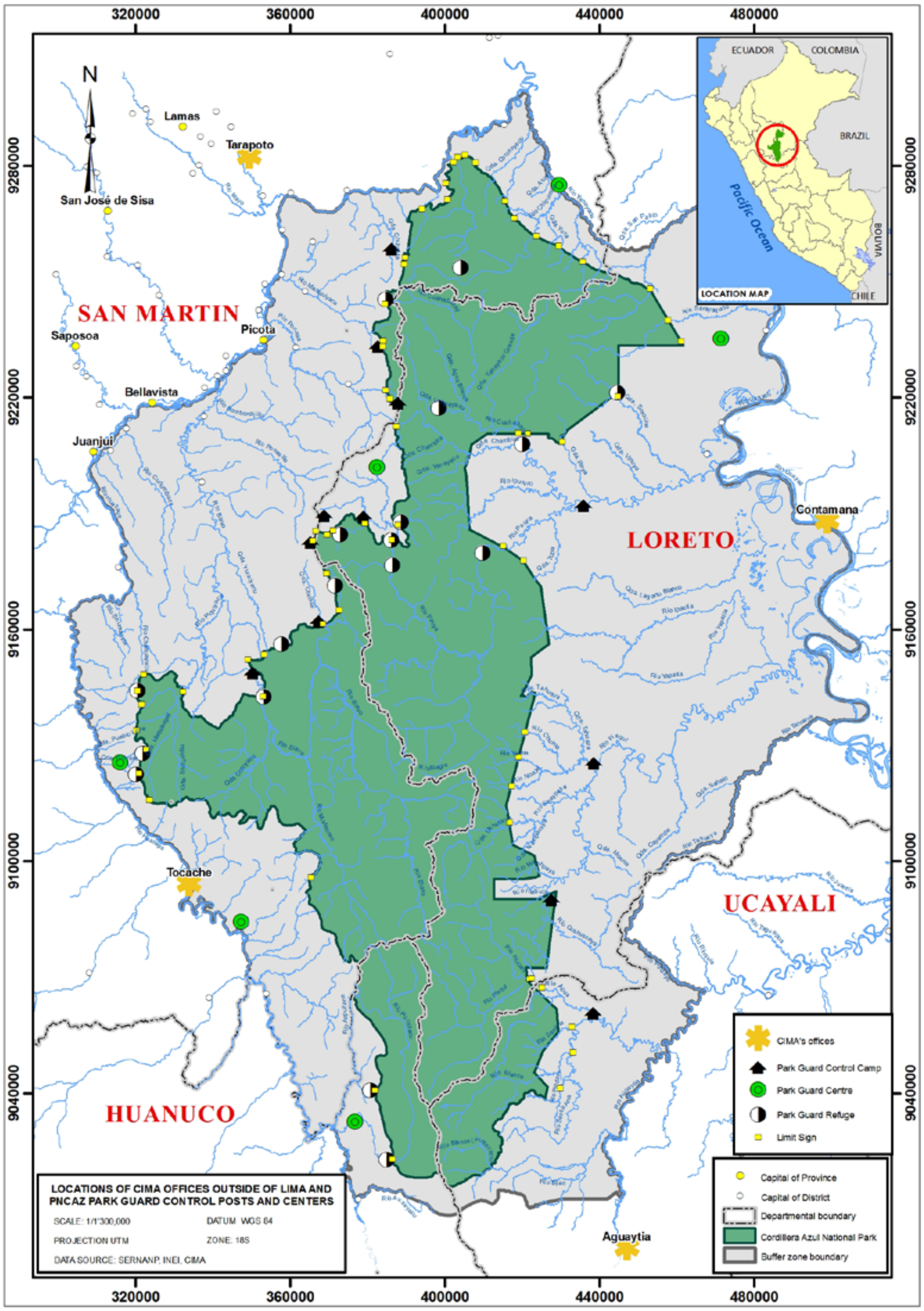
1.3.1 Park Management Team Skills and Experience

This project will be implemented and managed by the Peruvian non-government organization (NGO) CIMA in collaboration with partners in Peru and the United States. CIMA's experience is tightly linked to the effective management of PNCAZ. CIMA was created to provide institutional, technical, and financial support to the Peruvian government for the administration and management of PNCAZ. CIMA's success in its initial pre-project pilot efforts led the Peruvian government to sign a 20-year management contract with the NGO for full management of the park, ranging from field activities to strategic planning.

Although CIMA has the management contract, PNCAZ is a national park and all park guards are part of the national park system overseen by SERNANP. CIMA will provide funding for the park guards and control infrastructure and activities, work closely with SERNANP to design annual work plans, and monitor all park guard operations. In coordination with SERNANP, CIMA will also design and be responsible for implementing the strategies for managing the park outlined in the Plan Maestro.

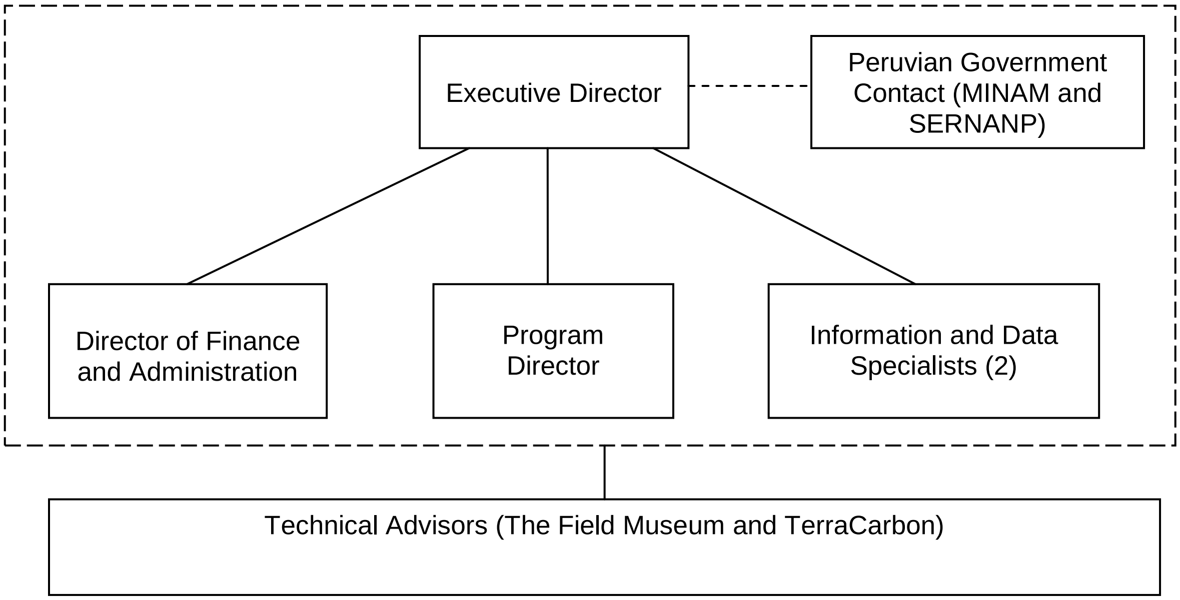
CIMA employs approximately 100 professionals, technicians, and park guards located in five offices and 18 guard posts and centers. The map below (Map 1.1) illustrates the park-guard posts and other CIMA infrastructure at the start of the project in 2008. CIMA heads the park-management activities from its field offices in Tarapoto, Tocache, Contamana, and Aguaytia. CIMA's Headquarters in Lima oversees the activities of all field offices and coordinates directly with the relevant offices of the national government. Decentralizing activities into the field offices allows CIMA to hire individuals from the different regions that surround the project area, promoting greater knowledge of, and better interactions with, local and regional communities and governments. Decentralization also allows CIMA to tailor programs and communications to reflect the needs of the communities and reduce travel times and cost.

Map 1.1: Locations of CIMA offices outside of Lima and PNCAZ park guard control posts and centers in 2008



CIMA staff has extensive experience in a variety of fields required by the project including finance, administration, law, anthropology, education, biology, forestry, mapping and GIS. An organizational chart is provided in Figure 1.1 below for the REDD project.

Figure 1.1: Project Organizational Chart



The personnel most directly responsible for the project and a brief summary of their responsibilities are listed below. A resume for each individual is provided in Appendix 1.

Executive Director - Patricia I. Fernández-Dávila

- Reviews project progress through quarterly and annual reports and internal meetings covering the budget, programs, and communications
- Ensures the resources needed for the project are obtained either through hiring or training of CIMA employees or through collaborations with, or retention of, outside organizations
- Represents CIMA in high level discussions and contracting with SERNANP, other governmental agencies, media, stakeholders and supporting organizations or contractors
- Ensures CIMA operates in accordance with all applicable regulations

Director of Finance and Administration – Jorge Aliaga

- Oversees all aspects of the project finances
- Ensures revenue distribution is in accordance with the agreed upon revenue-sharing plan
- Monitors annual project budget
- Oversees accounting
- Oversees all financial audits
- Oversees benefits and contracts for CIMA personnel ensuring compliance with applicable regulations and CIMA policies

Program Director – Cinthia Mongylardi

- Oversees the implementation of the 20-year park management contract
- Oversees all aspects of the project including strategy and project activity development and implementation
- Oversees programmatic activities of all regional offices and interfaces with local and regional partners
- Tracks project progress through personal involvement and review of quarterly and annual reports and internal meetings covering the budget, programs, and communications

- Represents CIMA in discussions regarding the project with SERNANP, other governmental agencies, media, stakeholders and supporting organizations or contractors
- Ensures coordination and communication among regional offices
- Ensures coordination and communication between regional offices and Lima office
- Provides local contact for SERNANP's Park Director
- Ensures coordination of park guard activities, including scheduling, supplies, safety, and other functions
- Implements activities supporting the park management contract
- Ensures the project operates in accordance with all applicable regulations

Information and Data Specialist – Tatiana Pequeño

- Oversees collection, mapping, analysis, and storage of project data including project monitoring
- Manages programs supporting the REDD project reviewing the schedule, budget and effectiveness of the programs
- Coordinates training for park guards and CIMA personnel as needed including the development of training tools and programs, obtaining funds for training, and securing qualified trainers
- Works with GIS group responsible for interpreting satellite imagery, mapping information, conducting analyses, and providing reports
- Represents CIMA in technical discussions regarding the project with SERNANP, other governmental agencies, media, stakeholders and supporting organizations or contractors
- Participates in Mesa REDD network and Climate Change National Commission's REDD Technical Group

Information and Data Specialist – Jorge Luís Martinez

- Oversees collection, mapping, analysis, and storage of project data
- Develops monitoring or status reports for funding institutions, government and internal uses
- Coordinates training for park guards and CIMA personnel as needed including development of training tools and programs, obtaining funds for training, and securing qualified trainers
- Works with GIS group responsible for interpreting satellite imagery, mapping information, conducting analyses, and providing reports
- Reviews field reports and prepares summary documents

Technical Advisor – Debra Moskovits

- Has provided and continues to provide support to the Executive Director and Program Director including financial, technical, strategic, and administrative assistance since prior to the Park's inception
- Assists in development of project documentation and models
- Assists in searching for additional experts as needed for project work

Peru Government Contact – Lucia Ruiz Ostoic

- Represents MINAM in discusses regarding the revenue sharing plan
- Coordinates the integration of the pilot project into the national REDD effort

As indicated, CIMA will collaborate with a wide range of institutions that bring a complementary set of skills to implement management activities in PNCAZ and the buffer zone. CIMA will work with these diverse institutions through a variety of relationships, including some collaborative agreements and contracts. The range of CIMA collaborators includes:

- Academic institutions: local, national, and international universities and museums, such as The Field Museum, Centro de Datos para la Conservación (CDC) of the Universidad Nacional Agraria La Molina (UNALM), Herbario of the Universidad Nacional Agraria La Molina (Herbario MOL), Centro de Conservación y Sostenibilidad Ambiental (CSA) of the Universidad Peruana Cayetano Heredia (UPCH), Museo de Historia Natural (MUSM) of the Universidad Nacional Mayor de San Marcos (UNMSM).
- Schools and training centers: Administrative educational units (*Unidades de Gestión Educativa Locales*, UGEL), elementary and high schools, professional institutes.

- Community-base organizations: *Federaciones nativas* (Native federations), APAFA (parents/teachers association), *rondas campesinas* (local vigilance groups), various community committees (sports, other interest groups).
- Authorities and different government organizations at the national, regional, and local levels (including institutions that review/approve CIMA's initiatives, as with master plans for the park, and zoning efforts for the buffer zone); Provincial Municipalities of Picota and Ucayali; and the Regional Government of Loreto.

The Field Museum has been a key collaborator since before the park was established in 2001. Field Museum scientists led the Rapid Biological Inventory used to demonstrate the critical biological and ecological importance of the area (Alverson et al. 2001), which resulted in the interest to create a national park and the documents necessary for establishment of the park. In addition, The Field Museum helped CIMA develop and implement the Index of Conservation Compatibility (ICC) (Pequeño 2007) and the community asset mapping methodologies (in Spanish, Mapeo de Usos y Fortalezas or MUF) (Del campo et al. 2007) that are integral to CIMA's planned project activities. The Field Museum team also brings carbon offset project documentation and implementation experience and will continue to collaborate with CIMA.

TerraCarbon's team of forestry and modelling experts provided CIMA with support on quantifying the amount of avoided deforestation, measuring the park's carbon stock and properly documenting the process. TerraCarbon also provided advanced training to CIMA's information management and GIS team so that CIMA can be a full participant in the methodologies used in the project proposal and complete future monitoring and project documentation activities. In addition, Terra Carbon trained PNCAZ park guards extensively on the prism methodology used to measure carbon stocks (Shoch et al. 2007). This technical knowledge enabled park guards to participate in the initial carbon stock assessment and to engage in future monitoring as needed. The trained park guards can now train others in measuring carbon stock with prisms building capacity in Peru for accurate REDD data collection and monitoring. TerraCarbon also provides expertise in developing the revised VCS baseline module used for this project and assisting in the double validation process. The team is dedicated to being a resource for CIMA moving forward.

1.3.2 Worker Training and Safety

For this project, CIMA will continue its policy of recruiting professionals, technicians and others from the local communities they represent. The hiring policy outlines the general process and emphasizes that CIMA does not discriminate on any basis. The policy is included in the Internal Work Regulations. In the case of parkguards, CIMA will make all selections in tight coordination with the Park's Head (Jefatura, SERNANP). Each position will be advertised in multiple ways such as postings, social media announcements, and word of mouth in the communities to solicit as many applicants from as many backgrounds as possible. Applicants for park guards will be accepted with a variety of backgrounds, considering minimal/basic knowledge and skills (SERNANP 2010) as long as they are willing and able to learn the skills necessary for the position. This will provide a means for women, underrepresented minorities or other groups to have a fair chance for employment as well. For example, current park guards include former teachers, hunters, farmers, and a wide variety of other occupations. The minimum criteria for application will be included in the announcement as well as the criteria for selection to ensure that the hiring process is understood by applicants. The criteria for selection will be dependent on the specific open position. If applicants feel that unfair hiring practices have occurred, they will be able to use the conflict resolution process described in Section 7.2.

New employees will attend an orientation appropriate to their position. A training matrix has been developed to identify the type of training required for each position. Training of administrative and other personnel in Lima will be conducted by the appropriate supervisor or team member. In the case of field staff, such as field technicians and park guards, this orientation will include training in both classroom and the field, and will be conducted by CIMA personnel. CIMA and the Park's Headquarters will coordinate the training for all field, office, and park-guard personnel. Outside experts may be hired to train the team depending on the desired subject, such as the prism method for measuring carbon stock in the forest. Park guards will attend training programs that include: in-depth first aid, basic life support, wilderness survival skills, and GPS training. The training will allow them to work more safely and enable them to provide assistance in their communities when emergencies occur. If employees desire additional training, they will be able to request it from the field offices or Headquarters to be planned as possible depending on the topic, cost, and schedule. Periodic training will be conducted as refreshers, or to introduce new topics identified by Headquarters or the field offices. Cross training will occur as practical to ensure skills and project knowledge is retained in the event that personnel leave the project team. If needed CIMA's network of professionals will be used to bring in outside experts to fill gaps while in-house personnel are trained.

CIMA will promote the safety of all of its employees through (1) security protocols that include measures to prevent and respond to threats of violence or robbery and social unrest, accidents or illness, and natural disasters and (2) training and appropriate equipment such as facility location, first-aid kits including anti-venom serums, GPS, and radios for park guards. In areas where employee safety may be at greater risk due to narcoterrorism or similar activities in the region, CIMA will minimize these risks by establishing offices and park guard stations in populated areas. During trainings, regional differences will be identified if appropriate to ensure all employees are knowledgeable about their potential risks and appropriate preventive actions. In addition, park guards will use a system of daily reporting by radio to the Park Headquarters to ensure that all guards are present and safe and that any new risks or threats in the region are identified, CIMA's security protocols are extensive and cover a wide range of potential risks from natural disasters to injuries to animal attacks to kidnapping. All employees receive specific training on the protocols relevant to their positions and are given access to all protocols. This serves to lower the risk of all CIMA field activities and allows technicians and park guards to assist communities in times of emergencies as well.

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1.3.3 CIMA Financial

CIMA places a great emphasis on efficient and responsible use of resources including funds. Budgets, whether at the organization or project level, will be carefully monitored and reviewed through a series of tools. The Director of Finance and Administration will closely monitor spending against approved budgets using a series of spreadsheets, regularly meet with project managers and provide reports to the Executive Director. The spreadsheet tools will also allow the Director to identify trends in spending and make suggestions regarding improvements or best practices that can be shared across CIMA. Administrative procedures will guide employees on financial matters including procedures on managing funds, expenses, cash advances and reimbursements.

Oversight from donors will provide an additional level of assurance that CIMA is fiscally responsible. An annual audit by an independent, USAID-selected auditor will provide a review of CIMA's financial records and practices. Other foundations may conduct audits of the records when they choose. When audits have findings, CIMA will correct the identified issues and implement measures to prevent the error from occurring again, as it has to date.

Specific financial data and plans are provided in Section 2.5, Additionality.

1.4 Other Entities Involved in the Project (CCB: G4.2)

The following organizations assisted in development of the project documentation:

Additional Project Participant: The Field Museum
Contact: Debra Moskovits
Address: 1400 S. Lake Shore Drive, Chicago, IL 60605 USA
Telephone Number: +1 312 665 7431
Email Address: dmoskovits@fieldmuseum.org

Responsibilities: Provide technical, strategic and administrative support to all areas of the project as requested by CIMA

Additional Project Participant: TerraCarbon LLC
Contact: Scott Settelmyer
Address: 5901 N. Sheridan Road, Peoria, IL 61614 U.S.A.
Telephone Number: +1-309-693-9303
Email Address: scott.settelmyer@terracarbon.com
Responsibilities: Provide technical assistance in the application of REDD methodologies and development of portions of the project documentation

1.5 Project Start Date

The project began on August 8, 2008 with the signing of the management contract.

Section 1.8 provides a description of how the project activities differ from the pilot activities conducted prior to the project.

1.6 Project Crediting Period (CCB: G3.4, G3.7)

The project crediting period is twenty years long extending from August 8, 2008 – August 7, 2028, because this is the length of the management contract between CIMA and the Peruvian government.

The project lifetime is likely greater than 100 years because the project area is a legally recognized national park and the government has shown a commitment to ensuring it continues to be privately managed and protected. CIMA has been able to renew its management contract each renewal period to date since 2002 as described in Section 1.11. CIMA expects to be able to renew its contract when the current one expires. Both CIMA and the government have agreed that a portion of the revenue obtained from the sale of carbon credits will be used to establish an endowment for the park's protection as outlined in Section 2.5.3. This endowment will fund CIMA's or any other future management contract holder's park protection activities.

The design of the project, including the government's commitment discussed above and the project activities--emphasizing land tenure and sustainable land-use practices in the surrounding areas, and the creation of an endowment to ensure continued funding for park management activities well after the project's end--serve to ensure the project's benefits last beyond the project's lifetime. The project area is a national park so it will continue to have a SERNANP approved Plan Maestro beyond the project lifetime, which will outline activities and indicators that must be monitored and reported upon. CIMA has worked diligently to ensure that community indicators are included in the Plan Maestro for PNCAZ and this provides a means for community impacts (both positive and negative) to be monitored beyond the lifetime of the project.

The project plans to conduct carbon monitoring events every two years and account for avoided emissions, project emissions and leakage at that time. Social and biodiversity monitoring events will occur every two or four years in conjunction with data collection as outlined in the project milestones in Section 1.8.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Per the requirement in the methodology used, ex ante projections are provided below for the first ten year period. At the end of ten years, the baseline will need to be re-evaluated and the PD will be updated to include ex ante projections for the remaining ten years, as outlined in the climate monitoring plan in Section 4.

The ex ante projections assume that no deforestation, or other sources of emissions, occurs in the project in the with-project case, i.e. that park protection activities are successful in preventing land clearing within the park boundary. Park protection and border patrolling, as well as community awareness programs, are key components to the project implementation. CIMA has a proven track record from 2003 to 2008, of effective protection work and conflict resolution.

There are no standard approaches to estimate future leakage attributable to a REDD activity, nor does the methodology provide detailed guidance. Some leakage due to the project is expected. However, as detailed in the project description, project implementation focuses on activities that should reduce leakage, including support to potential leakage agents (i.e. communities in the park buffer zone) in increasing crop productivity, land zoning and securing land tenure. To be conservative, a 20% annual leakage rate is used.

Table 1.1: Annual ex ante projections for the PNCAZ project, 2008 to 2018

Project	
Large project	X

Years	Estimated GHG emission reductions or removals (tCO2e)
Aug 2008 – Aug 2009	997,497
Aug 2009 – Aug 2010	1,066,047
Aug 2010 – Aug 2011	726,995
Aug 2011 – Aug 2012	876,887
Aug 2012 – Aug 2013	1,109,247
Aug 2013 – Aug 2014	1,473,343
Aug 2014 – Aug 2015	1,846,955
Aug 2015 – Aug 2016	2,215,939
Aug 2016 – Aug 2017	2,524,164
Aug 2017 – Aug 2018	2,915,610
Total estimated ERs	15,752,683
Total # of crediting yrs	10
Average annual ERs	1,575,268

1.8 Description of the Project Activity (CCB: G3.1, G3.2, G3.4, CL3.2, CM3.3, B3.3)

The project's primary objective is to prevent all deforestation in PNCAZ.
CIMA will achieve this objective by focusing on two categories of activities:

- park protection activities and
- buffer zone activities to stabilize and promote sustainable land use and improve the quality of life for the communities.

1.8.1 Project Activities

The project zone represents a large, diverse area. Prior to the project's start, CIMA needed to develop a relationship with the national, regional, and provincial governments, as well as with the immigrant and indigenous communities in the project zone. Without these relationships in place, CIMA would not be able to obtain the management contract or receive meaningful input from communities to design the project activities.

History

As described in Section 1.12.1, CIMA's initial agreement with INRENA was signed in 2002. In this agreement, CIMA agreed to support the management of the park and was given responsibility for developing and implementing a Plan Maestro in conjunction with INRENA. CIMA's agreement was renewed every one to two years until the 20 year contract was signed in 2008. A Plan Maestro was approved for 2003 – 2008, which outlines the strategy for this period. Work focused on implementing traditional park protection, used by the government in other national protected areas, and on beginning to meet and get to know the communities in the buffer zone, to involve them in the implementation of the park. During this initial period the infrastructure for park protection, such as boundary signs and guard posts, was installed along the periphery of the entire park, and park guards were hired. At CIMA's urging, applicants from communities surrounding the park were interviewed and ultimately selected to be park guards.

CIMA began to introduce itself to the communities surrounding the park, recognizing the essential role of the local residents in the long term protection of the park. CIMA worked hard to build strong and trusting relationships with the communities, essential to designing a park-implementation strategy that would build on the cultural values and aspirations of villagers neighboring the park. As often occurs, especially in regions with a history of failed outside projects, the communities were at first wary of a new non-profit group working in the area. The limited nature of CIMA's contracts presented a serious challenge as CIMA was unable to plan for more than one or two years at a time or to discuss a long-term vision with the communities. At the same time CIMA was also developing a relationship with INRENA and the regional and local governments around the park. By remaining consistent in its messages, delivering on its promises, and staying in the region rather than abandoning it after a few months, CIMA began to build deep trust with the communities and with the many levels of governments.

Based on the analysis of available information, including the 2003 MUF, CIMA identified the river basins invaded by illegal loggers inside PNCAZ, and prioritized the intervention in the following order:

- Northwest Sector (Biavo and Alto Pauya)
- Northeast Sector (Cusahabatay and Bajo Pauya)
- Southeast Sector (Pisqui)
- South Sector (Santa Ana – Shambo)

In the North and Southwest sectors, illegal logging inside PNCAZ was not on a large enough scale to demand implementation of a structured strategy. Park guards designated in these areas were responsible for developing specific control actions whenever they encountered any illegal logging.

The objective of the intervention—whether as a structured strategy or in isolated incidents—was to remove the illegal loggers in a peaceful manner by working directly with the illegal loggers and collaborating tightly with local communities. The program was devised by the Park Head and CIMA and deployed local park guards and community assistants in targeted patrols, direct communications with the illegal loggers to organize their departure, and monitoring after the illegal logging activities were removed to ensure that no logger returned. Between April 2003 and November 2006, all illegal logging camps were dismantled peacefully. The watersheds are now free of illegal logging and both ground patrols and aerial surveillance have confirmed that the loggers did not return to the park. (Rubio 2007)

This important groundwork laid the essential foundation with the communities and local governments that enabled the project to begin with effectiveness and high probability of long-term success. In August 2008, CIMA was granted a 20-year full management contract by INRENA. CIMA was no longer a technical advisor, but was now the responsible party for financing and managing the park and buffer zone for the next twenty years. This was the first time a contract of this nature and magnitude had been granted by INRENA for a national park, and the contract would not have been possible without the enormous work CIMA had conducted in the area and the close relationship developed between the two organizations for the initial five years, pre-project.

Project Start

With its new role as the full manager of the park, CIMA will conduct the following activities for the project beginning in 2008 and 2009. The input received from activity 2.h and 2.i will be used to revise the 2009 activities and plan the specific activities for the future. High level project activities for 2008-2018 are presented in the Major Project Milestone table later in this section. Activities 1a, 1b, 1c, 3a, 3b and 3c will continue for the entire project lifetime although strategies and specific points of implementation may change in response to new threats or information. Activities in the buffer zone will also continue over the project lifetime but may take different forms based on community input and changing conditions.

	Activity	Location	2008	2009
1. Park protection activities				
	a. Current signage, park guard stations and control posts will be evaluated and expanded as appropriate.	See Map 1.1 - perimeter of the park	X	X
	b. Signs and park guard stations will be maintained.	See Map 1.1 - perimeter of the park	X	X
	c. Strategies of protection and control inside the park will be updated and modified as needed	PNCAZ (San Martin, Loreto, Huanuco and Ucayali); All CIMA offices	X	X
	d. The communal park guard program will be expanded.	1. Communities in the Aguaytia, Pisqui, Cushabatay and Chipaota valleys (indigenous communities) 2. Other communities near park guard checkpoints and shelters who wish to participate	X	X
	e. Park guard reports will be sent to both CIMA's Tarapoto office and SERNANP.	See Map 1.1, reports come from each checkpoint and shelter	X	X
	f. A strategy for legally removing the cattle rancher from inside the park will be coordinated with SERNANP and steps will be taken to implement the strategy	Lima (CIMA and MINAM attorney), Tarapoto (CIMA) and San Martin (Municipality of Bellavista)	X	X
	g. Begin drafting a new Plan Maestro	Lima, with support from all CIMA offices, SERNANP and communities in the buffer zone	X	
	h. Begin quarterly reports to SERNANP to summarize CIMA's activities	Lima with information from all CIMA offices (Tarapoto, Contamana, Tocache and Aguaytia)		X
2. Buffer zone activities				
	a. Implement the *Zonificación Ecológica Económica* in the districts of Shamboyacu, Pólvora, Campanilla y Alto Biavo; including 15 towns (*centros poblados*) and 1 indigenous community in the four districts.	Shamboyacu, Pólvora, Campanilla and Alto Biavo districts	X	X
	b. Design a comprehensive extension strategy for involvement of buffer-zone communities in protecting the park.	All CIMA offices (Lima, Tarapoto, Contamana, Tocache and Aguaytia)		X

	c. Analyze the 2008 MUF data to gather the socioeconomic information needed to plan activities and update the Plan Maestro.	Tarapoto CIMA office	X	X
	d. Implement Classroom in Action primary education modules in 3 towns in Shamboyacu.	Shamboyacu district	X	
	e. Renew agreements with the UGELs (Education Districts) of Tocache, Contamana, and San Martin to continue working formally with the schools in these areas on environmental education.	Tocache, Contamana, and San Martín	X	
	f. Publish two formal environmental education guides: Classrooms in Action and Protecting Our Watershed.	Tarapoto CIMA office, to be distributed mainly to the UGELs (Education Districts) of Tocache, Contamana, and San Martin	X	
	g. Implement a community outreach program: RARE	Tarapoto CIMA office, to be implemented in Shamboyacu district, San Martin	X	
	h. Hold regional community meetings to identify regional land use and quality of life 20-year visions.	Tarapoto, Tocache, Tingo María, Aguaytía, Contamana, Iquitos	X	X
	i. With the input from the meetings, identify community-wide activities that will achieve the goals of the communities, diminish deforestation in their lands, and avoid deforestation in PNCAZ, and define the best means to scale the pilot projects up to community or region-wide efforts.	All CIMA offices (Lima, Tarapoto, Contamana, Tocache and Aguaytia)		X
	j. Continue to gather data on the individual community characteristics, composition, backgrounds, values, and activities to inform, update, and revise activity planning.	89 2008-MUF communities and population centers and any new population centers	X	
3.	Government agency relationships			
	a. Relationships with local, regional, and national governments will be maintained and expanded strategically	Lima (national government), San Martín, Ucayali, Huánuco, and Loreto (regional and local governments)	X	X
	b. CIMA will identify ways to support the government agencies in processing information, raising awareness of laws and regulations, and identifying threats to PNCAZ	Lima (national government), San Martín, Ucayali, Huánuco, and Loreto (regional and local governments)	X	X
	c. CIMA will continue to advocate for the park as necessary to mitigate threats from new roads; logging, mining, or oil concessions, and other impending events	Lima (national government), San Martín, Ucayali, Huánuco, and Loreto (regional and local governments)	X	X

CIMA's ability now to receive park guard reports directly, rather than wait for copies to be provided by SERNANP in Lima, will allow for more immediate response to identified threats or community questions or complaints.

The community input process will be captured in a companion piece to the next Plan Maestro to document better the thorough involvement of communities. Following the community meetings for discussing the design and needs for park management and avoiding deforestation, specific activities and an implementation plan will be developed, with input and feedback from the communities. This plan will be documented in the Plan Maestro. Because the Plan Maestro takes a long time to be formally approved, CIMA will begin implementing the strategies prior to the Plan Maestro being completed.

These activities are designed to combat the greatest driver of deforestation in the project zone which is the advancement of the agricultural frontier. As immigrants move to the area from the high Andes, they are not familiar with the local ecosystem, crops or communities. Immigrants tend to clear an area and then farm for a period of time until the land erodes or is unfertile. Once this happens, the family tends to move on to a new parcel of land and repeat the cycle. This process is common in the Amazon basin.

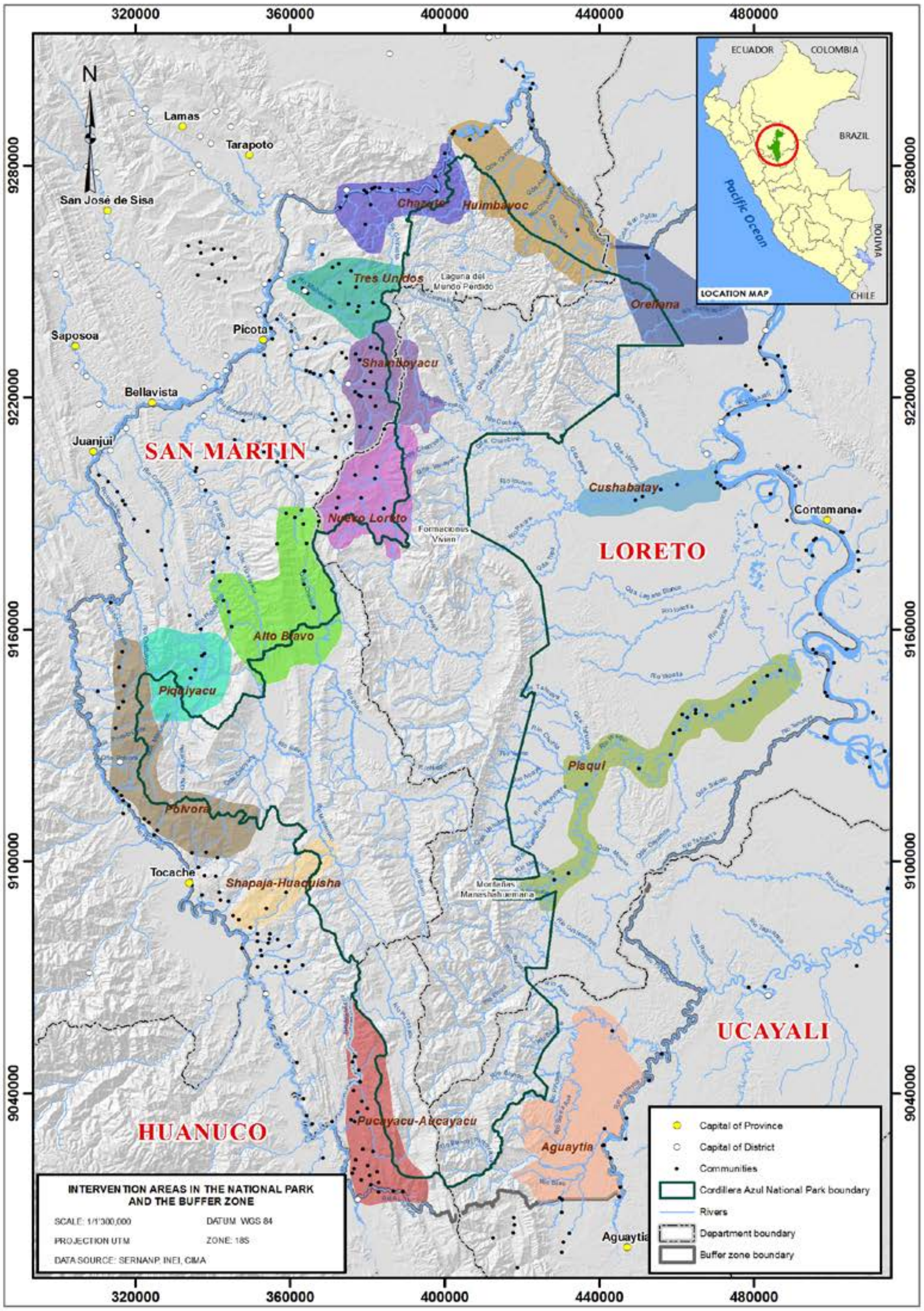
Park protection activities prevent incursions into the park and raise awareness of the boundaries and permitted uses inside the park. As a result of this protection, the park's biodiversity and forests thrive. Protecting the forests also has positive climate and community impacts, as described later in this document.

The buffer zone activities are designed to slow or stop advancement of the agricultural frontier. Assisting communities in land-use zoning and development of sustainable agricultural practices allows families to use their land in ways that reduce erosion or depletion, permitting them to remain in the same location rather than move on and deforest additional lands every few years. Land tenure also helps stabilize land use: families with clear, uncontested title to their land are much less likely to migrate or deplete their soils.

Developing specific activities for different communities requires close coordination with each community to ensure that the activities implemented address the threat of deforestation and at the same time are closely aligned with the communities' social, cultural, and economic values. Activities that do not align with the communities' values do not lead to sustainable results. CIMA has conducted pilot programs over the last several years to learn which techniques work best in the region and to develop an understanding of community responses. In addition, CIMA has collected a significant amount of data on the characteristics of the communities. These efforts, combined with the significant amount of community input planned over the first six months of the project, will ensure that new project activities are designed to have the greatest possible positive impacts for communities and for avoiding deforestation.

Given the size of the project region (equivalent to the state of Massachusetts), it is not possible for CIMA to work with all communities in the buffer zone from the start. Instead, CIMA will focus its efforts initially on communities located in "critical areas," which are characterized by their proximity to the park, ease of access into the park (using rivers, foot paths, or old logging roads), historic deforestation rates, or areas that represent a threat to communities because of narcoterrorism. The critical areas are included in Map-1.1a. Critical areas will change over time as new threats emerge or existing ones are mitigated. To be most efficient and cost-effective, CIMA will reassess the location of critical areas periodically.

Map 1.1a: Intervention Areas in 2008 (Intervention areas are critical areas plus areas where communities need assistance completing processes already begun.)



As CIMA works with each community in the critical areas, extension agents build local capacity in land-use zoning, working with local governments on infrastructure processes, and implementing and maintaining ecologically compatible agricultural practices. CIMA's programs are designed to be facilitative in nature, allowing communities to guide the process and develop competencies. Once both CIMA and the community are comfortable with the level of competency and sustainability of the programs, CIMA will move to new communities. At no time will a community be "abandoned" by CIMA. CIMA will continue to lend support to communities as appropriate, with the goal of creating self-sufficiencies. The identification of new or growing threats may bring additional communities into priority intervention status.

Illegal activities occur in the buffer zone. Even in departments with a highly efficient regional government, local law enforcement is not sufficiently ample and strong to enforce national and regional laws in the most remote areas, as is discussed in Section 1.11. The illegal activities tend to be small in scale and may include logging, hunting, and mining conducted by individuals or bands. CIMA's activities raise awareness of the regulations and CIMA's presence in the region discourages illegal activities. CIMA does not, however, have the authority directly to enforce regulations in the buffer zone. When illegal activities are detected, CIMA and parkguards report immediately to the appropriate local authorities. CIMA's land-use zoning and land tenure efforts with local residents further reduce illegal activities. Land owners aware of the regulations are much more likely to report illegal uses on or near their lands to the proper authorities and to refrain from conducting such activities themselves.

Additional project activities will be conducted to ensure a successful REDD project. These include work relating to monitoring and writing up monitoring-event reports, and maintaining close connections with local, regional, and national government organizations. The relationships allow CIMA to be aware of potential special-use authorizations that may not be compatible with the approved uses in the park, so that CIMA can argue successfully to avoid new threats. The project activities are scheduled as part of CIMA's annual planning processes, and adjustments are made quarterly or as necessary. Major milestones for the project are presented later in this section. Annual reviews and monitoring are discussed in the monitoring sections.

An activity lifetime has not been defined individually for each project activity as the lifetime of the activity will depend on many factors. Every five years, the PNCAZ Plan Maestro's formally lays out strategies that enable these goals to be met. In-between the revisions to the Plan Maestro, CIMA's monitoring and the ICC process allow the project's activities to be adjusted as needed based on realities on the ground, as explained in Section 1.12.4 and the Risk Assessment provided in Appendix 3.

This project is a conservation project designed to maintain the project area's High Conservation Values (HCVs) identified in Section 1.10.7. All of these activities will maintain the HCVs of the project area through physical preservation of the standing forests, communication with and engagement of the surrounding communities, and more sustainable land-use practices in the buffer zone.

No illegal activities were occurring inside the project area when the project started except for one cattle rancher who was in violation of the approved uses of the park. More information on the cattle ranch operation is presented in Section 1.10.4. Monitoring through satellite images, park guard patrols and information provided by surrounding communities will allow CIMA to continue to prevent illegal activities from occurring inside the project area.

Major Project Milestones

Year	Event
2008	Project Begins MUF Occurs (See Section 1.10.1)
August 2008- February 2009	Regional Community meetings occur
2009	Develop large-scale buffer zone activity strategy based on community input

	including timeframes for implementation Draft new Plan Maestro
2011	MUF Occurs
2012	Social, Biodiversity and Climate/VCS Monitoring Events and Reports Generated Project VCS/CCB Validation and Verification Dissemination of Verified Monitoring Reports
2014	MUF Occurs Social, Biodiversity and Climate/VCS Monitoring Events and Reports Generated Project VCS/CCB Verification Dissemination of Verified Monitoring Reports
2016	Climate/VCS Monitoring Event and Report Generated Project VCS Verification Dissemination of Verified Monitoring Report
2017	MUF Occurs
2018	Social, Biodiversity and Climate/VCS Monitoring Events and Reports Generated Project VCS/CCB Verification Dissemination of Verified Monitoring Reports Begin baseline revision process and establish schedule for next 10 years

1.9 Project Location (CCB: G1.1, G1.2, G1.3, G1.4, G3.3)

The project consists of the area within the boundaries of Cordillera Azul National Park (PNCAZ) owned by the government of Peru. The limits of the park were defined in the official *Supreme Decree No. 031-2001-AG*, and lie between 06°29'13.3" - 08°54'07.5" south and 75°20'52.3" - 76°24'17.4" west. The park has an area of 1,353,190.85 hectares as defined in the Supreme Decree and an approximate perimeter of 974 km. A small amount of land within the park is privately owned, so the project area is 1,351,963.85 hectares and covers portions of seven provinces in four departments in the Republic of Peru, San Martín, Ucayali, Huánuco, and Loreto. Note that by mistake the supreme decree names only six provinces; however, subsequent documents for management of the area (the "master plans") name all seven provinces. Additional information regarding the private land owners is located in Section 1.10.4. Figure 1.2 is a map of the project area and buffer zone.

The park's buffer zone was provisionally delineated by the Peruvian government in the Resolución Jefatural Nº 314-2001-INRENA on 13 December 2001, covering 2,061,259.79 hectares. In June of 2007 INRENA passed a resolution (Resolución Jefatural Nº 144-2007-INRENA) amplifying the buffer zone to more than 2.3 million hectares and making official the limits proposed in the Plan Maestro 2003-2008 (Resolución Jefatural Nº 245-2004-INRENA).

To ensure a consistent understanding throughout the PD, the following definitions are provided:

Project area (VCS and CCB) – area within the boundary of PNCAZ owned by the government of Peru (Figure 1.2) that comprises the carbon project and over which CIMA has direct control

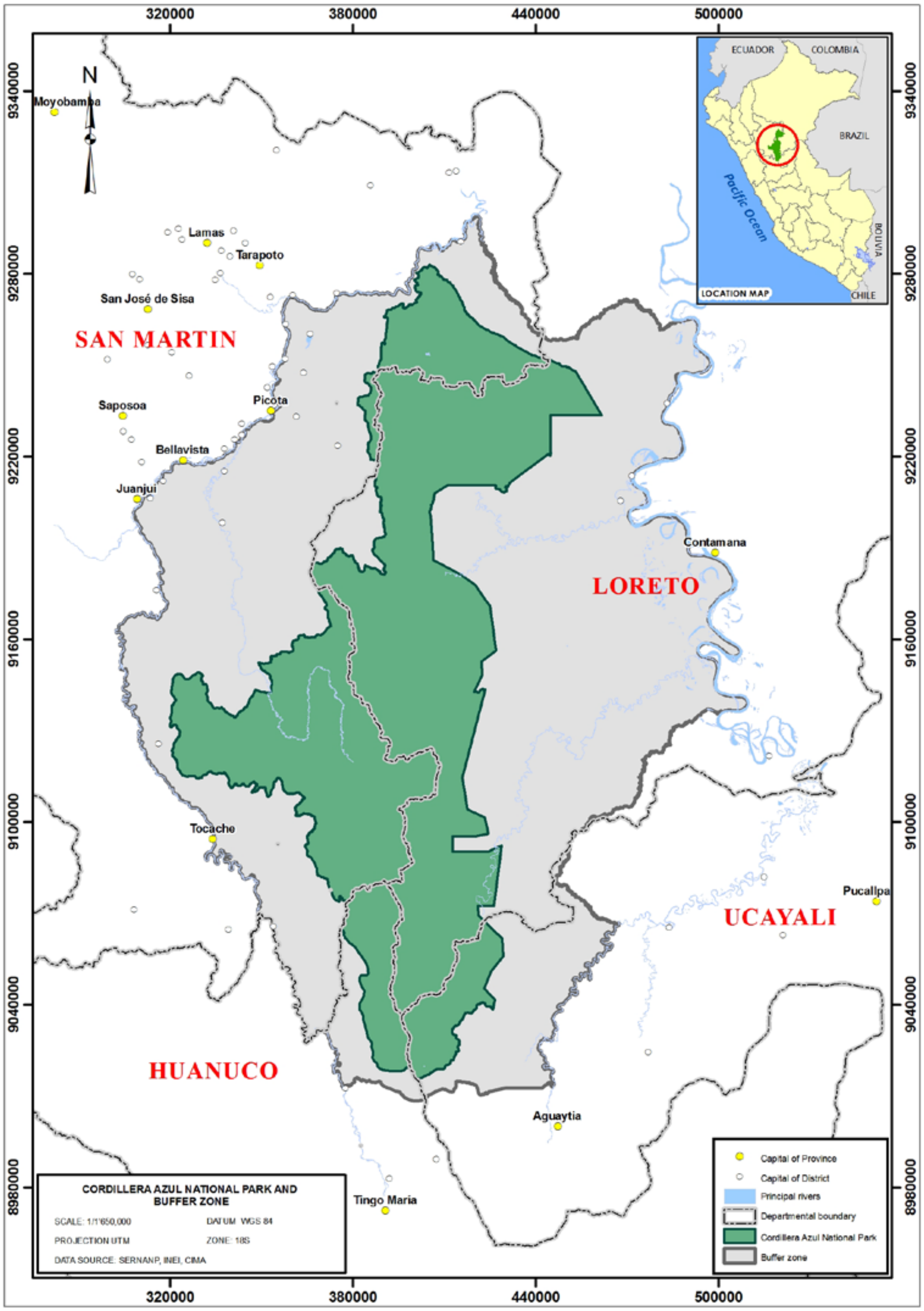
Buffer zone – area surrounding the park as defined in the Supreme Decree and resolution (Figure 1.2). The buffer zone is the land within the boundaries of the surrounding communities that may be potentially affected by the project**.**

Project zone (CCB) – combination of the project area and the buffer zone (Figure 1.2). Because no human communities exist within the project area, communities within the buffer zone represent all communities within the project zone.

Offsite (CCB) – area beyond the project zone.

The reference region for deforestation, the reference region for location, and the leakage belt are presented in Section 3.1.1 along with maps and justifications for the choices made.

Figure 1.2: Project Map and Location in 2008
Map of PNCAZ/project area (shaded in green) and its buffer zone (shaded in grey). The project zone consists of the entire shaded area (project area and buffer zone). The inset shows the park's location in central Peru.



1.9.1 Soils and Geology

The area within and surrounding the project zone—PNCAZ—encompasses unique geological formations (Alverson *et al.* 2001). These in turn influence the biological communities in the park.

The Jurassic and Cretaceous strata that make up most of Cordillera Azul are formed from a mixture of very acidic continental and marine sediments. The substrate is primarily soft sandstones, but may include harder quartzites or granites and other rock that create acid soils. In contrast to the nutrient-poor strata that dominate the mountains, the lower slopes and lowlands have considerable exposure of rich strata such as limestones and rich alluvial terraces. These slopes date to the Cretaceous-Tertiary boundary and more recent Tertiary and Quaternary sources. They are sometimes interlaced with pockets of acid soil, usually displaced from above, just as some strata of more basic soil is perched higher on the mountains. The recent (Tertiary) hills extending from the mountains eastwards are mostly intermediate in acidity.

The park protects the easternmost outlier of the Andes at this latitude, except possibly for the much lower Serranía de Contamana, just east of the Ucayali River. Each mountain range in the park is a separate, uplifted block of mostly Jurassic and Cretaceous strata, which predominate in the northeastern Peruvian Andes south of the Marañon River. Most of these tilted blocks are oriented north and south, but some curve to run east and west. The easternmost uplift, the most recent of all, is a long, remarkably uniform sinuous ridge system. This eastern escarpment of the Cordillera forms a sheer rock wall that blocks access to the southern two-thirds of the park from the eastern lowlands. Only the Pauya and Pisqui rivers penetrate this formidable wall of mountains (towering 1800 m above the adjacent lowlands) through a few narrow openings. To the north, this escarpment curves westward and ends at the north-south running escarpment that terminates at the Pauya River.

In the northeastern part of the park, a similar but lower escarpment faces northeast and is bisected by the Huallaga River to the north. In the broad gap between this steep, northeastern wall and the main escarpment to the south, the Cushabatay River penetrates into two low, broad, ridge-filled basins. Northward, these basins constrict into narrow necks, separated by a high north-south running mountain range with peaks of 1700 m and higher. The broader, western basin is an extraordinary geological formation, with long, low, flat anvil-shaped ridges sloping to the south and a virtually flat-bottomed center (elevation 450 m) with dozens of emerging small, steep ridges up to 400 m. Nestled in this landscape is a large, isolated blackwater lake. A tributary of the Chipurana River drains this northern part of the park, then plunges through a narrow canyon in the eastern wall and finally runs north to merge with the Huallaga River.

In the central portion of the park, the eastern slopes of the peaks (reaching up to 2400 m) drain down narrow openings to the Ucayali River. The west slopes of these peaks drain into the straight, northward flowing valleys of the Biabo River and eventually to the Huallaga River. In the southern portion of the park, a small river passes through high-elevation swamps and into the upper Huallaga to the southwest. These high swamps (at 1400 m elevation) are an unexpected feature in such close proximity to steep mountains. A newer uplift of very hard rock may have formed these unusual swamps by blocking drainage.

A distinctive geological feature, the Vivian formations, are rows of giant, flat, sloping triangles of rock up to 7 km broad at the base and 4 km along the ridge (but usually smaller), resembling “zigzags” (see Fig. 1.3). They are well developed and almost perfectly symmetrical in two areas of the park. Smaller versions of similar, sloping rock triangles occur in the park. Recent uplift of erosion-resistant rock, such as quartzite, and concurrent erosion of much softer rock beneath it presumably created these Vivian formations.

Figure 1.3: Vivian Formations - a distinctive geological formation in PNCAZ. Photo by Álvaro del Campo*.*

Drainage from the higher mountain valleys above the Vivian formations continues to carve gaps between the segments, often resulting in spectacular waterfalls. North of the Pauya River are higher and presumably older rows of Vivians that are more eroded, but still maintain their basic "zig-zag" form.

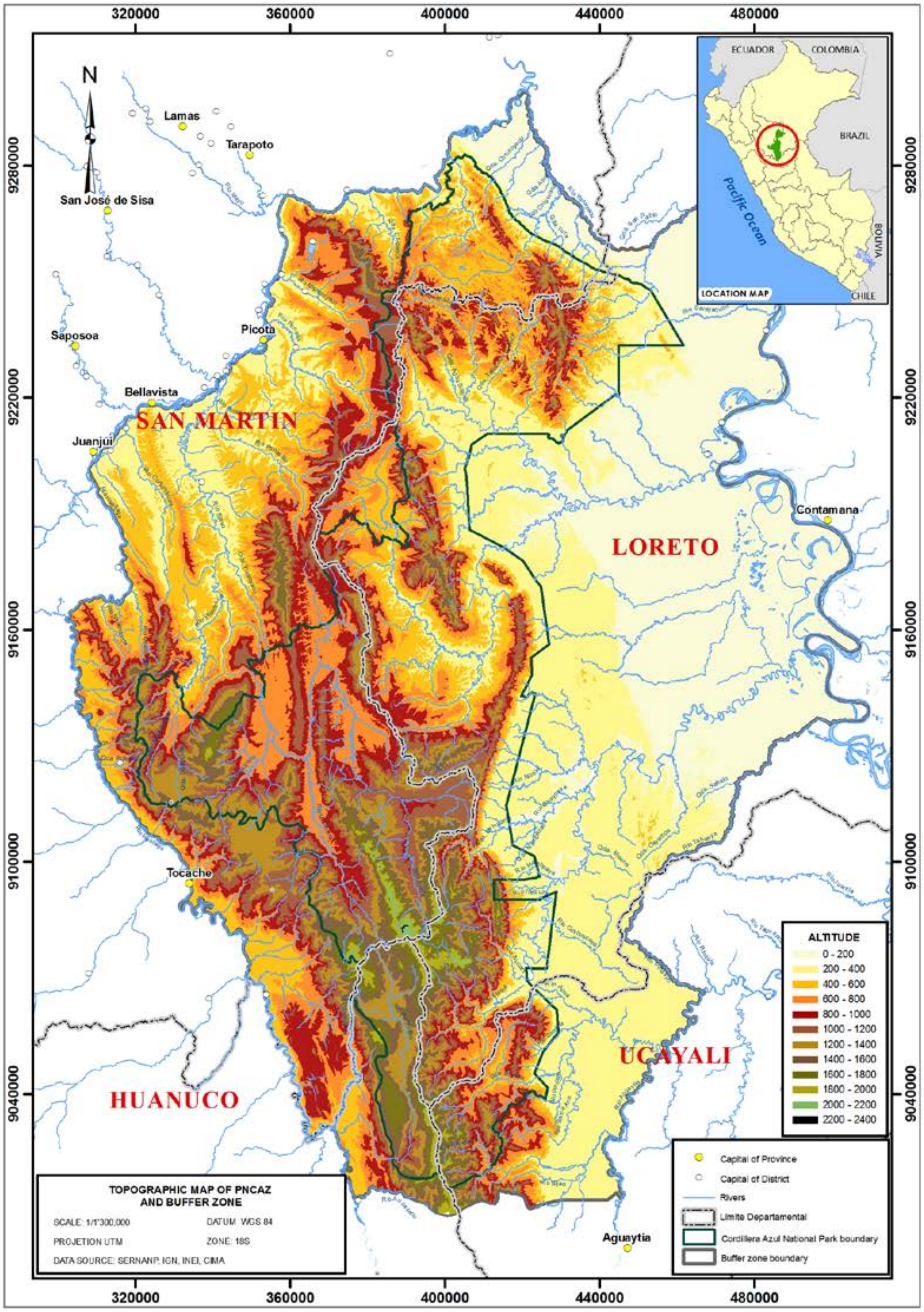
The high range of hills between the Ucayali River and the eastern border of the park appear to be the beginning of the uplift of the next mountain range, as the Nazca Plate at the bottom of the Pacific Ocean continues to slide eastwards under the South American continent. This uplift emphasizes the geologically dynamic nature of the eastern slopes of the Andes.

Structures are formed from the accumulation of sea-salt deposits over 1000 m in some places, and is one part of the evidence that this portion of the Amazon was covered by the sea. In the Blue Mountains, a region of instability of the crust caused the marine invasion, allowing the accumulation of sediments occupying the Huallaga basin called the Chonta Formation. The marine invasion peaked during the Cenomanian (about 95 million years).

The current geological structure of the Peruvian lowland formed during the Cenozoic evolution of the Andean mountains, and the present relief of the basin was developed in the Miocene-Pliocene (23 to 6 million years) and occurred in sub-subdivision the late phase of evolution. These changes in the earth layers above the rocks after suffering severe tectonic deformations form what is called a salt dome.

The salt used in the area (white, pink and red) is the product of artisanal blocks arising from the cliffs at the edge of salt domes as a result of the action of exogenous processes. Salt can be white or crystalline, with red clay and greenish gray gypsum, as in the case of the Tiraco dome, or may be colored by the effect of impurities, such as the dome that occurs at Callanayacu which is reddish and gray. (INRENA 2003, Zarate et al. 1997)

Map 1.2: Topographic Map of PNCAZ and Buffer Zone (together forming the project zone) in 2008. The area encompasses an elevation range of approximately 2000 meters.

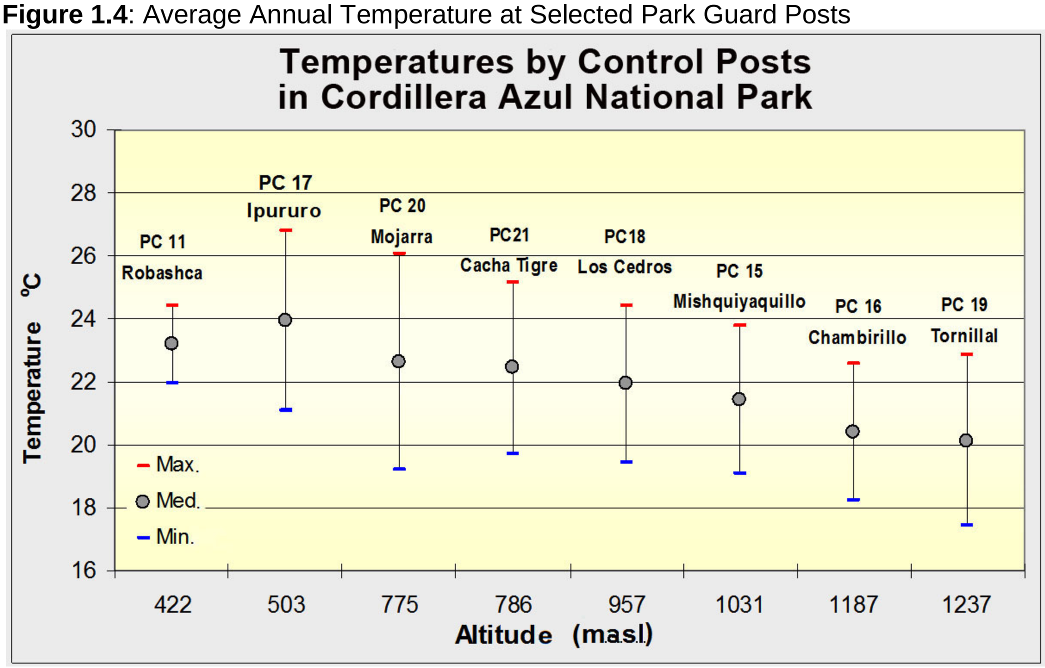


1.9.2 Climatic Conditions

The project area is subject to a highly seasonal climate, with marked wet (November – May) and dry (June – October) seasons. Precipitation and temperature in PNCAZ vary spatially and with altitude. In lowland areas (150 - 650 m), precipitation ranges from 2000 mm – 3500 mm annually. On steep mountain slopes and in cloud forests (600 – 2000 m), precipitation ranges from 3500 mm – 6500 mm annually (INRENA 1995). The northwest part of the project area is comparably drier at all elevations than the rest of PNCAZ due to walls of mountains along the eastern and southern borders of the park that block moisture coming from the Amazonian plains to the east and from Argentina and Bolivia to the south. The average annual temperature of the lowlands is 24 degrees Celsius, with a range of 19 to 27 degrees Celsius (INRENA 1995). Based on data from the control posts in PNCAZ, the average temperature at altitudes between 750 - 1250 m is 22 degrees Celsius with a range from 16 to 27 degrees Celsius. According to Young & León (1999), the average temperature in montane forests at altitudes between1500 to 2500 m is 17 degrees Celsius with a range from 15 to 19 degrees Celsius.

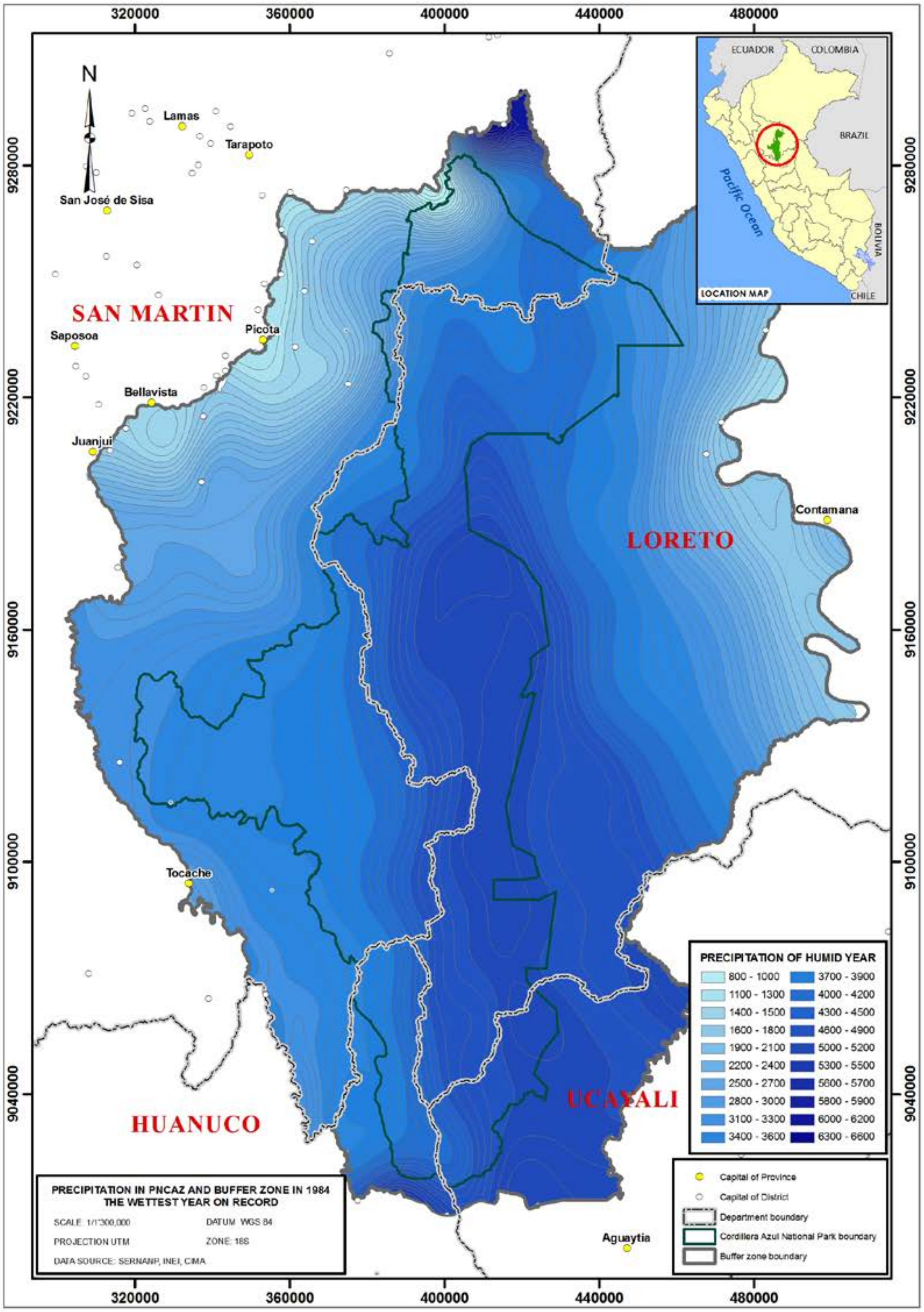
Park guards record temperature and precipitation daily at 18 guard posts and centers. Map 1.1 in Section 1.3.1 shows the locations of these points. The table below shows the average monthly temperature for eight of the posts that had four years of data and demonstrates the correlation between elevation and temperature. These correlations are expected to be true for the buffer zone as well since most of the points are along the boundary of the park. Some of the control posts have been built within the last few years and did not have enough data to produce meaningful averages. The precipitation data also come from averaging control-post data. The closest weather station of the Servicio Nacional de Meteorología e Hidrología (SENAMHI) is located in Picota just west of the buffer zone. This weather station is not in the park or the buffer zone and Picota is not of comparable topography so these data were not included.

Figure 1.4: Average Annual Temperature at Selected Park Guard Posts



Map 1.3 below presents the distribution of precipitation across PNCAZ based on information from the SENAMHI meteorological stations and the data collected in the guard posts. (Zuñiga 2010) Specific monitoring stations within the park would have to be established to obtain higher quality, park specific precipitation data.

Map 1.3: Precipitation in PNCAZ and the 2008 buffer zone in 1984, the wettest year on record (Zuñiga 2010)



1.9.3 Vegetation

PNCAZ and its buffer zone, the project zone, comprise a heterogeneous landscape that includes 21 unique structural habitats (i.e., based on structure not vegetational composition). Only 18 of these habitats occur within the park itself. These structural habitats are largely distinguished by differences in underlying geology, soils, and hydrology. The vegetation in each habitat reflects these differences. Descriptions of all 21 structural habitats are included in the 2003 – 2008 for management of the park (INRENA 2006).

The four forest categories (or clusters of structural habitats with similar biomass and topographic position) described below are the forest strata used for the project's biomass inventory. Certain habitats were not sampled because of low vulnerabilities and these areas were masked out. A detailed discussion of the forest inventory is provided in Appendix 8.

1.9.3.1 Alluvial Forests

This structural habitat cluster includes those forests along rivers that are periodically flooded, and forests found on terraces up to ~40 meters above the river level. These habitats include well-drained alluvial forest, poorly drained alluvial forest, and medium-terrace forest. Typical successional species (*Gynerium, Cecropia, Guazuma, Triplaris, Acacia,* and occasionally *Ficus* and *Cedrela*) are characteristic of the vegetation in alluvial and terrace forests, as well as a palm-dominated understory (e.g., *Attalea, Astrocaryum* and *Phytelephas*). Swampy habitats dominate open areas. Denser forests have patches with many vines, and spiny plants. Floral and faunal diversity is very high, and species composition varies considerably from site to site. The large number of fruiting species in alluvial and terrace forests attracts ungulates.

1.9.3.2 Hill Forests

This structural habitat cluster includes low, medium, and high hill forests and eroded red hills. This habitat cluster shares many plant species with alluvial forests and a palm-dominated understory. In areas not reached by illegal loggers prior to the park's formation, Cedar (*Cedrelinga*) forests still exist. The highest hills are the most humid parts of this habitat cluster, experiencing morning mists and regular cloud cover, and maintaining a high diversity of epiphytes and ferns. Eroded red and white hills (the color is due to iron oxides and minerals) have steep slopes and exposed rocks as a result of landslides.

1.9.3.3 Mountain Forests

This habitat cluster includes mountain forests, stunted forests, and cloud forests. Arborescent ferns (dominated by *Metaxya*) grow in some of the habitats. Tree species include *Cedrelinga, Brosimum, Tachigali, Protium, Attalea*. The highest elevations, in acidic soils, are poor in woody species but rich in epiphytes, bamboo, palms, and herbs. Here, superficial root systems form spongy, humid carpets. At lower limits of cloud levels, mountain forests are covered by algae, lichen, orchids, mosses, and ferns. The very tall mountain forests in the headwaters of the Cushabatay River are of particular importance, as the habitat is rare and shelters several endemic species.

1.9.3.4 Wetlands (Aguajal)

In depressed or low-lying areas of the park, *Mauritia* palm forests are often dominant. Other species associated with poorly drained areas include *Eritrina poeppigiana, Ficus insipida, Ficus maxima,* and *Acacia loretensis.*

1.10 Conditions Prior to Project Initiation (CCB: G1.5, G1.7)

This project is a conservation project which prevents deforestation and forest degradation. It has not and could not be implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

Section 1.9.3 Vegetation presents a summary of the vegetation in the project area prior to project initiation. This section provides a summary of the human communities, including land use and property rights, and biodiversity prior to the project's initiation.

1.10.1 Human Communities in the Project Zone

1.10.1.1 Communities in the Project Area

There are no organized human communities within the project area. The one known dweller inside the park – a cattle rancher – does not have legal land tenure. Details regarding the ranch are provided in Section 1.10.4, Land Use and Property Rights.

There is evidence of indigenous Kakataibo people in isolation in the eastern section of the park and its buffer zone (FENACOCA-IBC 2005, Ponce 2009). When the park was created, there were rumors that they lived in the southeast region of the park. These rumors consisted of oral histories provided by the Kakataibo people living in the buffer zone whose relatives spoke of individual families deciding to return to living in isolation and wishing not to be contacted. The family members returning to isolation had not been in contact with the buffer zone community in multiple generations, so little was known about their existence or their location.

While there was no direct evidence found to indicate whether these people still live in isolation within the park and if so, where, CIMA was committed to protecting their right to remain uncontacted and have their way of life protected. A group consisting of government officials, tribal leaders, Field Museum anthropologists and CIMA worked to delineate every possible location for the isolated families based on all known stories. The group then expanded the range of possible locations to include entire watersheds to ensure a high level of probability that the potential areas of use were surrounded by a wide buffer. The entire area was declared an "intangible zone" (Zona de Protección Estricta) that permits zero entry of outsiders. Until people come out of their own volition and request contact, the region will remain closed to all entry or use.

Laws establishing national parks list approved uses of the park areas but do not include discussions of why uses are acceptable or not. For this reason, the law establishing PNCAZ does not specifically indicate that the intangible zone was established to protect the rights of the possible uncontacted people living in this area. The law by itself also does not describe who is able to enter the park for traditional uses as discussed in the following section. CIMA will ensure that this information is included in the new Plan Maestro developed in 2008 (as it was in the previous Plan Maestro) to document the objectives formally.

1.10.1.2 Human Communities in the Buffer Zone

The major source of the data on the people located in the buffer zone is the Social Asset Mappings that CIMA and The Field Museum conducted in 2003, 2005, and 2008. Del Campo et al 2005 describe the methodology. The process was spread regionally as part of the Toolbox for Managed Areas in Peru (INRENA – CIMA – The Field Museum – GTZ/PDRS 2008)

Detailed community statistics including the age, gender, occupation, forms of community organization or institutions, and point of origin for residents were collected and results provided in the Master Plan for PNCAZ (INRENA 2006). One of the requirements of the park's 2003 – 2008 Master Plan (INRENA 2006), approved by INRENA (now SERNANP), was to study the communities in the buffer zone to engage them effectively in the protection of the park and to ensure that, in turn, protection of the park improved the quality of life of park neighbors.

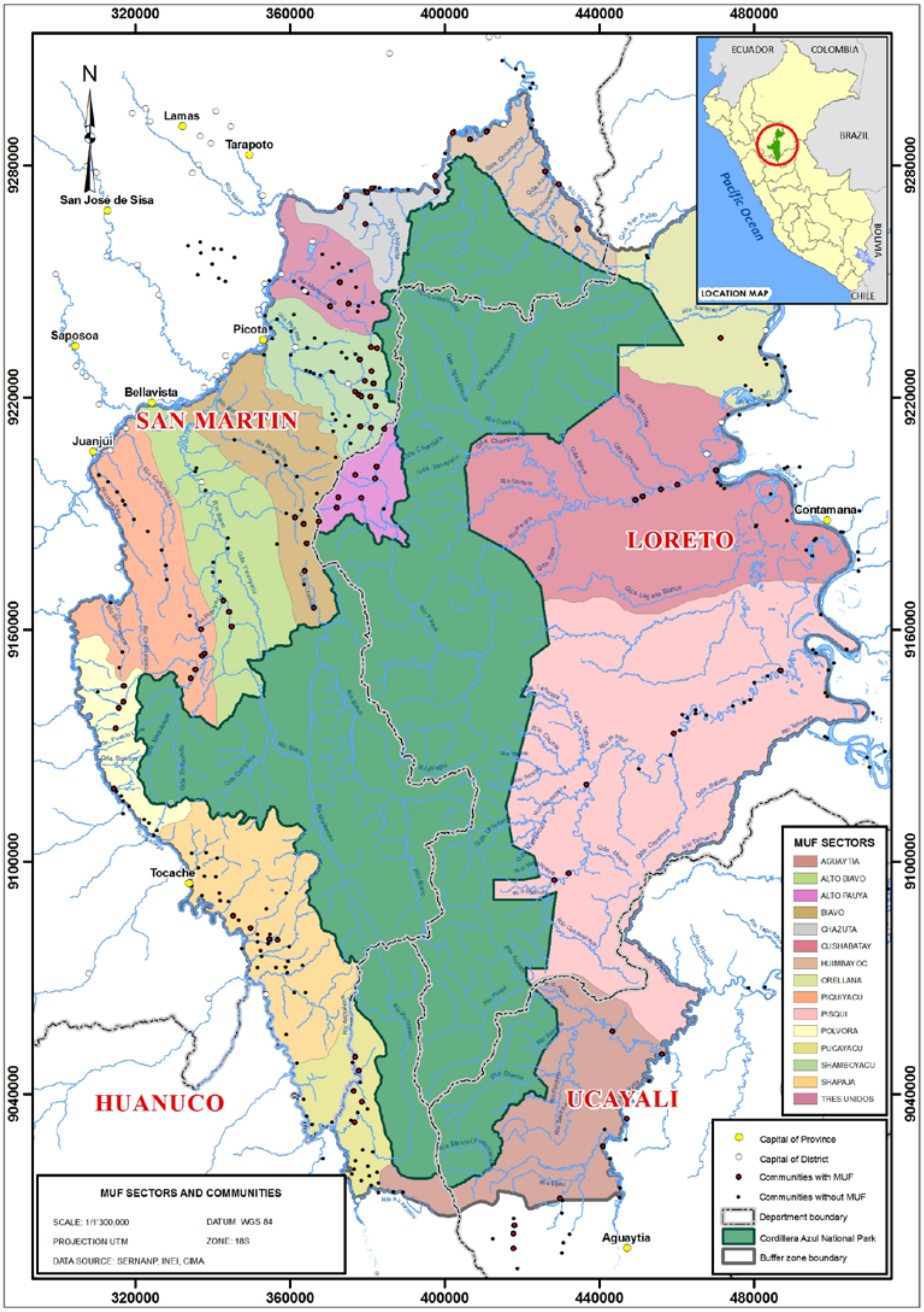
CIMA and The Field Museum initiated the Social Asset Mapping (*Mapeo de Usos y Fortalezas*-MUF) in 2003 and the program has been expanded over time to include new communities in the buffer zone. The MUF serves as a baseline as well as an important means to guide program design and to indicate entry points for working with the community. The MUF then becomes a tool to monitor the project's impacts on communities and to solicit feedback. MUFs were conducted again in 2005 and 2008. All communities within the critical areas were invited to participate. In 2003, 53 of 58 communities participated in the MUF, representing 91% of the critical-area communities, defined as communities with immediate access to the project area. In 2008, 89 communities participated in the MUF (Wali et al 2003).

The MUF process has evolved over time. For the 2003 MUF, communities elected their local facilitator. Depending on the size of the community, more than one facilitator was elected. For example, for the 2003 MUF, 53 facilitators, 5% women, were hired for the two month period while for the 2008 MUF, 345 community representatives were hired, 19% women. CIMA and The Field Museum personnel trained the facilitators and community representatives on data collection and provided information regarding PNCAZ and CIMA. In 2003, facilitators collected data on social organizations and use of natural resources over a two month period, using community assemblies and household interviews to conduct structured and semi-structured interviews. Eight focus groups were used in each community along with individual interviews: four focus groups included residents of both genders and all age groups, two focus groups included only women, one group was of community leaders, and one included only specialists or experts (e.g., the best hunters). Individual interviews were conducted with health workers, teachers, and directors of the local school if one is present, and other significant individuals like shamans, healers, and community leaders or founders. In 2008, a change was made to the process to improve data collection and workshops were held with community representatives from each geographic area. Three to four representatives from each community participated in the process to update the data from the previous MUF.

For the MUFs, data are collected on a variety of topics including community identity, migration, visions for the future, local myths and legends, resource consumption, social organization, agriculture, timber and non-timber products, and economic activities. At the end of the period, CIMA staff members collect and compile the information for analysis. Reports summarizing the digitized databases are available to the public.

CIMA staff members continually collect socio-economic data and add that information to the MUF database. The goal is for this information to be available to CIMA, the communities, local, regional, and national governments, non-governmental organizations, students, and researchers. The database is stored on CIMA's institutional server. Communities and other interested parties can ask CIMA for a copy of the data (e.g., on a CD). CIMA has organized the 2008 data (CIMA 2008, format MS Access) and put comparative data from the 2003, 2005, and 2008 MUFs in a user-friendly format.

Map 1.4: MUF Sectors and Communities in 2008



1.10.2 Demographics

The buffer zone around PNCAZ encompasses 2.3 million hectares in four political departments.

The total population of the districts around the park is approximately 321,000. District population data are used in the Plan Maestro. The actual population in the buffer zone is estimated at 180,000, with the rest of the population living beyond the buffer zone. This estimate was derived by multiplying the census population data for each district by the percent of the district's area that lies within the buffer zone.

Most of the off-site communities are on the western side of the buffer zone, along the Huallaga valley. In 2008, the number of communities in the Huallaga buffer zone was 181 and the estimated number of residents was 128,990 (72% of the total). Districts, which experienced the largest population growth rates from 1993 to 2007 were Shamboyacu (8.2%), Bajo Biavo (8.8%) and Pampa Hermosa (5.2%). Additional community information is contained in the Plan Maestro 2003-2008 (INRENA 2006) and the INEI 1993 (INEI 2002) and 2007 census (INEI 2008). Most of this growth resulted from an influx of migrants from the Andes, the northern coast, and other Amazonian regions that have experienced environmental degradation, especially with recent improvements of the main highway that traverses the length of the Huallaga River. Of these, the 94 communities and annexes who participated in the 2008 MUF (Ponce 2009) represent almost all of the communities in the "Critical areas"—with the greatest access to the park.

Among the 94 communities participating in the 2008 MUF (89 population centers and native communities listed in the report; an additional five annexes were included in the MUF but are not yet independent population centers), there are a total of 33,853 people in 7,686 families (Ponce 2009). Of these, 345 villagers and authorities were directly hired as facilitators or communicators. As seen in Table 1.2, the Sectors with the most population are Shamboyacu, Chazuta and Huimbayoc, all in the Department of San Martin. Chazuta and Huimbayoc are experiencing the greatest degree of population increase as the new sites for migrants. The lowest populations are found in Orellana and Cushabatay sectors in the East and Alto Biavo in the West.

Table 1.2: Population and number of families in the 94 communities and annexes participating in the 2008 MUF grouped by sector (Ponce 2009)

District	Population	Families
Aguaytia	2733	647
Alto Biavo	609	135
Alto Pauya	2398	548
Biavo	2864	524
Chazuta	4017	679
Cushabatay	625	123
Huimbayoc	3686	776
Orellana	126	22
Piquiyacu	935	226
Pisqui	2935	509
Pólvora	1322	411
Pucayacu	2581	718
Shamboyacu	5027	1059
Shapaja	2269	894
Tres Unidos	1736	415
Total General	**33863**	**7686**

Most Huallaga residents are *mestizo*. The only officially recognized indigenous population on the Huallaga side with land titles as a “native community” is a small Quechua-Lamista community located in the district of Chazuta.

The Ucayali buffer zone on the park’s eastern side differs markedly from the west. Here the current number of communities in 2008 is 51, and it is estimated to include 50,160 residents (28% of the total buffer zone population). The population is sparse and predominantly indigenous—principally Shipibo, with some Piro/Yine and Cacataibo groups—each group conserving its cultural identity and mother language. The use of the mother language is noteworthy, given how much traditional ecological knowledge is conserved in indigenous languages. Further, use of these native languages helps to conserve knowledge of indigenous technologies and traditional resource management practices of native communities, which often cause small impact on natural ecosystems.

Figure 1.5: Shipibo women in a typical ritual in Pisqui, Comunidad Nativa Charasmana, 2005. Photo credit: CIMA

1.10.2.1 Socioeconomic Conditions

The villagers in the park’s buffer zone are small-scale farmers who cultivate staple crops (plantains, yucca, maize) in small- to medium-sized family plots (one to five hectares), hunt and fish, and use non-timber forest products (e.g., palm fiber and fronds) to meet basic necessities (Mayer 2006). Cash comes from the sale of surplus crops and cash crops (e.g., corn, coffee, cacao), and occasional wage labor in the larger towns and cities. Resource-use maps from the 2003 MUF reveal that residents use areas in the immediate vicinity of their communities for their subsistence activities.

The degree of involvement in the market economy has fluctuated widely over time and in different regions of the buffer zone. On the Ucayali (eastern) side, involvement with the market remained low and consisted largely of barter-type exchange until the mid-1990s, when timber extraction entered the region. In 2000, the Government of Peru passed a new Forestry Law to regulate extraction processes and designate appropriate areas for timber removal. Any timber extraction outside of designated areas is now illegal. Nevertheless, with minimum resources devoted to enforcement, illegal logging was widespread in the designated park area and some Ucayali-side residents joined the logging enterprises. In general, these residents spent long hours cutting trees in remote areas, floating them downstream to access points, and then selling or trading the lumber to small-scale operators who provided chainsaws and gas for the operation. Note that CIMA and park guards, with support from local residents, removed all illegal loggers from the park by 2006.

Around 2005, a new economic activity emerged in the Cushabatay: monoculture of corn as a cash crop. Anticipation of a new road project in the region fueled this development. During the 2005 MUF workshops, participants recounted that this cash crop was fraught with problems, including the effects of infestations (parakeets “pihuicho”), and drought.

On the Huallaga side, communities have experienced cycles of boom and bust driven by different factors. A major boom came with the building of the *Marginal* Highway in the 1970s, connecting Tarapoto with Peru’s north and coast, and flanking the whole western buffer zone of the park. The road resulted in a large influx of migrants to the region. (Bernardi, R. 2005, Bernardi, R. 2005). In the 1990s, the demise of a decade of coca cultivation and subsequent turmoil in the Huallaga led to incentives by the US government for alternative development programs in the region. Vast monocultures (e.g., coffee, corn, rice) entered the valley, leading to deforestation, erosion, and deterioration of water quality. Field notes from community visits in 2002 highlighted little or no market activity for the produce grown locally, which led to wide frustration and worsening quality of life. Today the region still struggles to establish sustainable markets because the crops are not suitable for the local growing conditions.

Those living closer to the park in the Huallaga valley engage in subsistence agriculture and enjoy a self-professed better quality of life as noted in the 2005 MUF and ongoing data collection by CIMA through monthly reports from the extension team and regional coordinators. Communities in relatively intact forests closer to the park continue to value the self-sufficiency afforded by a subsistence lifestyle that is largely independent of cash and external markets. Meanwhile, communities closer to the road and farther from intact forests need ever-increasing cash to meet basic household needs.

In sum, the park’s buffer zone communities present a mixed profile with respect to socio-economic status. In general, communities closest to intact forests are able to meet roughly 90% of their basic needs with resources from the forest in the buffer zone, with minimal use of forest resources inside the park. These communities meet most of their cash needs through sale of surplus subsistence crops or through small-scale cash cropping. The data suggest that there is only a small gap in income presently in these communities – largely experienced at times of year when annual school fees must be paid, or when large festival celebrations drive up expenses, or in moments of crisis such as when a family member falls ill. (Del Campo et al. 2007, Ponce 2009, Wali 2010) These gaps can be overcome with improved land use and technical assistance to increase cash options from conservation-compatible agroforestry activities. In communities living near the road, where deforestation is prevalent and access to natural resources is low, the need for cash is greater and socioeconomic status is unstable and prone to the fluctuations of the market economy.

In social organization, the population of the buffer zone communities is similar to many of Peru’s small rural communities, combining a national form of local governance with varied patterns customized to fit specific cultural practices. Community authorities are elected for specified terms, recognized by the national government, responsible for managing village affairs and budgets and working with district and municipal authorities. Indigenous communities with officially recognized titles have an added layer of governance—a “tribal chief” (*apu*) who stands for traditional authority in the villages. More than half the communities also have a form of local “police” called self-defense committees (*rondas campesinas* or *rondas communales*) that patrol village boundaries, intervene in disputes, and maintain peace.

In addition to village authorities, communities have other strong organizations—associations of school-age parents, mothers’ clubs—through which adults engage in community improvement efforts. Other voluntary organizations include small agricultural producer associations, churches, sports clubs, and others. In most communities, families rely on mutual support networks (*choba-choba)*, in which a family calls on its support network to assist in large agricultural tasks (e.g., clearing and preparing fields for planting). These networks ensure that residents do not spend cash to hire labor, keeping expenses low. Additionally, all communities use voluntary collective labor (*mingas*) for communal tasks such as maintenance of trails and common areas and infrastructure repair (i.e., schools, health clinics, meeting halls).

Basic health and education services are limited and do not reach all of the communities and population centers in the buffer zone. Most communities do not have a health center and the few communities that do often face shortages of personnel, equipment, and medicine. Most educational centers in the districts are primary schools; secondary schools are few and located only in major population centers. This inadequate infrastructure impedes the ability of rural populations to achieve high levels of education but most have some basic primary education.

Despite the cultural diversity among buffer zone communities, the general pattern with respect to gender is fairly similar. Both men and women are deeply involved in the daily subsistence tasks of tending fields, caring for small livestock, fishing, hunting, and processing game. Men tend to have a dominant role in the political structures, although women attend communal assemblies. Women are involved in communal work.

Access to water is scarce in the sector west of the park. Water sources for human settlements originate inside the park, where they are protected. But the watersheds are affected by deforestation outside the park and most reportedly have substantially reduced flows. In the sector east of the park, where forest cover is still primarily intact, water is easily accessible. However, similar problems will affect this region if influx of colonization remains disorganized and watersheds are not protected.

A table summarizing the community characteristics is provided below in Table xx. Communities west and east of the park are grouped in two because they have similar characteristics within each group and are distinct from each other.

Characteristic	Communities East of PNCAZ	Communities West of PNCAZ
Number of Communities in 2008	51 villages (*centros poblados* and indigenous communities)	181 villages and towns (*centros poblados* and indigenous communities)
Estimated population	50,160 (or 28% of the 179,150 total for the buffer zone. Up from 49,290 in 2007)	128,990 (the total for the buffer zone is 179,150 in 2008[1] and 72%[2] is on the west flank of PNCAZ, the Huallaga valley). This is up from 126,750 in 2007.
Language spoken	• Immigrants: Spanish • Indigenous communities: Yine, Shipibo, and Kacataibo, with some Spanish	• Immigrants: Spanish • Indigenous communities: Kechua and Spanish
Immigrant or indigenous?	Mostly indigenous. Immigrants flow much more slowly into the Eastern side of PNCAZ, with the Departments of Loreto and Ucayali as the largest immigrant pools. Because of its proximity to the urban center of Pucallpa, Aguaytia has the largest rate of immigration. In the PNCAZ buffer zone, however, immigration rates are low because of the Shipibo and Kakataibo territories.	Mostly immigrants. San Martín is the region with the highest rate of immigration. In the Buffer Zone, the highest numbers in 2008 are Shamboyacu (21% of the population is migrant), Alto Pauya (17%), and Chazuta (14%)[3] The largest sources of immigration in the Buffer Zone are the Departments of Cajamarca, Huánuco, Piura, and Amazonas. People come in via the road that flanks the entire western border of PNCAZ, the *Fernando Belaunde Terry* (Olmos – Tarapoto) road. Immigrants come in primarily looking for

1 Data calculated on the basis of 320,880 people in the 33 districts encompassing PNCAZ and its Buffer Zone in 2008; and calculating the proportion of the districts' area inside the Project (PNCAZ+Buffer Zone).
2 MUF data: the west sectors have 72% of the population in the Buffer Zone, while the east ones have 28% (Ponce 2009)
3 Ponce 2009. Information from the MUF (Mapeo de Usos y Fortalezas) 2008 analysis.

		lands to farm.
Literacy level	Most of the education is primary. High-schools are available only in the larger towns. The heads of household tend to have some education (90% according the MUF data), although most of the time they have not completed primary education. High-school education is very low (20%) and anything above high school is essentially nill. The percentage of people with zero education is low. It's primarily women who get no access to education(12.3%) in comparison to men (4.6%).	
% of population with no formal education	12% of men, 17% of women	9% men, 13% women
% of population with some primary education	88% men, 83% women	91% men, 87% women.
Typical Livelihood	The population in the East is primarily indigenous, from the ethnic groups Yine, Shipibo, and Kakataibo. They live in indigenous communities and are associated with indigenous federations: FECONBU, FENACOCA, FECONACURPI. The communities have a primarily subsistence economy based on the forest's fauna and flora. There may be a low level connection with markets. The main activities are slash-and-burn plots for food crops, hunting and fishing, and some gathering of non-timber forest products. Some communities also farm animals (chickens, pigs, cows) and a few have a closer link to markets. These communities hold on to their traditions and cultures. They speak their indigenous languages, although they also know Spanish. They dress traditionally, and hold on to their traditional arts crafts and foods and drinks (e.g., masato).	The population in the West is primarily immigrant. There are a few indigenous communities, of the Kechua Lamista group, in the northwest portion of the Buffer Zone. Only MuchuckLLacta de Chipaota is recognized by the government as an indigenous community. These indigenous communities are affiliated with the indigenous federation FEPIKRESAM. The communities in the west base their economy primarily on agriculture and they are linked to the market (they do not only produce for their own consumption). The closer the community is to the road, the tighter their link to market. The Kechua Lamista maintain the indigenous norm of reciprocity ("minga"), their Kechua language and typical foods. Their colonizing culture developed closely to that of the immigrants, however. The Kechua Lamista gave rise to many of the main urban centers in the region, including Sisa, Chazuta, Pongo de Cainarachi, and Juanjuí.

1.10.3 Summary of Changes between 2003 and 2008

The MUF processes of 2003 and 2008 provide a portrait of the dynamics of change in the communities of the buffer zone of PNCAZ, aside from the demographic changes mentioned above. In terms of infrastructure, such as access to basic water, sanitation, health, and education, little changed over the five years. Most communities still lack these basic infrastructures.

Another change concerns attitudes and perceptions of the park. There is a noticeable increase in positive attitudes toward the park between 2003 and 2008. More people are aware of the park's boundaries, of the potential for traditional resource use within the park, and of the park's potential contribution to their quality of life by protecting important water and forest resources. In 2003, the MUF data indicated that although most communities were aware of the existence of the park, they only had a vague sense of its significance and had many doubts about whether or not they would benefit from the park. According to the MUF 2008 data collected from the 94 participating communities and annexes, 99 percent know of the park and 70 percent know where the park boundaries are with respect to their communities. An estimated 70 percent of the communities perceive direct benefits as stemming from the park, including: 1) more animals appearing in the buffer zone closer to their communities (37%); 2) a perception (not based on scientific evidence) of more rainfall since the creation of the park, lessening exposure to drought (15%); 3) conservation of biodiversity (9%); 4) community support from the park management team and park guards (8%); 4) provision of local employment as park guards (6%).

1.10.4 Land Use and Property Rights (CCB: G1.6, G5.2, G5.3, G5.4, G5.5)

Land within the project area is a national park owned by the national government of Peru. Land use in national parks is limited by Law No. 26834 to non-commercial activities. The park is sub-divided into four zones, each with a range of restrictions, from areas with no permitted entry to ones that permit traditional and low-impact uses (INRENA 2006). With SERNANP, CIMA developed criteria for land use based on the history of traditional use and fragility of the land and then implemented programs to patrol and enforce the designated uses.

As described in Section 1.10.1.1, there is a possibility that an uncontacted group of Kakataibo resides in or near the park, which led to the development of the intangible zone that permits no entry or use by anyone other than the Kakataibo in voluntary isolation. CIMA worked extensively with Kakataibo tribal leaders and the Peruvian government to identify the greatest possible range of these people when defining this intangible zone. Park guards, communal park guards and extension team personnel all receive training regarding how to respect the rights of these people to remain uncontacted and the best ways to react if contact accidentally happens in the buffer zone. Any attempts to locate these people in voluntary isolation, to ask them for permission to develop a REDD project, would directly violate their right under Peruvian laws and the international agreements signed by Peru as described in Section 1.11 to remain uncontacted. However, through the efforts discussed, CIMA has taken every possible measure to ensure that the project design allows no project activity in any way to encroach on these people. In fact, the activities in this region are designed specifically to allow the uncontacted peoples to conduct their lives as they wish, with zero interference from outsiders.

In late 2000, when CIMA's predecessor organization APECO and The Field Museum were preparing the documents necessary to establish Cordillera Azul National Park, they partnered with Conservational International (CI). CI retained a law firm in Peru to research land ownership and claims in the area so that boundaries for the park could be designed to avoid any private properties inside. Due to an oversight, ownership claims filed in the district of Loreto were not investigated. As a result, the park was established with some private parcels, 1,227 hectares, inside the park boundaries. CIMA reached agreements with all 21 landowners to limit land-clearing activities in the park. Although there are no permanent residences in the park, the project will not claim any avoided deforestation credits for these areas.

When the project began, only one area inside the park continued to be incompatible with conservation: an estimated 220 hectare, cattle ranch on the southwest corner of the park that had not been detected when the park was established. Once it was detected, the cattle rancher was asked to leave the park (Carta Multiple Nº 002-2006-INRENA-IANP-PNCAZ/J) since he did not own the land. In a response letter, the rancher offered not to expand his operations and to help keep watch for illegal uses of land within the park (Carta de respuesta y compromiso del 18 de febrero de 2007), since he was there prior to the development of the Park. SERNANP and CIMA agreed to this and allowed the rancher to remain under these terms because he had been there prior to the Park's establishment. Just prior to the start of the project, monitoring demonstrated that the cattle rancher has expanded his operations in violation of his agreement. CIMA is working with SERNANP to develop a plan for legally relocating the rancher to suitable, already cleared land in the buffer zone. The legal process will be handled by MINAM and will work through the Peruvian legal system to ensure that the cattle rancher obtains appropriate legal representation in the proceedings.

The Peruvian government has assigned rights or designated areas in the buffer zone for various uses including forestry concessions, petroleum lots, mining concessions and community lands. While the area assigned for a specific use is clearly delineated, designated lands often overlap with each other. The majority of people in the buffer zone do not legally own their land. They are squatters who live and work on land owned by the national government. These overlapping concessions and squatters lead to conflict when all try to work the same land. One of the project priorities is to work with the communities in critical areas where roads or rivers provide access into the park to establish community boundaries, obtain land tenure for residents, lessen land erosion, and strengthen interest in conservation and sustainable land use. The communities in critical areas and other areas of priority in the buffer zone have had extensive interaction with CIMA as described in Sections 1.10.2 Demographics, 6.1 Net Impact on the Community, 7.1 Stakeholder Involvement in Project Design, and 6.2 Community Monitoring.

The buffer zone includes a mosaic of land uses, including old-growth forests, secondary forests or abandoned agricultural fields (*purmas* or secondary vegetation), pastures, agricultural lands, and community lands. Land uses differ markedly in intensity and expanse between the eastern and western sides of the buffer zone. To the west of the project area in the Huallaga River valley, most forest has been cleared and pastures and croplands dominate the landscape. To the east of the project area in the Ucayali River valley, much old-growth forest remains standing and agricultural lands are primarily small, individual family plots.

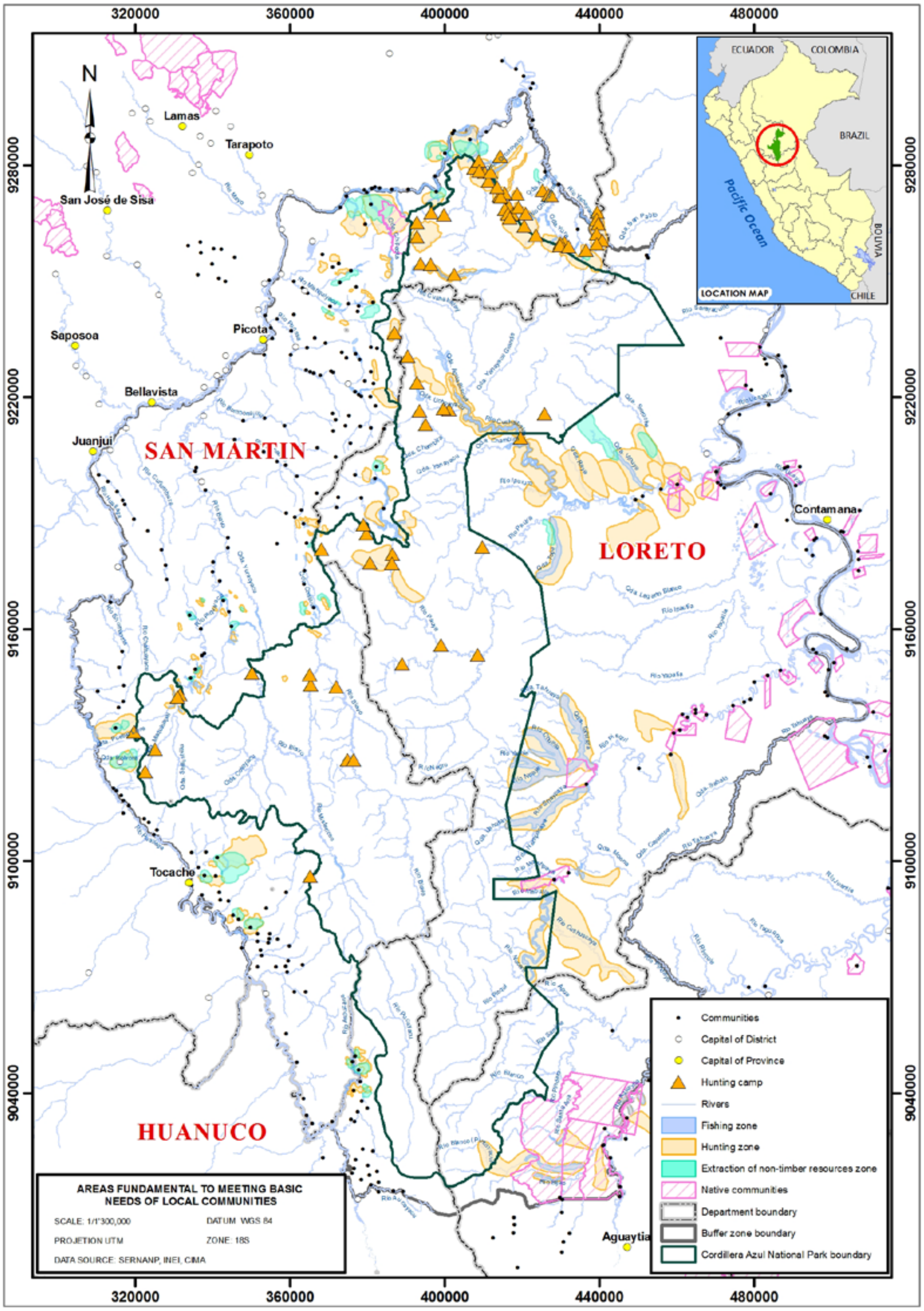
Hunting is mainly a subsistence activity and, along with fishing, provides a major source of protein for people living in the buffer zone. Hunting is more frequent in the dry season, when it is easier to track animals in the forest. It is primarily a male activity that is done individually or in small family groups. The migrant population that settles in the area is not used to eating bush meat and does not hunt often. The main species hunted in the buffer zone are paca (*Agouti paca)* and white-lipped peccary (*Tayassu pecari)*. Depending on the size of the prey, bush meat is eaten fresh or it is salted, smoked and distributed to the community for consumption. In some instances, the meat may be used as a form of payment within the communities.

Fish is a very important protein source for the local population, particularly on the eastern side of the park. Fishing is conducted primarily for consumption using traditional methods like nets. There may be limited use of poisons or explosives for fishing but these methods are banned in many areas because of negative impacts on the rivers and streams. Fishing is usually an individual activity although at certain times of year it may be done collectively. The most important species for consumption are bagres (large Pimelodid catfishes), boquichico (*Prochilodus nigricans*), carachamas (*Chaetostoma* spp. and other Loricariids), doncella (*Pseudoplatystoma fasciatum*), lisas (*Leporinus* spp.), sábalos (*Brycon* sp., *Salminus* sp.), mojarras (*Astyanax* spp., and other Characids), fasaco (*Hoplias malabaricus*), and bujurqui (*Bujurquina* sp. and other Cichlids).

Another activity in the buffer zone is harvesting of non-timber resources, such as resins, fibers, dyes, and other materials. These are primarily used for making houses (e.g., palm fronds), handicrafts (e.g., piazaba and seed of huayruro), or traditional medicines (e.g., sangre de grado and Cat's Claw).

A map depicting the locations of areas important to meeting the needs of the local communities is provided below.

Map 1.4a: Areas fundamental to meeting the basic needs of the communities in 2008



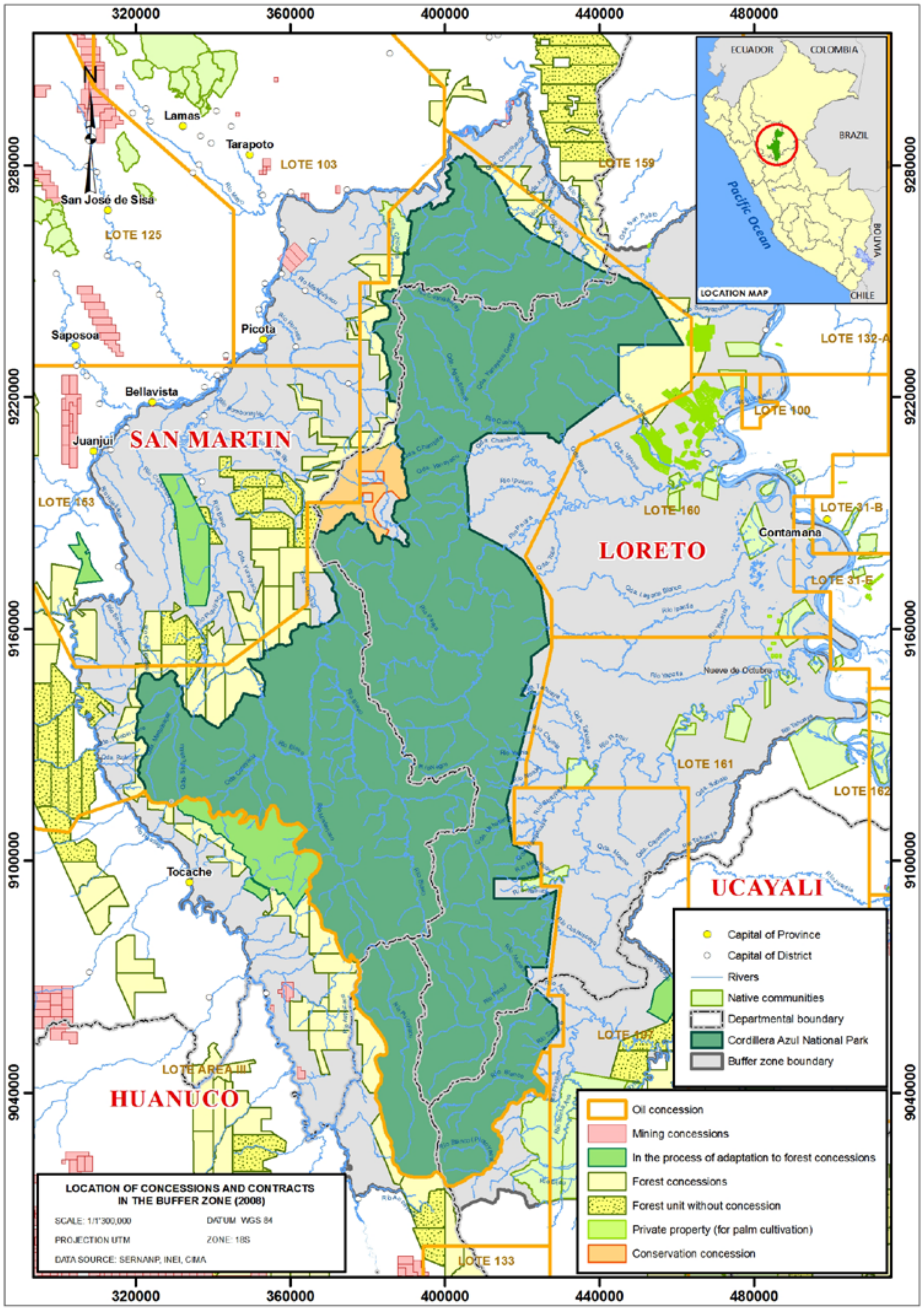
Agriculture has changed with increased migration into the area. Villages closest to the park still reflect the traditional agriculture of slash-and-burn, growing coffee, corn, fruit, and cacao and maintaining pastures. The use of technology is low, the food produced provides for the families, and excess crops are sold.

As populations increase in the buffer zone, conditions change and agriculture intensifies. Incoming families are predominantly from mountain regions of the Andes where the styles of farming are very different. These families view farming as a commercial endeavor, and have had no experience with the climate and soils in this area. Many programs promote large-scale agriculture of a single product, like coffee, rice, or corn. The monocultures often lead to severe land erosion and degradation and crop vulnerability to pests. Although several products are marketable – plantains, various fruits, cacao, coffee, rice, and corn – access to large markets varies in relation to where the community town center is located, and is too expensive to be economically viable if the town is not near major roads.

Ranching or livestock-raising has increased in the last five years, spreading from isolated ranchers to an activity that almost every community undertakes to some degree. Ranching is small scale with little mechanization and technical assistance, reducing its profitability. Cattle are the primary livestock, followed by sheep and pigs. Horses and donkeys are raised for transporting cargo.

Logging is another economic activity in the buffer zone. Timber species most commonly extracted in the concessions are lupuna (*Ceiba pentandra*), copaiba (*Copaifera reticulata*), tornillo (*Cedrelinga cateniformis*), moena (Lauraceae family) and occasionally cedro (*Cedrela odorata*, *Cedrela fissilis*), mahogany (*Swietenia macrophylla*), and cumala (*Virola* spp., *Iryanthera* spp.). Map 1.5 shows the locations of timber, oil and mining concessions approved by the government of Peru.

Map 1.5: Locations of concessions and contracts in the buffer zone (2008)



1.10.5 Biodiversity (CCB: GL3.1)

PNCAZ protects a large, intact expanse of lower-montane forest remaining in Peru. Besides encompassing a wide range of habitat types— from lush lowland forests, to stunted vegetation on the rugged sandstone ridges, to elfin forests on the mountain tops—and rare geologic formations such as the Vivians, the park offers intact forest cover from the lowlands at 150 meters to mountain peaks at 2,400 meters. The park protects an eastern outlier of the Andes that has been isolated for a sufficiently long period for massive speciation to occur.

Most knowledge of the project area's impressive biodiversity and endemism comes from a Rapid Biological Inventory (RBI) led in 2000 by scientists from The Field Museum with Peruvian counterparts. Full documentation of the findings of the inventory is in Alverson *et al*. 2001. The highlights are provided here. Appendix 2 contains a table of the endemic, endangered, and threatened species within the project area, as classified by the following entities: IUNC Red List, CITIES, and the Peruvian government's lists per Decreto Supremo N° 034-2004-AG.

<u>Plants</u>—The park contains a variety of different habitats and life zones which is further described in Section 1.9.3 Vegetation. Plant communities vary spatially in the park, and among and within these general habitat types. In 2000, RBI scientists estimated a total of 4000 – 6000 plant species in the park, with at least 12 likely new to science registered in the inventory, along with new records for Peru and hundreds of range extensions. PNCAZ has an extraordinary richness of palms: the 45 species found in the park represent 43% of the palm species known in Peru, including at least two species new to science or newly registered for Peru in 2000.

<u>Mammals</u>—Richness and uniqueness of terrestrial fauna also contributes to the biological importance of the park. During the 2000 three-week inventory, RBI scientists observed 71 large mammal species including bush dogs, spectacled bears, 10 species of primates, and enormous herds of white-lipped peccaries. The sheer abundance of large mammals in the park is as striking as the richness of mammal species. Subsequent inventories in the montane forests (not including bats) increased the list to 91 species and the current projection is more than 120 species total (Alverson 2001 and Luna 2005).

<u>Birds</u>—Bird diversity is pronounced, with more than 600 species registered for the small portion of the park that has been inventoried (Alverson 2001; Dasmahapatra et al. 2006). Total richness should exceed 800 species between PNCAZ and the buffer zone. Broadly speaking, forest birds in PNCAZ can be divided into three components: 1) those restricted to lowland forests, including floodplain forests (along rivers and large streams) and old river terraces, at elevations below 300-500 m above sea level; 2) those that occur in slope forests, including hills and ridges from approximately 300 to 1000-1100 m; and 3) those in crest forests -- tall cloud forests or mossy, short, and spongy forest, elfin forests, or high-elevation shrublands (~1100 m and higher). The biogeographic patterns of bird species from hill and crest forests in the park appear to be complex: some of the most characteristic birds of Andean hill forests seem to be absent from the park or present in low numbers, whereas poorly known and spatially constricted species are common at one or more sites. One species—the Scarlet-banded Barbet (*Capito wallacei*)—is known from a single range of cloud forests in PNCAZ.

<u>Amphibians and Reptiles</u>—The herpetofauna of the park represents a mix of species typical of both montane and lowland forests, and of northern and central Peru. The 2000 inventory registered 58 species of amphibians and 26 of reptiles, these numbers undoubtedly underestimate the total number of amphibians—particularly frogs—since the RBI was conducted during the dry season when few species are calling and active. Subsequent inventories have taken the totals to 70 amphibians and 41 reptiles, with more than 110 species in total (Alverson 2001 and Martinez 2008). The higher slopes and crests are particularly important habitats, as are small, upper elevation streams and ravines.

<u>Fishes</u>—Aquatic environments of the park include streams, rivers, lagoons, and swamps. Inventories to date have confirmed more than 175 species (Alverson 2001, Hidalgo et al 2004, Hidalgo et al. 2006, Meza 2008); total richness should be more than 250 species. The fish community is particularly rich in species of Characiformes and Siluriformes. Many species encountered in the inventory were endemic,

rare, or poorly known, often with conspicuous adaptations to life in clear, fast-flowing waters. Several large migratory fishes also make use of habitats in the park for spawning.

Around PNCAZ, between the Huallaga and Ucayali rivers, lies the buffer zone covering an area of over 2.3 million ha, with an altitude range of 100 to 1,200 meters. On the west side of PNCAZ, the buffer zone is quite affected by human activities. There are still some intact forests in the basin headwaters near the limits of the park and high hills. In these forests there are stands of commercial timber species such as tornillo, ishpingo, and others. To the east of PNCAZ, the buffer zone maintains large tracts of forest with commercially valuable timber such as bolaina, tornillo, ishpingo, estoraque, Lupuna, shihuahuaco, moena and others, in addition to the existence of about 10,700 hectares of wetlands (MINAG 2004). Also, the wildlife in these forests is very representative of the lowland biodiversity in the north-central part of Peru.

1.10.6 Endemism and Unique Species (CCB: GL3.1)

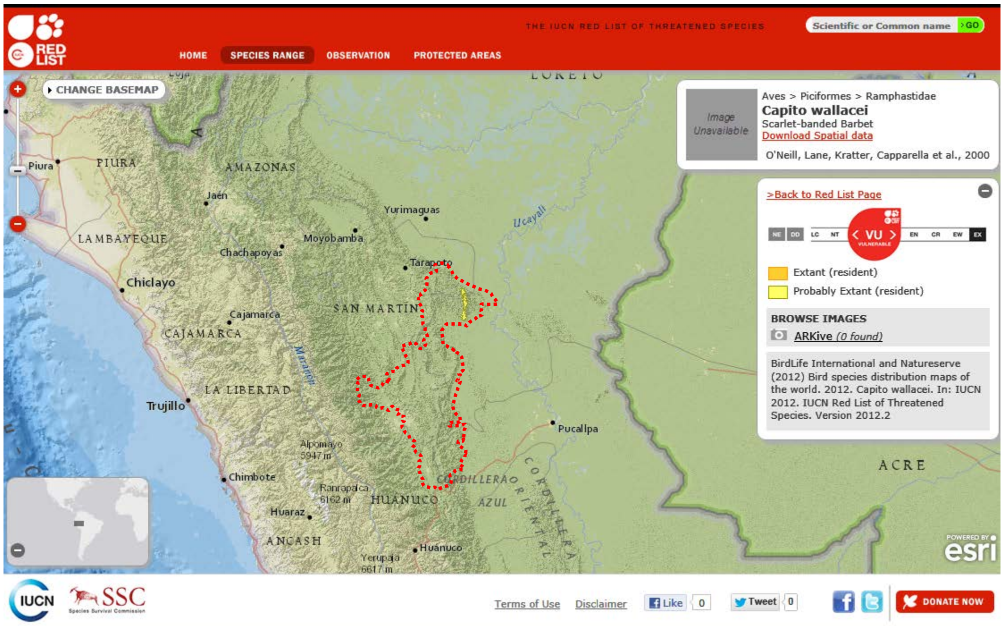
PNCAZ offers remarkable opportunities for protection of large numbers of endemic and rare species in all groups of organisms sampled in the Rapid Inventory—vascular plants, fishes, amphibians and reptiles, birds, and large mammals. The park also harbors many range-restricted species and unique assemblages of species.

Plants - At least 12 species of plants likely new to science were recorded during the Rapid Inventory along with several new records for Peru and hundreds more that were range extensions. A list of all plant species identified during the inventory is included in Alverson *et al.* 2001. Rapid Inventory scientists also found plants with unusual biological features or behaviors, including more than 20 species that have obligate mutualism with ants. At least five tree species, all in the genus *Tachigali*, show evidence of monocarpy (i.e., flowering only once in their life, then dispersing seed and dying). Large, commercially valuable species—such as mahogany (*Swietenia macrophylla*) and tropical cedars (*Cedrela odorata, Cedrela fissilis*)—are now very rare and have nearly vanished from riparian and river floodplain areas due to selective harvesting elsewhere in the tropics.

Large Mammals - The fauna of PNCAZ includes several endemic and rare mammals. Of the 71 species registered in 2000, 12 are of international concern because of their global rarity—three species of monkeys—Spider monkey (*Ateles chamek*), Woolly monkey (*Lagothrix lagotricha*), and Saki monkey (*Pithecia monachus*)—and nine other mammals are listed in CITES: Spectacled bears (*Tremarctos ornatus*), Neotropical otters (*Lontra longicaudis*), Giant river otters (*Pteronura brasiliensis*), Tapirs (*Tapirus terrestris*), White-lipped peccaries (*Tayassu pecari*), Jaguars (*Panthera onca*), Bush dogs (*Speothos venaticus*), Giant anteaters (*Myrmecophaga tridactyla*), and Giant armadillos (*Priodontes maximus*). The inventory team also found a likely new species of squirrel (*Microsciurus* “oscura”). Two species, the water opossum (*Chironectes minimus*) and the short-eared dog (*Atelocynus microtis*) are rare.

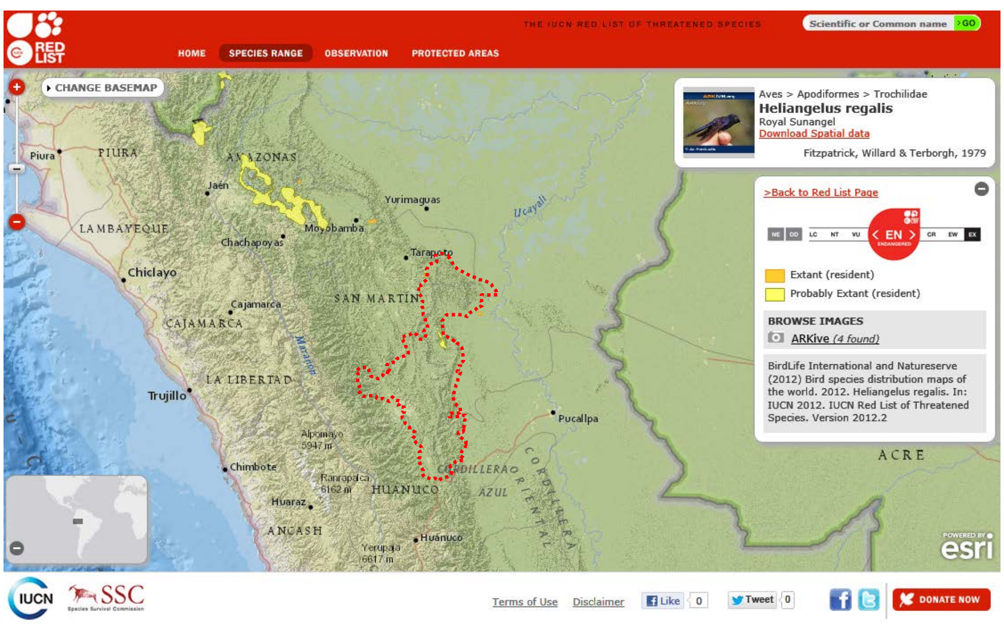
Birds - The park’s stunted forests seem to be the center of distribution of three endemic, very poorly known species of birds—the Scarlet-banded Barbet (*Capito wallacei*) (O'Neill et al. 2000), Bar-winged Wood-Wren (*Henicorhina leucoptera*), and Royal Sunangel (*Heliangelus regalis*). The park also protects large populations of big gamebirds—threatened by hunting throughout their range: the Spix’s Guan (*Penelope jacquacu*), Blue-throated Piping-Guan (*Pipile cumanensis*), Wattled Guan (*Aburria aburri*), and importantly, the Razor-billed Curassow (*Crax tuberosa*), which is particularly vulnerable to local extinctions.

Scarlet-banded Barbet (*Capito wallacei*): locally fairly common in humid Montano forest in the northeast of the Cordillera Azul (1300-1550 masl) (Schulenberg et al. 2010), at the east bank of the upper Río Cushabatay, 77 km west-north-west of Contamana in Loreto. The ridge is long (>50 km) and narrow (O'Neill et al. 2000) and, in spite of searches at suitable elevations in the adjacent Cordillera Azul, this species remains known only from Peak 1538 (D. Lane and T. S. Schulenberg in litt. 2000), currently Cerro Cinco Puntas.



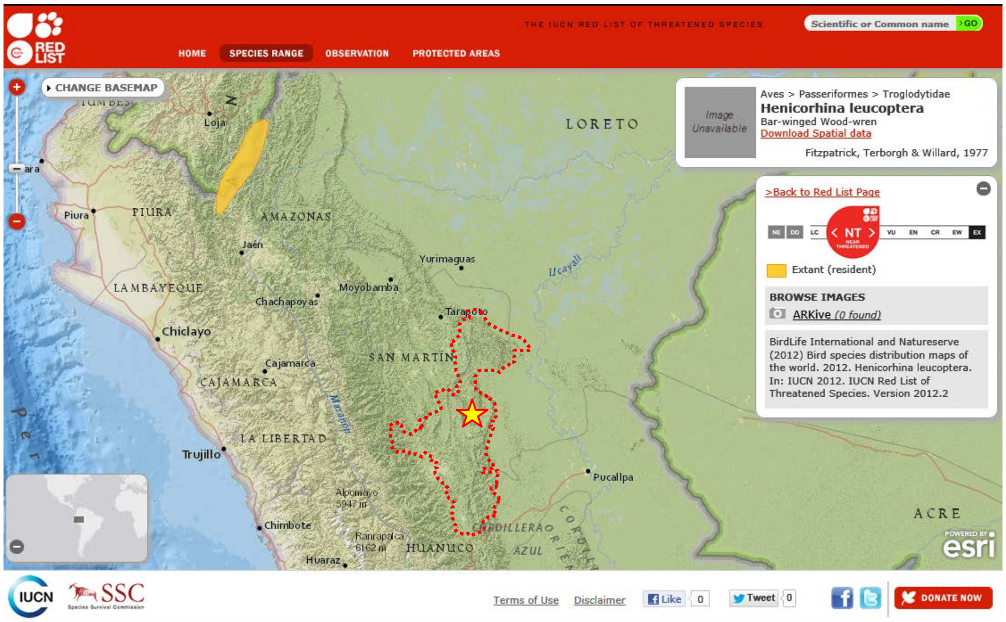
Fuente del mapa: http://maps.iucnredlist.org/map.html?id=160030236

Bar-winged Wood-Wren (*Henicorhina leucoptera*): very local species, in isolated mountain chains, especially in low stature forests, such as those of sandy soils and poor nutrients, altitudinal range between 1350-2600 msnm (Schulenberg 2010); has a very restricted range in north Peru (La Libertad, San Martín, on the Cordillera del Cóndor in Cajamarca, with a single record from Amazonas) (Ridgely and Tudor 1989, Schulenberg and Awbrey 1997, Clements and Shany 2001) and extreme south Ecuador (the north end of the Cordillera del Cóndor [Krabbe and Sornoza 1994]). It was recorded in mountains of the Pauya camp during the RBI 2000. Although its habitats are reasonably intact (Schulenberg and Awbrey 1997), this species has a small, apparently disjunct range, with elfin forest in the south of its range readily accessible from the páramo and clearly vulnerable to grazing and burning (Stattersfield et al. 1998).



Fuente del mapa: http://maps.iucnredlist.org/map.html?id=106006980

Royal Sunangel (*Heliangelus regalis*) fairly common, but irregularly distributed in patches. Restricted to humid forests of low stature and shrubby areas, usually in sandy soils and rocks of sandstone, in isolated mountains; altitudinal ranges between the 1350 – 2200 masl. This species is now known from eight areas in northern Peru – Amazonas, San Martin, Cajamarca y Loreto) and south-eastern Ecuador (Graves et al. 2011). San Martín (Davis 1986); the río Chipaota valley in the Cordillera Azul, San Martín (Merkord et al. 2009); and the río Pauya valley in the Cordillera Azul, Loreto (Schulenberg et al. 2001). In San Martín occurs the more striking johnsoni, recently described subspecies from a specimens collected at Pauya, Loreto, is as yet only known from the Cordillera Azul (Graves et al. 2011).



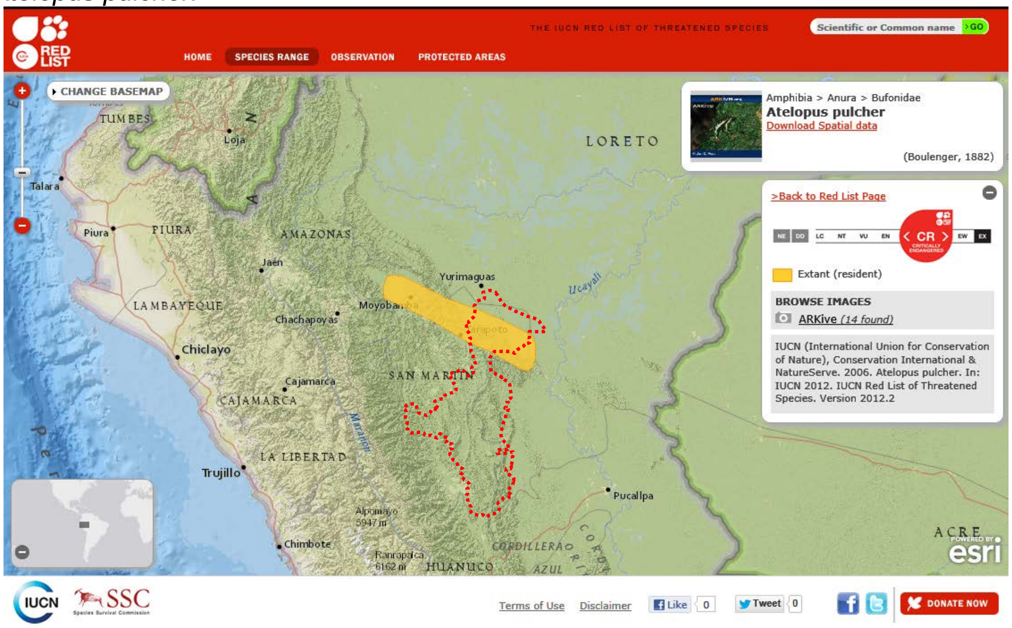
Fuente del mapa: http://maps.iucnredlist.org/map.html?id=106006980

Reptiles and Amphibians - In terms of reptiles and amphibians, the park protects the habitat of a rare salamander (*Bolitoglossa sp.*), and several species of endemic, new, or geographically restricted frogs in the genera *Pristimantis (Eleutherodactylus in RBI)* and *Ameerega* (*Epipedobates* in the inventory report).

It is worth noting that the *Atelopus pulcher* frog is a species considered by IUCN as Critically Endangered (CR) species. This species has a restricted range in the Andean foothills of Amazonian slope of the eastern Andes of northern Peru in the regions of Amazonas and San Martin (lotters et al. 2002). So far, few data are known natural history of A. pulcher and there are records of his disappearance in some localities of San Martín[4] (lotters et al. 2005).

[4] One of the main causes of the decline of amphibians in the Neotropical region is chytridiomycosis, caused by the fungus Batrachochytrium dendrobatidis, linked primarily to the rapid disappearance of many species of Atelopus (La Marca et al. 2005). Chytridiomycosis is often the only explanation for the disappearance of Atelopus frogs in pristine places like national parks, where habitat destruction, pollution and overfishing are not possible (La Marca et al. 2005).

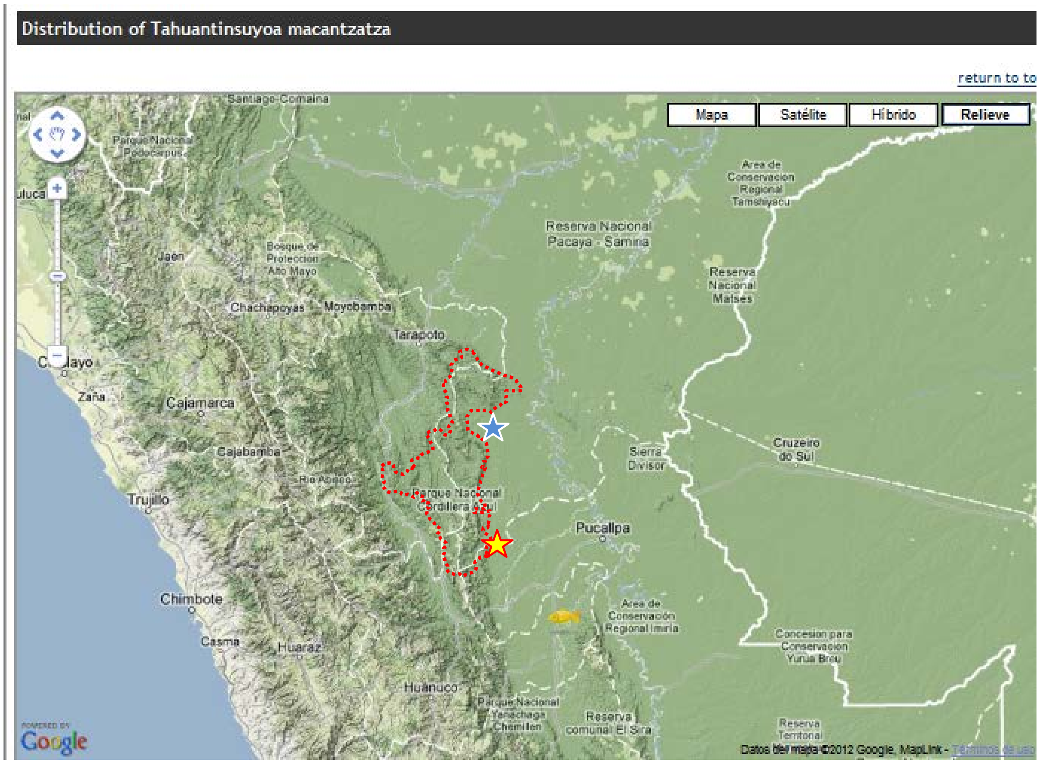
Atelopus pulcher.



Fuente del mapa: http://maps.iucnredlist.org/map.html?id=54544

<u>Fishes </u>- Streams and rivers draining the park contain unique species assemblages of fishes, particularly in headwater areas (Weber et al. 2002, Rengifo 2007 and Lujan et al. 2010). In the 2000 inventory, scientists recorded 22 new species for Peru and ten probably new to science. Some examples are *Hipostomus fonchii*, a new species recorded during the RBI, and restricted to the Cushabatay River Basin, *Tahuantinsuyoa macantzatza* which is restricted to the Aguaytia basin and its tributaries, and the *Crossoloricaria Pisqui* (Alverson 2000).

Map of the distribution of the *Hipostomus fonchii* (blue star) y *Tahuantinsuyoa macantzatza* (yellow star)



Fuente del mapa:
http://www.fishwise.co.za/Default.aspx?TabID=110&GenusSpecies=Tahuantinsuyoa_macantzatza&SpecieConfigId=231800#distribution

Fishes in headwater areas are adapted to life in shallow, fast-flowing water. Aquatic habitats in the park also provide spawning areas for migratory species, including large species consumed by riparian human communities: *Colossoma macropomum* (gamitana), *Piaractus brachypomus* (paco), *Prochilodus nigricans* (boquichico), *Brycon cephalus* (sábalo cola roja), *Brycon melanopterum* (sábalo cola negra), *Salminus affinis* (sábalo macho), *Pseudoplatystoma punctifer* (doncella), *Zungaro zungaro* (zúngaro), large Loriicarids (carachamas), and *Potamotrygon spp.* (rays), among others.

Table 1.3: Numbers of species observed, estimated, and new to science in the project area through 2008

Taxa	Observed in the Rapid Inventory	Total Observed (Rapid and Other Inventories to 2008)	Estimated for the Region	New to Science since 2000
Plants	1600	> 1600	6000	>12
Fishes	84	176	200	> 15
Amphibians	26	> 70	210	7
Reptiles	58	41		0
Birds	575	> 600	800	1
Mammals	71	91	120	1

1.10.7 High Conservation Values (HCVs) (CCB: G1.8)

PNCAZ protects critically endangered, globally important biodiversity. The project area includes High Conservation Values (HCVs), as outlined by the CCB Project Design Standards and described in detail by the High Conservation Value Resources Network (http://hcvnetwork.org). The Tropical Andes—encompassing parts of Venezuela, Colombia, Ecuador, Peru, and Bolivia—harbor extraordinary biological diversity and concentrations of endemic species that span various plant and animal groups. The 45,000 plant and 3,400 vertebrate species known from the region represent roughly 15% and 12% of the world's plant and vertebrate[5] diversity, respectively. Colonization and intensive agriculture have led to a substantial loss of habitat and today many Andean species are threatened or endangered. When compared with other global biodiversity hotspots (e.g., Myers et al. 2000), the Tropical Andes are among the top five most likely to experience greatest loss of species in the future as a result of deforestation and climate change (Brooks et al. 2002; Malcolm et al. 2006).

The sandstone ridges of the project area hold an outstanding example of the endangered, lower mountain ecosystem of the Andes. The mountain and lowland complex also encompasses a remarkable array of other habitats, including jagged peaks with nearly vertical slopes jutting a mile above the surrounding lowlands; tall, lowland forests that grade into elfin forests, shrublands, and meadowlands on ridges and crests; an unusual, high-altitude assemblage of wetlands; and isolated lakes amidst eroding towers of red rock. The project area protects a unique set of biological communities, many of which are endangered.

The unusual geological formations with acidic soils, the large number of unique species and species assemblages, and the abundance of game birds and large mammals, all point to the high conservation value of the project area. Importantly, the project area protects the entire, contiguous range of biological communities from dwarf vegetation at the mountain crests to the tall rainforests along lowland rivers. The project area is a rare assemblage of undamaged headwaters and nearly entire watersheds that still encompass intact ecological regimes, including pollinators and seed dispersers in a matrix large enough to include adequate population sizes for uncommon species. The sheer size of the project area allows it to function as a source and genetic refuge for game animals and for commercial tree species that are exploited to extirpation elsewhere in the Andes/Amazon.

[5] Excludes fishes.

Table 1.4: High Conservation Values in PNCAZ based on guidelines from the High Conservation Value resource network (http://hcvnetwork.org)

Category	Examples	PNCAZ	Comments / Examples
HCV 1: Areas containing globally, regionally or nationally significant concentrations of biodiversity values			
1.1 Protected areas	National parks, reserves	YES	Sections 1.10.4, 1.11.1 (Project area is a national park)
1.2 Threatened and endangered species	Species vulnerable to habitat loss, hunting, disease, etc.	YES	Appendix 2
1.3 Endemic species	Species found only in particular areas	YES	Appendix 2
1.4 Critical temporal use	Breeding sites, migration sites , migration corridors, globally important seasonal concentrations of species	YES	Sections 1.10.5, 5.1.2 (Part of the biological corridor for birds (e.g. altitudinal migrants: Swifts (*Steptoprogne* spp.), austral migrants: Swallows and Martins (Hirundinidae), Flycatchers (*Contopus, Elaenia, Myarchus, Myodinastes*, etc.), Masked Yellowthroat (*Geothlypis aequinoctialis*), Red-eye Vireo (*Vireo olivasceus*) and northern migrants: Canada Warbler (*Wilsonia canadensis*) and others), Breeding sites for migratory fishes from lowland areas (e.g., *Brachyplatystoma*, *Pseudoplatystoma*, *Salminus*, *Prochilodus*), Large mammals (e.g., Jaguar that has enormous home ranges and require extensive forests and connecting corridors; Spectacled Bear that need several elevational ranges for food at different times of year)
HCV 2: Globally, regionally or nationally significant large landscape-level areas where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance			
2.0 Large landscape-level areas	Viable populations of most (all) naturally occurring species	YES	Section 1.10.5
HCV 3: Areas that are in or contain rare, threatened or endangered ecosystems			
3.0 Rare, threatened or endangered ecosystems	Forest ecosystems that are rare	YES	Sections 1.9, 1.10.5
HCV 4: Areas that provide basic ecosystem services in critical situations (e.g., watershed protection, erosion control)			
4.1 Forests critical to water catchments	Vegetation that helps maintain water quality and prevent flooding	YES	Section 1.12.5.1, 1.9

4.2 Forests critical to erosion control	Vegetation that helps maintain slope stability	YES	Section 1.12.5.1, 1.9
4.3 Forests as barriers to destructive fire	Forest that reduce risk of fire to larger areas	NO	
HCV 5: Areas fundamental to meeting basic needs of local communities (e.g., subsistence, health)			
5.0 Forests critical to subsistence needs	Communities obtain essential fuel, food, fodder, medicines, or building materials, without alternatives	YES	Sections 1.10.1, 1.10.2, 1.10.4, 1.12.5.1
HCV 6: Areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities)			
6.0 Forests critical to communities' cultural identity	Provides values without which a local community would suffer unacceptable cultural change or has no alternative	YES	Sections 1.10.1, 1.10.2, 1.10.4 (noncontacted indigenous people and buffer zone communities)

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks (CCB:G2.2,G4.5,G5.1)

CIMA is committed to meeting or exceeding any regulation, standard, treaty, or international agreement that may cover its activities.

The only regulation that affects the project area is the regulation establishing the national park and appropriate uses (*Supreme Decree No. 031-2001-AG*). The project exists to enforce these regulations and is therefore in compliance with them. CIMA continues to monitor new or changing regulations to identify any that may affect the project area.

Many laws exist that govern activities by organizations and communities in the buffer zone. CIMA does not have authority to enforce any regulations in the buffer zone. Enforcement of these laws by the proper authorities is rare and is discussed further in Section 1.11.2. None of CIMA's activities in the buffer zone are governed by these regulations but the laws are included for completeness to show what laws are in place.

<u>About the use of natural resources in the buffer zones of natural protected areas (ANP):</u>
The ***Constitución Política del Perú*** establishes in its *artículo 68°* that the State is required to promote the conservation of the biological diversity in the natural protected areas.

Ley de Áreas Naturales Protegidas: Ley Nº 26834

Artículo 25o.- Buffer Zones are those adjacent to a nationally protected area that, because of their nature and location, require special treatment to guarantee the conservation of the protected area. The Plan Maestro of each area will define the extension of the buffer zone. Activities in the buffer zone should not threaten the natural protected area (ANP).

Reglamento de la ley de Áreas Naturales Protegidas: Decreto Supremo Nº 038-2001-AG

Artículo 4º.- About Buffer Zones

Activities in the buffer zone should not threaten the objectives of the ANP; both public and private entities should recognize the special provisions of the buffer zone.

Artículo 62º.- Activities in the buffer zone of ANPs

62.1 The following activities are encouraged in the buffer zone: ecotourism; management and restoration of flora and fauna; habitat restoration; agroforestry projects; issuance of Private Conservation Areas, Conservation Concessions, Concessions for Environmental Services; other activities that promote protection of the ANP.
62.2 The Plan Maestro establishes the criteria for implementing the activities in 62.1.

Artículo 63º .- Forestry activity in the buffer zones of ANPs

For concessions, permits, and authorizations of forestry activities to be approved by INRENA (now SERNANP) in buffer zones, the activities must previously have an opinion issued from Headquarters, based on the existing regulations and the approach laid out in the Plan Maestro. Land-use planning in the buffer zone should incorporate the special considerations given the goal to make the buffer zone compatible with effective protection of the ANP.

Ley Forestal y de Fauna Silvestre and its Reglamento: Ley Nº 27308 y Decreto Supremo Nº N° 014-2001-AG. These also are relevant since they establish specific means for use of timber and non-timber forest resources, and for the establishment of timber and non-timber concessions in appropriate regions (which include ANP buffer zones).

Artículo 64°.- Environmental Impact Assessments (EIA) of activities in the buffer zone

EIA and Programs of Environmental Management and Adjustment (Programas de Adecuación y Manejo Ambiental –PAMA) are required for activities that will alter the state of renewable natural resources (including water, soil, flora, and fauna) in buffer zones of ANPs, and must be reviewed by regional authorities and receive a favorable opinion from INRENA (now SERNANP).

Ley del Sistema Nacional de Evaluación de Impacto Ambiental, Ley Nº 27446 and its Reglamento, approved by Decreto Supremo Nº 019-2009-MINAM. These also are relevant.

Artículo 44º.- Technical opinions
To evaluate requests (Solicitud de Clasificación) without undue delays, the proper authorities can request technical opinions from other experts to be considered in the reply. The official response must address all expert opinions, explaining why they were or not heeded.

When the request is for activities inside the ANP or in its buffer zone, the proper authority must solicit a technical opinion from SERNANP (Servicio Nacional de Áreas Naturales Protegidas por el Estado).

Artículo 53º.- About technical opinions
When the competent authority desires, it can request expert opinion to review the EIA (the project solicitor can then be asked for as many copies as necessary of the plan under evaluation). Experts should comment only within their area of expertise. The competent authority will consider all expert opinions in making its decision.

In case the project or activities are inside an ANP or its buffer zone, SERNANP must be review the project and give a favorable opinion before it can move forward.

About the baseline of environmental studies:
The baseline should address characteristics of the specific site where activities will be conducted, along with a definition of the areas to be affected—directly or indirectly—at the micro and macro levels. To the extent that they are affected, the following elements must be included in the report: (1) description of the location, extension, and timeframe of the project, (2) identification of the area influenced directly or indirectly by the project and definition of the impact, (3) studies of macro and micro locations, (4) position of the project relative to a nationally protected area or its buffer zone, if relevant. Determination of the area of influence will be allowed or modified by the competent authority when the terms of reference are issued.

Artículo 88°.- Management of natural resources in ANPs and their buffer zones
All necessary measures must be considered by the State, so that the use of natural resources in ANPs and their buffer zones do not undermine the protection of these resources and of environmental services; INRENA (now SERNANP) must first give a favorable opinion for the activity to move forward.

Articulo 116°.- Proceedings for Oil and mining activities
Associated with the DECRETO SUPREMO Nº 003-2011-MINAM that modifies Artículo 116° and establishes the following:

Artículo 1.- Modification of artículo 116 of the Reglamento de la Ley de Áreas Naturales Protegidas, approved by Decreto Supremo number 038-2001-AG.

Change of artículo 116 del Reglamento de la Ley de Áreas Naturales Protegidas, which becomes the following:

Artículo 116.- Issuance of Compatibility and of a Favorable Technical Opinion
The soliciting entity—national, regional, or local—must receive from SERNANP a statement of compatibility with protection activities, as well as a favorable technical opinion to move forward with the proposal if the activities are to take place in an ANP.

116.1. The issuance of Compatibility is the binding technical opinion that consists of an evaluation of the activity's impact on the conservation of a nationally protected area or

regionally protected area, according the category of protection, zoning, Plan Maestro, and objectives for creation of the ANP.
The compatibility of the activity with a national ANP's buffer zone will depend on the specific ANP. Compatibility issuance will also include the general guidelines as well as the legal and technical conditions to operate in the ANP and its buffer zone.
SERNANP will issue its opinion within 30 days of receiving the solicitation.

116.2. The favorable technical opinion is the binding technical opinion that consists of evaluating the environmental management unit of the activity to be done inside the ANP or its buffer zone, based on the viability of the unit. The unit will only be approved upon a favorable technical opinion from SERNANP. SERNANP will issue its favorable or negative opinion within 30 days of receiving the request. SERNANP also will be requested to review the terms of reference and will issue its opinion within 15 days of receiving the request.

116.3. Independently of the previous articles, the appropriate authorities should recognize the following:
a) Rights granted to appropriate entities should be previously coordinated with the ANP Headquarters and communicated to them.
b) Activities related to operation—such as access of personnel, transport of hazardous substances, and others—inside a national ANP or its buffer zone, or inside a regional ANP, must be coordinated previously with the ANP headquarters or with the Gestión de las Áreas Naturales Protegidas - DGANP, to put in place the appropriate measures.
c) Reports on controlled activities, supervised by appropriate entities, must be copied to SERNANP

<u>About legislation that protects indigenous peoples in isolation or initial contact</u>

Ley Nº 28736 para la Protección de Pueblos Indígenas u Originarios en Situación de Aislamiento y en Situación de Contacto Inicial (Law for the protection of Indigenous peoples in isolation or initial contact):

Art. 2º Categorization.-

A group of humans is recognized as Indigenous Peoples in Isolation or Initial Contact. To validate that category, a study must be undertaken by a Multi-sectoral Commission, presided by the Instituto Nacional de Desarrollo de Pueblos Andinos, Amazónicos y Afroperuanos – INDEPA and formed by the Defensoría del Pueblo, representatives of the regional and local governments, two Anthropology faculty members from Peruvian universities (one public, one private), and by others as determined by law. The study must be able to prove that the group exists and must provide some estimates of the size of its population and the lands the group uses.

Art. 4º Rights of the peoples in isolation or initial contact

The State guarantees the rights of indigenous peoples in isolation or initial contact, recognizing the following obligations:

a. Protect their lives and health, primarily with protective actions given their vulnerability to diseases;
b. Respect their decision in relation to the rest of society;
c. Protect their culture and ways of life, recognizing their special, spiritual relationship with their habitat as part of their identity;
d. Recognize their right to the lands that they occupy, restricting the entry of foreigners into their lands. The lands that they inhabit shall be theirs if they decide to establish contact and live sedentary lives;
e. Guarantee their free access to extensive use of their lands and natural resources for their traditional activities and existence; and
f. Establish indigenous reserves over the lands that they use, until they voluntarily decide to seek contact

Regulations of the Ley Nº 28736, approved by Decreto Supremo Nº 008-2007-MIMDES.

Establishes that the peoples in isolation or initial contact are entitled to the rights established by law and the national and supranational norms, being allowed to use the natural resources inside indigenous reserves without interference of outsiders – be they indigenous or not. Isolated peoples will remain so until they voluntarily decide to seek contact.

Ministerial Resolution Nº 797-2007-MINSA, that approves the Guía Técnica: Relacionamiento para casos de interacción con Indígenas en Aislamiento o en Contacto Reciente.

The technical guide aims to prevent situations that threaten the life or health of isolated indigenous peoples through accidental contact – violent or not – prescribing the adequate behavior in case of such contact.

Ministerial Resolution Nº 798-2007-MINSA, that approves the Guía Técnica: Atención en Salud a Indígenas en Contacto Reciente y en Contacto Inicial en riesgo de alta morbimortalidad.

This technical guide addresses how to minimize risk for peoples in initial contact.

Ministerial Resolution Nº 799-2007-MINSA, that approves the NTS Nº 059-MINSA/INS-CENSI: Norma Técnica de Salud: Prevención, Contingencia ante el Contacto y Mitigación de Riesgos para la Salud en escenarios con presencia de indígenas en aislamiento y en contacto reciente.

This technical health norm explains what to do in case there are sightings of contact with isolated peoples and how to act with respect and minimize health risks. The norm focuses on human rights and especially rights to life and health. It attempts to minimize any possible contact.

International Agreement Regarding Non-contacted Peoples

Convention 169 from the International Labor Organization (text below from the ILO internet site http://www.ilo.org/indigenous/Conventions/no169/lang--en/index.htm)

"Convention No.169 is a legally binding international instrument open to ratification, which deals specifically with the rights of indigenous and tribal peoples. Today, it has been ratified by 20 countries (including Peru). Once it ratifies the Convention, a country has one year to align legislation, policies and programmes to the Convention before it becomes legally binding. Countries that have ratified the Convention are subject to supervision with regards to its implementation."

Legal and Other Requirements Relating to Biodiversity

Red List of endangered species and other threats category - IUCN Red List (http://www.iucnredlist.org/search/search-expert)

Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES (http://www.cites.org/eng/app/appendices.shtml)

Peruvian law (Supreme Decree No. 034-2004-AG).

1.11.1 Worker Regulations

CIMA abides by and exceeds its obligations to workers based on laws, providing all social and health benefits established by law.

In Peruvian law, workers are categorized by their type of work and different rights are given to different categories of work or types of contract (e.g., full-time vs. part-time staff, hourly vs. salaried). Salaries are based on a scale approved by CIMA's board of directors, and minimum regional salaries are considered in defining the pay scale. CIMA has a *Reglamento Interno de Trabajo* that regulates internal human resource issues. In addition, staff has their internal Reglamento document that provides general information, guidelines, and defines expectations.

In addition, CIMA has volunteers in protection activities. CIMA offers a small 'incentivo' for the time of work and specific activity. Communal park guards fall under this category. The volunteers are not staff and do not receive staff benefits; the relationships is purely of volunteerism and of learning through the activities. The communal park guards are members of the villages in the buffer zone and they work alongside the official park guards. CIMA provides these volunteers with training, equipment, and food for their rotations of up to two months.

In addition to the staff available to CIMA, the institution enters into contracts with selected consultants, allowing CIMA to meet its commitments to PNCAZ. As appropriate, CIMA complies with all tax obligations that relate to these contracts.

Specific regulations regarding worker rights include:
1. Current Constitution (Art.25) Workshop, resting right, regulating compensation.
2. D.S. N ° 003-97-TR, Competitiveness Act and Labor Productivity. (a) promoting job training and education of workers; (b) Provide transfer of persons engaged in urban and rural areas of low productivity and income to other more productive activities, (c) Ensure the incomes of workers and protection against arbitrary dismissal; (d) Unify works procurement rules and strengthen existing social benefits.
3. D.S. N ° 007-2002-TR Amended Text of Legislative Decree. Act No. 854 Workshop, Modification by Law No. 27,671.
4. D.Leg. No. 910, General Law on Labour Inspection and Labor Defense
5. D. Leg. No. 728 Ley de Fomento al Empleo

1.11.2 Regulatory Additionality

CIMA's agreement to support the management of the park was a completely voluntary action; there was no regulatory obligation. Because of resource limitations, it is almost certain that the Peruvian government would not have designated PNCAZ as a national park if an organization had not been willing to fund and manage the park. Additional background regarding the creation of the park is provided in Section 2.5, Additionality.

In the absence of this REDD project, the intense deforestation surrounding PNCAZ would overwhelm any weight that a national park designation carries when it is only a "paper park" and the intact forests of the park would succumb to fragmentation and deterioration. When the park was established, there were large-scale illegal logging settlements operating in the park. These operations were all removed from the park peacefully, in coordination and collaboration with surrounding communities.

In addition, the regional governments' resources are severely strained, especially given the rapid, large influx of immigrants. There is currently insufficient capacity to ensure awareness of and adherence to national, regional and local laws in the buffer zone. Without the project, land-use zoning and tenure processes would be limited to nonexistent and illegal activities would seldom be reported to the correct law enforcement authorities by community members

1.12 Ownership and Other Programs

1.12.1 Proof of Title (CCB: G5.2, G5.3, G5.4, G5.6)

All land in PNCAZ belongs to the Peruvian government, by order of its designation as a national park, except for 1,227 hectares located in the northeast portion of the park that were privately owned prior to the park's formation. The privately held areas are not included in the project area and are discussed further in Section 1.10.4, Land Use and Property Rights. The branch of the government responsible for national park oversight is the Servicio Nacional de Áreas Naturales Protegidas (SERNANP), a special technical agency of Ministerio del Ambiente (MINAM). SERNANP was created in May 2008. The branch of government formerly responsible for national parks was Instituto Nacional de Recursos Naturales (INRENA).

Upon CIMA's formation in 2002, the organization signed an agreement with INRENA to support the management of the park. The agreement granted CIMA responsibility for developing and implementing the Plan Maestro in coordination with INRENA, as outlined in the November 13, 2002 inter-institutional agreement. The agreement was renewed for one-to-two year terms until August 8, 2008 when CIMA and INRENA signed a 20-year full management contract under the Peruvian Protected Areas legislation (a law passed on July 4, 1997 with its supporting regulation passed on June 26, 2001). When SERNANP was formed, it ratified the management contract with CIMA.

The Peruvian government gave CIMA the right to develop an avoided deforestation carbon project for the park in 2008. The 2008 management contract includes legal authorization for CIMA to use revenues from the sale of carbon credits from avoided deforestation for park activities for the 20-year term. CIMA's exclusive right to sell carbon credits from the project is further documented in a letter from the Peruvian government dated December 30, 2009. Copies of the relevant contracts and documentation will be provided to the validator.

The Field Museum has been providing technical support to CIMA and collaborating in the management of the park and its buffer zone since before CIMA was founded. For this project, The Field Museum has the authority to act on CIMA's behalf to develop the project documentation, manage the validation and verification of the avoided deforestation carbon project and to provide advice on the sale of the carbon credits generated. This authority was initially outlined in a Memorandum of Understanding between the two organizations and was later formalized in a contract. A copy of the contract will be provided to the validator.

The project will not encroach on other lands as the project activities are restricted to the project area and the buffer zone. Every attempt has been made to ensure that project activities will not encroach upon the uncontacted Kakataibo people that may be living in or near the park as was described in Section 1.10.4. The cattle rancher located inside the park has violated his agreement with SERNANP and CIMA that allowed him to remain inside the park. Further information regarding the rancher is provided in Section 1.10.4.

1.12.2 Emissions Trading Programs and Other Binding Limits (CCB: CL1.5)

The avoided emissions from this project will not be used for compliance purposes in a regional or national compliance program or to demonstrate conformance with a binding limit on GHG emissions. Neither Peru nor regional or local governments have established a national target, a compliance program or a cap and trade system.

1.12.3 Participation under Other GHG Programs (CCB: CL1.5)

This project is only seeking registration under the VCS and CCB programs. CCB does not issue carbon credits and the project is not seeking to register credits with any other program.

1.12.4 Other Forms of Environmental Credit (CCB: CL1.5)

This project has not and will not seek to generate any other form of environmental credit.

1.12.5 Projects Rejected by Other GHG Programs

This project has not been rejected by any other GHG program.

1.13 Additional Information Relevant to the Project

1.13.1 Eligibility Criteria

This is not a grouped project so no eligibility criteria are required.

1.13.2 Leakage Management (CCB: CL2.2)

Leakage will be mitigated through the project activities conducted in the buffer zone. These activities focus on engaging local communities and other stakeholders in the management and financial sustainability of the park, building local capacity for sustainable land use and improving the quality of life in the buffer zone communities. Details of these project activities are provided in Section 1.8. Leakage is further discussed in Section 3.3.

1.13.3 Commercially Sensitive Information

The contracts between CIMA and the Peruvian government, the contract between CIMA and The Field Museum and the details of the project's financial plan are commercially sensitive information. These documents will be made available to the validators but will not be made publicly available.

1.13.4 Risk Assessment (CCB: G3.5)

The risk analysis has been conducted in accordance with the Verified Carbon Standard, AFOLU Non-Permanence Risk Tool Version 3.1 dated February 1, 2012 (VCS Non-Permanence Tool). Risks were assessed over a period of 100 years in accordance with the Tool's requirements. The overall risk rating is calculated using the formulas included in the Tool and the criteria for each subsection. The overall risk table summarizes the scores for each sub-section and presents the total risk. The Non-Permanence Risk Report details the analysis and is included in Appendix 3.

Table 1.5: Overall Risk Rating Table (Summary from Appendix 3)

Risk Category	Rating
a) Internal Risk	0
b) External Risk	0
c) Natural Risk	3
Overall Risk Rating (a + b + c) = 3	

The Overall Risk Rating is 3. Per the requirements of the tool, the project will use 10 for its risk rating since that is the lowest rating allowed.

Additional risks to the project not included in the VCS risk assessment include the following issues. CIMA has worked and will continue to work actively to mitigate these potential threats as detailed below each risk.

<u>Concessions in the buffer zone</u> – The Peruvian government has granted timber, mining, and oil concessions in the buffer zone. Not all of these concessions are active but the concession owners do have the right to use the land. While these concessions are not in the park directly, they pose a risk to the park. Threats to the park may result from illegal operations in or misuse of the concessions, resulting in deforestation or pollution within the park and displacement of immigrants who move closer to or into the park, increasing pressure in the area.

Mitigation strategy: CIMA will continue to build relationships and work closely with local, regional, and national government entities to monitor concession activities. In addition, CIMA will raise awareness of laws and regulations in the communities to enable community members also to monitor and report illegal activities to the proper authorities.

<u>Lack of land tenure in the buffer zone</u> – As discussed several times in this document, most individuals in the buffer zone do not own their land. This results in immigrants having only weak ties to a specific location and no motivation to remain as erosion and soil depletion occurs, when instead they move to a new location. This advancing agricultural frontier presents one of the most severe threats to the park as waves of immigrants advance their deforestation and erosion-provoking practices closer to and eventually well into the park.

Mitigation strategy: CIMA will work to train local community members in sustainable land-use practices; to facilitate land-tenure processes; to ensure constant communication with as many communities as possible, and to strengthen and improve the quality of life in the communities. Many of the specific activities will be further defined once the regional meetings with communities have taken place to allow communities to provide their input into the design process.

Illegal activities in the buffer zone – Illegal activities in the buffer zone place additional deforestation pressure on the park by increasing deforestation in the buffer zone and pushing immigrants closer to and eventually into the park.

Mitigation strategy: CIMA will raise awareness of laws and regulations in the communities to enable communities also to monitor and report illegal activities to the proper authorities. Because many illegal activities are driven by a need for additional resources, CIMA will work to train local communities in sustainable land-use practices; to facilitate land-tenure processes; to ensure constant communication with as many communities as possible, and to strengthen and improve the quality of life in the communities (as mentioned above).

Increased tensions between communities CIMA is initially working with and those that will be worked with in the future – There is a possibility that communities not located in the critical areas will become jealous of the communities that have received priority. On the one hand, this would indicate a major success in that jealousy will only arise if CIMA's activities are perceived as having value and improving the quality of life for buffer zone communities. On the other hand, increased tensions might be a negative issue and may pose a risk to the project if raids or land grabs occurred as a result. For example, some communities may become jealous of others who have been formally granted land tenure or zoning.

Mitigation strategy: CIMA will work to ensure constant communication with as many communities as possible to identify and address concerns as quickly as possible and to institute a strong, proactive communication program and complaint-resolution process. CIMA will never be able to work with all communities simultaneously but these measures will assist communities in understanding the priority-setting process and to be able to voice concerns.

1.13.5 Further Information (CCB: G2.4)

1.13.5.1 Ecosystem Services

Ecosystem services provided by mountain landscapes such as those of PNCAZ are essential to the well-being of local communities. These services can be grouped into three main categories: provisioning services, regulating and supporting services, and cultural services (Millennium Ecosystem Assessment 2005). Table 1.6 summarizes the ecosystem services provided by the project area. This table is based on the methodologies used in the Millennium Ecosystem Assessment Reports, considered best practice for these types of assessments. A team of professionals from CIMA and The Field Museum reviewed MUF data and biodiversity data to ascertain the services provided by the park. Professional judgment based on the available data was used to rank the importance of each service. Selected services are discussed in greater detail below.

Intact vegetation in PNCAZ affords multiple benefits to neighboring communities. Supply of clean water to human settlements in the buffer zone is largely guaranteed by PNCAZ. Streams that originate in the park are the principal source of water for crops, animal stock, agriculture and ranching operations and domestic uses. Intact vegetation cover in the park is essential to maintain water quality in downstream areas by reducing erosion and sedimentation upstream. Clean streams provide a safe environment for fish, an important protein source for buffer zone communities. In addition, the park provides a protected area for game species, which are often overhunted in the buffer zone. Individuals from healthy populations in the park migrate into the buffer zone where they become available to local hunters.

The park protects landscapes important for the traditional cultural identity of indigenous people. For example, Shipibo peoples from the Pisqui region periodically enter the park on traditional walks in search of salt (APECO 2001). The salt is used for direct consumption and to salt meat for longer term storage. PNCAZ is also a migration and communication route among indigenous communities in the Pisqui and Aguaytía river basins.

In addition, the Lost World lagoon is an important cultural location for the MuchukLLacta and in general for all of the Chazuta (Lamista Quechua). This is an almost inaccessible lake of tectonic origin in the northern portion of PNCAZ. The route from the Chipaota community and around the lake is a place of abundance for hunting, but is used only on special occasions during traditional festivals.

The Manashahuamana Mountains in Pisqui are an important spiritual location for the Shipibo communities. In the Shipibo language, "manashahuemana" means turtles (Alverson 2000). The Shipibo use this name because the impressive peaks of the Cordillera chain line up like turtles on a log (Vivian formations). Additionally, this area provides the entry point for the traditional Shipibo salt walks discussed earlier. Individuals from Nuevo Eden travel from here to a salt dome that is located two days from the community. According to tradition, they cannot hunt or fish along the way, as "Roni" (Mother Earth) would become angry: "If someone was hunting or fishing in the high Pisqui, the river rose to turn the boat of the offender, punishing his disobedience with his life." While this tradition is no longer necessarily believed, it is still widely known and respected. (APECO 2001).

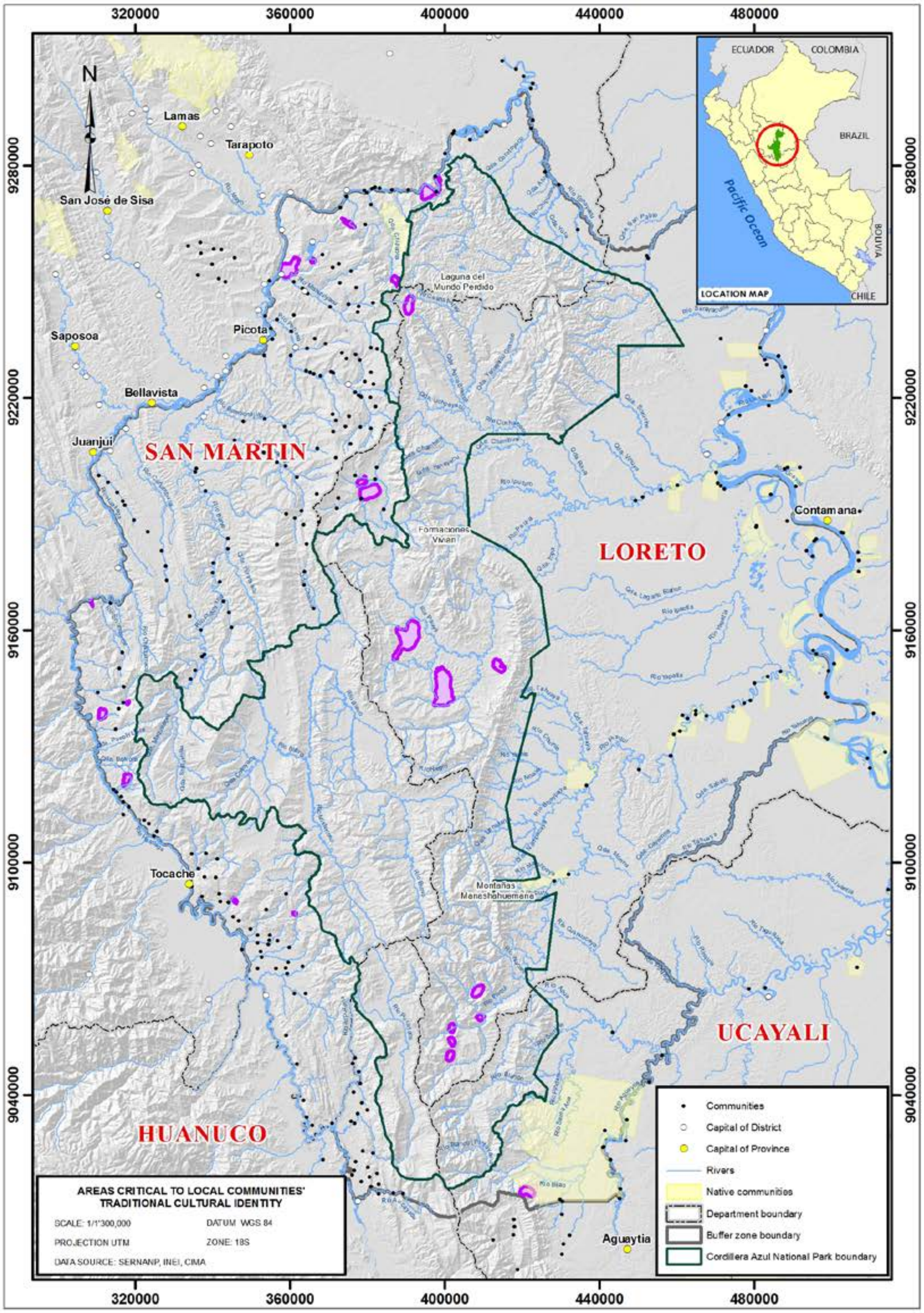
Map 1.6 shows the locations of these landscapes.

Table 1.6: Examples of ecosystem services provided by PNCAZ to local communities

Ecosystem	Provisioning Services				Regulating and Supporting Services			Cultural Services		
	Freshwater	Non-timber forest products	Food	Wild harvest medicinal plants	Carbon storage	Down slope safety	Floodplain and soil fertility	Recreation	Spiritual and sacred values	Biodiversity (Sense of place)
Rivers and streams	+++		+++			++	+++	+	+++	+++
Mountain forest	++	++	+	+	+++	+++	++	+	++	+++
Hill forest	++	++	+++	++	+++	+++	++	+	++	+++
Alluvial forests	++	+++	+++	+++	+++	+	+++	+	+++	++
Mauritia palm swamps	++	+++	++		+++		+++		++	+

Key: + Relevant ++ Important +++ Very important

Map 1.6: Areas important to the traditional cultural identity of the communities in 2008



Ecosystem services provided by the park extend well beyond the buffer zone to the larger Amazon basin. Riparian forests and soils in the upper reaches of the Huallaga and Ucayali basins encompassed by PNCAZ are critical sources of organic matter, sediment, and nutrients to downstream areas. Scientific research has shown that these Andean inputs strongly influence the ecology and biogeochemistry of the mainstream Amazon River (McClain and Naiman 2008). Many fish species of importance to commercial and subsistence fisheries in the Amazon Basin—*Prochilodus*, *Pseudoplatystoma*, *Salminus*—migrate to the eastern streams of PNCAZ to spawn (see photo of *Pseudoplatystoma punctifer*) (Araujo-Lima et al. 2007, Ortega et al. 2008 and Ortega et al. 2001).

Figure 1.6: *Pseudoplatystoma punctifer.* Photo taken in August 2009 at the Río Ushpayacu. Photo credit: Jorge Luís Martinez, CIMA

1.13.5.2 Index of Conservation Compatibility (ICC)

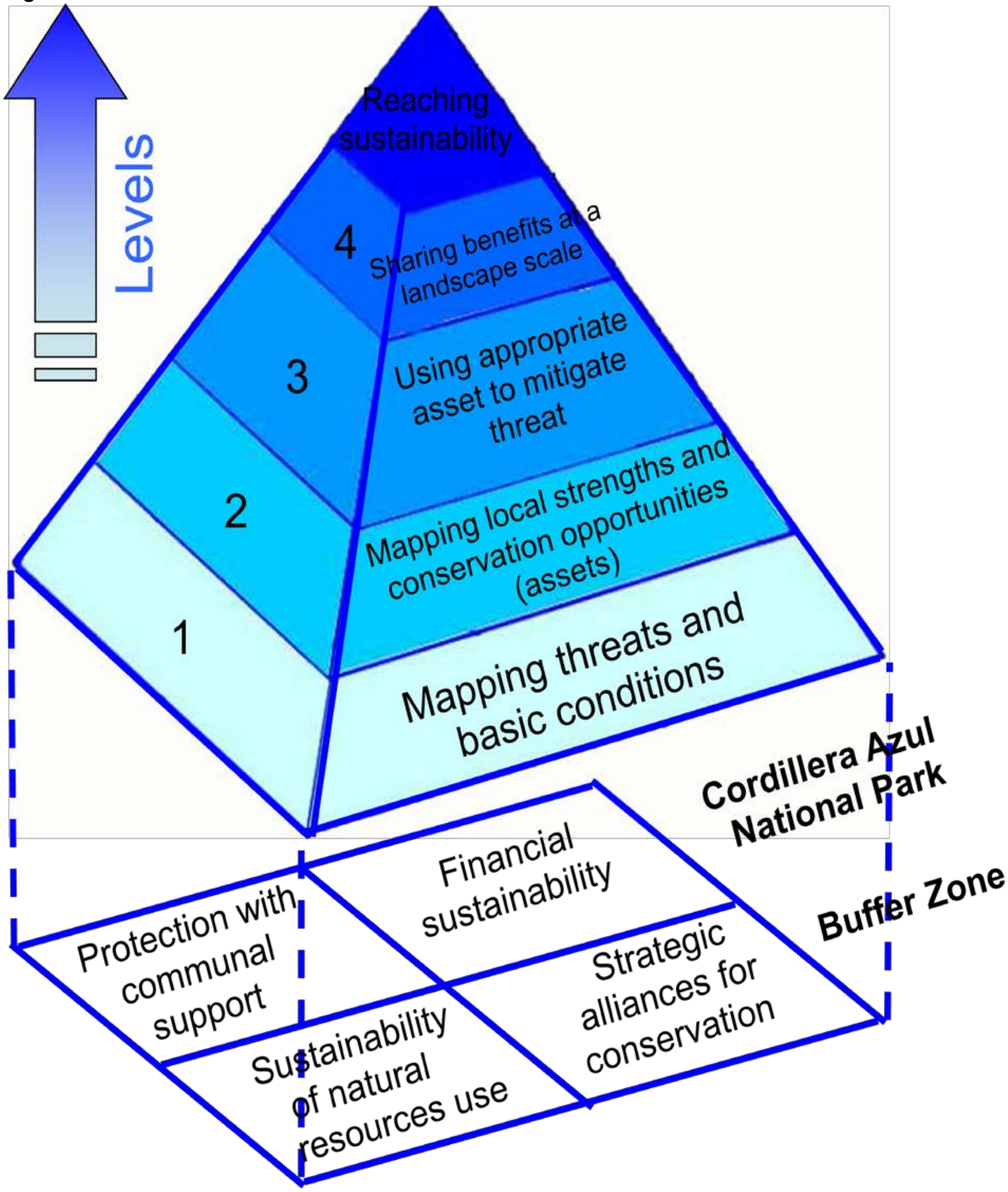
The Field Museum, CIMA, and USAID developed the Index of Conservation Compatibility (ICC) as a planning and monitoring tool (Pequeño 2007). The ICC guides management activities and measures success or failure, based on geo-referenced information gathered in the field and synthesized onto maps. The ICC is a composite measure of cultural assets, quality of human life, threats to cultural and biological diversity, operational (on the ground) and institutional mechanisms, and biological diversity. The index has six levels, each denoting an incremental state of conservation success and providing a recipe for reaching the next level. Holding the ICC together is a system of information management that allows CIMA to scale across geography and across levels of organization. Because the ICC is spatially based, the tool successfully depicts the heterogeneity of a site, showing areas of progress and areas of setbacks.

The ICC is a results framework and evaluation scheme that integrates across disparate activities, keeps a sharp focus on the vision of intact wilderness with sustainable livelihoods, and guides planning for maximum efficiency of limited resources on a large landscape. The ICC capitalizes on the capacity of GIS to integrate field-collected data to reflect the management status of lands inside and outside the park. This framework is instrumental in guiding and organizing the project's activities: it shows different levels of progress in different sections of the landscape and allows CIMA to react quickly to new threats and assets.

Ecological monitoring should be a sustainable, iterative process for measuring progress toward conservation and management goals. Successful monitoring should allow the project's managers to evaluate whether the conservation actions are having the desired effect on threats to human communities, biodiversity, and the project. This ideal, however, is rarely if ever reached. Management decisions often must be made fast, even if adequate information is unavailable. The ICC is designed as a practical answer to the ideal monitoring program. The individual hectare-block in the area of focus becomes the unit of measure. Each hectare is assigned a level of conservation compatibility, according to overall defined parameters as explained below in Figure 1.7.

The ICC integrates across the varied programs, is visual and easily updatable, and portrays the differences in level of achievements, threats, and opportunities across the landscape of interest. As the ICC approach is improved, the ICC maps become as useful for evaluating progress toward conservation goals as for planning future actions and correcting the project's course midstream. The ICC allows CIMA to define spatially specific goals. The index allows the field team to track overall results easily and regularly throughout the year, for timely adjustments or modifications of plans and activities as needed (for example, when results are not reached even though all activities have been successfully completed; or when massive new threats or significant new opportunities appear and affect all other activities).

Figure 1.7: The levels of the ICC



2. APPLICATION OF METHODOLOGY (CCB: G2.3, CL3.1)

2.1 Title and Reference of Methodology

Two standards were used in developing and documenting this project: Verified Carbon Standard (Verified Carbon Standard, Version 3, 2011) and Climate, Community and Biodiversity Project Design Standards, Second Edition (CCBA 2008). This PD follows the VCS documentation template. Citations for the CCB Standard are provided in parentheses next to each section heading for simplified cross reference.

The methodology used to quantify the avoided emissions is the framework and component modules of the modular REDD methodology VM0007 REDD Methodology Modules, Version 1.3 approved 20 November 2012.

This project uses the following modules and tools:

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

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”, v1.0

BL-UP “VMD0007 Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation”, version 3.1

LK-ASU “VMD0010 Estimation of emissions from activity shifting for avoided unplanned deforestation”, version 1.0

E-BB “VMD0013 Estimation of greenhouse gas emissions from biomass burning”, version 1.0

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

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

X-UNC “VMD0017 Estimation of uncertainty for REDD project activities” version 2.0

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

T-BAR “Tool for AFOLU non-permanence risk analysis and buffer determination”, version 3.1

T-SIG CDM “Tool for testing significance of GHG emissions in A/R CDM project activities”, version 1.0

2.2 Applicability of Methodology

This project meets the applicability conditions for use of the modular REDD methodology, as detailed in Table 2.1 below.

Table 2.1: 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 at least 10 years before the 2008 project start date, confirmed by classified Landsat images from 1996 and 1999.
The project area can include forested wetlands	Forested wetlands are present in the project

(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.	area. These wetlands do not grow on peat as confirmed by studies of similar areas in the buffer zone. (CIMA 2010, CIMA 2010)
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.	Project proponents can demonstrate control over the project area and ownership of the carbon credits from the project. This is described further in Section 1.12.1.
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 (fuelwood and charcoal production) (VCS category AUDD).	The project falls within the Unplanned Deforestation (AUDD), as the baseline involves transition from forest to non-forest conditions due to unauthorized actions by external agents. As a result of the official designation as a national park, the project area is not legally authorized and documented to be converted to non-forest.
Baselines shall be renewed every 10 years after the start of the project.	Baseline will be renewed in July 2018.
All land areas registered under the CDM or under any other carbon trading scheme (both voluntary and compliance-oriented) 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 regrow (i.e. temporarily unstocked), this framework shall not be used.	Land deforested in the project area is being converted to an alternative productive use by residents and subject to subsistence grazing and cultivation with fallow periods generally not exceeding five to six years (i.e. insufficient to achieve forest status), as detailed below in Section 3.
Where post-deforestation land use constitutes reforestation this framework shall not be used.	Post-deforestation land use in the project baseline is expected to be for settlements, grazing and agriculture, not reforestation.
Leakage avoidance activities shall not include: • Agricultural lands that are flooded to increase production (e.g. paddy rice); • Intensifying livestock production through	Leakage avoidance activities do not include flooding agricultural lands or intensifying livestock production.

use of "feed-lots" and/or manure lagoons	
Specific Conditions for the Unplanned Deforestation	
The module shall be applied to all project activities where the baseline agents of deforestation: (i) clear the land for settlements, crop production (agriculturalist) or ranching, where such clearing for crop production or ranching does not amount to large scale industrial agriculture activities; (ii) have no documented and uncontested legal right to deforest the land for these purposes; and (iii) are either resident in the region or immigrants.	Baseline agents of deforestation clear the land for settlements and crop production which do not amount to large scale industrial activities, have no documented and uncontested legal right to deforest the land for these purposes, and include both residents in the reference region and immigrants.
It shall be demonstrated that post-deforestation land use shall not constitute reforestation	As explained above, post-deforestation land use in the project baseline is expected to be for settlements, grazing and agriculture, not reforestation.
Where pre-project, unsustainable fuelwood collection is occurring within the project boundaries modules BL-DFW and LK-DFW shall be used to determine potential leakage	No illegal fuelwood collection, other than as part of the process of deforestation, is expected to occur in the project area in the baseline or with-project case. No evidence of illegal fuelwood collection was found during 4 months of field work on the PNCAZ inventory in 2009 and the continuous park guard observations.

2.3 Project Boundary (CCB: CL1.2, CL2.4)

The geographic boundaries of the project area, leakage belt and reference region are presented in Section 3.

2.3.1 Project Greenhouse Gas Sources, Sinks and Reservoirs

In table 2.2 are defined the GHG emission sources and justifications for exclusion.

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	No	Conservative to exclude because emissions from burning in the baseline exceed emissions from burning in the with project case. No biomass burning occurs as part of the project activity.
	N_2O	No	
Fossil Fuel Combustion	CO_2	No	Emissions are small and negligible.
	CH_4	No	Emissions are small and negligible.
	N_2O	No	
Use of fertilizers	CO_2	No	Emissions are small and negligible.
	CH_4	No	
	N_2O	No	Excluded. No increase in fertilizer use is contemplated in the project case as part of leakage mitigation or any other activity.

No evidence of significant slash and burn agriculture (>1ha), motorized boat or vehicle fossil fuel use, or other sources of non-CO2 emissions have been observed within the park boundaries by CIMA technicians or park guards or in imagery analysis since the park was formed in 2001. Given the size of the project area and the total estimated baseline emissions, this would indicate that non-CO2 emissions are negligible and significantly less than 5% of the total projected baseline emissions. In addition, to be conservative, non-CO2 emissions are excluded from the baseline.

Each monitoring period, non-CO2 emissions will be evaluated as described in the monitoring plan in Section 4 of this document. If during any period, these emissions exceed 5% of the total emissions reductions, the non-CO2 emissions will be included.

Selection of pools for inclusion in the project is outlined and justified in the table below.

Table 2.3: Selection of pools and reservoirs for inclusion in the project

Carbon pools	**Included / Optional/ Excluded**	**Justification / Explanation of Choice**
Above-ground	Included	Mandatory to include. Most significant carbon pool. Only live trees are included; woody non-tree vegetation (woody shrubs and understory) is conservatively not included because post deforestation stocks in this component are not greater than in the forest.
Below-ground	Included	Significant pool, often equivalent to ~25% of above-ground stocks.
Dead-wood	Included	Significant pool, often equivalent to ~10% of live aboveground stocks.
Harvested wood products	Not included	Harvest of wood products is not occurring in either the baseline or project scenario, hence can be conservatively omitted because this pool is neither significant nor greater in baseline than project scenario. There are no illegal loggers currently operating in the park, and hence recovery of harvested wood products is not expected to occur in

		the with-project case. It is always conservative to exclude wood products in the project case.
Litter	Not included	Generally not significant (representing <5% of total stocks) and conservatively omitted per methodology option.
Soil organic carbon	Not included	Conservatively excluded because emissions are expected to be greater in baseline than project scenario and significant (see analysis below).

Table 2.4: Analysis of weighted average emissions

	Cultivated	Purma media (fallow)	Purma baja (fallow)	Pasture
Percent area (CIMA post-deforestation land-use area data from zoning work conducted in San Martin)	67%	6%	18%	10%
Soil carbon stock loss over 20 years (IPCC 2006)	20-36%	18%	18%	0%
Emission in t C/ha (base stock 77 t C/ha for primary forest; source: Dr. Julio Alegre, National Agrarian University La Molina, unpublished data from Pucallpa)	15-28	14	14	0
Weighted average emission in t C/ha	8-15			

Sinks of GHG emissions are conservatively omitted in project accounting of VCUs. Forest carbon stocks are assumed to be stable, although there is increasing evidence that many mature Amazonian forests are not steady state but are carbon sinks (Baker *et al.* 2004 and Chave *et al.* 2008).

2.4 Baseline Scenario (G1.7, G2.1, G2.4, G2.5, G3.6)

2.4.1 Baseline Identification and Justification

The identification and selection of alternative land use scenarios for determination of the baseline and assessment of additionality was conducted in accordance with the VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, Version 3 and VM0007 methodology module BL-UP "VMD0007 Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation", version 3.0.

The project meets the applicability requirements of VT0001 as follows:

- The proposed project activities do not violate any applicable law whether it is or is not enforced. Additional details regarding relevant laws are provided in Section 1.11.
- The project is not proposing a new baseline methodology but is using VMD0007 Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP), Version 3.0, which includes a detailed step by step approach for development of the baseline.

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

The following alternative land use scenarios were identified for the project:
Alternative 1: Continuation of deforestation activities taking place prior to CIMA's work in the region.
Alternative 2: Creation of large agricultural (biofuel) projects.
Alternative 3: Creation of logging, mining or oil concessions in part or all of the project area and subsequent use of these concessions.
Alternative 4: Management and protection of the national park by the national government of Peru.
Alternative 5: Project activities occurring without being registered as a VCS/CCBA project.

Alternative 4 is not a plausible alternative. As discussed in Section 2.5, the Peruvian government does not have adequate funds to manage and protect this national park. In fact, it is not likely that the government would have created the national park if it were not for the agreement for management by the non-profit organization. Therefore this is not considered a plausible alternative.

The remaining four alternatives will be considered further.

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

Alternative 1 includes the deforestation for subsistence agriculture, ranching and logging that was occurring for many years prior to CIMA becoming involved in the area or the national park being created. Information gathered during the MUFs, work CIMA conducted to remove illegal loggers, and discussions with local experts and communities indicate that these activities were widespread in the project zone (project area and buffer zone). Therefore, either these activities were considered legal or the laws were not being enforced. It is assumed that the activities would have been allowed to continue in the region, so this alternative remains plausible.

Alternative 5 includes all project activities without being registered as a VCS/CCBA project. As outlined in Section 1.11, all project activities are in conformance with all applicable laws and regulations.

Alternative 2 includes the granting of agricultural concessions or the development of large scale agricultural initiatives in the project area. Alternative 3 includes the granting of logging, mining or oil concessions within the project area. Because the project area is a recognized national park, it would be illegal for concessions to be granted in the project area. For this reason, Alternatives 2 and 3 are eliminated from further consideration.

Alternatives 1 and 5 remain as plausible alternatives.

Sub-step 1c. Selection of the baseline scenario:

The investment analysis in Section 2.5, Additionality, demonstrates that Alternative 5 is much less financially attractive than Alternative 1, which indicates that Alternative 1 is the most likely baseline scenario, and is further elaborated in Section 3.1 applying methodology VM0007 module VMD0007, Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP), Version 3.0.

2.4.2 Human Communities: Baseline Conditions (Without the Project)

2.4.2.1 Communities in the Project Area

There is high risk without the project to the non-contacted indigenous peoples reported to use the southeastern portion of PNCAZ. The area these indigenous people reportedly use is highly vulnerable to illegal logging because of access from the Pisqui and the Aguaytía Rivers. The illegal logging operations were removed from this area after the park was established, and it is expected that without the project, the loggers would re-establish their logging camps.

2.4.2.2 Human Communities in the Buffer Zone

Peruvian legislation restricts activities like timber harvesting, hunting, and fishing within park boundaries. A "without-project" scenario would simply mean less or no control over park boundaries because there would be no park guard posts or patrols at critical access points. As a result, there would be expansion of settlements and subsistence farming activities from the buffer zone into the park and an expected increase in illegal logging. In the absence of the project, extraction of park resources and deforestation could generate short-term economic gains for a few people, but these activities would be illegal and thus not without risk for most people doing the work. Expansion of agricultural lands into the park area would occur in the absence of the project, but without opportunity for land title, ownership, or stewardship.

Without the project, there would be no sustainable funding to stabilize land use in these frontier communities for the long term. In general, there would be no funding for land-use planning in the buffer zone and reduced support to local and regional governments to enforce zoning. This would result in fewer hectares being under community generated management and being used in accordance with agreed upon land-use plans.

Without the project, communities in the buffer zone, particularly those that lack authorized land-use zoning, would see continued increases in land speculation, and uncontrolled population growth with more in-migration, resulting in an increase in already severe erosion and soil loss, and aggravated droughts and reduced river flows. CIMA personnel have observed that communities that have not yet participated in the land-use zoning processes are witnessing increasing conflicts over land tenure and over boundaries between communities. This instability is affecting the ability of the communities to establish norms or rules for resource use and weakening community organization.

The quality of life of residents will fall as they find themselves forced to move from location to location in search of less degraded forest lands, pushing them closer to or into the park. As the health of the environment drops, the need for cash to purchase basic necessities will rise, increasing intensification of land and natural resource use, furthering processes of environmental degradation. This vicious cycle has been well-documented elsewhere in the Amazon (Hecht et al 1990 and Colchester et al 1993). One indicator of similar processes occurring here comes from observation of events in 2005-2007, when temporary setbacks in funding resulted in the withdrawal of CIMA's services from some communities, particularly Shamboyacu, Tres Unidos, and Biavo. Land speculation rose, migration increased and land became concentrated in fewer hands, pushing displaced people into more remote areas in the buffer zone, and closer to the park.

On the Ucayali side, there is also clear evidence that when communities are not engaged, processes of land erosion accelerate. Such was the case in the North-East sector, near the Cushabatay River, where in 2006-2007 rumors of a road project connecting the region to Lima, resulted in a sudden rush to increase the monocultivation of corn. The migration of people from the Department of San Martín increased and significant deforestation occurred. Community residents reported to the technical team in the Contamana office that droughts have led to diminished harvests and people in the region have not capitalized on their investment.

If CIMA can no longer operate in the region, then an important link between the communities and Municipal and Department level governments will be weakened. In the absence of the REDD project, neither the Department nor Municipal governments have the resources to maintain the current level of land-use zoning support. Municipal budgets are limited and there is typically only one person available to provide such technical support. As a result, communities will be increasingly vulnerable to displacement or to involvement with illegal extractive activities and illegal commercial activities (e.g., coca production). The livelihoods of rural residents are tightly linked to natural resources, and long-term availability and persistence of these resources requires appropriate management and protection, as afforded by the project. Without the project, a lower number of communities will have their needs met through sustainable economic activities and individuals will not be developing new technical skills in resource management, project administration and governance. Few communities will have the resources or skills to develop and implement quality of life plans and fewer women will be involved in planning and governance activities.

There would also be a reduction in temporary and long-term local employment as MUF facilitators, official and communal park guards and technical team members would no longer be needed. In addition, park guard station supplies are obtained locally, adding to the local economy.

In sum, the evidence is clear that the work CIMA has undertaken to stabilize land use and improve quality of life has been successful and led to increased positive perceptions of the park. Without sustained funding, all of these gains could be lost as communities experience increased environmental degradation. Deforestation and forest degradation have serious implications for the region's climate and for the provision of ecosystem services, something that also directly affects local populations. Deforestation can result in increased local temperature and changes in precipitation regimes, can lead to extreme soil erosion, and can negatively affect surface water resources that are crucial for local villagers. In the without project scenario, the increased deforestation and erosion would destroy many of the ecosystem services provided by the project, including the drying of rivers, severe floodings and droughts, loss of top soil, and pollution and sedimentation of watersheds. Many of these effects were already being observed by local residents in some of the regions most severely devastated by deforestation.

Section 6.1 outlines the likely specific net impacts of the project on the human communities. Section 6.2 outlines the monitoring plan that will be implemented, along with specific parameters that will be measured, to track the project's impact on the communities.

2.4.3 Biodiversity: Conditions Without the Project

The impact of deforestation on biodiversity is deleterious in any landscape. In PNCAZ the impact would be especially devastating because it would fragment one of the largest protected areas and one of the last remaining, intact altitudinal corridors in the eastern tropical Andes. Without the project, notable reductions in population sizes and declines in species numbers are expected in PNCAZ and the surrounding region. Most affected will be the endemic, rare, and already threatened species that characterize the park and represent a globally important array of natural communities of the tropical Andes, which are endangered or unprotected elsewhere and are fast disappearing. As a region, the tropical Andes is expected to experience the greatest loss of species in the near future, given present rates of deforestation and projected impact of climate change (Brooks et al 2002; Malcolm et al 2006).

In the absence of enforcement of park boundaries and stabilization of land-use in the buffer zone, deforestation, and forest degradation will compromise the integrity of the park. The projected deforestation results show significant deforestation along rivers and in a path across the north portion of the park. Deforestation along this path would cut the park in two and decrease the effective size of the protected area. In addition, deforestation will increase the ease of access into the park and its resources.

The habitat loss and fragmentation of the park would have cascading effects on biological communities. Deforestation and degradation would alter the basic structure of the landscape as a mosaic of habitats within which many faunal species move in search of habitat, food, or reproducing grounds. Habitat fragmentation and degradation is one of the primary drivers of faunal species declines worldwide, in both terrestrial and aquatic environments. A limited number of species would thrive in the newly cleared areas, but the majority, beginning with the rare and specialized species, would decline rapidly. Also, as deforestation occurs along the rivers, it will limit the water supply for species that are unable or will not travel through cleared spaces to reach the rivers. The fragmentation of the park would have a significant impact on the larger mammals, especially spectacled bears, tapir, spider monkeys, and the large herds of white-lipped peccaries.

The implications of loss of species extend beyond reduction in numbers, as deforestation can negatively affect community structure. Of particular concern would be the decline of large carnivores, seed dispersers, and pollinators, based on their roles in ecosystems. The risk of faunal extinctions is also high in PNCAZ: the RBI found more than 30 species likely new to science and potentially restricted to the park (Table 1.3).

Information provided by neighboring villagers through the MUF process, park guard reports and CIMA personnel indicate local residents have been suffering the effects of deforestation in the buffer zone. According to resource use information, it is known that hunters have to travel much farther to find game, especially in the Huallaga populations when compared to the native communities of the Ucayali who live further from access routes and therefore have more intact forest. In some areas, people have forbidden hunting of certain species to protect them from local extinction, unless it is for traditional use such as in indigenous communities. The most vulnerable game animals in the park include tapir, spider monkey, and curassow.

Aquatic systems suffer degradation as a result of deforestation. The direct consequences of deforestation for aquatic environments have been well documented (Pusey and Arthington 2003) and include increased sediment, increased water temperatures, greater runoff from rain events, changes to river channels, and pollution. Of most concern for aquatic biota is increased sediment loading, as it alters aquatic habitats and results in physiological stress for gill-breathing organisms. Deforestation in other parts of the tropical Andes has been linked to major reductions in fish species richness, and the elimination of migratory fishes, such as *Brycon*, *Prochilodus*, and *Salminus* (Winemiller et al. 2008). These same genera are known to occur in streams of PNCAZ. Through the MUF process and the work monitoring the effects of extraction activities in the buffer zone, fishermen in the buffer zone have indicated that they have observed declines in several catfish such as Zungaro (*Zungaro zungaro*), Dorado (*Brachyplatystoma* sp.), Doncella (*Pseudoplatystoma fasciatum*) and Carachamas (*Chaetostoma* and other Loricariids), as well as Boquichico (*Prochilodus nigricans*) among others, over the last ten years.

The fact that PNCAZ encompasses the headwaters of two major Amazon tributaries deserves special mention, as the impacts of deforestation in this region under the baseline scenario would be exported to downstream areas. It is well known that ecological processes occurring in headwater streams influence biological communities and ecosystem function downstream, and for this reason river basins should be managed as a unit. Aquatic ecosystems in headwater streams are often driven by allochthonous inputs from terrestrial systems; deforestation in riparian areas would compromise the habitat, community structure, and ecosystem function of these streams. Several migratory species of fishes spawn within streams of the park: their survival depends on connectivity between upstream and downstream areas, and adequate habitat quality.

Without the project, increased deforestation and absence of CIMA's activities in the buffer zone will lead to a significant increase in human activity within the park. Increased hunting pressures, stemming from uncontrolled park access in the absence of the project, would compromise survival of the more vulnerable species in PNCAZ. Indiscriminate hunting would affect large mammals (tapirs, monkeys, peccaries, deer), game birds (curassows, guans), and favored fishes most quickly. But eventually, the entire biotic community would deteriorate.

A table outlining the specific impacts to biodiversity without the project is provided in Section 5.1 Net Impact on Biodiversity. The biodiversity monitoring plan, along with specific parameters to be measured, is included in Section 5.2.

2.5 Additionality (G2.2, G3.11, G4.7)

The project applied the steps outlined in the VCS Tool, VT0001, "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities" to demonstrate the additionality of the project. The baseline scenarios discussed are presented more fully in Section 2.4.

2.5.1 Investment Analysis

Sub-step 2a. Determine appropriate analysis method
This project generates no financial or economic benefits other than VCS related income. Therefore, Option 1, a simple cost analysis, is the appropriate analysis method. This analysis focuses solely on revenues generated by the project that can be used for project activities.

Sub-step 2b. – Option I. Apply simple cost analysis
The annual management costs associated with Cordillera Azul National Park are roughly $1.7 million (USD). Based on 2011 data, an estimated 39% of these costs were for park protection (i.e., park guard salaries, patrols, guard posts, training) and 36% of the costs were in support of land use, communications, quality of life, and extension activities in the buffer zone communities. Approximately 13% of the costs are for information collection and data analysis (including GIS), program development, coordination and monitoring. The remaining 12% is used for government relations, fundraising efforts to obtain bridge funds, and finance and office administration. Detailed financial information for 2008 to 2011 will be provided to the project validator.

With the successful validation and verification of the project, the annual costs are expected to increase 20% to an estimated average of $2.1 million (USD) annually. The additional costs are necessary to expand the land use and extension activities to a larger number of communities in the buffer zone (roughly 35% of communities have benefited to date and that proportion would increase), undertake the carbon monitoring and verification of carbon credits, expand communication efforts of the project to the secondary stakeholders, undertake outreach and capacity building among other REDD proponents in Peru, and cover inflation on such costs as salaries, transportation, and equipment. A financial statement, highlighting projected expenses and revenues for the period 2012 through 2017, will be provided to the validator.

Moving forward, revenues from the sale of carbon credits will be used directly to cover costs of park management activities, the additional activities relating to the carbon project as discussed in this document, and the establishment of an endowment to ensure long-term financing for Cordillera Azul. This will allow CIMA to continue its activities that ensure reduced emissions from deforestation. Any remaining revenues will be shared with the Peruvian government. A specific revenue-sharing agreement was reviewed and agreed to by the Peruvian government. Additional information regarding the financial plan for the project is provided in Section 2.5.3.

No additional sources of revenue exist for the project. Given the specific conditions under which PNCAZ was designated a national park, there is no established government funding for management of the park and protection of its intact forests. The project area will not be used for any revenue generating purposes and the organizations that have financed the REDD project to date will not provide additional funds once verified carbon credits have been generated. Additional information regarding the bridge funding to date is provided in Section 2.5.3.

In accordance with the management contract, the Peruvian government is not responsible for the financing of the park management activities. SERNANP did provide a small amount of funding directly to the PNCAZ Park Head for the hiring of two assistants in 2011 and a smaller amount in 2012 for their retention. However, SERNANP is not required to continue this funding, its use is decided by SERNANP and not CIMA, and it represents less than 2% of the park management costs, so it is not considered an additional source of project income.

Because the proposed project activity produces no financial benefits other than VCS related income, we proceed to the common practice assessment.

2.5.2 Common Practice

Step 4: Common Practice Assessment
There are twelve designated national parks in Peru. Two non-profit organizations have management contracts with the Peruvian government over two of these national parks. Cordillera Azul is managed by

CIMA and Bahuaja-Sonene is managed by AIDER. However, the management contracts are markedly different. CIMA has a 20-year, full management contract for all of Cordillera Azul and the buffer zone. When the project began, Aider had a 7-year contract that was limited to biological research in a small area of the park, which roughly covers 27% of Bahuaja-Sonene. In 2011, the term of AIDER's management contract increased to 20 years but the limited scope remains. In addition, CIMA is the only entity seeking to validate and verify a REDD project for the national park's protection.

Funding for support of natural protected areas in Peru is limited. Peru has 12 national parks, but PNCAZ received no federal funding from 2008-2010 and the park received less than 2% of its budget in public funding in 2011 and 2012 as discussed in the preceding section.

In 2009, the SINANPE budget shows that $1.78 million dollars was spent on 62 Natural Protected Areas excluding Machu Picchu. The financial plan includes mention of the partnerships it has with CIMA and other organizations to assist in financing the protection services. CIMA, whose purpose is the conservation of the park's ecosystems and the engagement of neighboring communities to ensure long-term success of the conservation efforts, spends roughly $1.7 million annually. In parks managed by the national government, there tend not to be extensive activities in the buffer zones on land use planning or environmental education and the overall funding available for protected areas is clearly limited.

Because of CIMA's unique management plan and CIMA's much more extensive activities, this project is not common practice and shows essential distinction from other national parks and conservation projects in Peru. Therefore Alternative 1 is the most likely baseline scenario.

2.5.3 Financial Plan

Sustained funding for appropriate management was an issue discussed prior to designation of Cordillera Azul National Park. INRENA (now SERNANP) had insufficient funds in its annual budget to manage existing national parks and no funds for additional parks, but INRENA recognized the importance of protecting regions of global importance. The Peruvian government decided to implement a new model for managing protected areas and identified Cordillera Azul National Park as a pilot for partnering with a non-profit organization. Because of resource limitations, it is almost certain that the Peruvian government would not have designated PNCAZ as a national park if organizations had not been willing to fund and manage the park. The non-profit organization would bear full responsibility for park management and funding.

APECO, a conservation NGO that was interested in the region and was member of a consortium (Red Ambiental Peruana) that had been advocating for protected status for the region, implemented basic protection programs for the park from 2001 – 2002, through an agreement with INRENA, technical and program support from The Field Museum, and grants awarded to the Museum for work in the park. In 2002, a team of scientists and other staff that had been dedicated to the management of the newly established PNCAZ, and had participated in the rapid inventory in 2000, founded a new conservation organization called Centro de Conservación, Investigación y Manejo de Áreas Naturales – Cordillera Azul, or CIMA. CIMA's goal was to devote itself entirely to the management and sustainability of the new national park. INRENA closely reviewed CIMA's activities in the park and buffer zone for the seven years following establishment of the park and continued to renew CIMA's management contract every one or two years. In 2008, the Peruvian government signed a 20-year management contract with CIMA, indicating the national government's belief that the model had been successful and allowing this pilot model to mature. SERNANP, as the successor to INRENA, will continue to monitor CIMA's performance.

By 2007, grants received by The Field Museum and CIMA for operation of the park and conservation-based activities in the buffer zone were nearly exhausted. CIMA began limiting its activities in the first quarter of 2007 due to budget cuts. In July of 2007, all CIMA staff resigned because program funding ended. Some were rehired as new funding permitted.

The Field Museum and CIMA had been aware of the need for a mechanism to provide sustainable funds for management of Cordillera Azul and its buffer zone. In 2007, the two institutions recognized that a REDD project may provide an option for sustainable funding for the park and buffer zone activities. After much investigation to learn more about REDD, the two organizations actively sought project sponsorship to provide funding for the development of the REDD project. The Field Museum and CIMA made numerous presentations to a variety of organizations regarding REDD and the need for the park to have a sustainable source of funding for the future. The goal was to provide funds to cover the operating costs for the park and to establish an endowment for the ongoing management of the park.

Bridge funding came in through several grants in 2007 and 2008 from organizations such as USAID, the Gordon and Betty Moore Foundation, the MacArthur Foundation, the JRS Biodiversity Foundation and AECID, to assist with operations until a permanent source of funding for CIMA's activities at PNCAZ could be found.

These funds allowed CIMA to expand its park management programs back to full capacity. In 2008 The Field Museum received funds from Exelon Corporation and in 2009 from the Frankel Family Foundation to develop a REDD pilot project, including the documentation and modelling to generate carbon credits.

When the bridge funds were provided, it was not understood how long it would take for the VCS methodologies to be approved and implemented. By August 2010, CIMA had insufficient funds to continue the full implementation of the project in the buffer zone. CIMA and The Field Museum negotiated with funders to obtain additional bridge funding. Additional funding was provided by USAID and the Gordon and Betty Moore Foundation. These funds have allowed the project to continue its protection activities and prepare the REDD project. CIMA will once again have insufficient funding in early 2013 however and these funders have indicated that they can no longer provide additional bridge funds.

Therefore, success of the project is contingent on the sale of carbon credits. The sale of carbon credits from project is the major source of funding in 2013 and 2014 and the sole source of funding in following years. There are two factors affecting the potential revenues from the sale of the project's carbon credits: the volume of carbon credits and the price received for those credits. To be conservative, the financial statements assumed that only 80% of the project's carbon credits would be available for sale, that the leakage would be 20% and that the risk rating would also be 20%. These are very conservative assumptions. The financial statements also conservatively assume a carbon market price of $3 USD per tonne of CO_2 for tons verified during the first monitoring period (2008-2012), $4 USD per ton for the second monitoring period, and an average of $4 - $5 USD per ton for the third and fourth monitoring periods. This assumption is based on current voluntary carbon market prices. It was also assumed in the financial statements that the sale of carbon credits would occur every two years to keep the costs of an external verifier manageable and to spread out the work load of CIMA staff that support carbon credit verification.

The amount of revenues generated from the sale of carbon credits will dictate how revenues will be used. CIMA has an agreed upon revenue sharing plan with the Peruvian Government that will dictate the distribution of funds. A third party financial institution will be responsible for distributing the funds in accordance with the revenue sharing plan. Revenues will be shared in an order that reflects the priority of maintaining the project and park protection activities. While the exact details are confidential (and will be shared with the validator), the order of distribution is as follows:

1. PNCAZ protection activities
2. PNCAZ REDD project monitoring and registration
3. PNCAZ Endowment Fund
4. SERNANP (minimum amount)
5. Field Museum partial investment recovery (first two monitoring periods only)
6. CIMA Operational Reserve
7. SERNANP (any remaining funds)

As stated earlier, the priority is to use any carbon revenues for the management of the park. In the event that either not all of the credits are sold each monitoring period or carbon offset prices are less than projected, then all of the money will be used for park management and there will be no payment of investment recovery costs to The Field Museum, no money put into an Operating Reserve, and no money shared with the Peruvian government. On the other hand, if carbon prices are higher than expected and all the carbon credits sold, then more money than indicated in the financial statements will be shared with the Peruvian government net of the stated payments to The Field Museum and CIMA's contribution to its Operating Reserve. Given this arrangement, there is very low risk that the project cannot be fully funded with the sale of carbon credits.

As described in Section 1.3.3, CIMA places a great emphasis on responsible management and use of its funds. CIMA will provide the validator with any records needed to demonstrate the financial health of the organization.

2.6 Methodology Deviations

Note that rather than using a constant root to shoot ratio to estimate belowground biomass (as prescribed in methodology VM0007 module CP-AB), belowground biomass was estimated using an allometric equation, where the relationship varies continuously with aboveground biomass.
Root biomass was estimated applying the equation developed by Cairns *et al.1997*,

Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111, 1-11.

The equation is derived from 151 observations from a global dataset of upland forests (R-squared=0.83). The use of the Cairns et al equation does not affect the conservatism of the project accounting: area-weighted average mean belowground biomass estimated using Cairns et al and using root:shoot ratios for tropical rainforest sourced from Table 4.4. in IPCC GL AFOLU (as prescribed in methodology VM0007 module CP-AB) was 27.0 t C/ha and 27.3 t C/ha, respectively.

3. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS (CCB: G2.3, CL1.1, CL2.1, CL2.2)

Overview

Development of the project baseline emissions from unplanned deforestation, both rate and location, was conducted in conformance with methodology VM0007 module BL-UP v3.1. The project meets the conditions to use this module as outlined in Section 2 above.

The population driver approach is employed. Applicability of the population driver approach is demonstrated in the Table 3.1 below.

Table 3.1 Applicability conditions for the population driver

Applicability condition	Demonstrated by
Historic census data for the RRD for population driver approach is available for 2 or more points in time in the interval 20 years prior to the project (with the last census date within 2 years of the project start date), or, official population projections are available	Official censuses (to the district level) for the RRD are available for the years 1993, 2005 and 2007, produced by the Instituto Nacional de Estadística e Informática (INEI) (INEI 2002 and 2008).
Periodic population census data for the RRD for population driver approach is expected to be available over the project crediting period, with planned re-census at least every 10 years (≤10 years)	INEI is scheduled to periodically produce population censuses.

Common practice is that non-forest land in the RRD is not left idle for more than 10 years (such that productive land required to accommodate a growing population cannot be met by existing non-forest land) which can be demonstrated through a qualitative assessment, opinion of local experts or literature sources	Although variable, cultivated sites in the reference region tend to remain in cultivation and seldom are left fallow for more than five to six years, regardless of state of soil impoverishment (CIMA field personnel, personal communication).

3.1.1 Definition of geographic and temporal boundaries (CCB: G3.3)

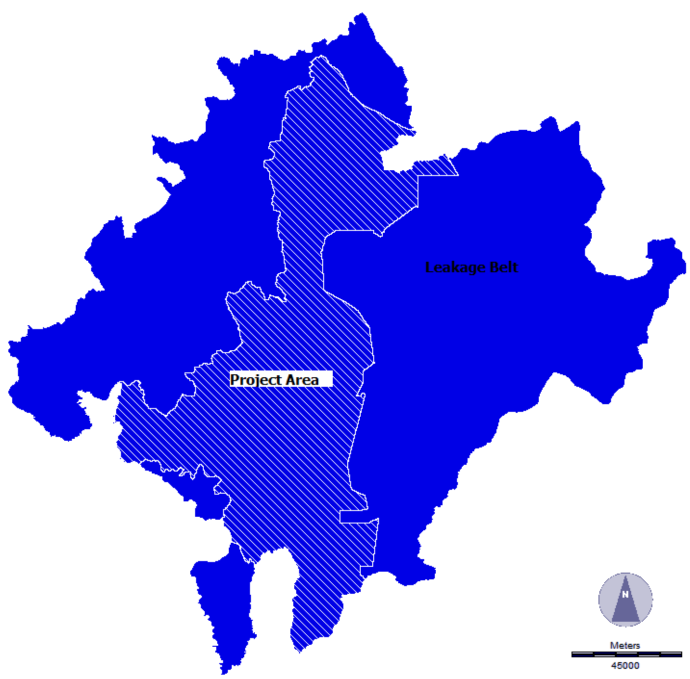
For the development of the baseline, spatial and temporal boundaries are set from which information on the historical rate of deforestation is extracted and projected into the future. The rate of deforestation is derived from the reference region for deforestation rate, (RRD) while the reference region for location (RRL) is used in the spatial modeling component of the baseline, which are the same using the population driver approach. The leakage belt is the area in the RRD/RRL outside the project area, where activity shifting leakage (i.e., deforestation which was displaced from the project area due to implementation of the project activities) from local agents is monitored.

3.1.1.1 Spatial Boundaries

Reference Region for Projecting Deforestation Rate

The reference region for deforestation rate, RRD, (Figure 3.1) is defined as the consolidated area of the population census units that include and surround the project area. The reference region is defined by the boundaries of the 16 included districts (Figure 3.2 and Table 3.3 below), and covers a combined area of 3.6 million hectares.

Figure 3.1. Reference region is defined by the boundaries of the municipalities included in the reference region



The RRD as delineated includes all significant forest areas surrounding the project area that are accessible and attractive to local deforestation agents, with the exception of the southern/southwestern districts (Polvora, Tocache, Uchiza, Jose Crespo y Castillo and Padre Abad) and Sarayacu in the northeast.

Sarayacu was excluded because it is a large district encompassing two deforestation frontiers (including one in the east affecting Sierra Divisor), and hence its population expansion is not solely directed toward the project area, and its inclusion would not be conservative.

Padre Abad was excluded because it contains large indigenous community territories that are separated from the park by an area currently being proposed as a Territorial Reserve for Cacataibos in isolation (FENACOCA - IBC 2005). Populations on the far side of these territories would not expand toward the park.

José Crespo y Castillo, Tochache and Uchiza contain topographical features along their northern edges which would preclude rapid population growth near or in the park. These mountains are known as the Padre Abad Boqueron.

Pólvora has historically been isolated due to a history of narcotics production and violence in the valleys. Based on an oral history from long time residents, between approximately 1985 and 1995, there was intense violence in the area between “terrorist" organizations (MRTA) and national police. This also involved the war on drugs. Between 1995 and 2000 terrorism quelled, but narco-traffic remained. During these two periods, there was a de-population as people fled the region. After 2000, USAID alternative development programs coupled with active coca eradication campaigns diminished narco activity but when the project began in 2008, the district was still fairly isolated due to the narcotics history.

For some context, several previous studies of deforestation in Amazonian Peru, using demographic data and Landsat satellite imagery (1985, 1990 and 2000), have independently identified the San Martín and Loreto departments as having vast denuded landscapes and the highest ongoing rates of deforestation in the region, much of it taking place in protected areas (Dancé 1981, Reátegui 1996 and Portuguez and Huerta 2005). These two departments make up a substantial part of the reference region, and represent a classic agricultural frontier readily apparent from satellite imagery.

Temporal Extent

The reference timeframe was 1989 to 2003, which represents land use change dynamics in the reference region *in the absence* of CIMA’s activities. CIMA’s activities were implemented from 2003 to 2008 and would be suspended in the baseline from 2008 onward.

When using the population driver approach, the historical reference period is defined as (1) the years between the two census data points used to project the rate of deforestation and (2) the years between the three spatial data points to project location of deforestation.

To project rate of deforestation, forest cover and population change between 1989 and 2003 was assessed from a time series of classified Landsat imagery and from population estimates for each district for the years 1989 and 2003 interpolated from 1981, 1993 and 2007 Instituto Nacional de Estadística e Informática (INEI) official censuses (INEI 1989, 2002 and http://www.inei.gob.pe/biblioineipub/bancopub/Est/Lib0842/index.htm)

The historical reference period for analyzing the location of deforestation is here defined by the dates of land-cover classifications of Landsat imagery: 1989, 1999, 2003.

Table 3.2: Temporal boundaries

Project activity	Date
Start date and end date of the historical reference period (for both rate and location of deforestation).	1989-2003 (Represents regional dynamics in the absence of CIMA's activities)
Start date and end date of the REDD project crediting period.	August 8 2008 August 7 2028
Date at which the project baseline will be reviewed. The baseline must be renewed every 10 years from the project start date.	August 8 2018

3.1.2 Estimation of Annual Areas of Unplanned Deforestation

Analysis of historical deforestation and correlation to population
Parameter *DP* (change in deforested area (ha) coinciding with change in population (# of individuals)) was estimated through analysis of imagery and population census data (module BL-UP Step 2.1.2 alternate).

3.1.3 Collection and processing of appropriate data sources

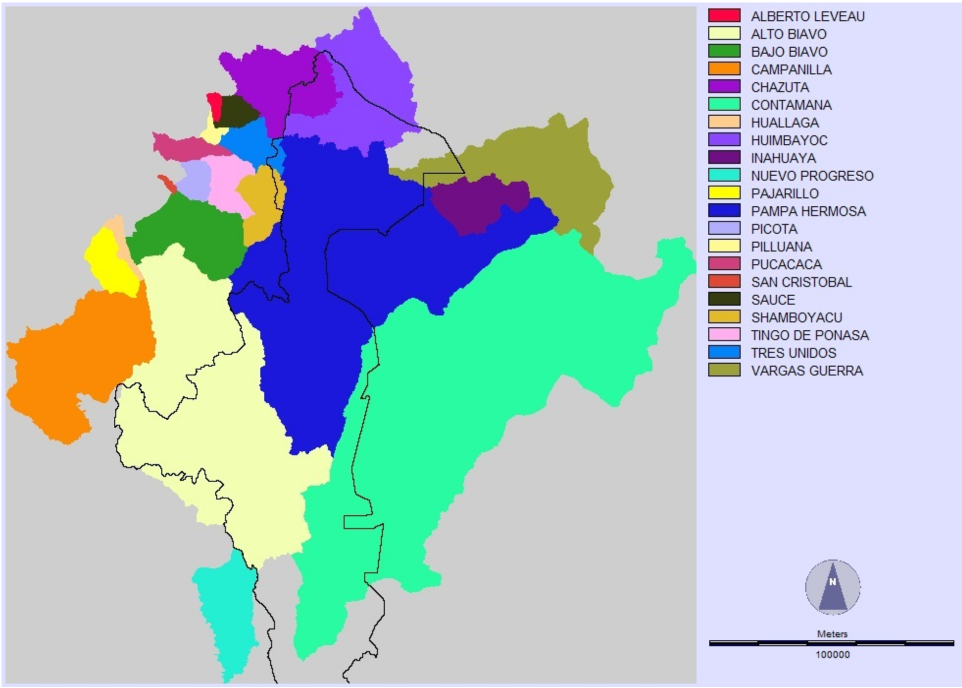
Landsat TM imagery, medium resolution remotely sensed spatial data from the years 1989, 1999 and 2003 were acquired for analysis. All imagery analysis was conducted by CIMA and detailed information on the data processing is included in Appendix 4. A Minimum Mapping Unit (MMU) of 0.36 ha (2 * 2 Landsat pixels or 60 m * 60 m) was used to most closely conform with the Peru DNA forest definition minimum area of 0.5 ha. Land cover classifications of forest and non-forest were created for each time step. Forest cover change in each district between 1989 and 2003 was assessed from this time series of classified Landsat imagery (data and analysis, including classification accuracy assessment, presented in Appendix 4).

3.1.4 Dynamic analysis of correlation between population and deforestation

For the RRD, deforestation rate was projected using the dynamic analysis of the correlation between population and deforestation. This consists of developing a regression model to derive (*DP*), or the relationship between change in deforested area and change in population in the historical reference period 1989 to 2003.

Sixteen (16) districts compose the reference region and were used in the analysis (Figure 3.2).

Figure 3.2: Districts included in the analysis



Population for each district for the years 1989 and 2003 was interpolated from 1981, 1993 and 2007 Instituto Nacional de Estadística e Informática (INEI) official censuses (INEI 2002, 2008). Interpolated estimates from INEI are considered robust as the range of census dates includes the years of interest.

Table 3.3: Population and forest area change over the historical reference period

Distrito	Population 1989	Population 2003	Change (decrease) in forest cover (ha) 1989-2003
ALTO BIAVO	11354.58	23133.24	11778.66
BAJO BIAVO	19863.81	38658.15	18794.34
CAMPANILLA	28978.02	43869.33	14891.31
CHAZUTA	14737.05	22945.86	8208.81
CONTAMANA	21228.93	38794.14	17565.21
HUALLAGA	2245.14	3357.27	1112.13
HUIMBAYOC	15500.79	21885.39	6384.60
INAHUAYA	1836.00	3748.86	1912.86
NUEVO PROGRESO	26997.12	30285.00	3287.88
PAJARILLO	13905.63	20324.61	6418.98
PAMPA HERMOSA	8269.74	17293.23	9023.49
SAN CRISTOBAL	1132.11	2128.50	996.39
SHAMBOYACU	6477.30	15464.79	8987.49
TINGO DE PONASA	13292.73	21573.09	8280.36
TRES UNIDOS	6743.61	12219.21	5475.60
VARGAS GUERRA	7439.94	15709.32	8269.38

For purposes of deriving DP, the RRD was divided into 2 subsets. One district, Huimbayoc, with declining population during the historic reference period, was delineated as a discrete subset (#1), with an effective DP of 0 (zero), and hence contributes no deforestation in the baseline. Application of the methodology conservatively assumes that Huimbayoc, with decreasing population, has zero gross deforestation; in fact, historically, deforestation continued in this district even with decreasing population. All other districts are combined in one remaining subset (#2), for a total of 2 subsets composing the RRD.

The district of Huimbayoc is unique from the other districts included in the reference region, and thus treated as its own RRD subset. Populations in this district have no direct connection with the Fernando Belaunde (Marginal) road. In data obtained from the 2003 MUF carried out by CIMA, in contrast to other districts, in Huimbayoc there had been a decrease in population, attributed in part to its isolation but also to social conflicts (e.g. narcotraffic and terrorism). More recently, land use activities in this district have been conducted at medium to large commercial scales (e.g. the Plantación María, initiated in 2006), hence deforestation is less tied to small-scale subsistence agriculture as in other districts, and thus Huimbayoc follows a different trend in terms of the relation of population and deforestation.

The 15 districts composing subset #2 in the reference region displayed a strong correlation between change in population (1989-2003) and increase in deforested area (1989-2003). Furthermore, the relationship was found to be similar (slope not significantly different) for the 1999-2003 period, which demonstrates the stability of the relationship over time and appropriateness for projections.

A regression model was constructed to assess the relationship between change in deforested area in hectares and the change in population across the population census units for subset #2. The resulting model is

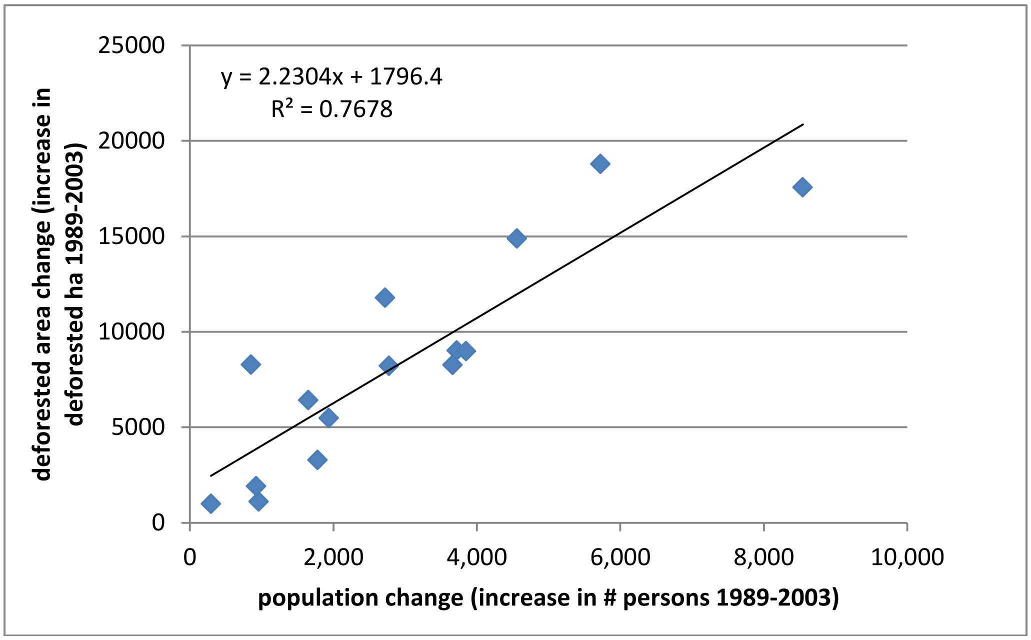
$$Modeled\ change\ in\ deforested\ area_{d,t} = 2.2304 * Change\ in\ population_{d,t} + 1796.4 \tag{8}$$

Where

Modeled change in deforested area,$_{d,t}$
Change in deforested area in district *d* over time interval *t* (ha)
Change in population $_{d,t}$
Change in number of people living in district *d* over time interval *t*

(n = 15, R^2 = 0.7678, P= 0.0000183)

Figure 3.3: Deforested area change (ha) versus population change (# of persons) for municipalities composing the RRD during the time interval 1989-2003



No trend in residuals was apparent (Figure 3.4).

Figure 3.4. Residuals for regression (observed minus modeled) plotted against population change

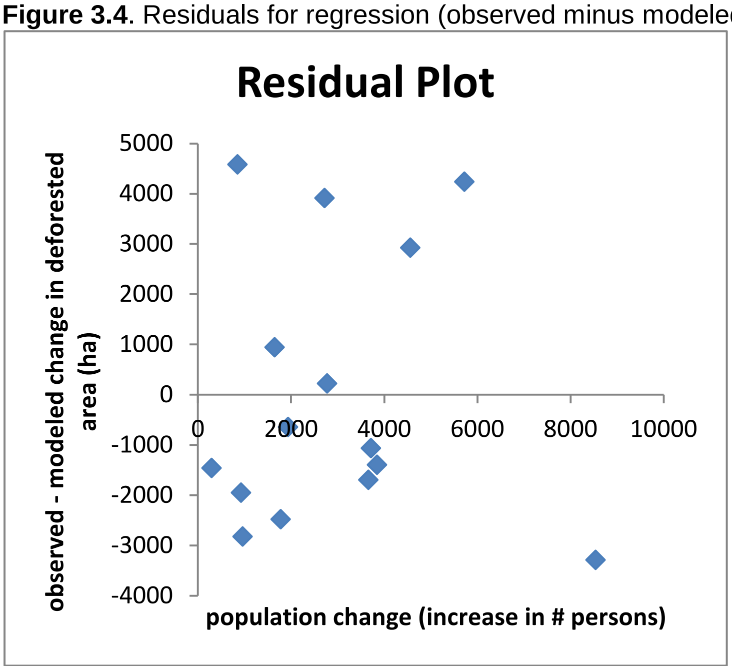
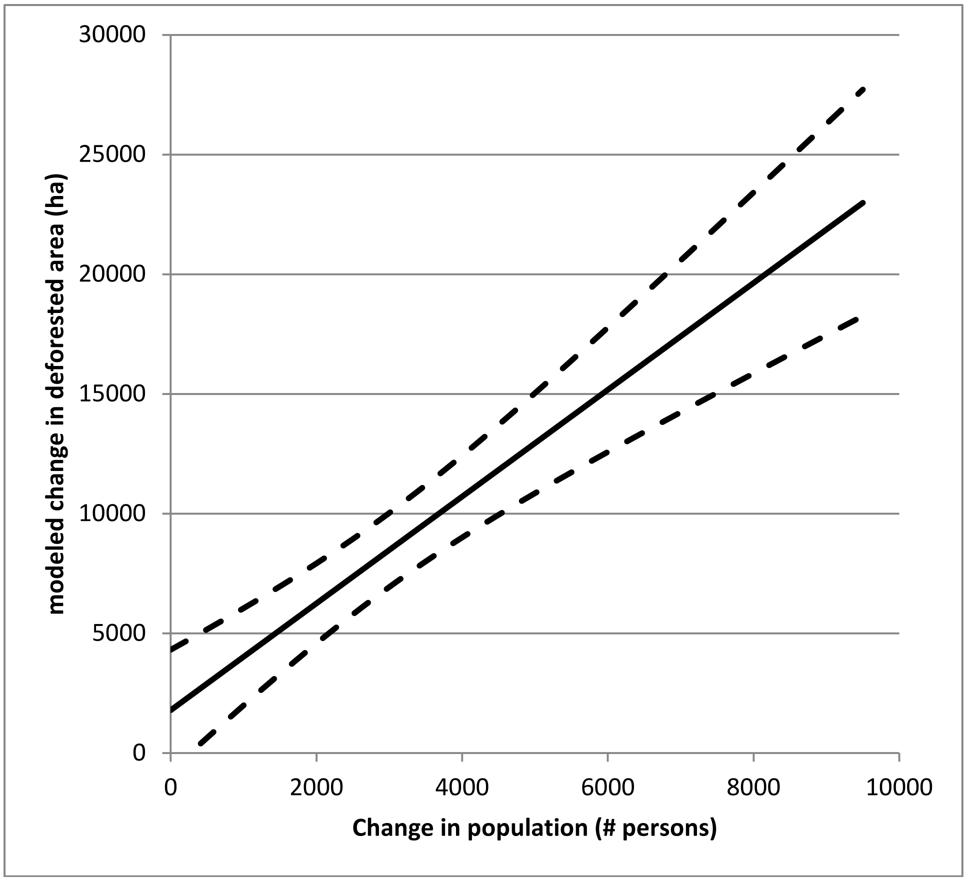


Figure 3.5: 95% confidence interval (dashed lines) of predicted change in deforested area



3.1.5 Project population in the RRD (alternate)

No official population projections covering the 10 year baseline period were available; therefore population growth rate was calculated from population data from the INEI census dates 1993, 2005 and 2007. No factors that would significantly reduce population growth in the selected districts over the project term are apparent. Examination of the rate of population change in the two intervals (1993 to 2003 and 2003 to 2005) demonstrated that some municipalities experienced increases in growth rate. In municipalities experiencing an increase in the rate of change between these two periods an exponential function was applied to project the population growth forward (according to equation 11, section 2.2.1. alternate). In those municipalities where there was no evidence of an increase in the rate of change, a straight linear projection was applied (according to equation 10, section 2.2.1. alternate) per the functions in the methodology. Population was projected forward through 2018 for each municipality.

Table 3.4: Projection of population in each municipality of the RRD. E- exponential growth projection L-linear growth projection (as defined in section 2.2.1. alternate)

	Growth	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ALTO BIAVO	E	6433.17	6821.44	7233.14	7669.7	8132.59	8623.43	9143.89	9695.77	10280.9	10901.4	11559.4
BAJO BIAVO	E	13983.6	16447.3	19345.1	22753.3	26762.1	31477.1	37022.9	43545.7	51217.7	60241.4	70855
CAMPANILLA	E	8730.54	9173.46	9638.86	10127.9	10641.7	11181.6	11748.8	12344.9	12971.2	13629.2	14320.7
HUALLAGA	L	2867	2852	2837	2822	2807	2792	2777	2762	2747	2732	2717
NUEVO PROGRESO	E	12610.3	13825.5	15157.7	16618.3	18219.7	19975.3	21900.2	24010.5	26324.1	28860.7	31641.8
PAJARILLO	L	5346.5	5438	5529.5	5621	5712.5	5804	5895.5	5987	6078.5	6170	6261.5
SAN CRISTOBAL	E	1363.46	1407.29	1452.53	1499.22	1547.41	1597.15	1648.49	1701.48	1756.18	1812.63	1870.89
SHAMBOYACU	E	7980.05	8960.34	10061.1	11297	12684.8	14243	15992.6	17957.2	20163.2	22640.1	25421.2
TINGO DE PONASA	L	4006	3957	3908	3859	3810	3761	3712	3663	3614	3565	3516
TRES UNIDOS	E	4671.29	5226.57	5847.87	6543.01	7320.79	8191.03	9164.71	10254.1	11473.1	12836.9	14362.8
CHAZUTA	L	8471	8107	7743	7379	7015	6651	6287	5923	5559	5195	4831
CONTAMANA	E	26020.1	27570.3	29213	30953.5	32797.6	34751.7	36822.2	39016	41340.6	43803.6	46413.4
HUIMBAYOC	L	4522.51	4517.03	4511.55	4506.08	4500.62	4495.16	4489.71	4484.27	4478.83	4473.4	4467.97
INAHUAYA	E	2342.73	2422.05	2504.07	2588.86	2676.52	2767.15	2860.84	2957.71	3057.86	3161.4	3268.45
PAMPA HERMOSA	E	9473.58	11670.8	14377.7	17712.4	21820.5	26881.4	33116.2	40797	50259.2	61916.1	76276.6
VARGAS GUERRA	E	8889.56	9047.89	9209.04	9373.06	9540	9709.92	9882.86	10058.9	10238	10420.4	10606
total change			9732.61	11125	12754.2	14665.5	16913.2	19562.9	22693.6	26400.9	30799.9	36030.4

3.1.6 Project deforestation in the RRL and project area as a function of population (alternate)

To project deforestation in the RRL, projection of deforestation for each census unit as a function of the projected population growth and the parameter *DP* was calculated as defined in equation 12 of BL-UP, and is reported in table 3.5 below. For annual projections, the y-intercept was divided by 14 when applying the regression model (to annualize, because the original equation was derived from a 14 year dataset). Further, annual deforestation projections were not permitted to exceed the highest value of the original dataset, i.e. where population change exceeded the highest value (8,544), the estimated deforestation was set as 17,565 ha, so that the model projections were not extrapolated beyond the known dataset.

Table 3.5: Projection of deforestation in each municipality of the RRD.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	*Total Municipal*
ALTO BIAVO	994	1047	1102	1161	1223	1289	1359	1434	1512	1596	12717
BAJO BIAVO	5623	6592	7730	9070	10645	12498	14677	17240	17565	17565	119205
CAMPANILLA	1116	1166	1219	1274	1332	1394	1458	1525	1596	1671	13752
HUALLAGA	0	0	0	0	0	0	0	0	0	0	0
NUEVO PROGRESO	2839	3100	3386	3700	4044	4422	4835	5289	5786	6331	43731
PAJARILLO	332	332	332	332	332	332	332	332	332	332	3324
SAN CRISTOBAL	226	229	232	236	239	243	247	250	254	258	2415
SHAMBOYACU	2315	2583	2885	3224	3604	4031	4510	5048	5653	6332	40184
TINGO DE PONASA	0	0	0	0	0	0	0	0	0	0	0
TRES UNIDOS	1367	1514	1679	1863	2069	2300	2558	2847	3170	3532	22899
CHAZUTA	0	0	0	0	0	0	0	0	0	0	0
CONTAMANA	3586	3792	4010	4242	4487	4746	5022	5313	5622	5949	46769
HUIMBAYOC	0	0	0	0	0	0	0	0	0	0	0
INAHUAYA	305	311	317	324	330	337	344	352	359	367	3348
PAMPA HERMOSA	5029	6166	7566	9291	11416	14034	17260	17565	17565	17565	123458
VARGAS GUERRA	481	488	494	501	507	514	521	528	535	542	5111
Total annual	24215	27320	30954	35217	40230	46140	53123	57724	59951	62041	***436914***

3.1.7 Projected Deforestation Location

In conformance with the VCS modular REDD methodology VM0007 module BL-UP, location analysis was conducted since the population driver approach for projecting rate of deforestation was employed.

Modelling Framework
Spatial analysis was conducted with the IDRISI TAIGA software (Eastman 2009), and the Land Change Modeler (LCM) which is an integrated software environment. LCM is a spatially-explicit modeling tool that was used to model the location of deforestation projected in the baseline for both the project area and leakage belt. LCM was developed by Clark Labs in conjunction with the Andes Center of Biodiversity Conservation of Conservation International, and has been tested extensively in the South America (Clark labs 2007). LCM provides a wide range of tools organized in a series of steps for analyzing land cover change; modeling potential for change; predicting change and validating results. For this analysis, LCM was used to produce a vulnerability map of the project area and leakage belt. Translation of the vulnerability map into a scenario map of deforestation through the project term was conducted with a rank and assign operation. This model meets the criteria of (1) being peer-reviewed, (2) transparent, (3) incorporating spatial datasets used to explain patterns of deforestation, and (4) is capable of projecting the location of future deforestation (Kim 2010, Sangermano et al. 2010, Eastman et al. 2005).

Exclusions
Several locations within the project area were excluded due to their biophysical characteristics that completely restrict human access and thereby anthropogenic deforestation, as well as lack of forest cover.

Figure 3.6 depicts the areas excluded from the analysis and Table 3.6 shows the criteria by which those areas were excluded. These areas are detailed more in Appendix 5.

Figure 3.6: Excluded areas: Black areas inside the map were excluded from the project area and modeling procedures due to biophysical barriers completely restricting anthropogenic deforestation. One area of planned deforestation is also removed from the leakage belt.

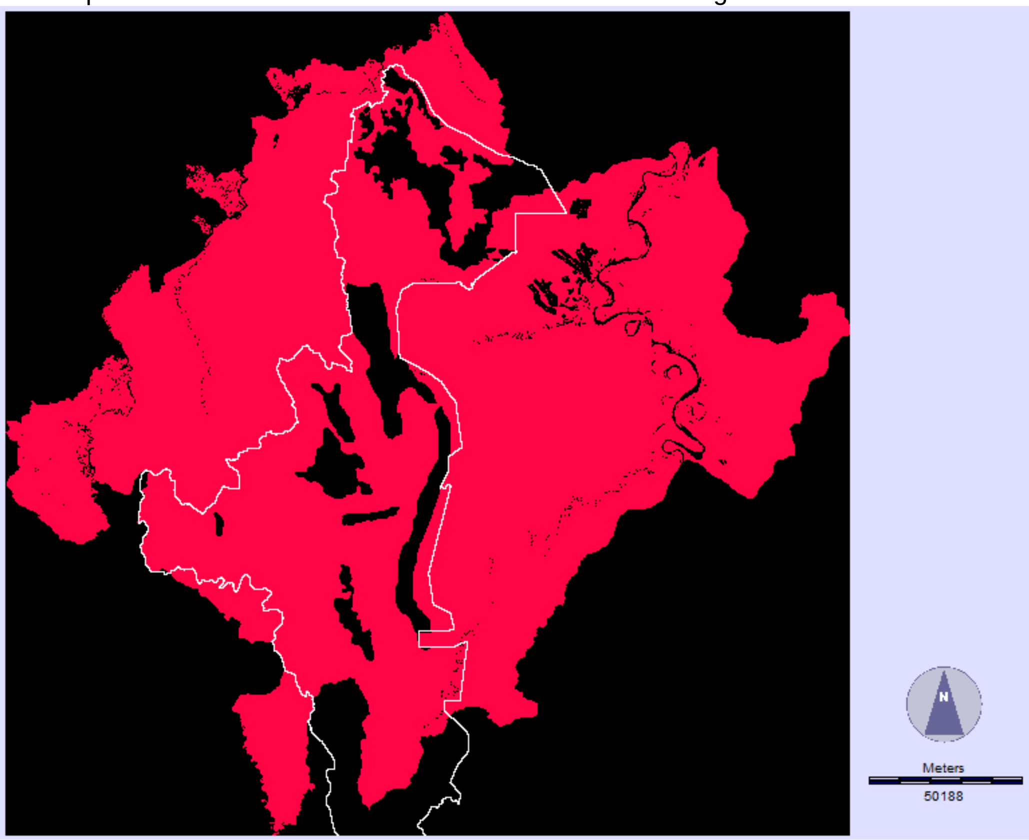


Table 3.6: Non-forest and forest land-use categories excluded from the project area and analysis

Land-use category	**Criteria***
Saline Domes	Areas with high mineral salt deposits inhibiting forest growth
Arbustal/Herbazal areas	Elevation and difficult access, mostly dominated by vegetation below forest threshold due to edaphic factors
Forest located on Vivian and Meseta formations	Areas on high slope terrains of difficult access no suitable for forestry
Cerros Rojizos y blancos	Highly eroded places and high slope terrains
Water bodies	Water bodies including lakes and main rivers,
Swamps	Difficult access, mostly dominated by herbaceous vegetation below forest threshold

*Criteria developed by CIMA technicians and field staff.

Preparation of spatial datasets
Land cover change modeling was conducted and assessed for accuracy with LCM using land cover classifications from 1989, 1999 and 2003 and 2008. Landsat based land cover classifications were conducted by CIMA. All remote sensing imagery meets the requirements defined in the methodology sections 3.1.2, 3.2, 3.3 and 3.4.2. Classification methods, accuracy assessment and remote sensing data used for these maps and technical information on the data used in this project is detailed in

Appendix 4. Each land cover map is shown in figure 3.7. Table 3.7 provides the estimated forest and non-forest areas for each land cover map.

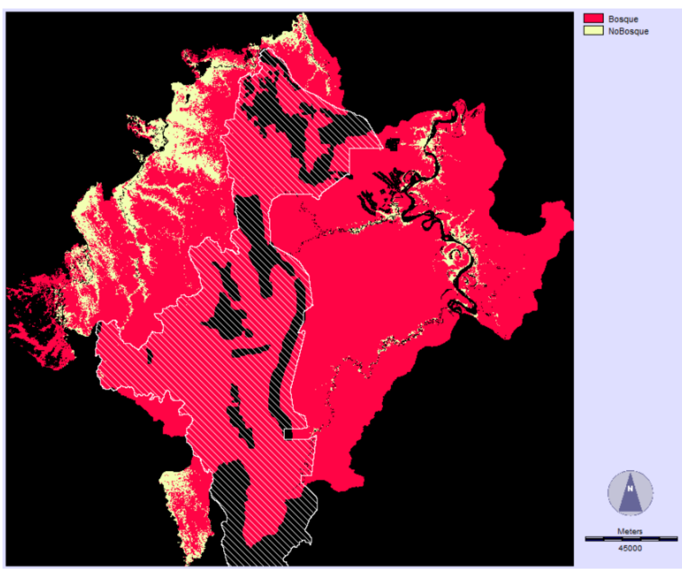
Land Cover Maps used for Model Calibration

Land cover maps from 1989, 1999 and 2003 (Figure 3.7) along with GIS coverages of spatial driver variables were analyzed with LCM to produce >50 different candidate vulnerability maps using different combinations of drivers.

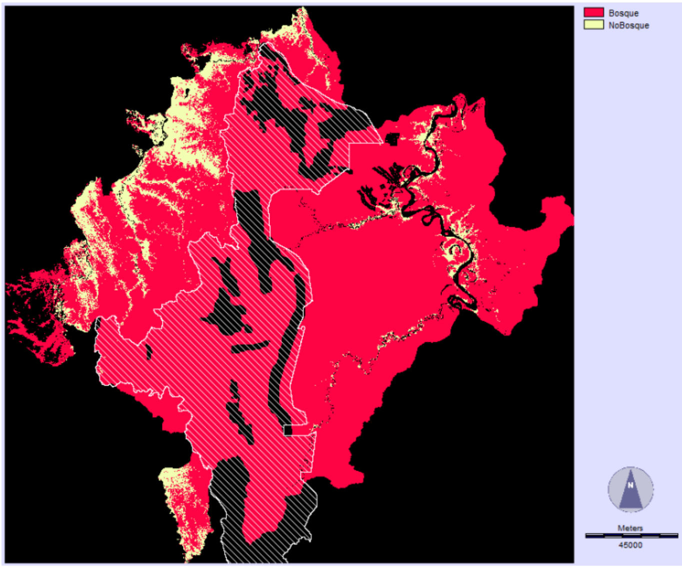
Table 3.7: Estimation of forest and non-forest areas for land cover maps 1989, 1999, and 2003. Total area of classification is included here and does not reflect exclusions detailed above

	1989	1999	2003
Bosque	2,962,686.87	2,886,630.75	2,824,823.52
NoBosque	230,792.49	306,848.61	368,655.84

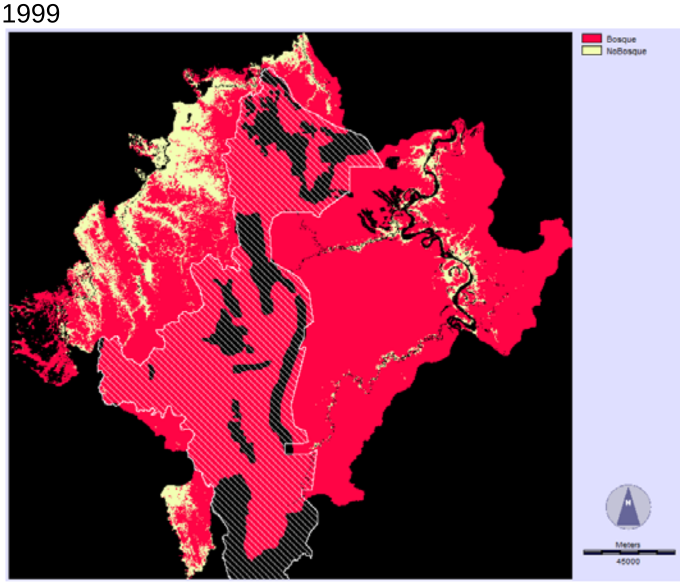
Figure 3.7: Forest cover maps (forest and non-forest) from classified imagery from 1989, 1999, and 2003. White hashed area is the project area.



1989



1999



2003

Land cover change modeling requires two phases; calibration and validation. The first time step, 1989-1999 was used to calibrate the model and the second time step 1999-2003 was used to validate the model's predictive capacity. For calibration, the classified maps from the first two time points (1989 and 1999) were analyzed. Locations that experienced a transition from forest to non-forest ("transition") and locations that do not transition but remained as forest ("persistence") were used to develop and test for relationships with potential driver variables. A large number of training sample locations were randomly chosen from both of these categories. This number may be user-defined, and in this model was set to 5,000 samples. An equal number of randomly selected locations were used to test the predictive capacity of the model within the calibration phase, and inform the adjustment of the weights of the input variables.

In summary, the model was calibrated with data from 1989 and 1999, validated against data from 2003, and projected from 2008.

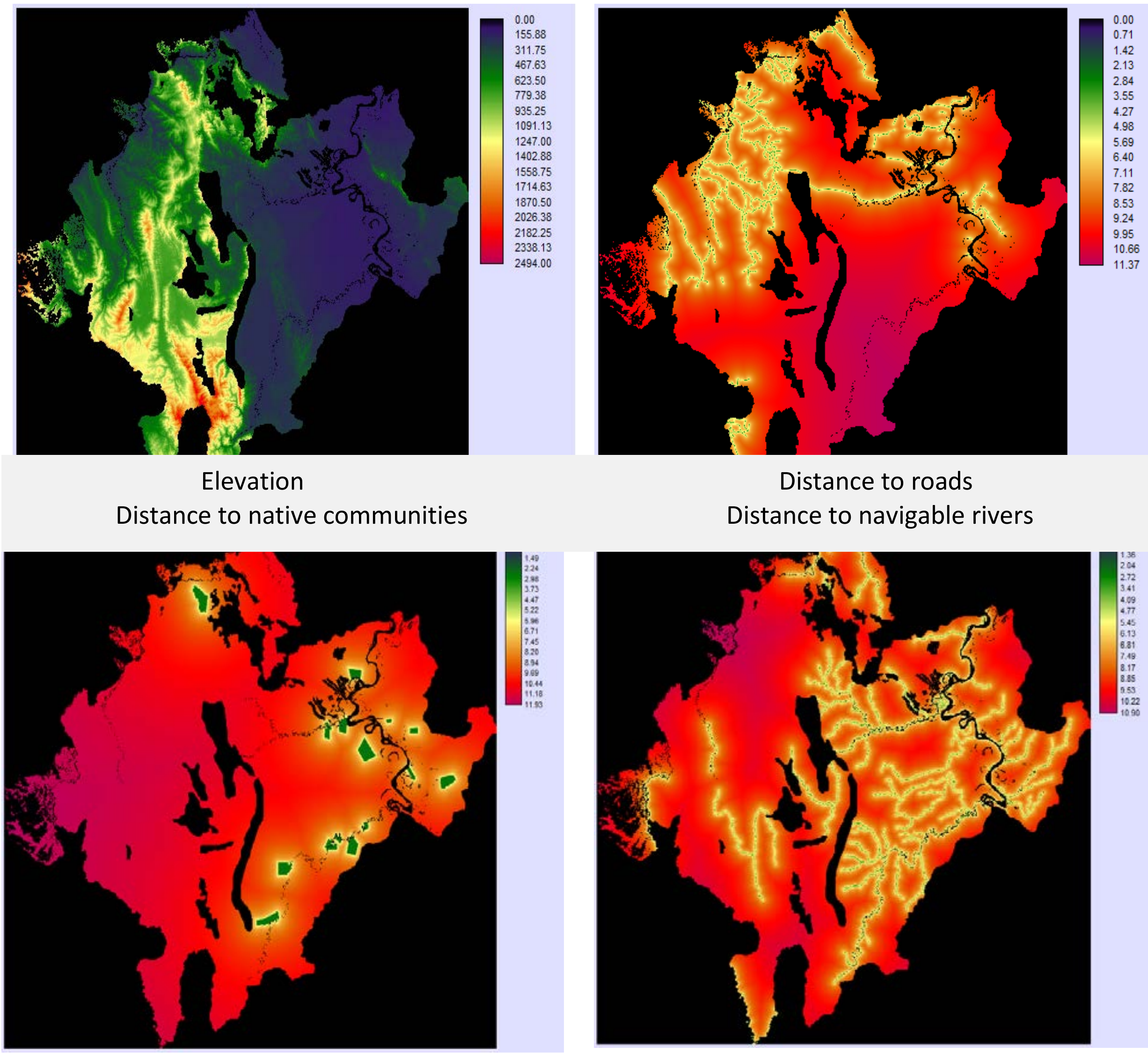
Developing a predictive model is an iterative process that requires exploration of the spatial variables that may drive deforestation patterns. Variables that have demonstrated strong correlation with deforestation in the field of land change science are categorized in the methodology into four categories: Landscape factors, Accessibility factors, Anthropogenic factors, and Actual land tenure and management. All variables must be spatially explicit, and for use in the model must be in raster format. Spatial variables used in the model are called factor maps.

Potential drivers of deforestation were assessed with input from experts at CIMA, literature review and input from other land change modeling efforts. Concerted effort was made to collect all available data that might be transformed into spatially explicit factor maps. CIMA provided all GIS data for this project (listed in Appendix 6). Commonly used transformations for variables were also explored. Although transformations are only required for logistic regression modeling, where variables must be linearly related to the potential for transition, transformations can improve the performance of other models, especially where there may be strong non-linearities, thus yielding higher accuracy. Distance based variables were tested to see if transformations improved model accuracy. These transformations included the natural log transformation (ln) which is commonly effective in linearizing distance decay variables, a square root transformation, which can assist in enhancing the importance of small changes in distance, and categorization of distances into classes, which can help to tease out the critical zones of distance-related functions. Some of the factor maps included in the modeling are shown in figure 3.8, and detailed in table 3.8.

Table 3.8: Factor maps assessed in the modeling. Bold indicates the finals factors included.

Accessibility factors	***Description***	***Relative contribution to model performance***
including transformation; ln, square root, classified distances	*Distance to roads (current & planned)*	***High***
	Distance to river (navigable & total)	***High***
	Distance to informal roads, paths & foot trails	*Low*
Anthropogenic factors		
	Distance to towns	*Low*
	Distance to settlements (new & established)	***High***
	Distance to forest edge	*Low*
Landscape factors		
	Elevation	***High***
	Slope	*Moderate*
	Soil	*Low*
	Vegetation	*Low*
	Geology	*Low*
Actual land tenure & management		
	Distance to mining concession	*Low*
	Distance to Indigenous Areas	***High***

Figure 3.8: Images of some factor maps included in the model



Planned Road development

In March 2008, the *Proyecto geopolítico Bioceánico Salaverry, Juanjui, Picota, Contamana, Cruzeiro do Sul, Perú Brasi*" was enrolled in the Single Register for Taxpayers (Registro Único de Contribuyentes – RUC) as an association dedicated to the business of social science research, whose legal representative (Mr. Sixto A. Morey Trigozo) is the creator of this project. One of the primary visions of this organization is to build a railway and road connecting the Atlantic Ocean to the Pacific Ocean through Brazil and Peru. It is felt that this will spur economic growth, communication and national security. (http://geopolitica.com.pe/articulos/proyecto-geopolitico-transversal.html)

The organization designed a proposed pathway for the rail and road system and lobbied to have it become a reality. On November 8, 2010, the Peruvian Congress of the Republic adopted a law that declares this transportation system, called the *Bioceanic geopolitical project Peru – Brazil's* Ferrovía Interoceanica Peru-Brazil (FERRIPEB), as a public need and national interest and raised the law for its promulgation by the President. Two days later the Law 29613 was published in the official newspaper El Peruano. (Appendix 7)

Between 9 and 10 November 2010 in Leoncio Prado (province Picota), the *IV Summit for the Integration of Amazonian, Andean and Peruvian Coast* was held and this project was presented as being backed by national law. The new road and rail generated great excitement and expectations among the local population, especially for the access to new lands. However, as seen in the map presented by Mr. Morey Trigozo at the meeting, the project passes through PNCAZ as well as the reserve zone Sierra del Divisor.

Figure 3.8a: Picture of the map presented at Leoncio Prado

On November 29, 2010, the head of PNCAZ sent a communication to SERNANP (Oficio Nº 080-2010-SERNMANP-PNCAZ) explaining the legal, physical - geographical, biological, social, economic and political reasons why this project is not feasible considering the proposed route. Likewise, a series of letters (Carta Múltiple No. 020-2011/CIMA/DE, de febrero 2011) were sent to members of Congress and other authorities to request their support in slowing implementation of the project and relocating the path proposed in Leoncio Prado.

Currently this project in on hold but could be reactivated at any moment.

3.1.8 Results

Selection of the most accurate deforestation risk map

Validation of Spatial Model

Using the above process, multiple risk maps (of various combinations of drivers/factor maps) and the corresponding prediction maps were created for the year 2003. Each prediction map was compared to the actual land cover map from 2003 to assess the model's performance. The measure of performance used as mandated by the methodology is the "Figure of Merit" (FOM) that assesses the model prediction in statistical manner (Pontius *et al*. 2008; Pontius et al. 2007). The FOM is a ratio of the intersection of the observed change (change between the reference maps in time 1 and time 2) and the predicted change (change between the reference map in time 1 and simulated map in time 2) to the union of the observed change and the predicted change. The FOM theoretically ranges from 0%, where there is no overlap between observed and predicted change, to 100% where there is a perfect overlap between observed and predicted change. The highest percent FOM and least number of factor maps used for creating the deforestation risk map are used as the criteria for selecting the most accurate deforestation risk map to be used for predicting future deforestation.

The minimum threshold for the best fit as measured by the Figure of Merit (FOM) is defined as the net observed change in the reference region for the calibration period of the model (Pontius et al. 2007). The calibration period is the first time step in the historical reference period, which is used to calibrate the model, here 1989-1999. The net observed change for the RRL is 2.38%. There were 76,056.ha deforested in the calibration period from 1989-1999, and the total area included in the land cover classification is 3,193,479.36.

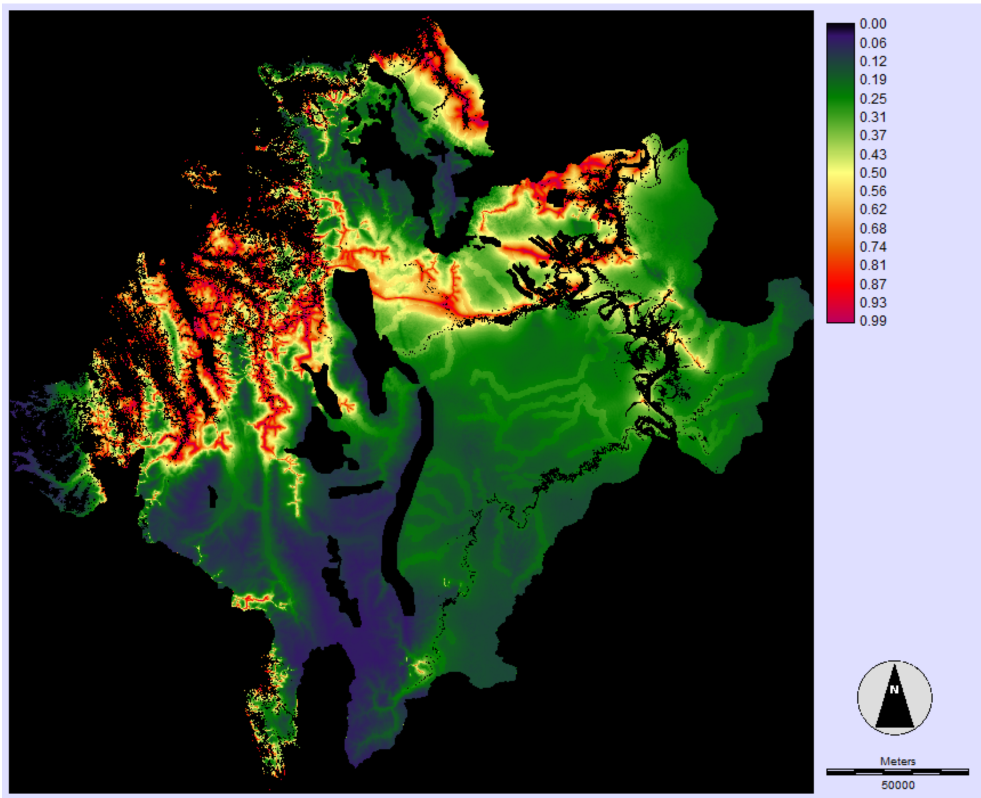
Table 3.9: Net observed change in the RRL for the calibration period

Change in forest from 1989 to 1999 in the RRL	ha
loss of forest	76,056.12
total area (all areas of classification)	3,193,479.36
% change	2.38%

The final model was selected from >50 runs, according to the methodology as having the highest FOM value with the fewest number of factor maps with a minimum of one factor map in each of the 4 categories defined.
FOM value: = 11.7%

18632.97 ha *(correct due to observed change predicted as change)*
79456.14 ha (*observed change predicted as persistence)* + 61315.2 ha (*observed persistence predicted as change)* + 18632.97 (*correct)*

Figure 3.9: Best fit vulnerability map used to model location of deforestation in the project baseline. Colors represent the gradient of deforestation probabilities, with high values in red.

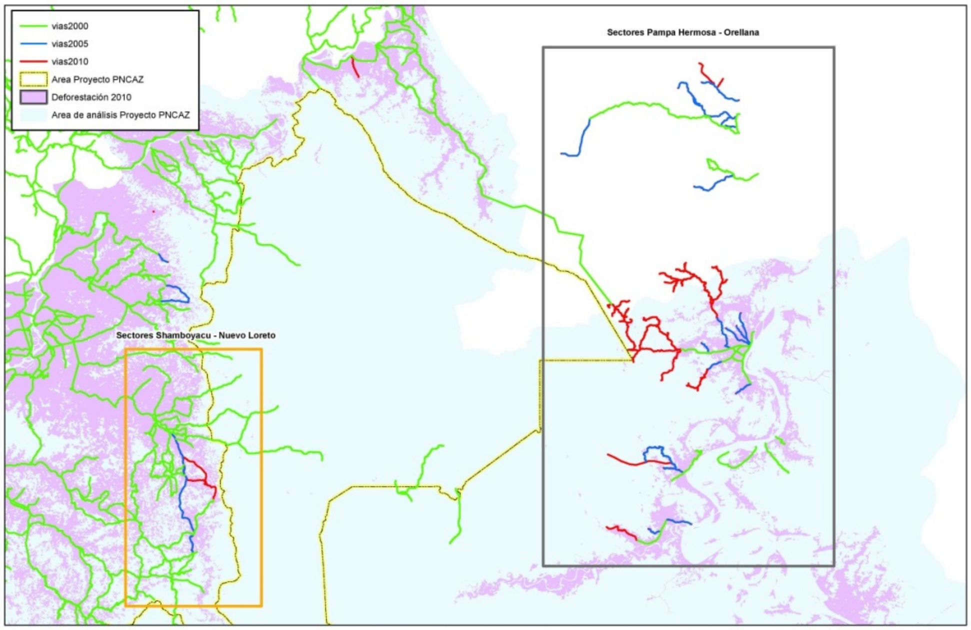


Unplanned Roads Development

Road development is a documented driver of deforestation, and should be incorporated as thoroughly as possible into deforestation models. Two distinct areas were chosen to measure historical development of unplanned secondary roads: Shamboyacu - New Loreto and Pampa Hermosa – Orellana (Figure 3.10). Road growth in these two areas was documented in satellite imagery analysis (2000, 2005, 2010), and further validated by CIMA staff on the ground.

The first region, Shamboyacu - New Loreto, is located in the area of greatest deforestation in the area, and where there is concentrated deforestation pressure on the project area. In this area the density of existing roads is higher than in other sectors. From 2000-2010, growth of roads in this area was slowed because of CIMA efforts in these areas since 2003. The pattern of road development documented here is that existing foot trails and dirt roads are developed into paved roads over time. The second region, Pampa Hermosa - Orellana, located in a zone of lower general pressure to the project area shows more dynamic growth of roads, reflecting the initial stages of colonization and exploration. Here the road growth is extending to the limits of the project area as seen in the figure 3.10 This is a trend like that would occur in the surrounding areas to the project area in the absence of intervention. Hence, the two proxy areas represent the range of rates of road evolution expected in the project area.

Figure 3.10: Map of road networks used to parameterize road building model



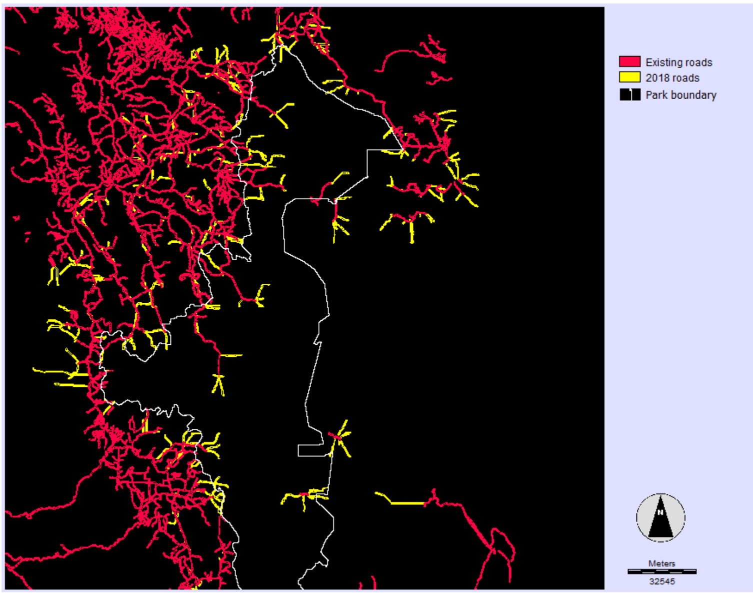
Using these two areas, distance between secondary roads, and length of roads were measured. These values were used to calculate regional averages that were incorporated into the road building model.

Table 3.10 Values used to parameterize the road building model

Area	Average distance between roads (m)	Average road length (m)
Pampa Hermosa - Orellanna	5,000	16,500
Shamboyacu- Nuevo Loreto	10,000	23,000
Regional	7,500	19,750

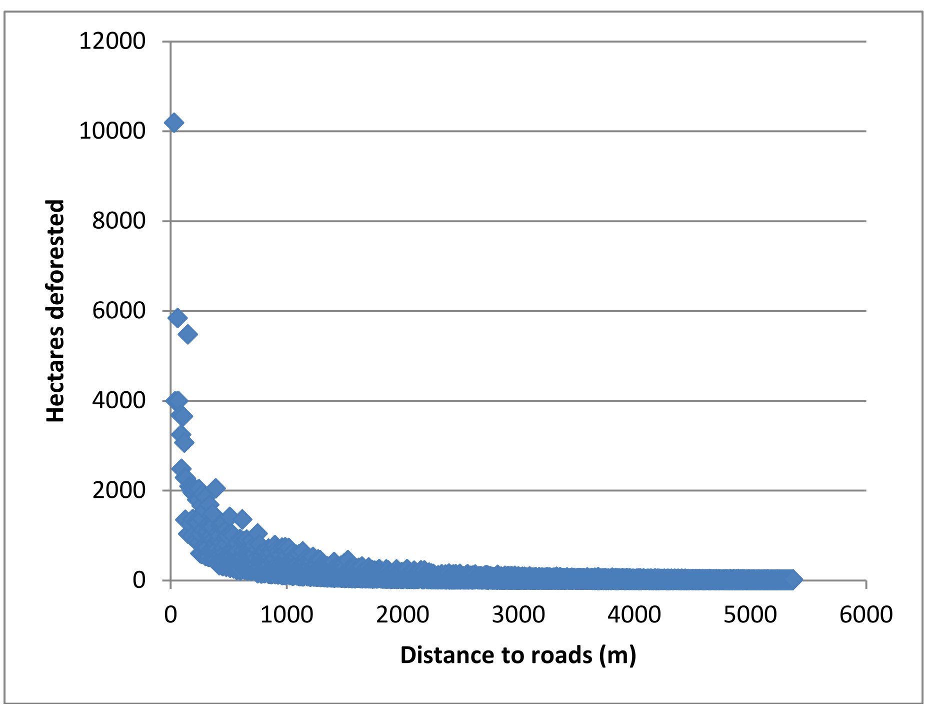
Dynamic road development is an extension of the land change modeler in the Idrisi software system (Eastman, 2009. The dynamic road development uses the change in land cover and historical road secondary road growth to forecast future potential roads, and is modeled on the pioneering work of the DINAMICA team (Soares-Filho 2003 and Soared-Filho 2004). New road end-points are chosen by means of a procedure that looks for the location of highest transition potential within the determined growth length parameter, calculated above. The route between the existing roads and the new end point is determined by the minimum gradient route. This route is a balance between trying to achieve a short route and the need to avoid steep slopes as much as possible, reflecting typical rationale of road building as witnessed in practice. Using the values derived above for road growth (road spacing, length), the model predicted road development at 5 year intervals. The output of this model is a map of potential future roads that was used to assist in prediction of areas at higher risk for future deforestation. Figure 3.11 shows a 500 m buffer around the predicted road network in 2018. The yellow lines indicate the unplanned roads predicted in the road builder model.

Figure 3.11: 500m of road network predicted to 2018. New (unplanned) roads are shown in yellow



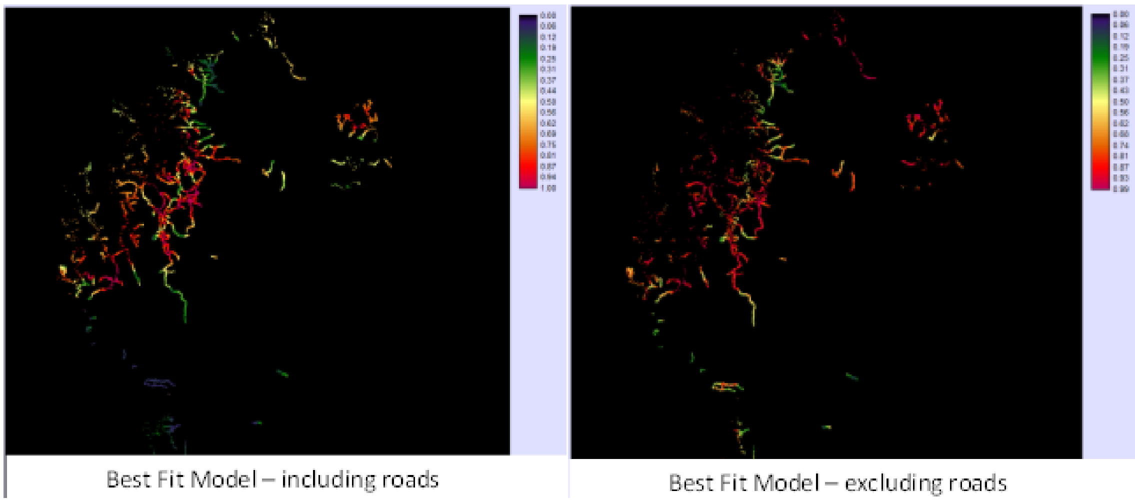
To determine the distance of road impact on increasing deforestation in the region, the quantity of deforestation and the distance from roads was analyzed. The results show a clear relationship between distance to roads and deforestation as shown in figure 3.12. Numerous studies have documented the strong relationship between road growth and deforestation (Gonzales et al. 2006, Overdevest et al. 2008, Chomitz & Gray 2005). To be conservative, we defined an impact zone for new roads as areas within 500m of roads, consistent with observations (Figure 3.12) and ignoring any (minimal) effects beyond that distance.

Figure 3.12: The area deforested within distances to roads. Only distances up to 5500 m included in graph.



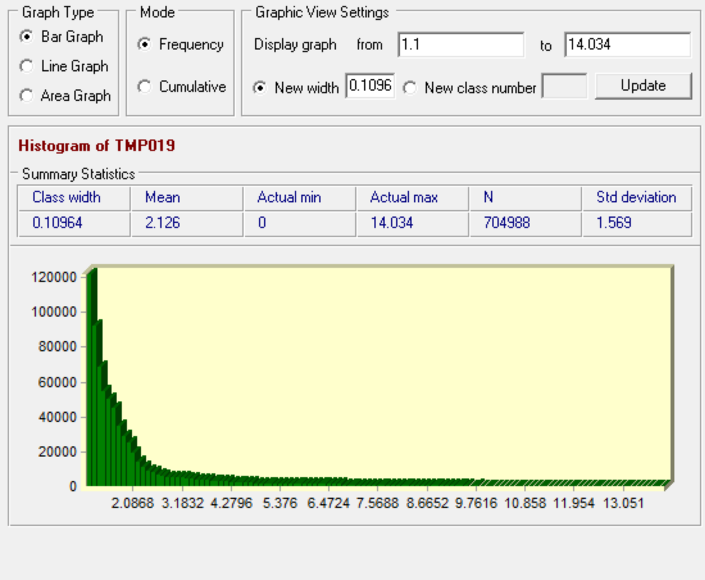
Within the impact area, to determine the relative importance of roads in predicting deforestation, all areas within a 500m buffer of *existing* roads were masked. Values from the vulnerability map of the best fit model were extracted from these areas. The model was run again with no road information as a driver variable, and the vulnerability values were extracted from these same areas to assess the incremental impact of the roads on deforestation probability. Figure 3.13 shows these two maps.

Figure 3.13: Maps of vulnerability with and without road drivers within a 500m buffer zone of existing roads



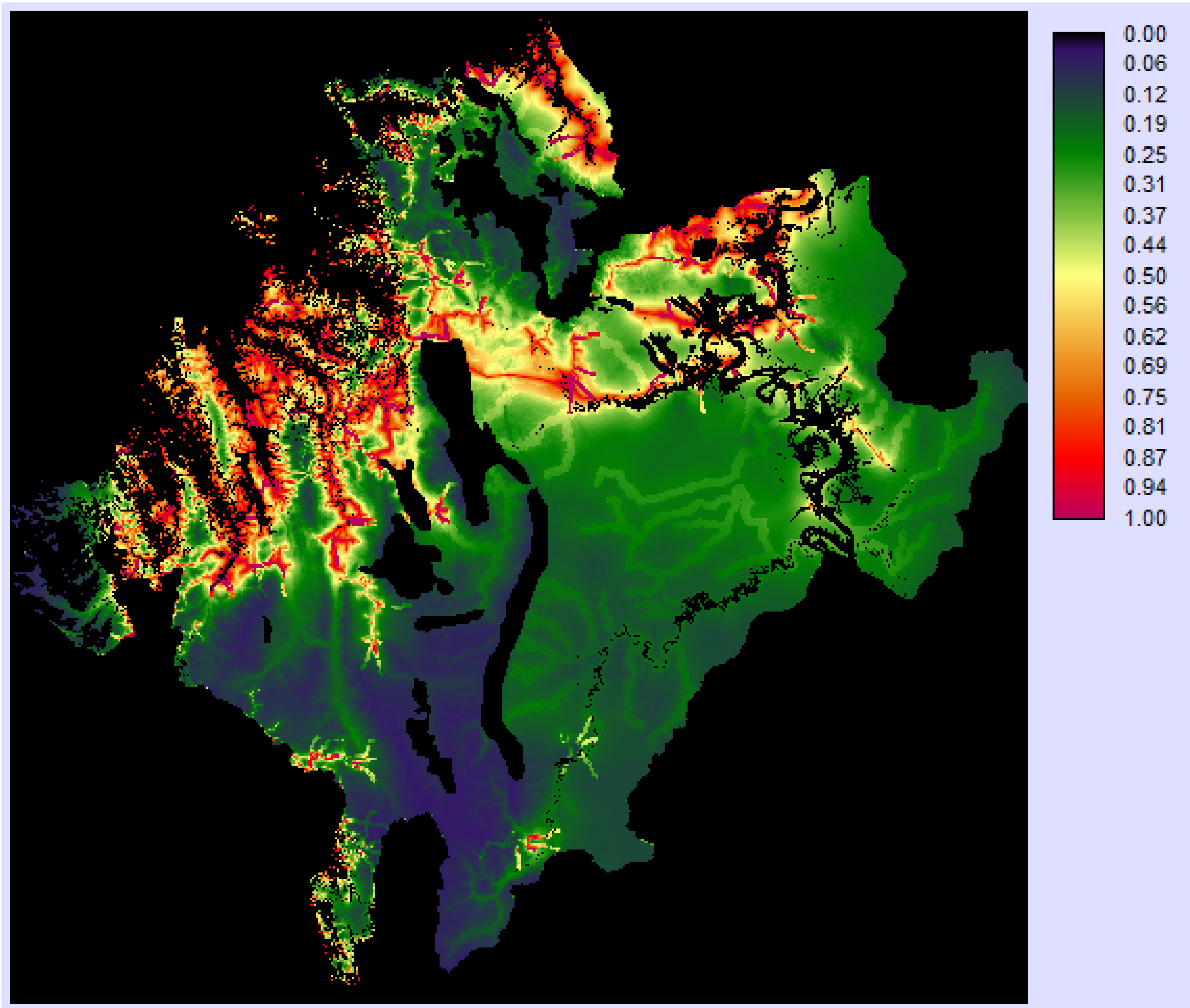
The increased impact of roads was calculated as probability values of the 500m buffer road zone *with roads* in the model / the 500 m buffer road zone areas *without roads* in the model. The mean value was an increase in vulnerability of 2.12 times (i.e. roads on average doubled the vulnerability of areas to deforestation).

Figure 3.14: Distribution of increase in vulnerability values within 500 meters of existing roads (x axis = increase in probability, y axis = frequency).



Areas with new roads predicted to occur were then masked using the 500 m buffer zone, and the existing transition potentials were multiplied by the factor of 2.12. The highest transition potential in these areas was capped at 0.98 to avoid the assignment of un-realistically high probability values within the impact area of new roads, and as a result stagger any deforestation assigned in the projection through the baseline period. Only the areas within 500m of predicted roads were impacted by this procedure, and all predicted roads within the reference region are incorporated so that there is no geographical bias. The resulting final vulnerability map is shown in figure 3.15.

Figure 3.15: Vulnerability map with the incorporation of unplanned roads to 2018



As independent validation of the location modeling results, park guards were consulted in 2009 to identify and explain the highest risk locations for deforestation in PNCAZ based on their on the ground experience from substantial time in the field (Figure 3.16a, Figure 3.16b and Figure 3.16c).

Figure 3.16a. Risk map generated in consultation with park guards in 2009 (northern part of PNCAZ shown in this sample).

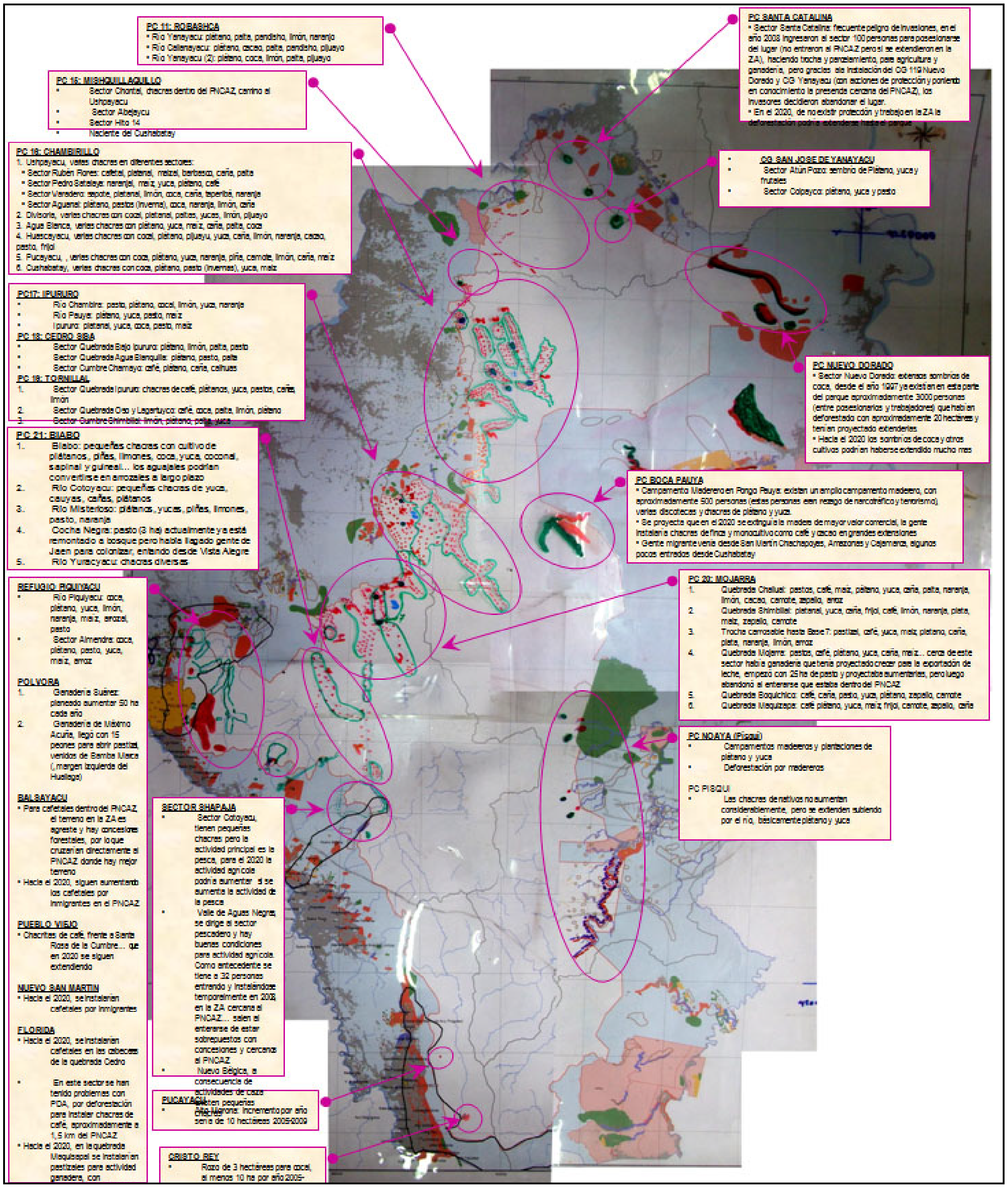


Figure 3.16b: Workshop with park guards in Tarapoto to identify the risk areas inside PNCAZ

The map was developed during a workshop in Tarapoto and included park guards from all 18 control points around PNCAZ. PNCAZ was divided in three sectors, (1) the Northwest sector: Tarapoto, (2) Southwest sector: Tocache; and, (3) East sector: Huimbyoc, Cushabatay and Pisqui. The park guards worked in 3 groups organized by these sectors directly on maps with basic information. The objective was to identify the areas that at that time or in the future (2010 and 2020) could lose forest if there were no park protection activities. The park guards also identified the anticipated potential causes of the deforestation in each sector which are presented below in Table 3.10b.

Table 3.10b: Potential causes of deforestation identified by park guards

Northwest Sector: TARAPOTO

Control Post 11: ROBASHCA	• **Yanayacu river**: banana, avocado, pandisho, lemon, orange, coca, pijuayo • **Callanayacu River**: banana, cacao, avocado, pandisho, pijuayo
Control Post 15: MISHQUILLAQUILLO	• **Chontal Sector**: different kind of crops inside the current boundaries of the PNCAZ, along the way to Ushpayacu River • **Abejaycu Sector**: different kind of crops like coffee, banana • **Hito 14 Sector**: different kind of crops • **Cushabatay headwaters**: different kind of crops
Control Post 16: CHAMBIRILLO	• **Ushpayacu**: different kind of crops in any sector: - Rubén Flores Sector: coffee plantations, banana, corn, barbasco, sugar cane, avocado - Pedro Satalaya Sector: orange, corn, yuca, banana, coffee - Varadero Sector: sapote, platanal, lemon, coca, sugar cane, taperibá,

	orange - Aguanal Sector: banana, grasslands (inverna), coca, orange, lemon, sugar cane • **Divisoria Sector**: several crops such as coca, banana, avocados, yucas, lemon, pijuayo • **Agua Blanca Sector**: several crops such as banana, yuca, corn, sugar cane, avocado, coca • **Huascayacu Sector:** several crops like coca, banana, pijuayu, yuca, sugar cane, lemon, orange, cacao, grasslands, frijol • **Pucayacu Sector:** several crops like coca, banana, yuca, orange, pineapple, sweet potato, lemon, sugar cane, corn. • **Cushabatay sector**: several crops like coca, banana, grasslands (invernas), yuca, corn
Control Post 17: IPURURO	• **Chambira River:** grasslands (invernas), banana, cocal, lemon, yuca, orange • **Pauya River:** banana, yuca, grasslands (invernas), corn • **Ipururo sector**: platanal, yuca, coca, grasslands (invernas), corn
Control Post 18: CEDRO SISA	• **Bajo Ipururo stream**: banana, lemon, avocado, grasslands (invernas) • **Agua Blanquilla stream**: banana, grasslands (invernas), avocado • **Cumbre Chamayo sector**: coffee, banana, sugar cane, caihuas
Control Post 19: TORNILLAL	• **Ipururo stream**: crops like coffee, bananas, yuca, grasslands, sugar canes, lemon • **Oso stream** and **Lagartuyco**: coffee, coca, avocado, lemon, banana • **Cumbre Shimbillal sector**: lemon, banana, avocado, yuca
Control Post 20: MOJARRA	• **Challual stream**: grasslands, coffee plantations, corn, banana, yuca, sugar cane, avocado, orange, lemon, cacao, camote, zapallo, arroz • **Shimbillal stream**: platanal, yuca, sugar cane, frijol, coffee, lemon, orange, avocado, corn, zapallo, camote • **Roads to Base 7**: grasslands (invernas), coffee plantations, yuca, corn, banana, sugar cane, avocado, orange, lemon, rice • **Mojarra stream**: grasslands, coffee plantations, banana, yuca, sugar cane, corn… additionally there was a cattle ranch (for the milk export) that was projected to grow fast, starting with 25 ha of grasslands, but left the site when finding out that it was within the park. • **Boquichico stream**: coffee plantations, sugar cane, grasslands (invernas), yuca, banana, zapallo, camote • **Maquizapa stream**: coffee plantations, banana, yuca, corn, frijol, sweet potato, zapallo, sugar cane
Control Post 21: BIABO	• **Biabo River**: little crops of bananas, pineapples, lemon, coca, yuca, cocona, sapinal y guineal… the wetlands (aguajales) could became into rice crops in the long term. • **Cotoyacu River**: little crops for yuca, cauyas, sugar cane, banana. • **Misterioso River**: bananas, yucas, pineapples, lemon, grassland, orange. • **Cocha Negra**: grassland (>3 ha al 2003) at the moment it is forest, but the area had immigrants from Jaen, entering from Vista Alegre. • **Yuracyacu River**: several crops.
High possibilities to set up villages inside the PNCAZ boundaries	• **Misquiyaquillo**: coffee crops and buildings (high lands)… at least 4 villages from San Martin; and in **Chambirillo** from Shamboyacu and Chazuta. • **Bajo Biabo**, people from Bella Vista, there are crops, settlements loggers, temporal buildings; at least 2 villages in 2009 and several to 2020. • **Base 7**, with pretty big buildings, and a big trail for logger's trucks • **Piquiyacu** with buildings inside the currently boundaries of the park

Southwest Sector: TOCACHE

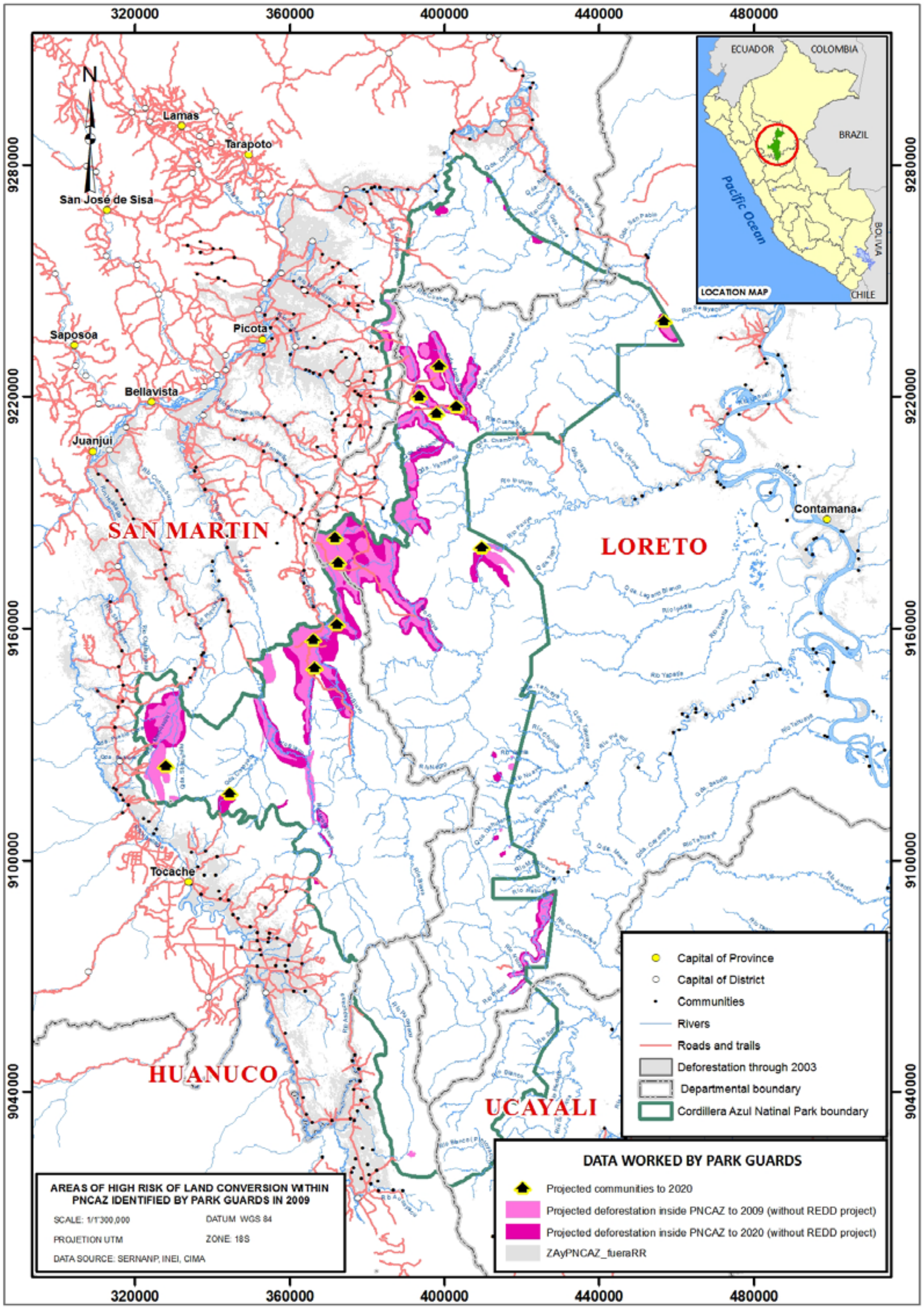
Parkguard Center 27: POLVORA	• **Cattle ranch Suárez**: planning to increase 50 ha / year • **Cattle ranch Máximo Acuña:** who arrived with 15 laborers to open huge grassland, from Bamba Marca (left margin of the Huallaga River). • **Conflicts with PDA**: to promote several crops of coffee in primary forest, no longer than 1.5 km from PNCAZ's boundaries. • **Maquisapal stream:** several grassland for cattle ranches, by immigrants. • **Aguas Verdes sector**: several grassland for cattle ranches in Piquiyacu River, by immigrants
Parkguard Center 53: SHAPAJA	• **Cotoyacu sector:** little farms, but the main activity is fishing, for the 2020 agricultural activity could increase if fishing will increased in this sector • **Valle de Aguas Negras**: near Pescadero sector, with good conditions for agriculture. In 2008, 32 people entering and settling in this sector of the buffer zone close to the boundary of PNCAZ; but leave this site when finding out to be overlapping with logging concessions and near the PNCAZ. • **Nuevo Bélgica**: little crops for hunters.
Parkguard Center 63: PUCAYACU	• **Alto Morona**: the increase of grassland and coca crops could be 10 ha / year, between 2005 and 2009. Coffee plantations within the PNCAZ, because in this sector the land in the buffer zone is rustic and there is logging concessions, so they would cross directly to the PNCAZ where there are better lands for agriculture. • **Cedro Head waters**: coffee plantations by immigrants. • **Santa Rosa de la Cumbre**: coffee plantations by immigrants.

SECTOR ESTE: HUIMBAYOC, CUSHABATAY Y PISQUI

Parkguard Center 119: NUEVO DORADO	• **Nuevo Dorado sector**: extensive coca crops, from 1997 this crops already existed in this sector, approx. 3000 people ("posesionarios" and workers) that had deforested around 20 ha / year and had projected to extend them.
Parkguard Center 02: YANAYACU	• **Santa Catalina sector**: permanent danger of invasions. In 2008, 100 people entered to the sector to take the place, making new trails and plots for agriculture and cattle ranch. Because the control actions the invaders decided to leave the place.
Control Post 106: BOCA PAUYA	• **Pongo Pauya logging camp**: with approx. 500 persons, several bars and small crops of banana and yuca. In the future the wood of greater commercial value will be extinguished, and people would install small farms for monoculture like coffee and cacao in great extensions • A lot of immigrants from San Martín, Chachapoyas, Amazonas y Cajamarca, or from Cushabatay
Control Posts: NOAYA and PISQUI	• Logger camps inside PNCAZ and crops of banana and yucca. • Deforestation by loggers.

This analysis which identified areas of high risk of land conversion was transcribed to a GIS shape file (Figure 3.16c), that aligns with the areas of highest transition potential in the spatial model. Although this data was not incorporated into the modeling analysis, it provides strong support for these findings from an independent source.

Figure 3.16c: Areas of high risk of land conversion within PNCAZ identified by park guards in 2009



3.1.9 Mapping of the Locations of Future Deforestation

From the model, a future deforestation risk map was created to assign a likelihood of deforestation to each pixel. Using a rank operation, all forested pixels of the RRL were ranked in descending order, so that the pixel with the highest likelihood of deforestation was assigned a value of 1. Future deforestation was assumed to happen first at the pixel locations with the highest deforestation risk value, so each pixel was allocated to deforestation in rank order for each year according to the annual projections from 2009-2018 ($A_{BSL,RR,unplanned,t}$). This operation resulted in a single map showing the *Baseline Deforestation for the Baseline Period* (figure 3.17) in the project area and surrounding reference region, and table 3.11 shows the total hectares of baseline deforestation in the reference region, project area and leakage belt.

Figure 3.17: *Baseline Deforestation for the Baseline Period* (project area outlined in white) - Simulated forest cover map for the project area from 2009-2018 (year denoted = year at end of projection)

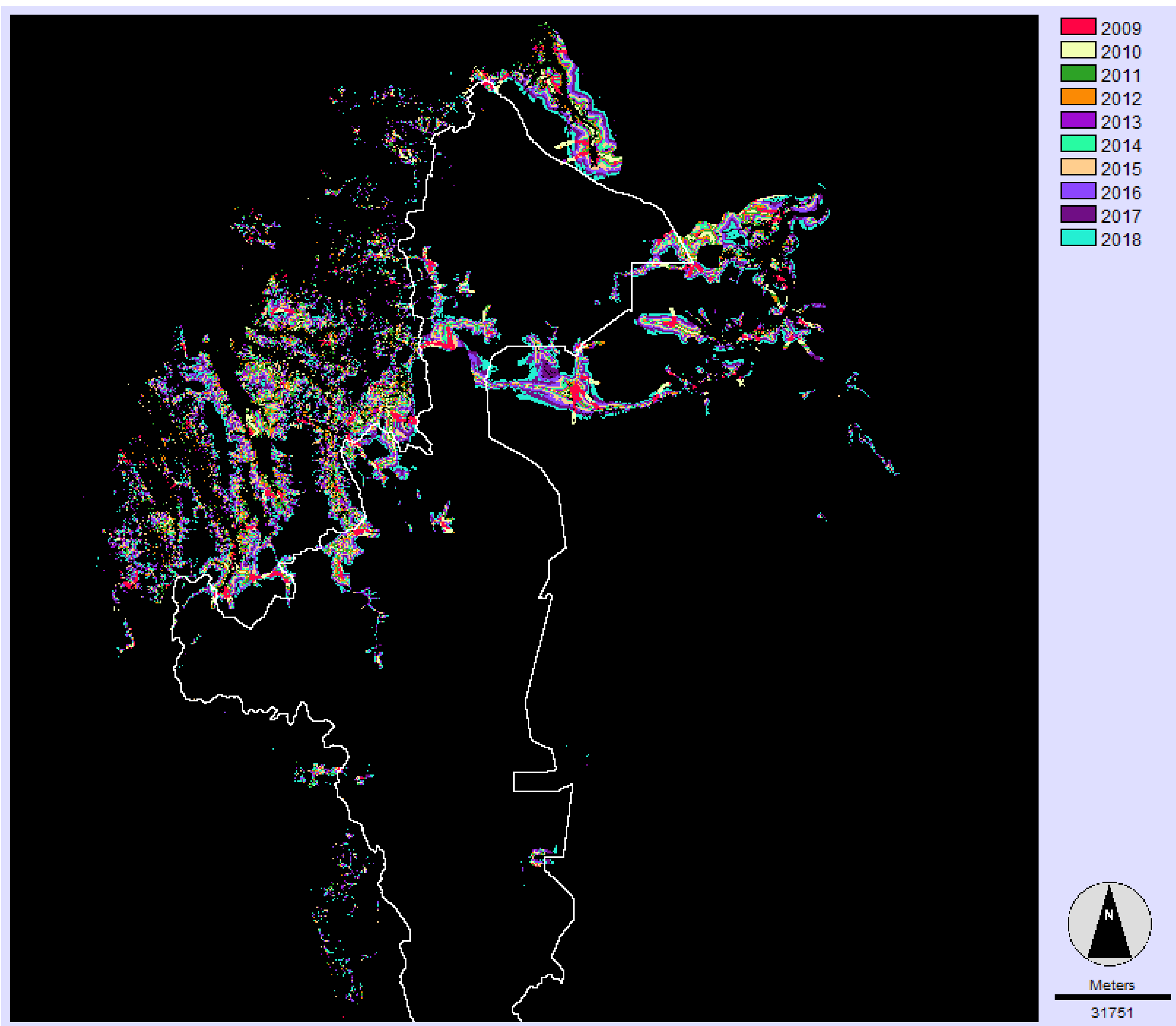


Table 3.11: Area deforested in ha for *Baseline Deforestation for the Baseline Period*

Year	Reference region (ha)	Project area (ha)	Leakage belt (ha)
2009	24,214.50	4,256.82	19,957.68
2010	27,320.04	5,420.34	21,899.70
2011	30,954.06	3,216.33	27,737.73
2012	35,216.91	3,818.16	31,398.75
2013	40,230.18	4,754.79	35,475.39
2014	46,140.21	6,254.28	39,885.93
2015	53,123.04	7,939.89	45,183.15
2016	57,723.84	9,533.52	48,190.32
2017	59,950.80	10,748.34	49,202.46
2018	62,040.60	12,409.38	49,631.22
Total	***436,914.18***	***68,351.85***	***368,562.33***

Figure 3.18:- Baseline deforestation in the project area from 2009 to 2018

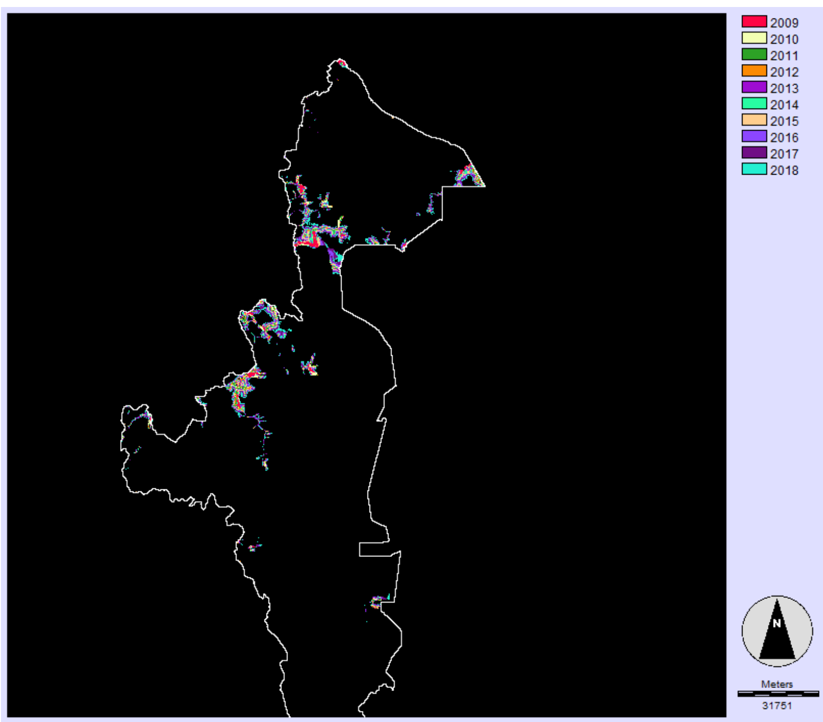


Table 3.12: Baseline projections (ha deforested) for baseline period 2009-2018 for the project area by forest class

YEAR	Alluvial	Collinosos	Montañosos	Humedales	*TOTAL*
2009	46.89	1,550.70	2,646.99	12.24	*4,256.82*
2010	715.86	3,423.51	1,271.97	9.00	*5,420.34*
2011	93.69	2,108.34	993.24	21.06	*3,216.33*
2012	150.75	2,369.97	1,267.56	29.88	*3,818.16*
2013	211.86	2,756.70	1,746.63	39.60	*4,754.79*
2014	354.87	3,267.18	2,566.44	65.79	*6,254.28*
2015	488.70	4,368.33	2,987.64	95.22	*7,939.89*
2016	579.33	5,518.26	3,361.14	74.79	*9,533.52*
2017	795.87	6,085.80	3,807.99	58.68	*10,748.34*
2018	1,227.06	6,724.98	4,390.65	66.69	*12,409.38*
TOTAL	*4,664.88*	*38,173.77*	*25,040.25*	*472.95*	***68,351.85***

Table 3.13: Baseline projections (ha deforested) for baseline period 2009-2018 for the leakage belt by forest class

YEAR	Anthropogenic Forest	Humedales-vegetación inundable	Vegetación de Tierra Firme	*TOTAL*
2009	1,416.96	3,786.03	14,754.69	*19,957.68*
2010	3,110.76	1,139.85	17,649.09	*21,899.70*
2011	3,387.42	1,435.68	22,914.63	*27,737.73*
2012	3,443.94	1,638.90	26,315.91	*31,398.75*
2013	3,558.51	1,943.64	29,973.24	*35,475.39*
2014	3,718.98	2,411.28	33,755.67	*39,885.93*
2015	4,170.51	2,957.67	38,054.97	*45,183.15*
2016	3,938.85	3,567.69	40,683.78	*48,190.32*
2017	3,628.53	3,910.05	41,663.88	*49,202.46*
2018	2,692.98	4,639.77	42,298.47	*49,631.22*
TOTAL	*33,067.44*	*27,430.56*	*308,064.33*	***368,562.33***

3.1.10 Estimation of Carbon Stock Changes (Baseline Emissions G1.5)

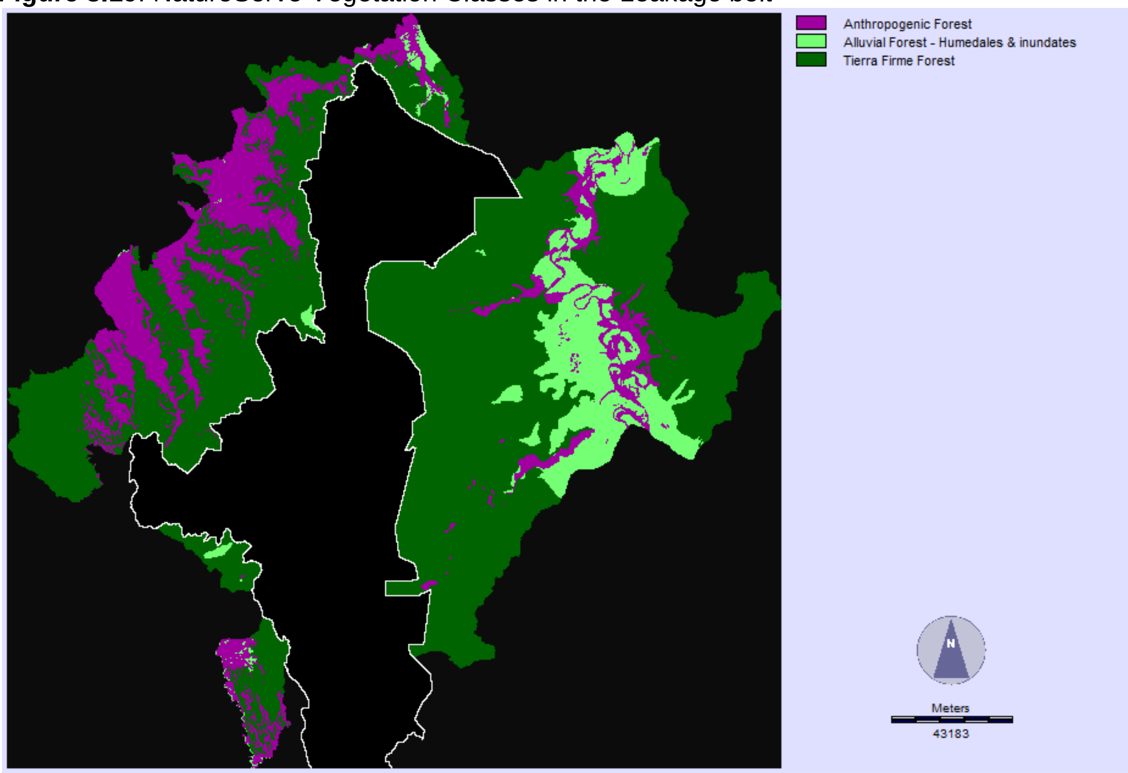
Estimates of forest carbon stocks in PNCAZ, including the project area and ineligible areas (private inholdings and areas not meeting the >10 years with forest criteria) within PNCAZ included in the leakage belt, were derived from the 2009 forest inventory of PNCAZ (Appendix 8).

For the leakage belt outside the PNCAZ boundary, stocks were derived by first delineating three high order forest classes (Natureserve: Josse et al 2007), humedales-vegetacion inundable and vegetacion de tierra firme (corresponding roughly with aguajales/alluvial forest and hill/mountain forest, respectively, from the project area) and anthropogenic forest. For each of the three classes, spatially-explicit aboveground biomass data were obtained from Saatchi (Saachi et al 2009), from which an area-weighted mean live aboveground tree carbon stock was estimated. Belowground biomass was then estimated from aboveground biomass applying the equation developed by Cairns *et al.* (1997; R-squared=0.83), where:

Root Biomass Density (t/ha) = EXP (-1.085 + 0.9256 LN(aboveground biomass density))

Stocks of lying and standing dead wood were estimated referencing proportion of total forest carbon represented by these pools of 7%, as calculated from results of the 2009 PNCAZ forest inventory.

Figure 3.19: NatureServe Vegetation Classes in the Leakage belt



Estimation of Post-deforestation Carbon Stocks

To quantify baseline carbon stocks, the "historical area-weighted average" approach (per VCS REDD methodology module BL-UP) was applied. This approach was selected over the "simple" approach because good data were available on the relative area of different post-deforestation land-uses in the project reference region.

CIMA conducted surveys in four provinces of San Martin, in the PNCAZ buffer zone, to characterize the mixture of anticipated post-deforestation land-uses in the baseline. Data were also collected through the land-use planning and zoning work conducted in the Chazuta sector and the upper and middle valleys of Pólvora-Piquiyacu and Shamboyacu. These sectors are representative of the communities near the park. Collection of data has occurred since 2004 and is ongoing. The results represent land-use change (historic deforestation) occurring over the past approximately 20 years. While the four provinces do not cover the entire reference region,[6] the surveyed provinces are where deforestation is concentrated and ongoing and are thus considered to be good predictors of near-term and future land-use changes.

[6] A complete ground survey of which would not be possible; land-use classes within non-forest could not be distinguished from remote imagery. In this case, ground survey information was augmented with data from the regional Macrozonificación San Martín (IIAP-GORESAM) and the middle and upper valley Shamboyacu sector (Picota), middle and upper valley Piquiyacu (Bellavista) and the upper and lower valley of Pólvora (Tocache).

Pools included match those in the with-project (forest) case: above and belowground live woody biomass and dead wood. Stocks in the baseline represent the long-term average stocks for a given, cyclical, land-use. The long-term average stocks are assumed to be stable for the 10-year period of the baseline. CIMA field personnel report that, in general, cultivated sites remain in cultivation and seldom are left fallow for more than five to six years, regardless of state of soil impoverishment.

The following broad land-use class designations were identified in the MUFs and other work conducted by CIMA in the PNCAZ buffer zone.

Table 3.14: Range of post-deforestation land-uses in the project reference region

Cultivated	**Purma media**	**Purma baja**	**Pasture**
Includes: • Shifting corn agriculture on a 2-4 year cycle (predominately) • Rice • Soybeans • Jatropha • Papaya < 5m	Includes: • Early successional vegetation (8 years old)[7] • Papaya > 5 m • Shade coffee • Cacao • Plantains/ bananas	Includes: • Early successional vegetation (1 – 8 years old) = fallow phase of shifting agriculture	Includes: • Grasses • Herbaceous vegetation for livestock

“Purma media” cannot be distinguished from forest in analysis of satellite images, thus it is not counted as deforestation (i.e., incorporated in assessment of historic and projection of future rates) and represents a conservative assumption in project accounting. Furthermore, much of the vegetation, and even agroforestry, within the “purma media” classification qualifies as forest under the Peru Designated National Authority (DNA) definition, with minimum height of 5 m and minimum percent canopy cover of 30%. Because “cultivated” and “purma baja” represent phases of the same cyclical agricultural practice, they are treated as one baseline land-use class. This represents a further conservative assumption, because the time-weighted average stocks for this combined class assume fallow periods for all agriculture (which is not always the case).

The resulting non-forest (conversion) land-use practices in the baseline are thus: cultivation (shifting cultivation) and pasture. Stock estimates within these two categories, to be applied in the estimation of the PNCAZ project baseline, are detailed in the table below. Preference was given to sourcing locally-derived estimates of biomass carbon stocks. Where local estimates were unavailable, values were sourced from IPCC 2006GL and global literature.

[7] Some sites are allowed to regenerate naturally to ~15 years old at which point pole-sized timber is harvested.

Table 3.15: Above- and belowground biomass carbon densities for agricultural lands

Activity/Land Use	Above- and Belowground Biomass Carbon (t C/ha)	Source
Cultivation	-	
Corn	4.4	Lapeyre *et al.* 2004
Rice	1.7	Lapeyre *et al.* 2004
Annual cropland	5	IPCC GL AFOLU 2006
Six-year old fallow	23.7	3.1 tC/ha-yr mean annual increment aboveground biomass over 20 years for secondary forest from San Martin Lapeyre *et al.* 2004, root biomass per Cairns *et al.* 1997
Pasture	6	Lapeyre *et al.* 2004, using root-to-shoot ratio of 1.6 (subtropical/tropical grassland) per IPCC GL AFOLU 2006

Due to the lack of information regarding the relative distribution of different agricultural activities within the broad "cultivation" class, the highest time-averaged biomass carbon value among the component activities/land-uses, 11.3 t C/ha (time-weighted average for shifting corn with a six-year fallow), is conservatively applied as the cultivation class level mean stock.

The following table details the calculation of the area-weighted average carbon stocks in the historical mix of post-deforestation land-uses (per VCS REDD methodology module BL-UP), considered as one strata.

Table 3.16: Historical area-weighted average carbon stock for the converted (non forest) baseline

	Cultivation	**Pasture**
Percent area of surveyed representative provinces in San Martin	88.27%	11.73%
Aboveground biomass carbon stock (t C/ha)	9.3	2.3
Historical area-weighted average above ground biomass carbon stock (t C/ha)	8.5	
	Cultivation	**Pasture**
Percent area of surveyed representative provinces in San Martin	88.27%	11.73%
Belowground biomass carbon stock (t C/ha)	2.7	3.7
Historical area-weighted average belowground biomass carbon stock (t C/ha)	2.8	

Carbon stock estimates applied in emission calculations are summarized in the table below.

Table 3.17: Summary of carbon stock estimates for land cover/land use classes

Class	**Area**	**AGB t CO_2/ha**	**BGB t CO_2/ha**	**DW t CO_2/ha**
Alluvial forest	PNCAZ	213.8	53.2	28.2
Hill forest	PNCAZ	350.5	84.3	31.9
Aguajal	PNCAZ	282.7	68.9	21.3
Mountain forest	PNCAZ	508.9	119.2	43.6
Humedales – vegetacion inundable	Leakage belt outside of PNCAZ	454.8	107.6	42.3
Vegetacion de tierra firme	Leakage belt outside of PNCAZ	343.4	82.9	32.1
Anthropogenic (forest)	Leakage belt outside of PNCAZ	366.2	88.0	34.2
		AGB t CO_2/ha	**BGB t CO_2/ha**	**DW t CO_2/ha**
Historical area-weighted average carbon stock for the converted (non forest) baseline, cultivation and pasture	Post forest conversion project area and leakage belt	31.1	10.2	0

Estimation of the Sum of Baseline Carbon Stock Changes

The sum of baseline carbon stock changes (ΔCTOT) was estimated using Equation 18 in the BL-UP module, shown below.

$$\boxed{\Delta C_{TOT} = C_{BSL} - C_{post} - C_{wp}}$$

Note that wood products and sources of GHG emissions are not included in the project boundary, as justified above in Section 2. ΔCTOT and CBSL are calculated in Tables 3.18 and 3.20 for the project area and Tables 3.19 and 3.21 for the leakage belt. All calculations are presented in the supporting spreadsheet “PNCAZ analysis.xls” (Appendix 9).

Table 3.18: C_{BSL} values for the Project Area

	$A_{unplanned,i,t}$ (ha)				*3.1.10.1* C_{BSL} (t CO2-e)				
YEAR	Alluvial	Collinsos	Montanosos	Humedales	Alluvial	Collinsos	Montanosos	Humedales	*CBSL*
2009	46.89	1,550.70	2,646.99	12.24	10,023.52	543,572.04	1,347,141.44	3,460.25	*1,904,197.25*
2010	715.86	3,423.51	1,271.97	9.00	153,027.01	1,200,054.37	647,347.93	2,544.30	*2,002,973.61*
2011	93.69	2,108.34	993.24	21.06	20,027.80	739,043.45	505,492.94	5,953.66	*1,270,517.85*
2012	150.75	2,369.97	1,267.56	29.88	32,225.33	830,753.48	645,103.54	8,447.08	*1,516,529.42*
2013	211.86	2,756.70	1,746.63	39.60	45,288.61	966,315.24	888,918.23	11,194.92	*1,911,716.99*
2014	354.87	3,267.18	2,566.44	65.79	75,859.38	1,145,255.50	1,306,146.86	18,598.83	*2,545,860.57*
2015	488.70	4,368.33	2,987.64	95.22	104,467.77	1,531,245.28	1,520,509.58	26,918.69	*3,183,141.32*
2016	579.33	5,518.26	3,361.14	74.79	123,841.44	1,934,334.07	1,710,596.18	21,143.13	*3,789,914.83*
2017	795.87	6,085.80	3,807.99	58.68	170,130.48	2,133,275.76	1,938,013.04	16,588.84	*4,258,008.12*
2018	1,227.06	6,724.98	4,390.65	66.69	262,304.53	2,357,329.66	2,234,548.14	18,853.26	*4,873,035.59*
TOTAL	*4,664.88*	*38,173.77*	*25,040.25*	*472.95*	*997,195.85*	*13,381,178.84*	*12,743,817.90*	*133,702.97*	***27,255,895.56***

Table 3.19: C_{BSL} values for the Leakage Belt

YEAR	Anthropogenic Forest	Humedales-vegetacion inundable	Vegetacion de Tierra Firme	Anthropogenic Forest	Humedales-vegetacion inundable	Vegetacion de Tierra Firme	*CBSL*
2009	1,416.96	3,786.03	14,754.69	518,892.12	1,721,714.97	5,067,365.70	*7,307,972.79*
2010	3,110.76	1,139.85	17,649.09	1,139,163.33	518,352.15	6,061,421.37	*7,718,936.85*
2011	3,387.42	1,435.68	22,914.63	1,240,476.49	652,882.24	7,869,823.77	*9,763,182.49*
2012	3,443.94	1,638.90	26,315.91	1,261,174.16	745,297.49	9,037,962.82	*11,044,434.47*
2013	3,558.51	1,943.64	29,973.24	1,303,129.81	883,879.44	10,294,039.94	*12,481,049.19*
2014	3,718.98	2,411.28	33,755.67	1,361,894.08	1,096,540.93	11,593,081.54	*14,051,516.55*
2015	4,170.51	2,957.67	38,054.97	1,527,244.80	1,345,014.36	13,069,637.49	*15,941,896.65*
2016	3,938.85	3,567.69	40,683.78	1,442,410.69	1,622,423.83	13,972,478.66	*17,037,313.17*
2017	3,628.53	3,910.05	41,663.88	1,328,771.20	1,778,113.65	14,309,085.20	*17,415,970.05*
2018	2,692.98	4,639.77	42,298.47	986,171.88	2,109,957.25	14,527,029.43	*17,623,158.57*
TOTAL	*33,067.44*	*27,430.56*	*308,064.33*	*12,109,328.56*	*12,474,176.31*	*105,801,925.91*	***130,385,430.78***

Table 3.20: Calculation of **ΔCTOT** for project area

Year	*CBSL* *(AGB only)*	CWP	*C post* *(AGB only)*	*BGB & DW*[8]	C_{TOT}
2009	1,904,197.3	0.0	132,355.64	62,668.51	1,834,510.1
2010	2,002,973.6	0.0	168,532.51	126,139.76	1,960,580.9
2011	1,270,517.9	0.0	100,004.09	166,512.36	1,337,026.1
2012	1,516,529.4	0.0	118,716.55	214,881.61	1,612,694.5
2013	1,911,717.0	0.0	147,838.82	276,152.29	2,040,030.5
2014	2,545,860.6	0.0	194,461.88	358,246.38	2,709,645.1
2015	3,183,141.3	0.0	246,871.89	460,490.42	3,396,759.9
2016	3,789,914.8	0.0	296,422.00	581,869.95	4,075,362.8
2017	4,258,008.1	0.0	334,193.93	718,410.32	4,642,224.5
2018	4,873,035.6	0.0	385,839.99	874,941.71	5,362,137.3
			ΔCTOT		**28,970,971.6**

Table 3.21: Calculation of **ΔCTOT** for leakage belt

Year	*CBSL* *(AGB only)*	CWP	*C post* *(AGB only)*	*BGB & DW*[9]	C_{TOT}
2009	7,307,972.8	0.0	620,536.33	223,404.28	6,910,840.7
2010	7,718,936.8	0.0	680,918.80	459,156.10	7,497,174.1
2011	9,763,182.5	0.0	862,438.38	757,330.36	9,658,074.5
2012	11,044,434.5	0.0	976,269.04	1,094,627.46	11,162,792.9
2013	12,481,049.2	0.0	1,103,022.41	1,475,799.31	12,853,826.1
2014	14,051,516.5	0.0	1,240,157.60	1,904,946.49	14,716,305.4
2015	15,941,896.6	0.0	1,404,861.99	2,391,846.21	16,928,880.9
2016	17,037,313.2	0.0	1,498,362.75	2,912,226.44	18,451,176.9
2017	17,415,970.0	0.0	1,529,832.82	3,444,186.41	19,330,323.6
2018	17,623,158.6	0.0	1,543,164.09	3,982,512.92	20,062,507.4
			ΔCTOT		**137,571,902.5**

[8] These values are calculated at a linear rate of decay over ten years, with annual increments of 1/10th each year following deforestation
[9] These values are calculated at a linear rate of decay over ten years, with annual increments of 1/10th each year following deforestation

Table 3.22: Summary parameters for the 10 year baseline period 2009-2018

Parameter	Project Value	SI Unit	Description
$\Delta C_{BSL,unplanned}$	**28,970,971.6**	tCO_2-e	Net greenhouse gas emissions in the baseline from unplanned deforestation
$\Delta C_{BSL,LK,unplanned}$	**137,571,902.5**	tCO_2-e	Net CO_2 emissions in the baseline from unplanned deforestation in the leakage belt
$A_{BSL,PA,unplanned,t}$	68,351.85	ha yr^{-1}	Projected area of unplanned baseline deforestation in the Project Area in year *t*
$A_{BSL,LK,unplanned,t}$	368,562.33	ha yr^{-1}	Projected area of unplanned baseline deforestation in the Leakage Belt Area in year *t*

3.2 Project Emissions (CCB: CL1.3)

Emissions expected in the with-project case result from un-prevented illegal deforestation. For ex ante calculations, it is assumed a 90% success rate in preventing illegal deforestation, i.e. 10% of the deforestation projected in the baseline is not prevented by the project activity.

Emissions resulting from degradation due to illegal logging (parameter $\Delta C_{P,DegW}$) are assumed to be 0. Despite continuous monitoring activities in the field, no illegal logging activities have been observed by park guards in or immediately around the project area since 2006. Further, during four months of field work in 2009 on the PNCAZ forest inventory, no indications of illegal logging were observed by field crews. MUF (Mapeo de Usos y Fortalezas) surveys were conducted by CIMA in September and October 2011 of communities in the buffer zone of PNCAZ to determine any potential for illegal wood extraction from the project area. Surveyed communities included all of those within 2 km of the project area/leakage belt interface, i.e. with close access to the project area. Again, no indications of illegal wood use from within the project area were detected.

Expected project emissions were estimated ex-ante by applying module M-MON of Methodology VM0007. Equation 1 from this module is used to calculate ex-ante project emissions. Values for individual parameters are justified in Table 3.23 or derived in Tables 3.24 and 3.25.

$$\Delta C_P = \sum_{t=1}^{t*} \sum_{i=1}^{M} \left(\Delta C_{P,DefPA,i,t} + \Delta C_{P,Deg,i,t} + \Delta C_{P,DistPA,i,t} + GHG_{P-E,i,t} - \Delta C_{P,Enh,i,t} \right)$$

Table 3.23: Parameters and Values used to Calculate Annual Ex-Ante Project Emissions

Parameter	Description	Value	Justification
ΔC_P	Net greenhouse gas emissions within the project area under the project scenario; t CO_2e	See table 3.25	
$\Delta C_{P,DefPA,i,t}$	Net carbon stock change as a result of deforestation in the project area in the project case in stratum i at time t; t CO_2e	See table 3.24	

$\Delta C_{P,Deg,i,t}$	Net carbon stock change as a result of degradation in the project area in the project case in stratum i at time t; t CO_2e	$\Delta C_{P,Deg,i,t=}$ 0	Emissions resulting from degradation due to illegal logging (parameter ΔCP,DegW) are expected to be 0 based on lack of recent evidence of illegal logging encountered in and around the project area.
$\Delta C_{P,DistPA,i,t}$	Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum i at time t; t CO_2e	$\Delta C_{P,DistPA,i,t} = 0$	Assumed to be zero for ex ante calculations (analysis of natural disturbance and demonstration of low rates of incidence of catastrophic natural disturbance is included in the Project Risk Assessment)
$GHG_{P-E,i,t}$	Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum i in year t; t CO_2e	$GHG_{P-E,i,t} = 0$	Not included in the project boundary, per justification in Section 2 above.
$\Delta C_{P,Enh,i,t}$	Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in stratum i at time t; t CO_2e	$\Delta C_{P,Enh,i,t} = 0$	Not accounted for, per Section 2 above. Conservative to exclude.

Table 3.24: Data used to Calculate ΔCP,DefPA,i,t *

Year	CTOT Net greenhouse gas emissions in the baseline from unplanned deforestation; t CO2-e	10% of baseline in project area by year
2009	1,834,510.1	183,451.0
2010	1,960,580.9	196,058.1
2011	1,337,026.1	133,702.6
2012	1,612,694.5	161,269.4
2013	2,040,030.5	204,003.0
2014	2,709,645.1	270,964.5
2015	3,396,759.9	339,676.0
2016	4,075,362.8	407,536.3
2017	4,642,224.5	464,222.5
2018	5,362,137.3	536,213.7

* Calculated as 10% of the ΔCBSL,PA,unplanned

Table 3.25: Data used to Calculate ΔC_P

Year	ΔCP,DefPA,i,t (t CO2-e)	ΔCP,Deg,i,t (t CO2-e)	ΔCP,DistPA,i,t (t CO2-e)	GHGP-E,i,t (t CO2-e)	ΔCP,Enh,i,t (t CO2-e)	ΔCP (t CO2-e)
2009	183,451.0	0	0	0	0	183,451.0
2010	196,058.1	0	0	0	0	196,058.1
2011	133,702.6	0	0	0	0	133,702.6
2012	161,269.4	0	0	0	0	161,269.4
2013	204,003.0	0	0	0	0	204,003.0
2014	270,964.5	0	0	0	0	270,964.5
2015	339,676.0	0	0	0	0	339,676.0
2016	407,536.3	0	0	0	0	407,536.3
2017	464,222.5	0	0	0	0	464,222.5
2018	536,213.7	0	0	0	0	536,213.7
						2,897,097.2

Anticipated with-project emissions are calculated in Table 3.35 and are expected to total for the 10-year baseline period 2,897,097.2t CO_2.

3.3 Leakage (CCB: CL2.3)

Leakage emissions accounted for are entirely from displacement of unplanned deforestation and were estimated applying the LK-ASU module of methodology VM0007.

Leakage due to market effects is equivalent to zero because the project is not anticipated to impact any commercial harvesting activities. Any wood collection that might take place in the baseline, whether for timber or fuelwood, is subsistence-driven. Per VM0007 module LK-ME, accounting market leakage is only required where "The process of deforestation involves timber harvesting for commercial markets[10]" or where "The baseline is calculated using BL-DFW AND fuel wood or charcoal is harvested for commercial markets."

Estimation of baseline carbon stock changes and greenhouse gas emissions in the leakage belt

The baseline specific to the leakage belt was developed applying module BL-UP, detailed above in Section 3 (Table 3.21, repeated below in Table 3.27).

Estimation of unplanned deforestation displaced from the project area to the leakage belt

Ex-ante baseline emissions occurring in the leakage belt are estimated by first estimating the amount of deforestation that is thought to be displaced from the project area to the leakage belt due to the implementation of the REDD project activity. For ex ante purposes, a leakage factor of 20% is applied, i.e. 20% of deforestation caused by local agents is shifted outside of the project area due the project activity. Leakage is then calculated as the difference between project and baseline emissions in the leakage belt, as outlined in Equation 1 from LK-ASU Module (below). Ex-ante estimates of the net CO2 emissions due to unplanned deforestation displaced from the project area to the leakage belt is calculated for each year in the baseline period in Table 3.38.

Equation for calculating net CO2 emissions due to unplanned deforestation displaced from the project area to the leakage belt (Equation 1 from LK-ASU Module):

10 Commercial markets here defined as sale of products to end users and public and private companies with sales conducted distant (>50km) from the project area

$$\Delta C_{LK-ASU-LB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned}$$

Table 3.26: Parameters and values used to calculate annual ex-ante GHG emissions in the leakage belt

Parameter	Description	Value	Justification
ΔCLK-ASU-LB	Net CO2 emissions due to unplanned deforestation displaced from the project area to the leakage belt; t CO2-e	See Table 3.28	Calculated.
ΔCBSL,LK,unplanned	Net CO2 emissions in the baseline from unplanned deforestation in the leakage belt; t CO2-e	See Table 3.27	Derived in Section 3.1.
ΔCP,LB	Net greenhouse gas emissions within the leakage belt in the project case t CO2-e	See Table 3.28	Ex-ante estimate was calculated by multiplying the estimated baseline emissions from the project area by a factor of 0.20, representing the % of deforestation expected to be displaced into the leakage belt. This result was then added to the estimated baseline for the leakage belt.

Table 3.27: Estimates of baseline emissions in the leakage belt (derived in Section 3.1)

year	$C_{TOT\ BSL\ LB}$
2009	6,910,840.7
2010	7,497,174.1
2011	9,658,074.5
2012	11,162,792.9
2013	12,853,826.1
2014	14,716,305.4
2015	16,928,880.9
2016	18,451,176.9
2017	19,330,323.6
2018	20,062,507.4
Total	137,571,902.5

Table 3.28: Estimates of the net CO2 emissions due to unplanned deforestation caused by local agents displaced from the project area to the leakage belt

Year	$C_{TOT\ BSL\ PA}$	% deforestation expected to be displaced from the project area[11]	ΔCP,LB1 (t CO2-e)	ΔCBSL,LK,unplanned	ΔCLK-ASU-LB (t CO2-e)
2009	1,834,510.1	366,902.0	7,277,742.8	6,910,840.7	366,902.0
2010	1,960,580.9	392,116.2	7,889,290.3	7,497,174.1	392,116.2
2011	1,337,026.1	267,405.2	9,925,479.7	9,658,074.5	267,405.2
2012	1,612,694.5	322,538.9	11,485,331.8	11,162,792.9	322,538.9
2013	2,040,030.5	408,006.1	13,261,832.2	12,853,826.1	408,006.1
2014	2,709,645.1	541,929.0	15,258,234.4	14,716,305.4	541,929.0
2015	3,396,759.9	679,352.0	17,608,232.8	16,928,880.9	679,352.0
2016	4,075,362.8	815,072.6	19,266,249.4	18,451,176.9	815,072.6
2017	4,642,224.5	928,444.9	20,258,768.5	19,330,323.6	928,444.9
2018	5,362,137.3	1,072,427.5	21,134,934.9	20,062,507.4	1,072,427.5
Total	28,970,971.6	5,794,194.3	143,366,096.8	137,571,902.5	5,794,194.3

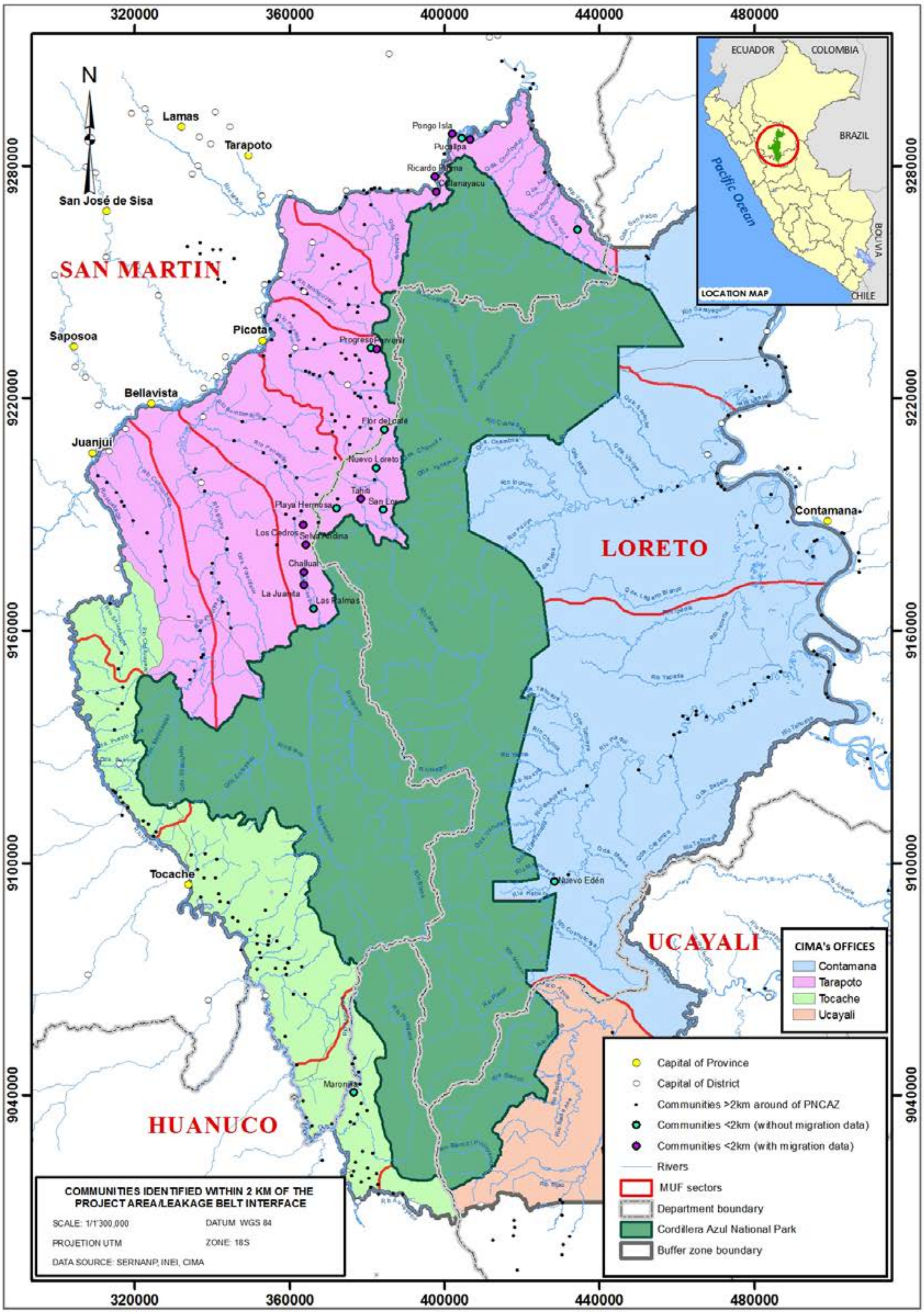
[11] Calculated as 0.20 multiplied by ΔCBSL,PA,unplanned plus ΔCBSL,LK,unplanned

Estimation of the proportion of area deforested by immigrant deforestation agents in the baseline

Derivation of $PROP_{IMM}$ parameter

In September and October 2011, surveys (Mapeo de Usos y Fortalezas, MUF) of communities in the buffer zone of PNCAZ were conducted by CIMA to determine the percentage of recent immigrants. Surveyed communities included all of those within 2 km of the project area/leakage belt interface (i.e. all of those baseline agents of the project area expected to shift activities locally within the leakage belt).

Figure 3.20: Communities identified within 2 km of the project area/leakage belt interface



Out of 20 communities identified within 2 km of the project area/leakage belt interface (Figure 3.20), 10 were selected to conduct surveys (Table 3.29). Communities were selected based on their relative dependence on the forest in the project area, and hence targeted those communities most likely to include baseline agents of deforestation. An additional community just beyond the 2 km limit but still relatively close to the park border, La Cumbre in Contamana district, was also surveyed to produce a total of 11 communities for which inhabitant immigration status was determined.

Table 3.29: Communities within 2 km of the PNCAZ project area/leakage belt interface

District	Centro Poblado	Sampled?
Huimbayoc	Santa Rosillo	
Huimbayoc	Pongo Isla	x
Huimbayoc	Pucallpa	x
Chazuta	San Juan de Solterito	
Chazuta	Ricardo Palma	x
Chazuta	Callanayacu	x
Shamboyacu	Porvenir	x
Shamboyacu	Progreso	
Pampa Hermosa	Flor de Café	
Pampa Hermosa	Nuevo Loreto	
Pampa Hermosa	Tahiti	x
Pampa Hermosa	San Lor	
Pampa Hermosa	Playa Hermosa	
Alto Biavo	Los Cedros	x
Bajo Biavo	Selva Andina	x
Alto Biavo	Challual	x
Alto Biavo	Juanita	x
Alto Biavo	Las Palmas	
Jose Crespo y Castillo	Maronilla	
Contamana	Nuevo eden	

In most selected communities, surveys were conducted with all inhabitants in the nucleus of the community, following MUF procedures, resulting in 41% of all inhabitants of selected communities interviewed, 2,086 persons in total. Three communities, Ricardo Palma, La Cumbre and Los Cedros, were surveyed by conducting focus meetings with community authorities with intimate knowledge of community demographics.

Persons who had immigrated to the community after 2005 (i.e. having arrived less than or equal to 5 years ago) were identified as recent immigrant potential deforestation agents. Per VM0007, the parameter $PROP_{IMM}$ is defined as "the proportion of area deforested by population that has migrated into the area in the last 5 years ($PROP_{IMM}$)." As it is extremely sensitive to ask explicit questions regarding responsibility for deforestation, interviewed persons were instead asked where they were originally from and when they had moved to the area. Thus, the percentage of recent immigrants among local population with potential access to the project area was used to infer "the proportion of area deforested by population that has migrated into the area in the last 5 years" (i.e. without directly asking if they are deforestation agents).

Results are detailed in Table 3.20. The resulting $PROP_{IMM}$ parameter is 32.5%, which is the population-weighted average percent recent immigrant (potential deforestation agents).

Table 3.30: Immigrant survey results

Community	Year founded	Total population	Households	Inhabitants surveyed	Natural	immigrant (>5 years)	recent immigrant (= or < 5 years)	areas of origin of immigrants	% immigrants
Pucallpa	1835	993	190	344	328	8	8	undetermined	2.3%
Pongo Isla	1920	207	57	169	164	4	1	undetermined	0.6%
Porvenir	2003	300	38	181	67	51	63	undetermined	34.8%
Tahiti	2003	182	37	168	24	9	135	San Martín, Amazonas y Cajamarca	80.4%
Ricardo Palma	undetermined	297	undetermined				57	undetermined	19.2%
Callanayacu	1925	650	80	210	158	47	5	undetermined	2.4%
Selva Andina	2001	295	88	219	48	50	121	Piura, Cajamarca, Dorado, Amazonas, etc.	55.3%
Challual	1998	1900	450	505	129	168	208	Cajamarca, Lambayeque, Amazonas, Piura, etc.	41.2%
Puente Juanita	2005	300	60	290	52	54	184	Cajamarca, Lamayeque, amazonas, piura, etc	63.4%
Los Cedros	1998	228	60				188	undetermined	82.5%
La Cumbre	undetermined	90	20				1	Utucuro (Alto Ucayali)	1.1%
								Population-weighted average % recent immigrants	**32.5%**

Deforestation caused by immigrant agents displaced outside the leakage belt is calculated in the series of steps detailed below.

The first step involves estimating the total available national forest area, TOTFOR. For this parameter we referenced the 2010 Peru FRA (FAO 2010) (Section 1.4) estimate of national forest area in 2010 of 67,992,000 ha. Parameter AVFOR, total available national forest area for unplanned deforestation, was set at 67,992,000 ha, equal to TOTFOR, conservatively not discounting areas of protected and managed forests.

Next the ratio ($PROP_{LB}$) of the forested area of the leakage belt (LBFOR) to the total available national forest area (AVFOR) was calculated using Equation 3 of module LK-ASU. LBFOR was calculated from the Leakage Belt Forest Cover Benchmark Map (derived above).

$PROP_{LB}$ = 1,920,311ha / 67,992,000 ha = 0.028

The mean aboveground live tree carbon stock (C_{OLB}) was calculated for Peruvian forests using above-ground biomass values reported in the FAO FRA Peru 2010 Country Report (Section 7.4, Tabla T7), equal to 218.4 t aboveground biomass per ha (14,848,000,000 t aboveground biomass total / 67,992,000 ha total), equivalent to 376.3 t CO2 equivalent per ha (applying a C fraction of biomass of 0.47). While the country level estimate provided in the FRA report includes the leakage belt area, it is conservative to use the country level average in calculations because biomass stocks in the forests of the project leakage belt and Peruvian Amazon are expected to be higher than stocks in other Peruvian forests, thus parameter C_{OLB} is *over-estimated* here (i.e. average stocks outside the leakage belt in Peru would be expected to be less than the country level average). Thus,

C_{OLB} = 376.3 t CO_2-e ha-1.

The area weighted average aboveground live tree carbon stock for forests available for unplanned deforestation inside the leakage belt (C_{LB}) was calculated by first delineating three high order forest classes from NatureServe (Josse et al 2007; and Ferreira et al 2007), humedales-vegetación inundable and vegetación de tierra firme (corresponding roughly with aguajales/alluvial forest and hill/mountain forest, respectively, from the project area) and anthropogenic forest. The latter class includes the “purma media” land-use category described above, which cannot be distinguished from forest from satellite imagery, as well as early successional (to 8-10 year old) vegetation and agroforestry, including papaya, shade coffee, cacao and plantains/bananas.

For each of the three classes, spatially-explicit aboveground biomass data were obtained from Saatchi et al 2009, from which an area-weighted mean live aboveground tree carbon stock was estimated.

The resulting estimates for the humedales-vegetación inundable, vegetacion de tierra firme and anthropogenic forest classes in the leakage belt are 454.8, 343.4 and 366.2 t CO_2/ha, respectively, in aboveground live tree biomass (Table 3.31).

For the 1,151 ha of ineligible areas within PNCAZ boundary, included within the leakage belt, stock estimates were referenced from the 2009 PNCAZ inventory.

Table 3.31: Derivation of parameter C_{LB} leakage belt forest mean aboveground live tree biomass stocks

Forest strata	ha	AGB t CO_2/ha	area/weighted average
Humedales – vegetacion inundable	246,079	454.8	58.3
Vegetacion de tierra firme	1,585,596	343.4	283.6
Anthropogenic forest	86,874	366.2	16.6
Mountain forest (PNCAZ class)	826	508.9	0.2
Hill Forest (PNCAZ class)	425	350.5	0.1
Alluvial forest (PNCAZ class)	512	213.8	0.1
total area	1,920,311		358.8

C_{LB} = 358.8 t CO_2-e ha-1.

The proportional difference in carbon stocks between areas of forest available for unplanned deforestation both inside and outside the leakage belt ($PROP_{CS}$) was calculated using Equation 4 of module LK-ASU as

$PROP_{CS}$ = 376.3 t CO_2-e ha-1 / 358.8 t CO_2-e ha-1 = 1.049

The proportional leakage for areas with immigrating populations was calculated using Equation 5 of module LK-ASU (below). The values for the parameters used in this equation are derived above and summarized in Table 3.32.

Equation 5 of module LK-ASU:

$$LK_{PROP} = PROP_{IMM} * (1 - PROP_{LB}) * PROP_{CS} \quad (5)$$

Table 3.32: Parameters and values used to calculate the proportional leakage for areas with immigrating populations

Parameter	Description	Value
LK_{PROP}	Proportional leakage for areas with immigrating populations; proportion	0.331
$PROP_{IMM}$	Estimated proportion of baseline deforestation caused by immigrating population; proportion	0.325
$PROP_{LB}$	Area of forest available for unplanned deforestation as a proportion of the total national forest area available for unplanned deforestation; proportion	0.028

$PROP_{CS}$	The proportional difference in stocks between areas of forest available for unplanned deforestation both inside and outside the leakage belt; proportion	1.049

The net leakage outside the leakage belt ($\Delta C_{LK\text{-}ASU,OLB}$) is calculated ex-ante using Equation 6 of module LK-ASU, revised below to correct the order of the first two terms in the equation.

$$\Delta C_{LK-ASU,OLB} = \left(\Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned}\right) * LK_{PROP}$$

Table 3.33: Ex ante estimation of net CO_2 emissions due to unplanned deforestation displaced outside the leakage belt

Year	ΔCBSL,LK,unplanned (t CO2-e)	ΔCP,LB1 (t CO2-e)	LKPROP	ΔCLK-ASU,OLB
2009	6,910,840.74	7,277,742.76	0.33	121,554.21
2010	7,497,174.15	7,889,290.32	0.33	129,907.62
2011	9,658,074.47	9,925,479.70	0.33	88,591.04
2012	11,162,792.89	11,485,331.79	0.33	106,856.76
2013	12,853,826.09	13,261,832.18	0.33	135,171.94
2014	14,716,305.43	15,258,234.44	0.33	179,540.44
2015	16,928,880.86	17,608,232.83	0.33	225,068.51
2016	18,451,176.86	19,266,249.42	0.33	270,032.58
2017	19,330,323.63	20,258,768.53	0.33	307,592.70
2018	20,062,507.39	21,134,934.86	0.33	355,293.95

Estimation of total leakage due to the displacement of unplanned deforestation (inside and outside the leakage belt)

The total leakage due to the displacement of unplanned deforestation is estimated in Table 3.34 using Equation 13 from LK-ASU module. Note that sources of GHG emissions (GHGLK,E) are not included in the project boundary, per justification in Section 2 above.

Table 3.34: Calculation of the total leakage due to the displacement of unplanned deforestation

Year	ΔCLK-ASU-LB	ΔCLK-ASU,OLB	GHGLK,E	ΔCLK-AS,unplanned
2009	366,902.0	121,554.2	0.0	488,456.2
2010	392,116.2	129,907.6	0.0	522,023.8
2011	267,405.2	88,591.0	0.0	355,996.3
2012	322,538.9	106,856.8	0.0	429,395.7
2013	408,006.1	135,171.9	0.0	543,178.0
2014	541,929.0	179,540.4	0.0	721,469.5
2015	679,352.0	225,068.5	0.0	904,420.5
2016	815,072.6	270,032.6	0.0	1,085,105.1
2017	928,444.9	307,592.7	0.0	1,236,037.6
2018	1,072,427.5	355,294.0	0.0	1,427,721.4

3.4 Summary of GHG Emission Reductions and Removals (CCB: CL1.4, CL2.3)

Net emission reduction calculations are summarized in Table 3.35.

Table 3.35: Ex ante estimates of net emission reductions from the PNCAZ REDD Project

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	Estimated net GHG emission reductions or removals (tCO2e)
2009	1,834,510	183,451	488,456	10%	165,106	997,497
2010	1,960,581	196,058	522,024	10%	176,452	1,066,047
2011	1,337,026	133,703	355,996	10%	120,332	726,995
2012	1,612,694	161,269	429,396	10%	145,143	876,887
2013	2,040,030	204,003	543,178	10%	183,603	1,109,247
2014	2,709,645	270,965	721,469	10%	243,868	1,473,343
2015	3,396,760	339,676	904,420	10%	305,708	1,846,955
2016	4,075,363	407,536	1,085,105	10%	366,783	2,215,939
2017	4,642,225	464,222	1,236,038	10%	417,800	2,524,164
2018	5,362,137	536,214	1,427,721	10%	482,592	2,915,610
Total	28,970,972	2,897,097	7,713,804		2,607,387	15,752,683

4. MONITORING (CL2.2, CL3.2, CM3.2)

4.1 Data and Parameters Available at Validation

Details on data and parameters available at validation are provided below.

Data Unit / Parameter:	$\Delta C_{BSL,PA,unplanned}$
Data unit:	t CO_2-e
Description:	Net CO_2 emissions in the baseline from unplanned deforestation in the project area
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:	$\Delta C_{BSL,LK,unplanned}$
Data unit:	t CO_2-e
Description:	Net CO_2 emissions in the baseline from unplanned deforestation in the leakage belt
Source of data:	Derived in Section 3.1 and 3.2 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:	C_{OLB}
Data unit:	t CO_2-e ha^{-1}
Description:	Area-weighted average aboveground tree carbon stock for forests available for unplanned deforestation outside the Leakage Belt
Source of data:	2010 FAO FRA Peru Country Report
Value applied:	376.3 t CO_2-e ha^{-1}
Justification of choice of data or description of measurement methods and procedures applied:	Derived above in Section 3.3 of the Project Description
Any comment:	

Data Unit / Parameter:	C_{LB}
Data unit:	t CO_2-e ha^{-1}
Description:	Area weighted average aboveground tree carbon stock for forests available for unplanned deforestation inside the Leakage Belt
Source of data:	Stocks were derived by first delineating three high order forest classes from Natureserve (Josse et al 2007; and Ferreira et al 2007), humedales-vegetacion inundable and vegetacion de tierra firme (corresponding roughly with aguajal/alluvial forest and hill/mountain forest, respectively, from the project area) and anthropogenic forest. For each of the three classes, spatially-explicit aboveground biomass

	data were obtained from Saatchi et al 2009, from which an area-weighted mean live aboveground tree carbon stock was estimated.
Value applied:	358.8 t CO_2-e ha-1
Justification of choice of data or description of measurement methods and procedures applied:	Derived above in Section 3 of the Project Description
Any comment:	

Data Unit / Parameter:	*CF*
Data unit:	t C t d.m.$^{-1}$
Description:	Carbon fraction of dry matter in t C t^{-1} d.m.
Source of data:	default value of from IPCC 2006GL
Value applied:	0.47 t C t^{-1} d.m
Justification of choice of data or description of measurement methods and procedures applied:	As permitted by methodology VM0007 module CP-AB "Values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3) shall be used if available, otherwise default value of 0.47 t C t^{-1} d.m. can be used"
Any comment:	

Data Unit / Parameter:	*D:RAD*
Data unit:	Dimensionless
Description:	Ratio of DBH to plot radius, specific to prism Basal Area Factor (BAF) employed in point sampling
Source of data:	Avery, T.E. and H.E. Burkhart. 1994. Forest Measurements. Fourth Edition. McGraw Hill, Boston, Massachusetts, USA. 408 pp.
Value applied:	(see table below)
Justification of choice of data or description	

	BAF gauge				
ft^2/acre	5	10	15	20	40
m^2/ha	1.15	2.29	3.44	4.59	9.18
ratio dbh/plot radius	1:46.7	1:33	1:26.9	1:23.3	1:16.5

of measurement methods and procedures applied:	
Any comment:	

Data Unit / Parameter:	$f_j(X,Y)$
Data unit:	t d.m. tree^{-1}
Description:	Allometric equation for species *j* linking measured tree variable(s) to aboveground biomass of living trees, expressed as t d.m. tree^{-1}
Source of data:	Chave, J., Andalo, C., Brown, S., Cairns, M.A., Chambers, J.Q., Eamus, D., Folster, H., Fromard, F., Higuchi, N., Kira, T., Lescure, J.P., Nelson, B.W., Ogawa, B., Puig, H., Riera, B. and T. Yamakura. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145:87-99. Freitas Alvarado, L., Otorola Acevedo, E., del Castillo Torres, D., Linares Bensimon, C., Martinez Davila, P. and G.A. Malca Salas. 2006. Servicios Ambientales De Almacenamiento Y Secuestro De Carbono Del Ecosistema Aguajal En La Reserva Nacional Pacaya Samiria, Loreto, Perú. Instituto de Investigaciones de la Amazonía Peruana. Documento Técnico Nº 29. Iquitos, Perú.
Value applied:	Detailed in PNCAZ 2009 forest inventory report
Justification of choice of data or description of measurement methods and procedures applied:	Both equations validated in PNCAZ 2009 forest inventory report
Any comment:	

Data Unit / Parameter:	*R*
Data unit:	t root d.m. t^{-1} shoot d.m.
Description:	Root to shoot ratio appropriate to species or forest type / biome; note that as defined here, root to shoot ratio is applied as belowground biomass per unit area:aboveground biomass per unit area (not on a per stem basis)
Source of data:	Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111, 1-11. Freitas Alvarado, L., Otorola Acevedo, E., del Castillo Torres, D., Linares Bensimon, C., Martinez Davila, P. and G.A. Malca Salas. 2006. Servicios Ambientales De Almacenamiento Y Secuestro De Carbono Del Ecosistema Aguajal En La Reserva Nacional Pacaya Samiria, Loreto, Perú. Instituto de Investigaciones de la Amazonía Peruana. Documento Técnico Nº 29. Iquitos, Perú.
Value applied:	Detailed in PNCAZ 2009 forest inventory report
Justification of choice of data or description of measurement methods and procedures applied:	Note that rather than using a constant root to shoot ratio to estimate belowground biomass, belowground biomass was estimated using an allometric equation, where the relationship varies continuously with aboveground biomass. The equation is derived from 151 observations from a global dataset of upland forests.
Any comment:	

Data Unit / Parameter:	D_{DWdc}
Data unit:	t d.m. m^{-3}
Description:	Mean wood density of dead wood in the density class (dc) – sound (1), intermediate (2), and rotten (3); t d.m. m^{-3}

Source of data:	Measured from dead wood samples, 30 from each decomposition class, collected in the project area. Density of dead wood was determined through sampling and laboratory analysis as follows. Discs were collected in the field and decomposition class and green volume determined as per standard protocols (Appendix 2). Discs were then transferred to a laboratory (Laboratorio de Análisis de Suelos del Instituto Nacional de Investigación Agraria, INIA) in Tarapoto and oven-dried at 80°C, conducting continuous weight measurements until reaching constant weight. The resulting dry weight was recorded and used to calculate dead wood density as oven-dry weight (g) / green volume (cm^3) for each sample.
Value applied:	Detailed in PNCAZ 2009 forest inventory report
Justification of choice of data or description of measurement methods and procedures applied:	Measurements follow procedures as outlined in methodology VM0007 module CP-D
Any comment:	

Data Unit / Parameter:	*Regional Forest Cover / Non-Forest Cover Benchmark Map*
Data unit:	
Description:	Map showing the location of forest land within the reference region at the beginning of the crediting period
Source of data:	Classified satellite imagery
Value applied:	*N/A*
Justification of choice of data or description of measurement methods and procedures applied:	Detailed procedures provided below under monitoring plan description.
Any comment:	Updated every 10 years at baseline revision

Data Unit / Parameter:	*Project Forest Cover Benchmark Map*
Data unit:	ha
Description:	Map showing the location of forest land within the project area at the beginning of each monitoring period. If within the Project Area some forest land is cleared, the benchmark map must show

	the deforested areas at each monitoring event
Source of data:	Classified satellite imagery
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Detailed procedures provided below under monitoring plan description.
Any comment:	Updated at each monitoring/verification event

Data Unit / Parameter:	*Leakage Belt Forest Cover Benchmark Map*
Data unit:	ha
Description:	Map showing the location of forest land within the leakage belt area at the beginning of each monitoring period. Only applicable where leakage is to be monitored in a leakage belt
Source of data:	Classified satellite imagery
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied:	Detailed procedures provided below under monitoring plan description.
Any comment:	Updated at each monitoring/verification event

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_2O).
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. Note that:

- *"value applied" is left blank because all parameters in this section are monitored*
- *"monitoring equipment" is left blank to provide flexibility in measurement and monitoring approach, essential for any longterm MRV plan*
- *Where a parameter is calculated from a methodology equation (i.e. not raw data), the methodology module and equation number is specified and "Description of measurement methods and procedures to be applied" and "QA/QC procedures to be applied" are appropriately left blank*
- *To avoid repetition and maintain an economical use of space in the summary tables, "Description of measurement methods and procedures to be applied" and "QA/QC procedures to be applied" for monitored (not calculated) parameters reference detailed accounts of procedures provided in the monitoring plan description below.*

Data Unit / Parameter:	Ä$C_{P,Def,i,t}$
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* at time *t*
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Equation 3, VMD0015
Any comment:	

Data Unit / Parameter:	$\Delta C_{P,DefLB,i,t}$
Data unit:	t CO_2-e
Description:	Net carbon stock change as a result of deforestation in the project case in the leakage belt in stratum *i* at time *t*
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Equation 4, VMD0015
Any comment:	

Data Unit / Parameter:	Ä$C_{P,DistPA,i,t}$
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* at time *t*
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
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* converted to land use *u* at time *t*
Source of data:	Monitored at each monitoring/verification event through analysis of classified satellite imagery
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Minimum Mapping Unit (MMU) of 0.81 ha, corresponding to 3 pixels by 3 pixels Landsat resolution (90m by 90m), providing closest conformance possible to 0.5 ha Peru DNA forest definition with Landsat.
Frequency of monitoring/recording:	Every $\leq$ 5 years

Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

Data Unit / Parameter:	$A_{DefLB,u,i,t}$
Data unit:	Ha
Description:	Area of recorded deforestation in the leakage belt stratum *i* converted to land use *u* at time *t*
Source of data:	Monitored at each monitoring/verification event through analysis of classified satellite imagery
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Minimum Mapping Unit (MMU) of 0.81 ha, corresponding to3 pixels by 3pixels Landsat resolution (90m by 90m), providing closest conformance possible to 0.5 ha Peru DNA forest definition with Landsat.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
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 procedures to be applied:	Detailed procedures provided below under monitoring plan description. Minimum Mapping Unit (MMU) of 0.81 ha, corresponding to3 pixels by 3 pixels Landsat resolution (90m by 90m), providing closest conformance possible to 0.5 ha Peru DNA forest definition with Landsat.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	

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*
Source of data:	Estimated from forest carbon inventory. For strata identified in the leakage belt from vegetation maps from Natureserve (Josse et al 2007), but not represented in the project area inventory, stock estimates specific to each stratum will be obtained from peer-reviewed values from Peru.
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description
Frequency of monitoring/recording:	Every $\leq$ 10 years. First re-measurement in 2018.
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description
Calculation method:	
Any comment:	

Data Unit / Parameter:	$C_{P,post,u,i}$
Data unit:	t CO_2-e ha^{-1}
Description:	Carbon stock in all pools in post-deforestation land use *u* in stratum *i*
Source of data:	Post deforestation carbon stocks are set as the historical area-weighted average carbon stock for pasture and cultivation land uses, derived from historical land use survey data and stocks estimates from regional studies in Section 3 above.
Description of measurement methods and procedures to be applied:	None
Frequency of monitoring/recording:	Every $\leq$ 10 years. Value to be re-assessed in 2018.
Value applied:	42.9 t CO_2-e ha^{-1}
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
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 post disturbance
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
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 survey results indicating general area of project potentially accessed and typical depth of penetration of illegal harvest activities from points of access
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording:	Repeated each time the PRA indicates a potential for degradation. PRA conducted every $\leq$ 2 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
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:	Detailed procedures provided below under monitoring plan description.

Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
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% of $A_{DegW,i,t}$
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
Any comment:	

Data Unit / Parameter:	Ä$C_{P,DegW,i,t}$
Data unit:	t CO_2-e
Description:	Net carbon stock changes as a result of degradation in stratum *i* in the project area at time *t*
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every ≤ 5 years where surveys and limited sampling continue to indicate possibility of illegal logging in the project area
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Equation 8, VMD0015
Any comment:	

Data Unit / Parameter:	*$PROP_{IMM}$*
Data unit:	Proportion
Description:	Estimated proportion of baseline deforestation caused by immigrating population
Source of data:	Calculated based on results of survey of communities within 2 km of the PNCAZ boundary.
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description. Questions will be structured as: how long have you lived here and where did you come from prior? Immigrants are defined as someone who has lived in the area less than 5 years and came from an area outside the leakage belt. As there are sensitivities to assessing responsibility for deforestation in an interview context, the proportion of baseline deforestation caused by immigrating population will be assumed to be equal to the proportion of immigrants in the surrounding population.
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	*MANFOR*
Data unit:	Ha
Description:	Total area of forests under active management nationally
Source of data:	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	May be conservatively set to zero

Data Unit / Parameter:	*PROTFOR*
Data unit:	Ha
Description:	Total area of fully protected forests nationally
Source of data:	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	May be conservatively set to zero A demonstration is required that areas will be protected against deforestation. Such a demonstration shall include either: 1. Designation as a UNESCO World Heritage Site, or 2. Management by an international NGO, or 3. Evidence that the government has immediately acted to evict any and all illegal squatters

Data Unit / Parameter:	*TOTFOR*
Data unit:	Ha
Description:	Total available national forest area
Source of data:	Official data, peer reviewed publications and other verifiable sources, including Peru FAO FRA reports, e.g. FAO. 2010. Global Forest Resources Assessment 2010, Peru Country Report. Forestry Department, Food and Agriculture Organization of the United Nations, Rome.
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	$PROP_{RES}$
Data unit:	Proportion
Description:	Estimated proportion of baseline deforestation caused by population that has been resident for ≥5 years
Source of data:	Calculated based on results of survey of communities within 2 km of the PNCAZ boundary.
Description of measurement methods and procedures to be applied:	Equals 1 - $PROP_{IMM}$ Detailed procedures provided under monitoring plan description below.
Frequency of monitoring/recording:	Every ≤ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

Data Unit / Parameter:	N
Data unit:	Dimensionless
Description:	Number of samples (i.e. clusters of 5 variable radius plots)
Source of data:	Detailed in PNCAZ 2009 forest inventory report
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	Detailed in PNCAZ 2009 forest inventory report
Any comment:	

Data Unit / Parameter:	DBH
Data unit:	Cm
Description:	Diameter at breast height of a tree in cm
Source of data:	Measured in the field
Description of measurement methods and procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report
Frequency of monitoring/recording:	Every ≤ 10 years
Value applied:	

Monitoring equipment:	Detailed in PNCAZ 2009 forest inventory report
QA/QC procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report and in description of monitoring plan below
Calculation method:	
Any comment:	

Data Unit / Parameter:	$Dia_{n,i,t}$
Data unit:	cm
Description:	Diameter of piece *n* of dead wood along the transect in stratum *i*, at time *t* in *cm*
Source of data:	Measured in the field
Description of measurement methods and procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	Detailed in PNCAZ 2009 forest inventory report
QA/QC procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report and in description of monitoring plan below
Calculation method:	
Any comment:	

Data Unit / Parameter:	*BDia*
Data unit:	cm
Description:	Basal diameter of standing dead tree in cm
Source of data:	Measured in the field
Description of measurement methods and procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	Detailed in PNCAZ 2009 forest inventory report
QA/QC procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report and in description of monitoring plan below
Calculation method:	
Any comment:	

Data Unit / Parameter:	TD_{SDW}
Data unit:	cm
Description:	Top diameter of standing dead tree in cm
Source of data:	
Description of measurement methods and procedures to be applied:	Not measured

Frequency of monitoring/recording:	
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	Standing dead wood volume calculations assume volume of a paraboloid, i.e. volume = cross sectional area * height * ½ (no need for top diameter)

Data Unit / Parameter:	H_{SDW}
Data unit:	m
Description:	Height of standing dead tree in m
Source of data:	Measured in the field
Description of measurement methods and procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report
Frequency of monitoring/recording:	Every $\leq$ 10 years
Value applied:	
Monitoring equipment:	Detailed in PNCAZ 2009 forest inventory report
QA/QC procedures to be applied:	Detailed in PNCAZ 2009 forest inventory report and in description of monitoring plan below
Calculation method:	
Any comment:	

Data Unit / Parameter:	*Project Forest Cover Monitoring Map*
Data unit:	ha
Description:	Map showing the location of forest land within the project area at the beginning of each monitoring period. (= updated *Project Forest Cover Benchmark Map)*
Source of data:	Classified satellite imagery
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording:	Updated at each monitoring/verification event every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
Any comment:	

Data Unit / Parameter:	*Leakage Belt Forest Cover Monitoring Map*
Data unit:	
Description:	Map showing the location of forest land within the leakage belt area at the beginning of each monitoring period. (= updated *Leakage Belt Forest Cover Benchmark Map)*
Source of data:	Classified satellite imagery
Description of measurement methods and procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Frequency of monitoring/recording:	Updated at each monitoring/verification event every $\leq$ 5 years
Value applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	Detailed procedures provided below under monitoring plan description.
Calculation method:	
Any comment:	

Data Unit / Parameter:	$A_{burn,i,t}$
Data unit:	ha
Description:	Area burnt in stratum *i* at time *t*
Source of data:	GPS coordinates and/or Remote Sensing data
Description of measurement methods and procedures to be applied:	Remote sensing analysis detailed below under monitoring plan description
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 applied:	
Monitoring equipment:	
QA/QC procedures to be applied:	
Calculation method:	
Any comment:	

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, through August 7 2018. The baseline will be revised every 10 years from the project start date.

4.3.2 Monitoring of actual carbon stock changes and greenhouse gas emissions

For accounting purposes the project conservatively assumes stable stocks and no biomass monitoring is conducted in areas potentially undergoing carbon stock enhancement, 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 illegal degradation
- Emissions due to biomass burning

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

4.3.3 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 (Ä$C_{P,Def,i,t}$ and Ä$C_{P,DistPA,i,t}$ 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 Ä$C_{P,Dist,q,i,t}$ and Ä$C_{pools,Def,u,i,t}$ $= C_{BSL,i}$). Stock estimates from the initial field inventory completed in 2009, are valid for 10 years (per VM0007), minimally through 2018. Post 2018, forest carbon stock estimates will be updated for any strata where deforestation or natural disturbance is detected.

4.3.3.1 Monitoring changes in forest cover

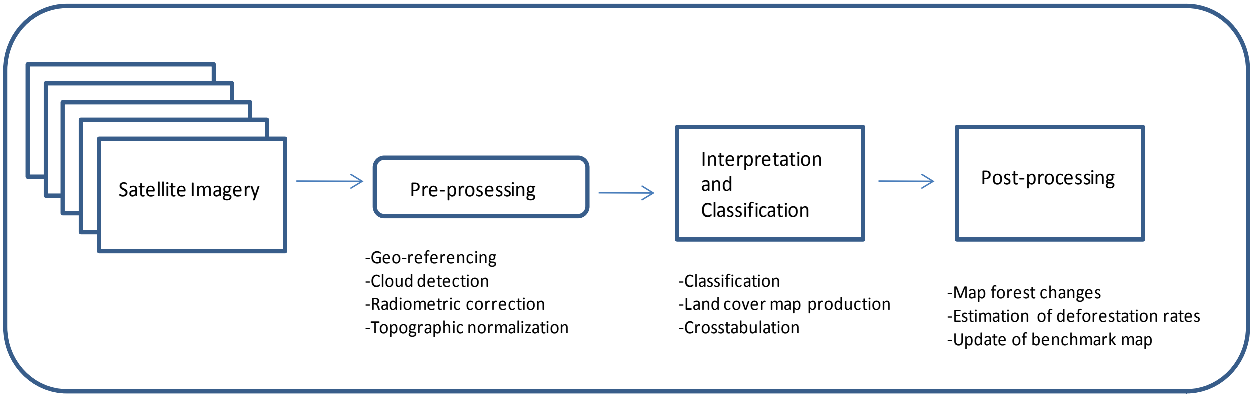
The project boundary, as set in the PD, will serve as the initial “forest cover benchmark map” against which changes in forest cover will assessed over the interval of the first monitoring period; the entire project area has been demonstrated to meet the forest definition at the beginning of the crediting 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. AMinimum Mapping Unit (MMU) of 0.81 ha, corresponding to 3pixels by 3 pixels Landsat resolution (90m by 90m) will be used throughout the duration of the project crediting period.

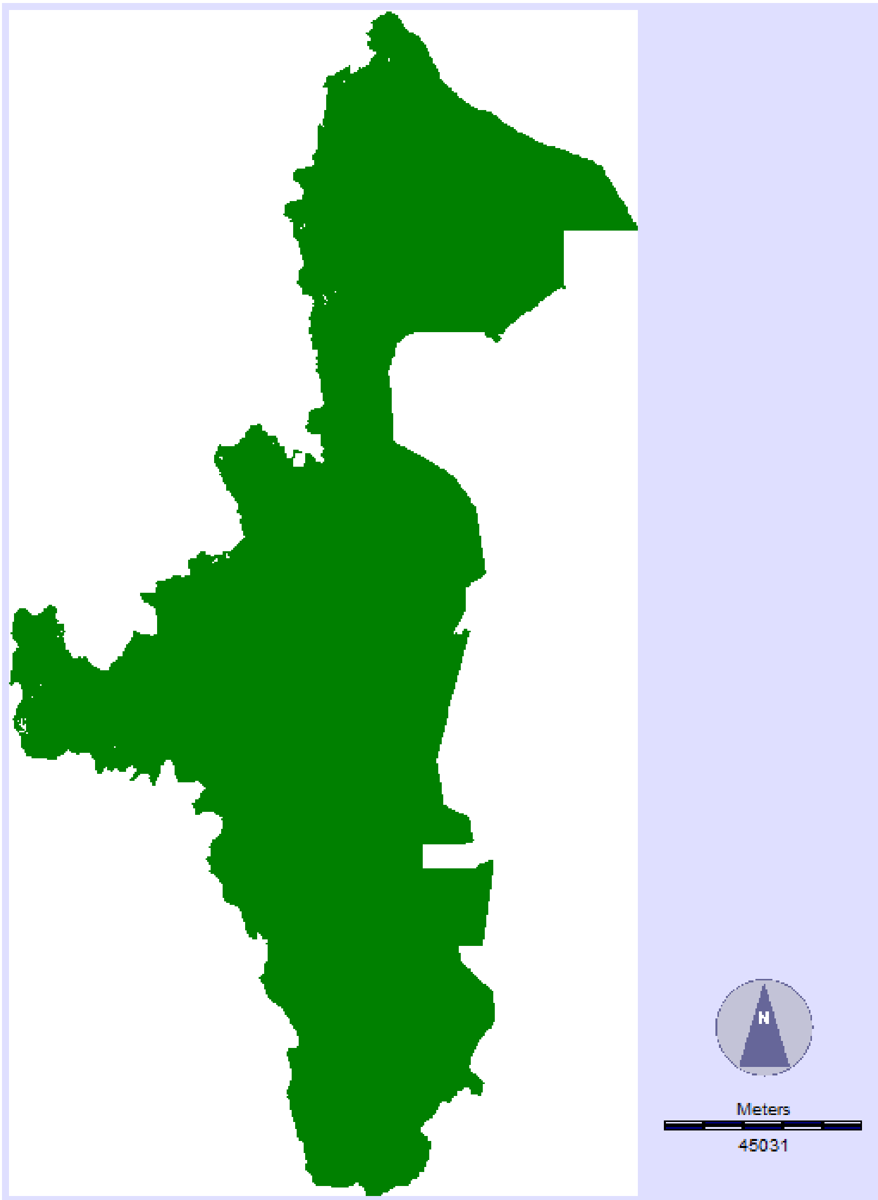
The general work flow for monitoring forest cover change is shown in Figure 4.1.

Figure 4.1: General workflow for monitoring of forest cover change in the project area and leakage belt



The forest cover benchmark map for the project start date in August 2008 (Figure 4.2) establishes the extent and location of forest and non-forest at the beginning of the crediting period and the first verification interval.

Figure 4.2: Forest cover benchmark map for project area, August 2008



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 forest cover benchmark map to detect forest cover change for the monitoring period, and becomes the updated forest cover benchmark map for the subsequent monitoring period. Thus, the forest benchmark map is updated at each monitoring event.

4.3.3.2 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 August 2008 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 both the project area and leakage belt (i.e. monitoring of project area and leakage belt will use the same data source) and will be from a single year, though it may include a mosaic of scenes over several months. Landsat imagery has been used in historical analysis, and will likely be used in the future, but with the failure of Landsat 5 in 2011, and the sensor error with Landsat 7, a final determination of the which sensor will be used will hinge on the successful launch of the Landsat data continuity mission (LDCM) in early 2013. In the case that LDCM is not launched successfully, other medium resolution remotely sense data will be used that can calibrate to acceptable levels with the previous imagery.

Imagery will be 90% cloud free. To achieve 90% classified area, where possible, clouded areas 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).

Per module M-MON, "If the areas with 10% cloud cover in either date in question do not overlap exactly, then the rate [will] come from areas that were cloud free in both dates in question.... estimated in % per year. Then, a maximum possible forest cover map [will] be made for the most recent time period [i.e. monitoring date]. The historical rate in % [will] be multiplied by the maximum forest cover area at the start of the period for estimating the total area of deforestation during the [monitoring] period."

The following cartographic data has also been collected to aid in geo-referencing and delineation of project area and leakage belt (all projected in UTM WGS 84 Zone 18 S):

- Carta Nacional 1:1 000,000 IGN (Hojas 13L, 14K, 14L, 19M, 15J, 15K, 15L, 15M, 16J, 16K, 16L, 16M, 17J, 17K, 17L, 17M, 18K, 18L, 18M)
- Hidrografía y red vial - CIMA Cordillera Azul.
- Project area
- Leakage belt area

4.3.3.3 Pre-processing

As stated above Landsat moderate resolution imagery will be used preferentially. Landsat imagery is 30m multispectral data that is composed of 7 bands. One of these bands, band 6 is a thermal band, and is not used in image classification. The other 6 bands will be included in image analysis.

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 mosaiced together.

The majority of Landsat imagery from USGS is obtained from EROS (Earth Resource Observation Systems) with multiple pre-processing steps completed. These processing steps are summarized below and more detail information can be found from NASA http://landsathandbook.gsfc.nasa.gov/level/.

The 1G product available to users is both radiometrically and geometrically corrected. The correction algorithms employed model the spacecraft and sensor using data generated by onboard computers during imaging events and ground control points and a digital elevation model are also used to improve the overall geometric fidelity. The geometric correction process utilizes both ground control points (GCP) and digital elevation models (DEM) to attain absolute geodetic accuracy. The WGS84 ellipsoid is employed as the Earth model for the Universal Transverse Mercator (UTM) coordinate transformation. Associated with the UTM projection is a unique set of projection parameters that flow from the USGS General Cartographic Transformation Package. The end result is a geometrically rectified product free from distortions related to the sensor (e.g. jitter, view angle effects), satellite (e.g. attitude deviations from nominal), and Earth (e.g. rotation, curvature, relief).

When using Level 1G processed imagery, pre-processing success must be confirmed, but frequently few extra pre-processing steps are necessary. The potential additional steps are detailed below.

Radiometric correction
Since change detection is conducted after classification, the only time radiometric correction is required is if severe atmospheric distortions are present in the only available imagery, or extreme topographic relief makes cloud shadows problematic. In these cases a haze reduction algorithm using a dark object subtraction may be used or a topographic normalization using a digital elevation model may be used.

Geo-referencing
For this procedure the August 2008 benchmark map will be used as a reference image from which all subsequent images will be geo-referenced. At least 7 well distributed ground control points (GCP) will be identified for the geo-referencing procedure. Each GCP will be known and recognizable in the source image and the reference image. A resampling operation using the nearest neighbor interpolation method, and a linear polynomial function will be used to ensure minimal distortion. 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. An unsupervised clustering technique or a post classification assessment will be used to identify all areas affected by clouds and cloud shadow. Other imagery from with 12 months of the image date may be used to fill in these cloud areas.

4.3.3.4 Interpretation and classification

In this step, the scenes are interpreted by applying a classification algorithm to identify forest and non-forest categories. A two-step approach to classification will be used. In the first step, an unsupervised clustering algorithm technique will be used to classify each scene. Visual interpretation of clusters by an image analyst with knowledge of the land cover and/or with the assistance of high resolution imagery will be conducted to identify and then group all clusters into forest, non-forest, fire or fire scars, cloud and cloud-shadow and water classes. In the case of mixed classed, a second stage clustering may be employed on just the areas of confusion to see if clear classes may be identified. If clear categorization has been obtained (tested through the accuracy assessment) then step 2 can be skipped. If the classification accuracy using the unsupervised technique is not sufficient, or if the analyst prefers the use of supervised techniques, then a maximum likelihood algorithm will be used for supervised classification using samples of known areas selected for training areas (AOI, Areas of Interest) for a minimum of the following classes: "non-forest" ,"forest" “fire scars” “water”. A final land use map with 2 categories (forest and non-forest) will be created to assess forest loss against the previous benchmark map. In the case of fire evidence, as can be detected through the distinct spectral signature of burn scars, typically for > 18 months, or naturally shaped (as opposed to more typically geometrically shaped anthropogenic disturbance) patches of re-growth,or from field reports of fires that have been investigated and substantiated through remote sensing evidence, these 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. 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. Special attention will be given to grasslands or herbaceous wetlands, and especially old fallows and shade crops like coffee (which can be

confused with forest) to avoid classification errors. Where necessary, corrections to the supervised 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.

Post classification
To ensure that the minimum forest definition is met the final classification will be filtered using a 3 by 3 mode filter. This will increase the MMU to 90m by 90 m to most closely meet the national forest definition. It will also improve any “speckle” in the classification due to small error.

4.3.3.5 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.

The project area has many extreme topographic features- Including very steep slopes, and areas at high elevation that have minimal tree cover. These areas were removed from the spatial modeling due to their inaccessibility, and will also be removed from the change detection analysis since any land cover change in these areas is due to non-anthropogenic sources. GIS files that delineate these masked areas are archived so that each analysis will maintain the same masks.

4.3.3.6 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 supporting photographic evidence) 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), with a minimum sampling intensity of 50 points each for the forest and non forest classes.

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)

Table 4.1: Example accuracy assessment results

Land-use class as determined from ground-truth points	Classification		Total	Accuracy (%) *User's accuracy (# 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%.

4.3.3.7 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 CIMA at its main office in Lima as described in Section 4.3.8.

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
- 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 supporting photographic evidence) 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 July 2030. 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.

4.3.3.8 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 for any strata where deforestation is detected. Initial above- and belowground biomass and dead wood stock estimates from the 2009 inventory are valid and treated as constant through 2018, after which they will be re-estimated from new field measurements.

To re-assess forest carbon stocks, twenty (20) point samples (four clusters of five points) will be randomly located in each forest strata and measured (following field protocols in Appendix 8) in 2018. Biomass will be estimated applying the allometric equations of Chave et al 2005 and otherwise maintain consistency with analytical procedures applied in the original 2009 inventory. For each strata, where the re-measured estimate of total forest biomass carbon (live and dead) is within the 90% confidence interval of the 2009 estimate, the 2009 stock estimate will continue to be used in the next 10 year baseline period. If the re-measured estimate is outside (i.e., greater than or less than) the 90% confidence interval of the 2009 estimate, then the 2018 stock estimate will be used in the next 10 year baseline period.

4.3.4 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:

1. Field crews with prior training in forest inventory will carry out all field data collection and adhere to field measurement protocols outlined in Appendix 8. Pilot sample plots shall be measured before the initiation of formal measurements to train and appraise field crews and identify and correct any errors in field measurements. Field crew leaders will be responsible for ensuring that field protocols are followed to ensure accurate and consistent measurement. During the course of implementation, field crews were periodically apprised of measurement errors to assess progress. 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. Calibration of prisms will be confirmed prior to formal field measurements. All borderline trees will be measured and assessed against prism plot radius factor, which is standardized as distance to the centre of the tree: diameter at breast height.
3. An opportunistic sample of plots will be re-measured to assess measurement errors. 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%.
4. Field measurement data will be recorded on standard field data sheets (Appendix 8) and transferred to electronic media (“entrada de datos PNCAZ inventario.xls”) following each return from the field. Original data sheets will be permanently archived at the CIMA office in Tarapoto and Lima, and the electronic database of all field measurements will be housed in the dedicated long-term electronic archive maintained on the CIMA server at its main office in Lima. The electronic database will also archive GIS coverages detailing forest and strata boundaries and plot locations.
5. 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.
6. For laboratory analysis of dead wood specific gravity, all balances for measuring dry weights will be calibrated against known weights prior to use. All calibration results will be documented and archived along with sample analysis results. 10% of samples will be re-analyzed/re-weighed to produce an error estimate

4.3.5 Emissions due to illegal degradation

Emissions due to illegal logging will be tracked by conducting MUF surveys in communities with access to the project area at least every three years. Communities surveyed will include, but not necessarily be limited to those listed in Table 4.2.

Table 4.2: Communities to be surveyed

Region de Referencia (distrito)	Centro Poblado
Huimbayoc	Pongo Isla
Huimbayoc	Pucallpa
Chazuta	Ricardo Palma
Chazuta	Callanayacu
Shamboyacu	Porvenir
Pampa Hermosa	Tahiti
Pampa Hermosa	Playa Hermosa
Alto Biavo	Los Cedros
Bajo Biavo	Selva Andina
Alto Biavo	Challual
Alto Biavo	Juanita
Padre Abad	Yamino
Contamana	La Cumbre

Surveys will produce information on wood consumers (fuel wood and wood for construction and charcoal production) in the surroundings areas, as well as general indications on the areas where wood is sourced from and maximum depth of penetration of harvest activities from access points.

In the event that any potential of illegal logging occurring in the project area is detected from the surveys (i.e. ≥ 10% of those interviewed/surveyed believe that degradation may be occurring within the project boundary), temporary sample plots will be allocated and measured in the area of the project indicated by the surveys as a potential source area for illegally-harvested wood. The potential degradation area within the project area ($A_{DegW,i}$) will be delineated based on survey results, incorporating general area information and maximum depth of penetration. 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.

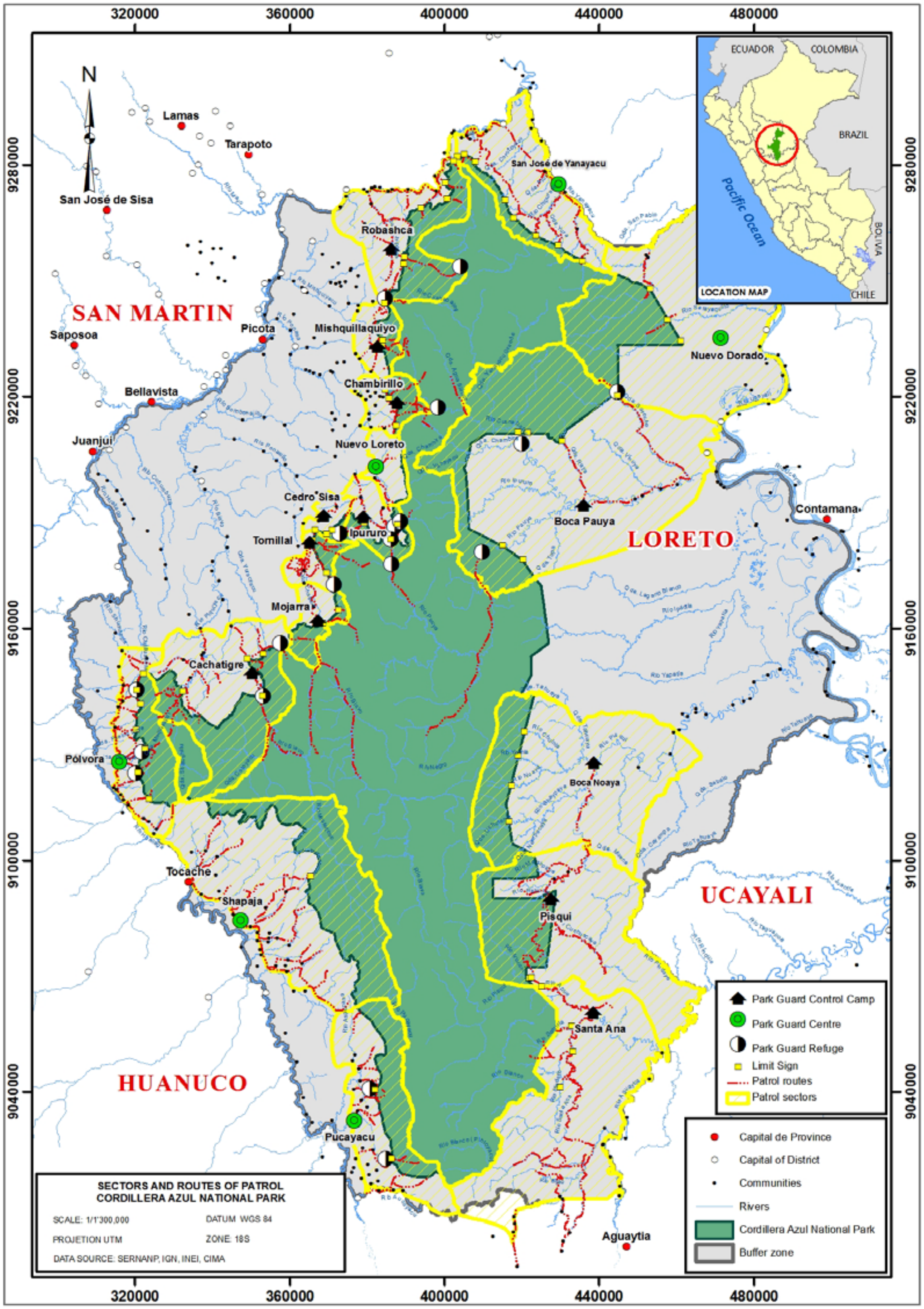
In the event that the sample plot assessment indicated that illegal logging is occurring in the area, supplemental plots will be allocated to achieve a 3% sample of the area. Biomass will be estimated from measured diameters (conservatively assuming that diameters of stumps cut below breast height are equivalent to diameter at breast height) applying the allometric equation of Chave et al 2005 and otherwise maintain consistency with analytical procedures applied in the original 2009 PNCAZ inventory. Emissions due to illegal logging (Ä$C_{P,DegW,i,t}$) 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 (Ä$C_{P,DegW,i}$). 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.

The same quality assurance/quality control and archiving procedures as detailed above for updating estimates of forest carbon stocks will be adhered to in the field surveys of potential degradation areas.

Within the project area and area bordering the park (PNCAZ buffer zone), routine patrols will be carried out throughout the year by park guards. Patrols will identify, and resolve where possible, any illegal wood harvest taking place in the PNCAZ and project area. There are 18 control posts and park guard centers on or near the border of the project area, from which guards will be routinely fielded on patrol routes totaling 2,041 km distance (544.6 km within PNCAZ). The total area to be routinely patrolled is located closest to communities with potential access to the park (i.e. highest potential pressure area for illegal harvest) and totals 1,779,984.7 ha (507,364.2 ha within PNCAZ). The density of patrol trails in the monitored area within PNCAZ is 1 km per 10 km^2. The location of patrol areas and park control posts are shown in Map 4.1.

Map 4.1: Location of patrol areas and park control posts

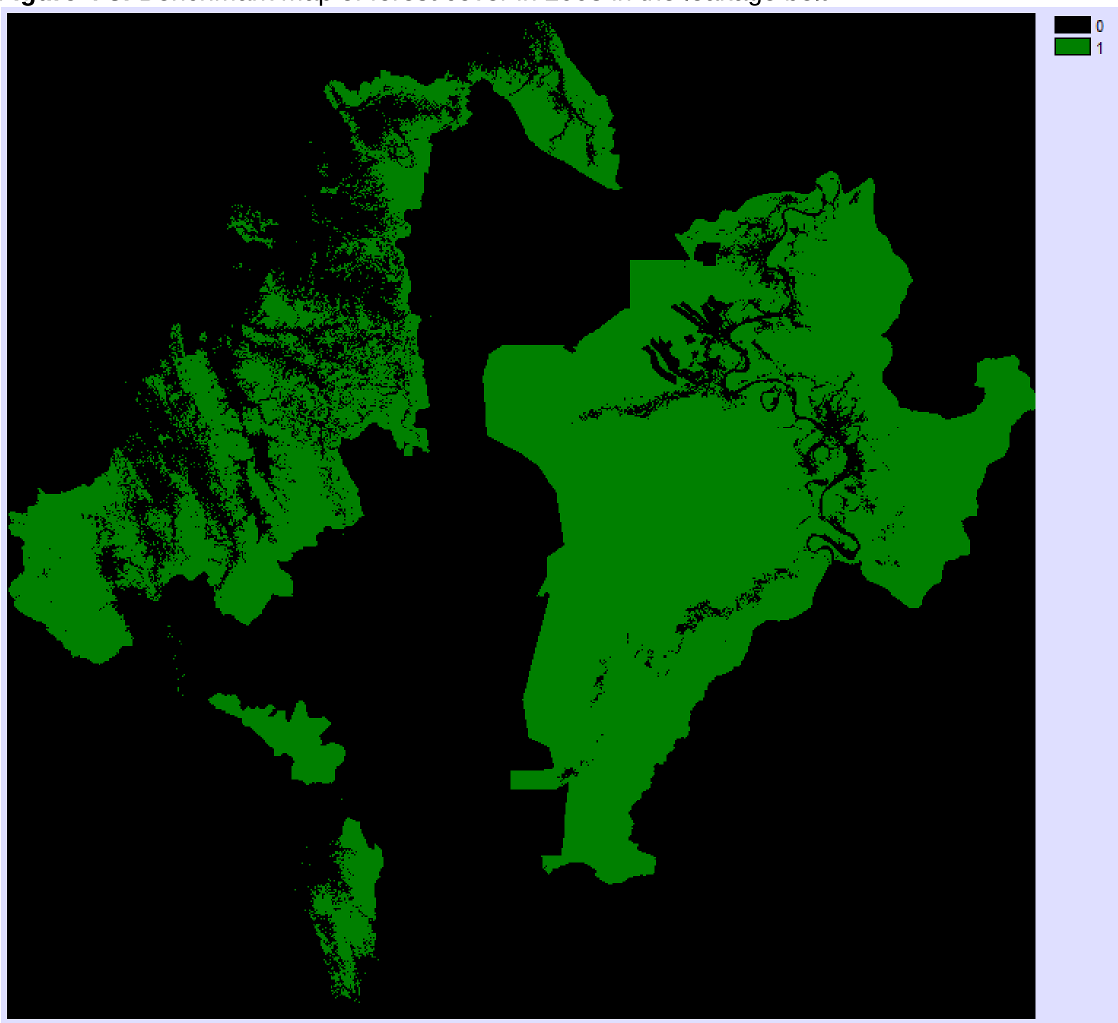


4.3.6 Monitoring of leakage carbon stock changes

Activity-shifting leakage in the leakage belt will be monitored by tracking forest cover change in the leakage belt (ADefLB,u,i,t), using classified satellite imagery produced following the same procedures outlined above in Section 4.2.1, referencing the 2008 forest cover benchmark map for the leakage belt (Figure 4.3). 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.

Note that the leakage belt includes private inholdings and ineligible areas (without forest >10 years old) within PNCAZ as well as planned deforestation areas for oil palm production in the northeast. The initial area of forest in the leakage belt is 1,920,311 ha.

Figure 4.3: Benchmark map of forest cover in 2008 in the leakage belt



Parameter, $\Delta C_{pools,Def,u,i,t}$, is derived from estimates of $C_{BSL,i}$ (forest carbon stock in all pools in the baseline case in stratum *i*) from PNCAZ forest inventory measurements, or for strata identified in the leakage belt but not represented in the PNCAZ inventory from peer-reviewed regional literature sources, as for initial estimates derived in Section 3 above. Parameter, $C_{P,post,u,i}$ (carbon stock in all pools in post-deforestation land use *u* in stratum) is assigned as the historical area-weighted average carbon stock for the converted (non forest) baseline land-use(s), the initial estimate derived in Section 3 above. Stock estimates will be re-assessed every $\leq$ 10 years.

Monitored parameters will be entered into the table format below to complete calculations of activity shifting leakage occurring in the leakage belt in the with-project case ($\Delta C_{LK\text{-}ASU\text{-}LB}$).

Table 4.3: Calculation format for area subject to activity shifting leakage in the leakage belt

equation	Derived in PD Sections 3.1 and 3.3		Derived from forest inventory estimates	M-MON 4	LK-ASU 1
Year	$\Delta C_{BSL,LK,unplanned}$ t CO_2	$A_{DefLB,u,i,t}$ ha	$\Delta C_{pools,Def,u,i,t}$ t CO_2/ha	$\Delta C_{P,DefLB,i,t}$ t CO_2	$\Delta C_{LK\text{-}ASU\text{-}LB}$ t CO_2
2009	6,910,840.7				
2010	7,497,174.1				
2011	9,658,074.5				
Etc…	6,910,840.7				

Activity shifting leakage outside the leakage belt will be tracked by monitoring deforestation in the project area ($A_{DefPA,i,t}$) and leakage belt ($A_{DefLB,i,t}$).

The value of parameter, $PROP_{IMM}$, 32.5%, as derived above in Section 3.3, will be employed for the first five years of the project. Subsequently, the parameter, $PROP_{IMM}$, will be derived from the results of surveys conducted among neighboring communities every $\leq$ 5 years. The same communities identified above for assessing potential for illegal degradation in the project area will be surveyed to determine for each interviewee how long the person has lived there and where did they come from prior to moving to the area. As there are sensitivities to assessing responsibility for deforestation in an interview context, the proportion of baseline deforestation caused by immigrating population will be assumed to be equal to the proportion of immigrants in the surrounding population. Immigrants are defined as someone who has lived in the area less than 5 years and came from an area outside the leakage belt.

Table 4.4: Calculation format for area subject to activity shifting leakage outside the leakage belt

equation		Derived in PD Section 3.1	LK-ASU 7			LK-ASU 8	LK-ASU 9	Derived in PD in Section 3.3	LK-ASU 11
Year	$PROP_{IMM}$	$A_{BSL,PA,unplanned,t}$ ha	$A_{LK\text{-}IMM,t}$ Ha	$A_{DefPA,i,t}$ ha	$A_{DefLB,i,t}$ ha	$A_{LK\text{-}ACT\text{-}IMM,t}$ ha	$A_{LK\text{-}OLB,t}$ ha	$PROP_{CS}$	$\Delta C_{LK\text{-}ASU,OLB}$ t CO_2
2009	32.5%	4,256.82						1.049	
2010	32.5%	5,420.34						1.049	
2011	32.5%	3,216.33						1.049	
Etc…	Etc...	Etc.						Etc.	

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

Estimates of GHG credits eligible for issuance as VCU's 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	Estimated net GHG emission reductions or removals (tCO2e)
2009	1,834,510.1					
2010	1,960,580.9					
2011	1,337,026.1					
Etc…						

4.3.8 Organization and Responsibilities

For all aspects of project monitoring, CIMA will ensure that data collection, processing, analysis, management and archiving are conducted in accordance with the monitoring plan.

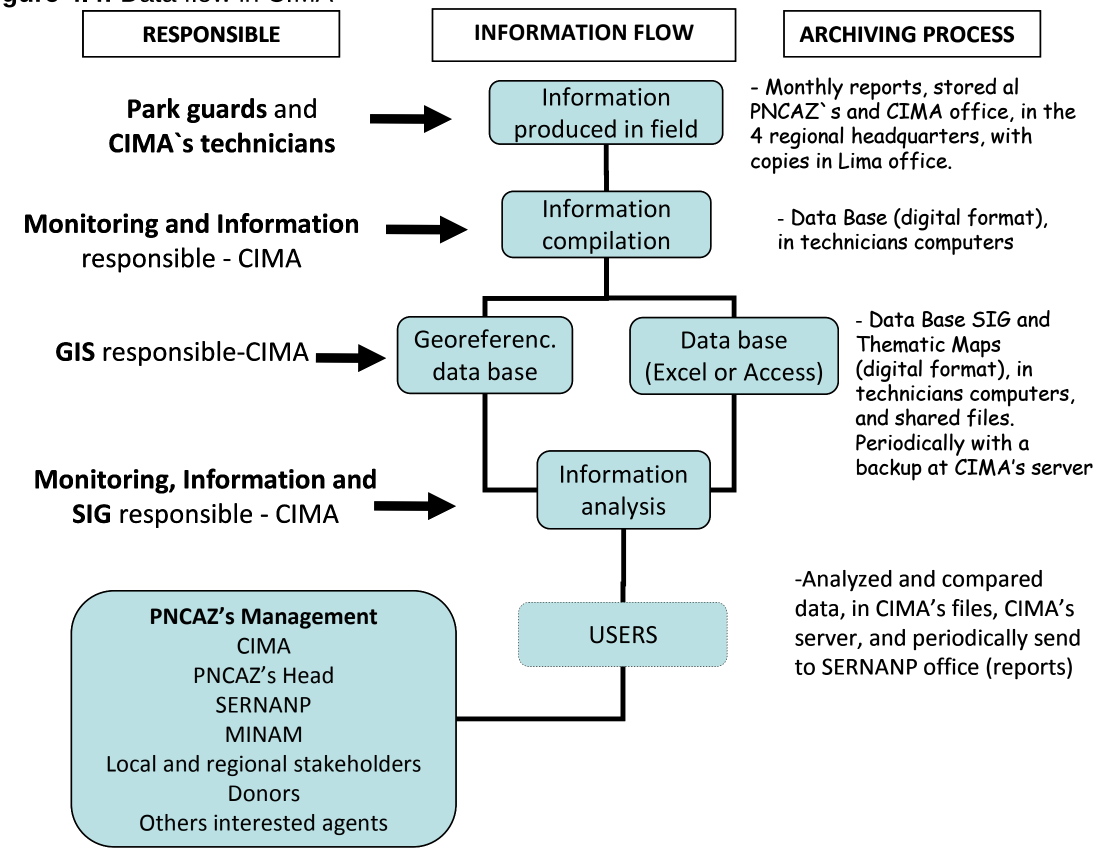
Remote sensing image analysis is conducted by CIMA's GIS team periodically according to the procedures discussed in Appendix 4.

Field data is the result of CIMA technicians' trips and the park guards routine and special patrols as part of their planning activities. Technicians and park guards are the key personnel in the generation of information - threats, social and environmental aspects of PNCAZ and buffer zone – and are trained to ensure that they are aware of the importance of the data they are generating. They are the first link in the chain of information flow (Figure 4.4).

This data is recorded in the monthly reports of the technicians and park guards at the offices of the Head of PNCAZ and CIMA, and copies of the park guards' reports are send to CIMA office in Lima headquarters. This information is analyzed by the CIMA Information and Data Specialists to provide quarterly and annual technical reports to SERNANP (or donors) about the progress in PNCAZ's management activities, to report results and impacts of management to SERNANP, and for review by CIMA Management as appropriate. This critical information is systematized and analyzed annually by the technical staff of CIMA.

Hard copies of all of the data is stored in Lima or Tarapoto. The most important information and data is converted to electronic format and placed on the server for sharing between the Lima and Tarapoto offices. This server is periodically backed up.

Figure 4.4: Data flow in CIMA



5. ENVIRONMENTAL IMPACT

5.1 Net Impact on Biodiversity (CCB: G2.5, G3.2, G3.6, B1.1, B1.2, B1.3, B1.4, B1.5, B2.1, B2.2, B2.3, B3.2)

This project will result in the long-term protection of Cordillera Azul National Park. Given the vast size of the park, protection activities inside the park, and land-use stabilization efforts in the buffer zone, no change in the abundance and diversity of the rich biota inside the park is expected to occur due to the project, thus maintaining the high conservation values associated with biodiversity. In fact, it is expected that protecting expanses of continuous forests across a large altitudinal range will assist species in adapting to climate change or other stresses by allowing species to migrate to higher or lower altitudes as needed. Up to 30 species in the park may occur nowhere but in PNCAZ, and many species not restricted to PNCAZ are currently protected nowhere else. Table 5.1 highlights some of the most important species under this project.

5.1.1 Species Used

This project protects a vast expanse of vegetation with native species. PNCAZ has not yet suffered any noticeable deforestation or degradation. The “use” of species in the project is solely to protect them. No species is “used” except in a designated area of the park, where traditional use (i.e., hunting, fishing, medicinal, housing) is allowed for subsistence.

All species in the park are native and as described previously in Section 1.10.5 Biodiversity, many are endemic and/or threatened. No invasive, non-native, or genetically modified species will be used or introduced into the park as part of this project. In fact, because the project’s protection activities will result in reduced or no human activity inside PNCAZ, the risk of accidental or purposeful introduction of non-native species, such as hunting dogs, in the park by anyone will be diminished with the project.

Table 5.1: Important species in PNCAZ due to global or regional rarity, influence on community dynamics, and/or significance for ecosystem function	
Organism group	**Important Species and Biological Communities in PNCAZ**
Biological communities	• Lowland forests with populations of *Cedrelinga* (tornillo), *Cedrela* (cedro), and *Swietenia* (mahogany, caoba) • Spongy, short forests; elfin forests; and shrublands on upper slopes and crests (unique assemblages of plants) • Alluvial terraces, hill forests, and lower slopes (important habitats for plants, birds, mammals, and herpetofauna) • Extensive wetlands of middle and high elevations, some with associated palm stands • Isolated lake • Streams and rivulets (important habitats) • Functional, representative samples of all habitat types
Tree species	• *Cedrela odorata* (Cedro, Meliaceae) • *Amburana cearensis* (ishpingo, salta, Fabaceae) • *Swietenia macrophylla* (caoba, Meliaceae) • *Cedrelinga catenaeformis* (tornillo, Fabaceae)
Fishes	• Headwater fishes: all species of Astroblepidae inside the park (at least two species), other genus of catfish (*Chaetostoma*), one endemic to Aguaytia headwater area (*Tahuantinsuyoa macanzatza*), and *Hypostomus fonchii* • Main-channel fishes the biggest armored catfish in Peru (*Panaque* sp nov), some migratory fishes of commercial importance (*Pseudoplatystoma, Prochilodus, Brycon, Piaractus*)
Reptiles and amphibians	• High altitude species: *Bufo* of the *B. typhonius* group, *Bolitoglossa* salamander • Species that live in mosses and terrestrial bromeliads: *Syncope* sp. • Centrolenidae species • *Atelopus andinus* (endemic) • 2 new species of lizards: *Enyalioides* sp nov1. and *Enyalioides* sp nov2. • 1 new species of frog: *Rhinella* sp nov. • *Pristimantis* of the *conspicillatus* group • Lowland species: Dendrobatidae • *Allobates* and *Amaerenga* species • *Chelonoidis denticulata* • *Podocnemis unifilis* • Caiman species (*Caiman sclerops*, *Paleosuchus* spp.)
Birds	• Hill-forest birds (e.g., *Hemitriccus rufigularis*, *Contopus nigrescens*, *Oxyruncus cristatus*) • Cloud-forest birds (e.g., *Capito wallacei, Ampelion* species, *Machaeropterus regulus aureopectus, Tangara varia*) • Birds of the short, spongy forest (especially *Heliangelus regalis* and *Henicorhina leucoptera*) • Large game birds (e.g., *Penelope, Pipile, Aburria, Crax*) • Endemic, elevation-restricted or patchily distributed birds (e.g. *Capito wallacei, Heliangelus regalis, Henicorhina leucoptera, Oxyruncus cristatus*)

	• Large parrots (*Amazona*, *Propyrrhura, Ara* macaws)
Mammals	• Primates (particularly CITES II species: *Ateles chamek*, *Lagothrix lagotricha,* and *Pithecia monachus* • Seed dispersers and seed predators • CITES I and CITES II mammal species (See Appendix 2 for examples) • *Microsciurus* “oscura” (endemic species), *Chironectes minimus* (rare), and *Atelocynus microtis* (rare)

5.1.2 Biodiversity Impacts in the Buffer Zone and Offsite

This project is devoted to preventing negative biodiversity impacts inside the project area and in the surrounding lands (buffer zone). Project activities themselves will generate positive, not negative impacts on biodiversity. Work with communities in the buffer zone focuses primarily on land-use stabilization and wildlife management. Both efforts benefit native biodiversity outside the park. In addition, stream recovery and agroforestry with native species is promoted in the buffer zone as well as reducing hunting pressure inside PNCAZ, further benefiting the native biota in the region which in turn benefits the local communities. For example, "huanganadas" (big herds of peccaries) have been seen entering the buffer zone as noted in Table 5.2.

Similar positive impacts may also be felt beyond the buffer zone (offsite). Stream recovery and erosion prevention measures will have impacts on biodiversity all along the stream and downstream waters. Increases in herd size and habitat may allow biota to travel in wider ranges and some locations offsite might also notice increases in biota numbers.

Table 5.2: Wildlife Sightings in the PNCAZ Buffer Zone (Source: CIMA Field Technical Team)

ITEM	Date	Community	Event
1	2006 No specific date	El Paraíso (Tres Unidos)	In the El Paraíso population center, a herd of 230 white lipped peccary was observed heading towards Paltaico. The population shot 23 with shotguns.
2	15/06/2008	Pilluana Y Mishquiyacu	A large herd of white lipped peccary was observed (about 300) passing through Pilluana, in the Mishquiyacu valley. The local population hunted about 30 with shotguns.
3	15/09/2008	Muralla (Alto Biavo)	A herd of white lipped peccary was observed heading towards PNCAZ crossing from the right bank to the left bank of the Biavo River.
4	22/12/2008	Pueblo Libre Km. 45	A herd of approximately 250 white lipped peccary, including large and small animals, was seen coming from PNCAZ by Cedros heading towards Pueblo Libre (45 km). The population hunted them with shotguns and clubs.
5	20/05/2008	Chimbana	A sighting was made of approximately 500 white lipped peccary at the first river crossing of the Yanayacu River in Chimbana y Santa Rosillo
6	25/02/2009	Pongo Isla	A sighting of white lipped peccary in the afternoon crossing the Huallaga from left to right in the Cerro Escalera area heading towards PNCAZ. The White lipped peccaries use this area as a corridor.
7	15/06/2009	Lejía	A herd of 200 white lipped peccary was seen in the lower part of Lejía
8	15/08/2009	Nuevo Loreto	About 300 white lipped peccary were sighted 30 feet from the center of Nuevo Loreto in the Topasapa sector of the buffer zone
9	01/01/2010	El Porvenir	A herd of 150 white lipped peccary was spotted leaving PNCAZ heading towards Porvenir. The entire herd did not pass through the town though due to the noise from villagers.
10	10/01/2010	Sector Chimbadillo	A herd of 200 white lipped peccary was seen leaving PNCAZ and heading north east.

In the worst-case scenario, the project's efforts will result in unchanged conditions for biodiversity outside the project area. More likely, results from project activities will greatly improve conditions for native biodiversity in the buffer zone, in accordance with the Source and Sink Model (Pulliam 1988) that has been described in the first Master Plan for PNCAZ (INRENA 2006). Combined with the positive benefits for biodiversity in the park, the overall effect of project activities for biodiversity conservation will be extremely positive.

Protection of species in the park will likely result in greater numbers of the species in the buffer zone as well. By providing a protected environment, especially for overhunted game animals such as deer, peccaries (white lipped and collared), tapir, several species of monkeys, guans and curassow, the park will allow the populations of the species to increase and stabilize. Larger populations inside the park will lead to larger populations in the buffer zone as animals travel or migrate. This benefits both the animals and the communities in the buffer zone. As discussed in Section 1.10.1 Communities, hunting provides an important source of protein for the communities. This concept is discussed in more detail in the wildlife management section of the 2003 Plan Maestro.

Because no negative impacts for offsite biodiversity are expected, no mitigation plans are required.

5.1.3 Soil and Water Resources

Project activities inside the park will secure long-term protection of natural vegetative cover in Cordillera Azul. In the buffer zone, project activities will focus on land-use stabilization activities. Effective implementation of these efforts will promote integrated protection of soil and water resources through maintenance of forest cover. Project activities will help to preserve the integrity of headwater streams and their ability to provide the goods and services that provide the basis for human life in the Amazon and Andean foothills. The reliance of buffer zone communities and regional watersheds and ecosystems on the rivers in the park has been discussed further in the community and ecosystem services sections.

5.1.4 Impact Analysis

5.1.4.1 Biodiversity impacts in the project area without the project

All of the impacts on biodiversity without the project are negative. There are no positive impacts of deforestation on the persistence of native biota in their natural populations, ranges, and distributions.

Tables 5.3 and 5.4 summarize the impacts on biodiversity that would occur with the activities and poor resource management practices, including flora, fauna, water, and soil, that would result in the without project scenario. A team of scientists from The Field Museum and CIMA familiar with the region developed the list and ranking system.

The impacts were assessed using four variables:

- Reversibility – how resilient are the habitats or populations affected by these activities,
- Severity – what is the expected level of damage to the habitat or natural communities and populations,
- Scale – what is the extent or geographical area covering the impact, and
- Order – is the impact generated directly from the activity or as a side effect

5.1.4.2 Biodiversity impacts under the with REDD project scenario

In a with-project scenario, there are two major positive impacts

- the numerous negative impacts listed in Tables 5.3 and 5.4 are avoided, and
- biodiversity has an intact area with diverse habitats and altitudes in which it can adapt to pressures from human activities such as climate change

The negative impacts listed in Tables 5.3 and 5.4 result from habitat destruction associated with deforestation and degradation, fragmentation of the park and the increase in human activity within the park and their negative consequences on biodiversity, as described in Section 2.4.4 Biodiversity: Conditions Without Project. The REDD project will not ‘increase’ biodiversity in the project area. It will maintain habitat for unique species found only in PNCAZ, or will provide refuge for species whose habitats are threatened or disappearing in other parts of the tropical Andes. There are no known negative impacts of the REDD project scenario on biodiversity and the high conservation values related to biodiversity are protected.

Table 5.3: Impacts of unsustainable resource use on biodiversity

Unsustainable resource use that negatively affects biodiversity		**Impact on biodiversity**			
		Reversibility (Capacity of recuperation)	Severity (Level of damage)	Scale (Geographic extension)	Order (Moment when the impact occurs)
		Reversible / Irreversible	High / Low	Local / Global	Primary / Secondary
1. Over-exploitation of wildlife by hunters and fishermen					
Vegetation	Altered seed-dispersal by vertebrates due to changes in predator-prey balance.	R	H	L	S
	Potentially increased seed predation due to higher rodent populations, leading to lower reproductive success of plants, particularly those with large seeds	R	L	L	S
	Reduced fruit and seed dispersal by large vertebrates	R	L	L	S
Terrestrial vertebrates	Local extinction of hunted species (medium- and large-sized mammals, game birds)	I	H	L	P
	Altered predator-prey relationships	R	L	L	P
Aquatic species	Local extinction of heavily fished species	R	H	L	P
	Possible introduction of exotic species, particularly trout and tilapia, for local interests	I	H	L	P
	Changes in community composition of aquatic biota	I	H	L	P
2. Use of poison and explosives for fishing					
Terrestrial vertebrates	Death by poisoning of animals that consume fishes	I	L	L	P
Aquatic species	Mortality events of fishes and macroinvertebrates, particularly severe in lentic habitats	I	H	L	P

3. Illegal logging					
Vegetation	Loss, or diminution, of local populations of some plant taxa, particularly hardwood species	R	H	L	P
	Large gaps alongside logging camps	R	H	L	P
	Inbreeding and loss of genetic diversity because of reduced population sizes.	I	H	L	S
	Reduced availability of seeds of some mature-forest species, which slows recovery of forests following disturbance	R	H	L	S
Terrestrial vertebrates	Increased incidence of hunting and changes in composition and structure of communities	R	L	L	S
Aquatic species	Destruction of riparian habitats	R	L	L	P
	Increased incidence of fishing near logging camps	R	L	L	P
4. Agriculture and cattle ranching					
Vegetation	Changes in the structure and composition of vegetation	I	L	L	S
	Increased incidence of fire	I	H	L	S
	Occurrence of pests and diseases more common to crops than forests	R	L	L	S
	Possible introduction of exotic and invasive species (e.g., grasses)	I	H	L	S
Terrestrial vertebrates	Pollution	R	L	L	S
Aquatic species	Water pollution associated with runoff from agricultural lands to which chemicals are applied, or where soil erosion is not well managed	I	H	G	P
	Downstream movement of aquatic species (e.g., macroinvertebrates) in response to loss of interstitial habitats	R	H	L	P
	Loss of spawning habitat for migratory fishes	R	H	G	P
	Decrease in viable populations of fishes and macroinvertebrates	R	H	L	S
	Decreased occurrence of migratory fishes	R	H	L	S

Table 5.4: Possible impacts of unsustainable resource use on biodiversity

Physical and climatic conditions of habitat affected by deforestation		**Impact on biodiversity**			
		Reversibility (Capacity of recuperation)	Severity (Level of damage)	Scale (Geographic extension)	Order (Moment when the impact occurs)
		Reversible / Irreversible	High / Low	Local / Global	Primary / Secondary
1. Physical loss of forest area and connectivity (e.g., forest fragmentation)					
Vegetation	Potential extinction of plant taxa endemic to PNCAZ, especially in upland areas.	I	H	G	P
	Loss, or diminution, of local populations of some plant taxa.	R	H	L	P
	Inbreeding and loss of genetic diversity because of reduced population sizes.	I	H	L	S
	Reduced availability of seeds of some mature-forest species, which slows recovery of forests following disturbance	R	H	L	S
Terrestrial vertebrates	Local extinction (extirpation) of animal populations associated with old growth forests	I	H	L	P
	Altered predator-prey relationships in more isolated patches of forest.	R	L	L	P
	Altered seed-dispersal by vertebrates due to changes in predator-prey balance.	R	L	L	S
	Potentially increased seed predation due to higher rodent populations, leading to lower reproductive success of plants, particularly those with large seeds	R	L	L	S

	Reduced fruit and seed dispersal by large vertebrates and (probably) by bats	R	L	L	S
Aquatic species	Reduced seed availability for fruit-eating fishes (e.g., *Brycon*)	R	L	L	S
2. Increased local air and water temperatures					
Vegetation	Cooling problems for species with large leaves, increased survivorship of species with smaller leaves or leaves with holes (e.g., *Monstera*)	I	L	G	P
	Change in composition and structure of the biological communities	I	L	L	S
	Increased chance of fires in cut, drying vegetation piles	I	H	L	S
Terrestrial vertebrates	Upward migration of species or populations to higher elevations	I	L	L	S
Aquatic species	Upstream movement of aquatic biota where warmer temperatures exceed thermal ranges.	R	L	L	P
	Mortality events for sudden increases in water temperature linked to increases in air temperature	R	H	L	S
	Changes in community composition of aquatic biota	R	L	L	S
3. Increased occurrence of windstorms					
Vegetation	Increased number of large, disturbed patches in forest	R	H	L	P
	Loss of nutrients now stored in living plants if windthrows are larger than typical gap sizes (say >500 m2).	R	L	L	S
	Shift to a vine or liana dominated forest	R	L	L	S
Terrestrial vertebrates	Incrased occurrence of species characteristic of open areas; resultant change in composition and structure of communities	R	L	L	S

Aquatic species	Landslides in areas with steep slopes could result in sedimentation in water bodies, affecting persistence of fishes and macroinvertebrate species (see #4)	R	H	L	P
4. Increased erosion of slopes and sedimentation in waterbodies					
Vegetation	Loss of soils and nutrients, now stored in living biomass, into streams and rivers.	R	L	L	P
	Reduction of fertility and productivity in upland habitats.	R	L	L	S
	Reduced populations of plant species growing on slopes (e.g., ferns) and along streams.	R	L	L	S
Terrestrial vertebrates	Changes in the availability of collpas	R	L	L	S
Aquatic species	Potential loss of fishes endemic to individual sub-basins (e.g., *Chaetostoma* spp.), where streams are heavily sedimented.	I	H	G	P
	Downstream movement and drift of aquatic species (e.g., macroinvertebrates) in response to loss of interstitial habitats	R	H	L	P
	Loss of spawning habitat for migratory fishes	R	H	G	P
	Decrease in viable populations of fishes and macroinvertebrates	R	H	L	S
	Decreased occurrence of migratory fishes	R	H	L	S
5. Drying and decreased soil moisture					
Vegetation	Reductions in population viability could lead to local extinctions of certain species, particularly plants typically found in wetter areas.	I	H	L	P
	Increased chance of fires in habitats not adapted to fire.	R	H	L	P
	Seedling and juvenile mortality where root systems are not sufficiently deep to obtain moisture.	I	H	L	P
	Loss of native species not adapted to fire regimes.	I	H	L	S
	Loss of viable populations where seedlings and juveniles have experienced substantial mortality	I	H	L	S

Terrestrial vertebrates	Changes in the availability of food resources for insectivorous forest species	R	H	L	S

Reversibility (Capacity of Recuperation):
Reversible = Restorable to healthier condition but will not recover on its own.
Irreversible = Extreme work would be needed to restore to a healthier condition and likely will never reach original condition.

Severity (Level of Damage):
High = Impact likely to affect several species and/or processes, and likely to take a long time to recover once threat is removed.
Low = Impact likely to affect only one or a small number of species and likely to start recovering shortly after threat is removed.

Scale (Geographic Extension):
Local = Impact expected over a small range.
Global = Impact expected to be widespread and go well beyond immediate area of damage.

Order (Moment when Impact Occurs):
Primary = Evidence of impact is immediate.
Secondary = Evidence of impact comes with time.

5.2 Biodiversity Monitoring (CCB: B3.1, B3.2, B3.3)

Because the park is essentially intact and sufficiently large to support basic ecological processes, the project's primary biodiversity objective is to prevent the park's effective size from decreasing. All biodiversity in the park will benefit given that this is a conservation project and the High Conservation Values relating to biodiversity will be maintained.

The results of biological inventories conducted by The Field Museum, the Louisiana State University Museum of Natural Science, and the Museo de Historia Natural de la Universidad Nacional de San Marcos provide an overview of the extraordinary biodiversity in the park (Alverson et al. 2001). However, it is not practical to conduct such elaborate studies on a frequent basis, nor is the monitoring of populations of different species conducive to adaptive management. A different system of ongoing monitoring needed to be developed for fast and appropriate reaction to results in the field that relate directly to management (i.e., location and mitigation of threats and identification of opportunities).

CIMA and The Field Museum developed a system called the Index for Conservation Compatibility (ICC). The ICC is explained further in Section 1.13.5. It is an integrated planning and monitoring tool that incorporates social, biological, institutional, and operational aspects.

Complementing the ICC, CIMA will evaluate forest integrity at two levels: landscape (hectares of forest conserved – i.e., intact forest cover) and biological community (assemblage of species that indicate lack of habitat degradation, including endemic and vulnerable species).

At the landscape level, CIMA analyze annually with satellite images (and aerial overflights when feasible) to confirm that there is no deforestation inside the park. Deforestation in the park is the best indicator readily available to the project, of any negative impact to biodiversity. Where incursions into the park are detected through review of images or park guard reports, cessation of the illegal activities and appropriate remediation become the highest management priority. In addition, CIMA will evaluate forest integrity at the landscape level using indirect information based on records of specific threats (violation of rules of use within the park) noted by park guards. This information will further assist in defining threats or possible impacts to biodiversity.

At the biological community level CIMA will focus on organisms that indicate habitat health and are easy to sight and identify. CIMA will specifically focus on sensitive game animals (tapir, deer, curassow, monkeys and big carnivores). Since the project began, regular observations (sightings and tracks) by park guards have occurred monthly inside the park, along the regular patrol routes around 18 control posts and park guards' centers that include a good sample of the habitat heterogeneity of the landscape. While the routes do include some terrain in the adjacent buffer zone, the area is not as extensive. As discussed in Section 5.1.2, healthy, protected biological communities in the park will lead to improved biodiversity in the buffer zone. Beginning in 2013, however, park guards will make also quarterly observations in equivalent terrain in the adjacent buffer zone, within one week of their observations inside the park. These observations will occur in 2-3 hour long morning walks in the 18 control posts and park guards' centers.

Information will be collected on the key species, number of individuals, trail, time, habitat type, and weather conditions. Park guards have been, and continue to be trained in identifying and correctly reporting fauna encountered on their patrols. This process continues to evolve based on results and feedback from park guards.

There are several benefits to using park guards to record information about flora and fauna, especially the species used by local villagers. Park guards routinely patrol large portions of the park and already have a system of reporting back to CIMA. Because most of the guards are from local communities, they usually have good knowledge of local flora and fauna and they receive additional training.

Table 5.5 summarizes the variables to be used for landscape and biological community monitoring.

Table 5.5: Variables for biological community monitoring

VARIABLE	INDICATOR	DATA COLLECTION METHOD	DATA SOURCE	FREQUENCY
Natural vegetation cover	# of hectares of conserved forest (canopy cover) in the Project and in the Leakage Belt	Satellite images analyzed by CIMA's GIS team	LANDSAT images, preferably in the dry season to reduce cloud cover	Annual, during monitoring events (sep - oct)
Presence of species locally threatened by hunting	# of species registered by park guards (spp. of monkeys, tapir, deer, spectacle bear, jaguar and curassow)	Park-guard reports and data from hunters	Observations from park guards and hunters	Monthly measurements and annual analysis
Abundance of species locally threatened by hunting	# of individuals by species (of monkeys, tapirs, jaguar, deer and curassow) registered by park guards	Park-guard reports and data from hunters	Observations from park guards and hunters	Quarterly measurements and annual analysis
Rules of use violations or infractions according to the protection status and zoning of the park	# of unauthorized hunters, use of illegal methods of hunting, or hunting forbidden species	Park-guard reports and data from hunters	Observations from park guards and hunters	Monthly measurements and annual analysis
Rules of use violations or infractions according to the protection status and zoning of the park	# of unauthorized loggers, or selective extraction of timber species (sightings or stumps)	Park-guard reports and data from hunters	Observations from park guards and hunters	Monthly measurements and annual analysis
Rules of use violations or infractions according to the protection status and zoning of the park	# of exotic animal or plant species introduced to PNCAZ	Park-guard reports and data from hunters	Observations from park guards and hunters	Monthly measurements and annual analysis

To simplify comparisons from year to year, the index presented in Table 5.6 has been created. The final sum of the individual variable scores provides a qualitative analysis of the status of biological diversity in the PNCAZ and its buffer zone.

Table 5.6: Index for biological community monitoring

VARIABLE	INDICATOR	Rank	Description
Natural vegetation cover	# of hectares of conserved forest (canopy cover) in the Project and in the Leakage Belt	99-100% = 3 96-98% = 2 91-95% = 1 80-90% = 0	• Intact Forest • Slightly disturbed Forest • Disturbed Forest • Very Disturbed Forest
Presence of species locally threatened by	# of species registered by park guards (spp. of monkeys, tapir, deer, spectacle bear, jaguar	> 6 spp = 4 4-6 spp = 3 2-4 spp = 2	• Intact Forest, low hunting activities • Medium hunting activities

hunting	and curassow). (Annual Accumulated)	1-2 spp = 1 0 spp = 0	• High hunting activities • Almost extinction of sensitive spp • Extinction of sensitive spp
Abundance of species locally threatened by hunting	# of individuals by species (of monkeys, tapirs, jaguar, deer and curassow) registered by park guards. (By patrol event)	> 10 ind.= Very high 6-9 ind. = High 3-5 ind. = Medium < 2 ind. = Low	• Intact Forest, low hunting activities • Medium hunting activities • High hunting activities • Almost extinction of sensitive spp
Rules of use violations or infractions according to the protection status and zoning of the park	# of unauthorized hunters, use of illegal methods of hunting, or hunting forbidden species	0 = 0 1 = -1 2-4 = -2 > 5 = -3	• Intact Forest • Slightly disturbed Forest • Disturbed Forest • Very Disturbed Forest
	# of unauthorized loggers, or selective extraction of timber species (sightings or stumps)	0 = 0 1 = -1 2-4 = -2 > 5 = -3	• Intact Forest • Slightly disturbed Forest • Disturbed Forest • Very Disturbed Forest
	# of exotic animal or plant species introduced to PNCAZ	0 = 0 1 = -1 2-4 = -2 > 5 = -3	• Intact Forest • Slightly disturbed Forest • Disturbed Forest • Very Disturbed Forest

Data will be compiled monthly and annually as noted, and beginning in 2013, comparisons will be made for sightings inside and outside the park. If a trend of lowering levels of sightings were to be detected inside the park, CIMA would first implement an immediate protection strategy to raise awareness and ensure that illegal activities are not occurring in the park and specifically in that area. Next, the CIMA information team would design appropriate research questions to identify the cause (threat) and to develop management activities appropriate to mitigate the threat.

Data collection and information flow follows the process outlined in Section 4.3.8. The Data and Information Specialists are responsible for ensuring data collection occurs and is compiled in the appropriate time frame. They also are responsible for reporting the data to CIMA Management and other interested parties.

6. COMMUNITY IMPACT

6.1 Net Impact on the Community (CCB G2.4, G3.2, CM1.1, CM2.1, CM2.2, CM2.3)

6.1.1 Human Communities in the Project Area

The project is expected to ensure that there is no contact with the indigenous people in isolation who use the park, as well as to protect the area they use. This is a net positive impact.

6.1.2 Human Communities in the Buffer Zone

The project is expected to result in a net positive impact in the communities in the buffer zone.

As indicated by comparison between the 2003 and 2008 data in Section 1.10.3, the presence of the park and associated park-team efforts have led to significant improvements in land security and quality of life for communities in the buffer zone. This trend will continue with the project.

In participating communities (i.e., those in critical areas), governance over natural resource use has improved through improved land-use zoning and implementation of norms and rules for hunting, fishing, and protection of soils. Access to technical assistance with agroforestry projects and environmental education has provided the beginning of a pathway for sustainable livelihood for those participants. For a small number of others, employment related to park management (i.e., community park guard program) has increased income.

Communities that have participated in land-use zoning processes, as documented in the zoning reports

- have a greater awareness of the sustainable alternatives to cattle ranching, logging or monocultivation;
- have begun to develop community level norms for resource use;
- are experiencing less conflict over land tenure, both within communities and between communities, and
- are creating their own protected resource areas within community or municipal boundaries.

However, to date only one-third of all the communities in the buffer zone have been able to participate in the CIMA-led programs because of limited resources. CIMA has focused on those communities with the most direct access to the park, strategically concentrating on these first in order to stabilize land-use and prevent encroachment into the park. With the project, more communities will be included in CIMA's land tenure activities because of the larger and sustainable source of funding.

In 2009, The Field Museum and CIMA will begin to work closely with indigenous communities and their advocate organizations to develop and implement "quality of life" plans. These plans will be designed designed to meet family income needs and improve community infrastructure within the context of land-use zoning and based on local cultural values and practices that are compatible with environmental conservation.

6.1.3 Human Communities Off-Site

The project is not expected to have any direct impact, positive or negative, on communities outside the project zone and therefore defined as off-site. As a result, no mitigation plan for negative impacts is required. MUF data to date have not shown a decrease in immigration as a result of project activities indicating that no effect is being felt by source communities for immigrants. CIMA works with regional and local governments, SERNANP, MINAM, REDD groups and other protected areas to demonstrate and teach the skills needed to successfully develop and implement a REDD project. This work may have indirect positive benefits for off-site communities if similar project activities are implemented in their areas.

6.1.4 Impact Analysis (CCB: G3.6, CM1.2, CM3.2)

In the expert judgment of both CIMA and The Field Museum professional staff, these benefits to communities will continue and expand with the implementation of the project because the sustained funding will allow the current work to continue and increased participation in targeted areas. Funding of the project will also allow CIMA to replicate activities in new communities as already participating communities are stabilized and empowered to continue with less intense technical assistance from CIMA. Following is Table 6.1 with likely high, medium, and low impacts projected from the project for buffer zone communities.

As demonstrated throughout this section, high conservation values for the project relating to the communities will be protected. Project activities will ensure the continuation of the ecosystem services provided to the communities by the project area, allow communities to meet their basic needs in a sustainable manner and allow for the project area to continue providing the ecosystem services needed for communities to retain their traditional cultural identities.

Table 6.1: Project Impacts on Communities

Component	Description of Impact	Intensity of Impact
Socio-economic	Increased net income for community residents from project-related employment: community park guards, "guides" for scientific investigators	Low (Positive) (The number of local people employed will be low compared to total population)
Socio-economic	Technical assistance with financial management of community funds, development of community resource management plans should increase local capital available for infrastructure.	High (Positive) (Improvements in infrastructure at communal level will lead to more sustainable use of natural resources and lead to self sufficiency)
Socio-economic	Increased empowerment to protect community resources through community-based ZEE (Zonificacion Ecológica y Económica) or other modes of land-tenure security throughout the region	High (Positive) (Communal land tenure security is critical for controlling speculation and establishing good governance over resources)
Social	Increased empowerment to protect local life-ways through validation of local ecological knowledge and cultural practices (quality of life plans)	Medium (Positive) (Processes of empowerment to resist external pressures to over-exploit resources in fragile landscapes take time and may be insufficient to thwart accelerating pressure from oil exploration, logging or biofuel plantations)
Social	Increased environmental awareness through school-based and informal education programs	Low (Positive) (Education processes are long-term in demonstrating impact)
Socio-Political	Increased regional coordination of large-scale environmental protection through the Oversight Committee *(Comité de Gestión)*	High (Positive) (The Committee affords the opportunity to bring together important actors to make region-wide decisions)

6.2 Monitoring of Human Communities in the Buffer Zone (CCB: CM3.1, CM3.2, CM3.3)

The monitoring of social impacts on buffer zone communities draws on guidelines offered in the Manual for Social Impact Assessment of Land Based Carbon Projects: Part II—Toolbox of Methods and Support Materials(Richards and Panfil, 2010). The project wants to ensure that it provides net benefits to local communities in a sustainable way, while minimizing risks or losses to the communities. To assess the social impact, the project follows the theory of change laid out in the Sustainable Livelihoods Framework approach, but also includes elements from the Review of Outcomes to Impact (ROtI) approach. The Sustainable Livelihoods Framework best fits the conditions on-the-ground of the majority of communities in the buffer zone because these are largely subsistence oriented, with high dependence on local natural resources for their livelihoods. Since 2002, when CIMA collaborating with The Field Museum began administration of the Park under an agreement with INRENA, a participatory methodology to design community-based conservation strategies and to measure the impact of these programs was used. Activities involve a technical team working closely with identified community leaders and organizations to implement land-use zoning, environmental education, and building of capacity to improve quality of life through strengthening the subsistence base and managing natural resources. Impacts of these programs are monitored through compilation of technical team reports and the MUF. In 2008, prior to the commencement of the REDD project, the technical team conducted the third MUF, which provides baseline data for measuring project impact going forward.

6.2.1 Application of ROtI and Sustainable Livelihoods Framework

The ROtI Approach assesses project impact based on a "results chain" from outputs to outcomes to impacts (Richards and Panfil 2010). As such, it allows measure of progress towards goals with opportunity for iterative corrective action, as necessary. This is similar to the approach currently used by the PNCAZ team, through the Index of Conservation Compatibility (See Section 1.13.5). The ICC establishes the results chain through six levels that eventually indicate sustainability for the Park and its buffer zone.

To measure impact using the ICC, CIMA analyzes specific outputs and determines whether the impact required to move up the ICC ladder has been achieved. The results of the analysis combining social and biological data are depicted in maps through GIS. Based on the results the team makes strategic decisions on how and where to reallocate efforts and resources, if necessary to improve efficiency and address rising threats or opportunities.

To complement the ICC and assess project impact on improvements to the quality of life of off-site communities, CIMA measures specific indicators drawn from the sustainable-livelihoods framework. These indicators include several in the list approved by the Social Carbon Methodology. CIMA divides them into the five capital components that constitute "quality of life," namely natural, social, human, physical, and economic.

6.2.2 Indicators and Methodologies

Ongoing monitoring of the impact of the project on buffer zone communities will be conducted in two main ways. Real-time monitoring will occur through the interaction of park guards and regional CIMA personnel and field staff directly with the communities. Complaints or suggestions will be addressed through the process described in Section 7.1.3 Stakeholder Communication Systems. Park guard and field staff reports are analyzed and synthesized quarterly and fed into the ICC monitoring system that allows for adaptive management of PNCAZ. Trends, changes, and suggestions or complaints will guide the development of new programs and modifications as necessary of existing ones.

Every three years CIMA will conduct a new MUF to get a more formal analysis of the status of communities and to detect positive or negative impacts of the project. The MUF is designed as a participatory data collection exercise, but data will be validated through triangulation with CIMA field staff and CIMA's technical advisors, who verify community-reported information and supplement it with quantitative surveys that address population heterogeneity and composition. To ensure high quality data collection, CIMA recruits and trains community-based facilitators who are also integral to the communications system. The MUF will be redesigned to include a small and minimally intrusive household survey to be taken by a selected sample within each participating community. The survey will collect household economic data on subsistence patterns and two additional exercises with focus groups will capture communitywide perceptions of project impacts on "quality of life." The MUF efforts include all communities participating in the project, but samples will be selected in the communities to reflect demographic and socio-economic composition.

MUF data are the responsibility of and are collected through the field technical team based in each of the four regional offices. The data are stored in a database available via the Internet (Drupal software) that can be shared by the Park team and its collaborators. The data analysis is the responsibility of the CIMA

Management Program, which establishes the mechanisms for internal review of information, analysis of this information, and the methodology for the return of the data to the people and its validation by the communities.

Project impact will be assessed by measuring against the indicators listed in Table 6.2. These indicators were selected as the most appropriate to measure the implementation of CIMA's activities designed to improve the quality of life in the buffer zone communities and stabilize land use through land-use zoning and land tenure programs. As discussed in Section 1.8.1, these activities directly mitigate the threats that lead to deforestation from advancing of the agricultural frontier and subsequent illegal activities. The deforestation in turn results in soil erosion, sedimentation and pollution of water, drying out of stream beds, weakened crop yields, and other negative impacts on the communities. Therefore, these indicators serve as the best measures of CIMA's success in avoiding reduced ecosystem services and negative community impacts.

Table 6.2: Social monitoring indicators

VARIABLE	INDICATOR	DATA COLLECTION METHOD	DATA SOURCE	FREQUENCY
Natural Capital	# of hectares under community-generated management or used according to land-use plans	Quarterly summaries of field staff reports and MUF	MUF report and ICC maps	Annually at time of ICC evaluation and more thoroughly every 3 years with MUF
Social Capital	# of communities implementing quality-of-life plans and sharing experiences with neighbors.	MUF	MUF report	Every 3 years
Social Capital (2)	# of communities with women as active participants in REDD project interventions	Quarterly summaries	Annual Report	Annual
Human Capital	# of REDD project participants applying new technical skills in resource management, project administration and governance	Number of individuals certified in new skills and field staff reports	ICC maps and data base	Annual
Physical Capital	# of communities with infrastructure improvements and mechanisms for maintaining them sustainably	MUF	MUF report	Every 3 years
Economic Capital	#of participating communities whose basic family and communal needs are satisfied through sustainable economic activities in accordance with land-use and quality-of-life plans	MUF	Economic analysis component of MUF	Every three years

6.2.3 Desired Project Impact and Long-term Vision

The vision established for the project in the current Park Management Plan (Plan Maestro) is one of communities with improved governance structures and institutionalized land-use norms, able to participate more actively in decision making for the park management through a more effective Park Governance Council (*Comité de Gestión).* In this manner, residents of the Park's buffer zone will always be ensured that the park contributes to the long-term sustainable use of the region's resources, guarantees ecosystem services, and provides a quality of life compatible with the local ecology and local cultural values.

To meet this vision, CIMA will continue to strengthen the relationship it has with the communities near the project area boundaries. The initial enthusiasm of the people regarding the national park has led to the direct participation of the population in park-protection activities. Park neighbors now have a better understanding of the benefits the park provides as they enjoy more frequent game animals, and a growing respect for their traditions and cultural values.

With the project the current extension and land-use zoning efforts that are fundamental to participatory conservation in the communities will not only continue full-force but will increase. The project will enable expansion of current programs in critical sectors to other communities in the buffer zone in the next eight to ten years.

7. STAKEHOLDER COMMENTS (G3.8, G3.9, G3.10, G4.3, CL3.2, CM3.3, B3.3)

7.1 Stakeholder Involvement in Project Design

Two groups of stakeholders were identified for the project: primary stakeholders are those with direct involvement in the project area. Secondary stakeholders are those in the buffer zone, who may be affected by some project activities but do not reside or have rights in the project area.

7.1.1 Primary Stakeholder Involvement

Primary stakeholders were involved in project design and are knowledgeable about the project. Their names and their contact information are noted in Table 7.1.

Table 7.1: Primary Project Stakeholders

Primary Stakeholder	Contact	Position	Contact Information	Key Involvement in the Project
Ministry of the Environment, Peruvian National Government	Lucia Ruiz Ostoic	Advisor to the Minister	lruiz@minam.gob.pe	Oversees SERNANP, the national authority for protected areas Establishes environmental policies (including REDD and other payments for ecosystem services) Leads the nested REDD approach with projects
SERNANP	Pedro Gamboa	Head	pgamboa@sernanp.gob.pe	Oversees the implementation of CIMA's contract, approves the Plan Maestro and designates the Chief of the park Oversees ecosystem-service-payment policies in protected areas
PNCAZ	Frank Oyola	Head	foyola@sernanp.gob.pe 968218428	Oversees all park protection activities

Regional Environmental Authority, San Martín	Silvia Reátegui	Manager	sylvia_reategui@hotmail.com (042) 56-4100	Major contact in the department of San Martín for implementation of project
Conservation, Management and Sustainable Use Program of Loreto's Biodiversity (PROCREL), Loreto	Jack Flores	Manager	jflores@procrel.gob.pe (065) 60-7250	Major contact in the department of Loreto for implementation of project
Moore Foundation	Avecita Chicchon	Program Director	avecita.chicchon@moore.org	Early investor in PNCAZ and concerned about the long-term viability of the park
USAID	Marilu Bacigalupo	Program Director	mbacigalupo@usaid.gov 618-1200 (central)	Early investor in PNCAZ and concerned about the long-term viability of the park
MacArthur Foundation	Steve Cornelius	Program Officer	scorneli@macfound.org (312)726-8000	Early investor in PNCAZ and concerned about the long-term viability of the park
Exelon	Steve Solomon		steve.solomon@ exeloncorp.com	Partial funder for the development of the PD
CIMA Board Member	Marleni Ramirez	CIMA Board Member	marleni301@aol.com (57)24450029 anex 107	Reviews CIMA's policies and strategies
Representatives of the park guards of PNCAZ	Pedro Saldaña Andrés Cenepo	Park guards CP 16 and CP 11	(042) 529844 (Jefatura)	Key contacts with the communities in the buffer zone and were engaged in the carbon stock inventory
Grupo REDD Peru representative	Hugo Che Piu	President of Derecho, Ambiente y Recursos Naturales (DAR)	hchepiu@dar.org.pe 266-2063 (oficina)	DAR leads Mesa REDD and the Technical Group for the Climate Change National Committee

SERNANP is integral to the discussions, work groups, presentations, and conferences that precede development of each Master Plan for PNCAZ. In addition, SERNANP must approve the final Master Plan. The working relationship between CIMA and SERNANP allows SERNANP to provide ongoing input into the project's implementation and any improvements that may be made over time as new information is obtained. Between May 2008 and December 2009, CIMA has met with representatives of SERNANP or the MINAM numerous times to discuss the project. Copies of the presentations made at these meetings are available.

SERNANP also has participated in national conferences and meetings regarding REDD projects in Peru and CIMA shared information on the project design at those times. These meetings began in 2009 and samples of the presentations made by CIMA at these meetings are available.

CIMA coordinates very closely with the PNCAZ Head. CIMA's Tarapoto offices are located within PNCAZ's Headquarters allowing for continuous communication.

CIMA meets periodically with the Regional Environmental Authority, San Martín as part of the regional REDD roundtables and the Regional Environmental Commission (CAR San Martin). CIMA typically meets with PROCREL twice a year per the terms of the agreement with the Regional Government of Loreto.

CIMA and The Field Museum have also briefed and sought input on project design from their major funding sources. Representatives of the Gordon and Betty Moore Foundation were briefed in 2009 and 2010 and copies of the slide deck are available for review. Representatives from the MacArthur Foundation, including Steve Cornelius, were also briefed in 2009 and 2010. Copies of the meeting notes and presentations are available.

LIMA-based, USAID staff members have also been briefed about the project, including Marilu Bacigalupo, on October and December 2009, and January, June and July 2010. Steve Olive oversaw the initial funding. Copies of the USAID presentations are available. On July 14, 2010 CIMA and other Peruvian NGO had a meeting with Mr. Todd Stern about climate change and opportunities of REDD.

Exelon, and its representative, Steve Solomon, who directed funds to The Field Museum for the development of the PD were introduced to the project in December 2008, briefed on the project's progress in March 2009, September 2009. March 2010 and September 2010. Copies of the presentations used in the briefings are available.

CIMA's Board met in May 2008 and had a conference call in 2009 and July and August 2010 to discuss the value of a REDD project as a sustainable source of funding for park management. In May 2010, a letter was sent to the members of the Board advising them of the project's progress. Minutes from the 2008 meetings are available.

CIMA is involved in a network of private and public organizations called the REDD Bureau (Grupo REDD Peru), which supports the government in developing REDD policy based on real experiences. CIMA personnel coordinate the San Martin REDD Bureau, which is recognized by regional government decree (Resolución Ejecutiva Regional No.864-2009-GRSM/PGR del 9NOV2009). These meetings began in 2009 (August and November). Minutes or presentations from these meetings are available.

The project has also been discussed with the park guards. Names and contact information of two representatives of the group of park guards who were trained and participated in the estimation of the carbon stock in the park in the August to December 2009 period are provided. These park guards interact with members of the off-site communities on a daily basis.

Communications with these stakeholders continue today.

7.1.2 Secondary Stakeholder Involvement

In order to meet the requirements for the CCB validation comment period, CIMA will ensure that copies of key project documentation (PD and any other documents developed) are translated into Spanish and are available to the public in each regional CIMA office. CIMA will also send letters and technicians to every community in the buffer zone to ensure that all communities receive direct notification of the location of the documents and are aware that CIMA welcomes their feedback. Any comments received will be addressed immediately in writing. If appropriate, the PD will be revised. CIMA will provide copies of the comments along with the responses to the VVB.

A communication plan has been developed to provide more detailed REDD information once the project has been VCS validated and verified and funding is available from the sale of carbon credits. This plan is provided in Appendix 10. When the full communication plan is implemented, CIMA will provide a project summary poster to each community. The poster will contain project information including the objectives, types of activities, project impacts, means of communicating with CIMA, and the grievance process. The

CIMA extension team will distribute the posters during community assemblies along with materials explaining REDD and the project process. The CIMA technician will review the poster and REDD materials content and answer questions. Community members who have questions or comments immediately will be able to have their concerns addressed at that time if possible. If a community member has a suggestion, complaint or question that the technician cannot immediately settle, the item will be handled in accordance with the process outlined in the next section. Community members will have numerous opportunities to voice questions or concerns as the technicians are frequently spending time in the communities. Community members wishing to submit comments to the CCB verification public comment period will be able to do so through CIMA or directly to the verification body conducting community visits. Copies of the PD, PIR and Monitoring reports will be made available in the regional CIMA offices for anyone who wishes to review them in more detail.

Community concerns and aspirations have been critical in the design and implementation of project activities. One of the first project activities is to have regional meetings with all communities who wish to participate in establishing regional visions and plans. As described in numerous sections of the PD, CIMA has worked and will work extensively with these communities to determine how the project can have the most positive impact on their lives. The desire for a participatory approach to park management is one of the primary goals of the project.

7.1.3 Stakeholder Communication Systems

Key project documents such as the PD, monitoring reports, and validation and verification reports will be posted to CIMA's website in both English and Spanish. Links from The Field Museum's website will also provide easy access for interested parties. Notices regarding the completion of the PD and the beginning of the CCB public comment period will be emailed to primary stakeholders and posted on the website. Key project documents will be made available to secondary stakeholders and the CCB public comment period will be publicized as described above.

Throughout the project, CIMA will be able to draw upon several existing communications systems that had been developed for the initial park management activities. Using these systems, CIMA will be able to gather and respond to data, questions, and comments both from internal and external sources. Primary stakeholders are most likely to contact CIMA via email, telephone, or in person during meetings, conferences, and workshops.

Monthly visits of CIMA's technical field staff to communities will provide an opportunity to present information and receive comments from the secondary stakeholders.

Park guards will continue to maintain logs at their posts and send daily radio reports and monthly written reports to the Head of the park, who will coordinate the specific patrol routes with CIMA. The Head of the park is based in Tarapoto, is in steady communication with CIMA, and provides copies of park-guard reports to the CIMA Information Officers. Park guards will continue to report on their activities and their observations of flora and fauna in the field. They will also continue to report on information from the communities, which they will obtain through direct discussions, letters, and attendance at local events or meetings. This information can be questions, comments, observations of flora or fauna, observations of illegal activities or rumors of illegal activities, notification of illegal activities being reported to the proper authorities, or other issues.

Field offices will regularly communicate both in writing and verbally with Headquarters through meetings and periodic informal reviews to ensure smooth coordination among all offices. Electronic mail, meetings, and other means will be used to disseminate information regarding new programs, policies, or reminders from Headquarters to all CIMA employees.

As discussed, most comments from buffer zone communities will go directly to park guards and the CIMA technical team, given their frequent interaction with the communities. Some comments, however, will be sent to the CIMA field offices. Park guards will forward questions they cannot answer and concerns or complaints voiced by residents to the field offices. Most items will be easily resolved by the field offices, but when necessary will be forwarded to the Program Director or local law enforcement authorities, as appropriate.

Concerns and comments will be handled in a consistent manner. Depending on the issue, conference calls, in-person meetings, interviews with the commenter or CIMA personnel, and other means will be used to obtain additional information as necessary, and appropriate actions will then be taken. Some complaints have resulted in expanded training, new communications to buffer zone communities, and even firing of an employee. There is no formal written procedure for this process but it will be applied consistently and will build on CIMA's close relationship with the buffer zone communities. CIMA's Executive Director will be ultimately responsible for the resolution of all issues but questions, complaints, and comments may be addressed by several individuals within the organization, depending on the topic. To date, all issues have been satisfactorily resolved through this process.

When issues are addressed immediately in the field by the park guard or technician, the interaction will be documented in the park guard's or technician's report but no formal written summary of the response will be provided to the individual with the question or concern. If the issue cannot be immediately resolved and is forwarded to CIMA's offices or Headquarters, a written response will be issued to the individual in question within 30 days.

If any stakeholder feels that an issue cannot be or has not been addressed satisfactorily through this process, all stakeholders could also raise the issue to the Comité de Gestión (CG). This organization includes representation from all stakeholders involved in the management of the park including communities, local and regional governments, local organizations, the Park Head and CIMA. CIMA will recuse itself from all CG meeting items regarding these issues to ensure the impartiality of the review. This diverse representation provides natural pathways for reporting issues and for providing an independent, third-party review of any issues raised. Outcomes of the CG reviews will also be provided in writing to the submitting individual or community within 30 days.

Minutes of the CG meetings, park guard reports and technician reports will capture the input received from communities while emails, meeting minutes and phone logs will capture input from primary stakeholders. In addition, reports to funders will often summarize much of the same information. All of this information will feed into the ICC system to provide data on new threats (illegal activities, tensions between communities), suggestions or other issues. As appropriate, CIMA's strategies and activities will be adjusted better to achieve the project's goals. Immediate threats may result in immediate changes in activities and will not require a quarterly ICC review. The ICC documentation and quarterly project reports will capture how the plan has been revised as a result of stakeholder dialogues.

Once the regional community meetings have occurred in 2008 and early 2009, a summary document will be prepared in conjunction with the new Plan Maestro documenting this input process, its results, and how the project has been developed in line with this input.

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