PROTECTION OF THE BOLIVIAN AMAZON FOREST

Fermin Aldabe

Project Title	Protection of the Bolivian Amazon Forest
Version	0.5
Date of Issue	15 March 2012
Prepared By	Fermin Aldabe
Contact	Nicanor Salvatierra 179 Zona Central Riberalta Bolivia

GENERAL SECTION

G1. Original Conditions in the Project Area

General Information

1. The project is a grouped one and currently has 1 instance in the tropical rain forest of the Beni Department in Bolivia. More accurately, it lies in the canton of Exaltacion, second section, province of Yacuma and about 150 kilometers from Riberalta (km 462 of National Route 8).

   Otherinstances incorporated in the future to the project may lie in the departments of Pando and Beni all in Bolivia. There are requisites that must be fulfilled by new instances, among others, the instance must be within a zone considered to be tropical rain forest.

   The Udapro has produced the "Atlas de Potencialidades Productivas Del Estado Plurinacional De Bolivia 2009" (**"The Atlas"**). See Appendix 1. From these document along with inspection of the project area the following characteristics can be obtained.

The project objectives are to

a) Improve climate conditions by eliminating the carbon emissions arising from deforestation.

b) Improve biodiversity by increasing the number of endangered and vulnerable species listed in section G1.8.

c) Increase the income of nearby communities by providing them with labor that is required to plant the tree species and improve biodiversity.

The project includes the ecosystem known as the Amazon Rain Forest.

Soils. The soils are tropept/udox. The terrain has slight inclination raging from 3% to 7% and the altitudes are below 200m and generally between 120 and 160m. The soil depth is 100cm. The soil is dark/red with medium texture, good drainage and no stone coverage.

Climate. Mean annual temperature is greater than 28C with May through August showing lower temperatures than the rest of the year. During these months "surazos", winds coming from the south tend to produce sharp drops in temperatures. The lowest temperature registered in Riberalta is 6.5C in the months of July. Annual rainfall in the region is between 1700 and 1900mm with the rain season spanning from November to April and the dry season from June to September.

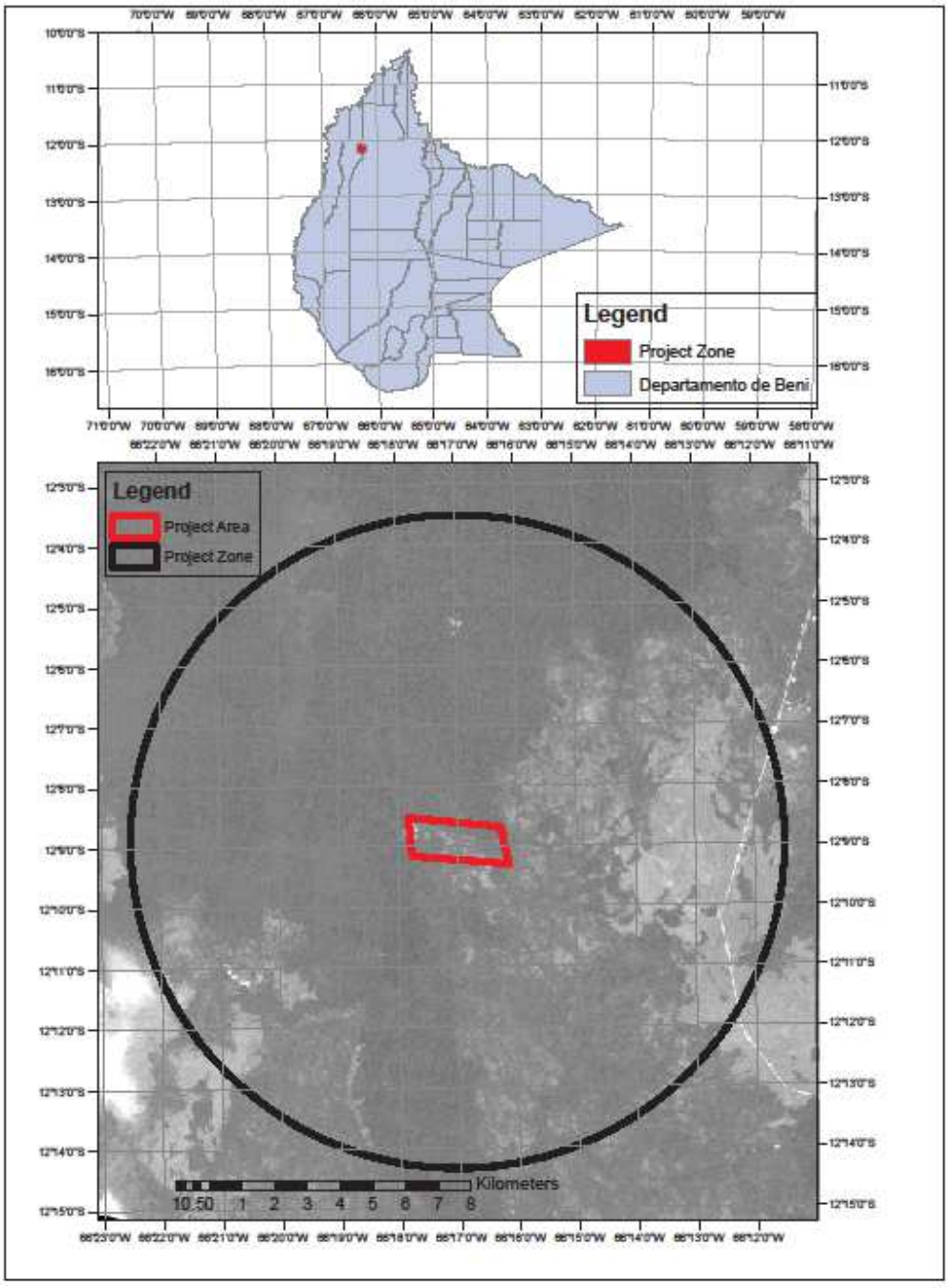
Geology. The project area is characterized by the quaternary formations represented by alluvial deposits through to the Devonian. The litology is represented by arcilitas and limonitas from the quaternary period. See map "Geologia del Departamento de Beni" in the Atlas.

2. The vegetation is typical of tropical Amazon rain forests ecosystem found in the north of Beni and Pando and such as that of the Manuripi National Amazon Wildlife Reserve in the Department of Pando which is located less than 150km from the Project area. However, the project area has suffered in the second half of the 1990's massive logging and deforestation to some degree or other. The project area has recovered since then to some degree. The project area also includes a stratum that has been burned in 2009. However, the project area is still characterized as a secondary forest as a result of human intervention. The height is between 16 and 25 meters with some areas reaching 30 meters. The principal species are: Bertholletia excelsa, Terminalia amazónica, Cedrela odorata, Amburana cearencis, Cedrelinga catanaeformis, Couratari guianensis.

3. Below are the coordinates of the polygons delimiting the project area of each instance.

Instance	Characteristic	Value		
1	Name	ML1ASP		
	Project area (Coordinates WGS-84 UTM 20South)	**Point**	**East**	**North**
		P1	143,923	8,655,283
		P2	144,174	8,654,140
		P3	143,675	8,654,181
		P4	143,347	8,654,498
		P5	143,252	8,654,498
		P6	143,077	8,654,621
		P7	143,065	8,654,832
		P8	142,934	8,654,855
		P9	142,557	8,654,887
		P10	142,390	8,654,935
		P11	142,359	8,655,094
		P12	141,982	8,655,217
		P13	141,922	8,655,121
		P14	142,168	8,654,859
		P15	142,204	8,654,693
		P16	142,114	8,654,309
		P17	141,201	8,654,384
		P18	141,150	8,654,895
		P19	141,421	8,654,959
		P20	141,348	8,655,105
		P21	141,507	8,655,191
		P22	141,570	8,655,187
		P23	141,513	8,655,108
		P24	141,685	8,654,830
		P25	141,768	8,654,830
		P26	141,771	8,655,121
		P27	141,599	8,655,217
		P28	141,414	8,655,270
		P29	141,417	8,655,333
		P30	141,112	8,655,347
		P31	141,095	8,655,562
	Project area Total Area	235 has		

The maps below show the project zone within the Beni Department and the project zone and project area limits in Landsat-5 image from August 13 2011. The project zone is defined as the area within a 10km radius from the center of the project area.


Legend
Project Zone
Departamento de Beni
Legend
Project Area
Project Zone
Kilometers
10 5 0 1 2 3 4 5 6 7 8

4. Each new instance must follow the criteria of the methodology VM0007

Methodology	**Category**	**Criteria**
VM0007	Geographic location	Departments of Pando and Beni in Bolivia
	Baseline scenario	Planned deforestation by a known agent of deforestation for conversion to agricultural land
	Property Type	Private
	Project Area	Any excluding peatland
	Conversion	Agricultural and herding activities
	Ownership	1. right of use arising by virtue of a contractual right in the land. Subject to a minimum number of credits being obtained or 2. A right of use arising under law
	Income	Only generates income from the sale of carbon credits

From the methodology the relevant GHG sources, sinks and reservoirs for the project and baseline scenarios of each methodology are defined below.

Source		Gas	Included?	Justification/Explanation
Baseline	Carbon stock in aboveground biomass in the baseline in stratum i	CO_2	Yes	Used in eq. 4 of module VMD0006
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock in belowground biomass in the baseline in stratum i	CO_2	Yes	Used in eq. 4 of module VMD0006
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock in aboveground non-tree vegetation in stratum i	CO_2	Yes	Used in eq. 4 of module VMD0006
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock in belowground non-tree vegetation in stratum i	CO_2	Yes	Used in eq. 4 of module VMD0006
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock sequestered in wood products in the baseline in stratum I	CO_2	Yes	Used in eq. 3 of module VMD0006
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Non-CO2 emissions due to biomass burning in stratum i	CO_2	No	NA
		CH_4	Yes	Used in eq. 1 of module VMD0013
		N_2O	Yes	Used in eq. 1 of module VMD0013
		Other	No	NA

Baseline Sources considered *de minimis*	**Justification**
Carbon stock in dead wood in the baseline in stratum i	It is conservative
Carbon stock in litter in the baseline in stratum i	It is conservative
Carbon stock in soil organic carbon in the baseline in stratum i	It is conservative
Emission from fossil fuel combustion in stratum i in year t	It is conservative
Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in	It is conservative

year t	
Mean post-deforestation stock in soil organic carbon in the post deforestation stratum I	It is conservative

Source		Gas	Included?	Justification/Explanation
Project	Carbon stock in aboveground biomass in the baseline in stratum i	CO_2	Yes	Used in eq. 12 of module VMD0015
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock in belowground biomass in the baseline in stratum i	CO_2	Yes	Used in eq. 12 of module VMD0015
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock in aboveground non-tree vegetation in stratum i	CO_2	Yes	Used in eq. 12 of module VMD0015
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock in belowground non-tree vegetation in stratum i	CO_2	Yes	Used in eq. 12 of module VMD0015
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Carbon stock sequestered in wood products in the baseline in stratum i	CO_2	Yes	Used in eq. 5 of module VMD0015
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Biomass carbon of trees cut and removed through degradation process from plots measured in stratum *i* at time *t*	CO_2	Yes	Used in eq. 7 of module VMD0015
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Average aboveground biomass stock before burning stratum *i*, time *t*	CO_2	Yes	Used in eq. 1 of module VMD0013
		CH_4	No	NA
		N_2O	No	NA
		Other	No	NA
	Non-CO2 emissions due to biomass burning in stratum i	CO_2	No	NA
		CH_4	Yes	Used in eq. 1 of module VMD0013
		N_2O	Yes	Used in eq. 1 of module VMD0013
		Other	No	NA

Project Sources considered *de minimis*	**Justification**
Carbon stock in dead wood in the baseline in stratum i	It is conservative
Carbon stock in litter in the baseline in stratum i	It is conservative
Carbon stock in soil organic carbon in the baseline in stratum i	It is conservative
Emission from fossil fuel combustion in stratum i in year t	It is conservative
Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t	It is conservative

Using the above methodologies and constrained to the sinks and sources defined above, the relevant carbons stock for the instance are

Instance	**Strata**	**Estimated Current carbon stocks (tCO2e)**	**Estimated carbon stocks for the duration of the project (tCO2e)**
ML1ASP	1	71,102	174,557
Total		**71,102**	**174,557**

Please refer to section CL1.1 and CL2.3 for a step by step process of GHG reductions/emissions including biomass plots, formulae and default values.

See appendix 3 for a map delimiting the project single stratum. Stratum 1 includes only forest that has suffered selective logging. ~~Stratum 2 includes only portions of forest that were burned in 2009 or which were deforested in the mid 1980 and has not fully recovered. As a result of the recent burning, Stratum 2 carbon stocks have been conservatively estimated to be nil.~~

Community Information

5. The origins[1] community ("**TCO**") Takana Cavineno Community borders the east of ML1ASP. Government land surrounds the remainder of the instance. The origins community Chacobo claims this government land. These communities show little social or economic diversity with members holding close to equal stakes of the community resources.

   Economy: the primary sources of income are derived from Brazil nut harvest. The harvest season takes place from November to April. The other important sources of income are hunting, fishing and fruit recollection. These take place year round. Small plantations of 1 hectare or less devoted to corn, rice and yucca are usually harvested from early January to late April.

   Social structure: Community members hold close to equal stakes of the community resources. The land is distributed among them in similar amounts and generally holding similar number of Brazil nut trees. However, they tend to live in hamlets and away from their land tenures. Their land tenures cannot be sold. Important Communal decisions are taken by vote. The community "captain" is in charge of everyday decisions. The captain also represents the community in meetings involving a cluster of communities in the region. The basic social unit is the family who usually share a one or two room house.

   Infrastructure: The communities have little if any basic needs. Running water is absent. Electricity if any is confined to the main hamlets like Los Cajuces. Drainage is non-existent. (See Graph 32 of the Atlas).

   Wealth: The main source of income is derived from the Brazil nut. However, this resources in generally insufficient to cover year round necessities and a result of which families are unable to meet their most basic needs (like food) during the months of September and October.

   Gender: These communities exhibit balanced genders of approximately 1 male for 1 female.

   Ethnicity: Chacobo and Takana-Cavineno.

   Languages: Chacobo and Takana as well as Spanish.

   Age: According the Instituto Nacional de Estadistica (Encuesta de Hogares 2007 y 2008), the age composition of indigenous people in rural areas in Bolivia is

Age	**Male**	**Female**

[1] The word indigenous carries a derogatory meaning and the communities that are *ab origin* prefer to call themselves *of origins* instead.

12-14	12.1	9.9
15-59	70.0	71.3
>59	17.8	18.8

There are no transient people and no other adjacent communities within the project zone.

6. The national government has since 1997 implemented a "sanitization" program of property titles. The purpose of this program was to eliminate any disputes between neighbors, disputes between landowners and their inhabitants and also to stamp out any land speculation by requiring that properties fulfill an Economic and Social Function ("**FES**"). This principle requires landowners to show that the property is being used for a greater good and not being left idle, especially when they are suited for production and there is shortage of foods and other commodities.

   The sanitization has already been carried out in the ML1ASP instance. The government has issued the Executive Title for Monte Libano. The instance does not have any disputes with their neighbors. The adjacent communities also have been through the sanitization process. It is important to note that the community members are owners of the right to be a member of the community and to usufruct the property resources within the community's policies. However the member cannot sell the property itself and can only sell the right to use the property. For origins communities, such a transaction is not possible[2].

   The land in the project area is used for herding as well as Brazil nut recollection. In the project zone, the land is used for Brazil nut recollection and hunting as well as in smaller proportions recollection of other wild fruits and vegetables. In addition, some subsistence agriculture (plots of 1 ha or so) is also carried out in the project zone outside the project area.

Biodiversity Information

7. The project zone ecosystem is Amazon tropical rain forest.

   The Manuripi National Amazon Wildlife Reserve in the Department of Pando is located less than 150km from the Project area. The similitude of ecosystem, climate,

[2] The word indigenous carries a derogatory meaning and the communities that are *ab origin* prefer to call themselves *of origins* instead.

geology, soil, and vegetation between this reserve and the project area make it an excellent proxy for the project area insofar as biodiversity is concerned. The biodiversity of this reserve is well documented and summarized in the WWF website (http://wwf.panda.org/who_we_are/wwf_offices/bolivia/our_work/amazon_program/pando_forests/). The following extract is here reproduced for convenience

> "The Manuripi National Amazon Wildlife Reserve, located in the south-eastern part of the Department of Pando (Bolivia), is the largest protected area in terms of Amazon forest extension and also represents the best example of biodiversity of this ecosystem in Bolivia…
>
> The following has been recorded for the Reserve:
>
> - 112 species of fish (up until now, 2 of the species are new to science)
> - 538 species of plants (the majority of them first recordings for the Reserve)
> - 83 amphibians (32 are new recordings for the Reserve, 3 are new for the Department of Pando and 4 are new for Bolivia)
> - 77 species of reptiles (13 are new recordings for the Reserve)
> - 501 species of birds (31 are new recordings for the Reserve, 6 are new recordings for Pando and 1 new recording for Bolivia)
> - 150 species of mammals (20 species are new recordings for the Reserve and 8 are new recordings for the Department of Pando).
>
> The high number of species per taxa and the ascending curve for species accumulation for fauna suggest that the area is relatively healthy and that the number of species will continue increasing as further studies are carried out in the future, which could lead this Reserve to be considered one of the most diverse in Bolivia."

By proxy, the project area and zone are habitat to those species recorded above for the Manuripi Reserve.

The only threat to biodiversity is deforestation for conversion to agricultural land and more precisely livestock farming. The appendix 2 shows that this is precisely the threat for amburana cearensis. In the 'without project' scenario the deforestation agent would have deforested the project area. A species inventory methodology to quantify biodiversity after the deforestation would have shown that only two species would have been present in the project area: cattle and pastures. Using the biodiversity recorded in the Reserve above as a proxy to the 'with project' scenario shows that the biodiversity would have decreased dramatically as a result of deforestation.

8. The project zone includes High Conservation Values (HCVs). According to the IUCN Red List, the project area is home to the following tree species which are sought after for their wood and are loosing their habitat to agriculture:

    a. Amburana cearensis. Status: Endangered.

    b. Bertholletia excelsa. Status: vulnerable

    c. Cedrela odorata. status: vulnerable

See the Appendix 2 for a detailed description of these species from the IUCN Red List website.

Therefore there are several species in the project area that are threatened or endangered. This suffices to fulfill the HCV1.2 attributes (See the High Convervation Value Forest Toolkit, 2003 Edition) under section 8.1.b of the CCB standard. The species present in the project zone are all healthy except for an Amburana cearensis that was recently partially destroyed during deforestation in the project area carried out by the deforestation agent.

All other HCVs are absent from the project zone and project area.

G2. Baseline Projections

1. The most likely land use scenarios were derived using the "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities". The table below summarizes the most likely scenario (baseline scenario) for each instance in the absence of the project.

Instance	Name	Baseline Scenario

1	ML1ASP	The deforestation agent extracts the wood from the project areas that is then converted to pastures. This is the most credible scenario because 1. It is permitted under current legislation. 2. It is the most profitable strategy generating high revenues with low costs and technology. 3. It is widely adopted in the project region. 4. The deforestation agent has applied to the Bolivian authorities to deforest the project area with subsequent conversion to to agriculture.

The table below list credible alternative land use scenarios to the proposed VCS AFOLU project activity.

Instance	**Name**	**Scenario**

1	ML1ASP	**Baseline Scenario** The deforestation agent extracts the wood from the project areas that is converted to pastures. This is the most credible scenario because: It is permitted under current legislation; It is the most profitable strategy generating high revenues with low costs and technology; It is widely adopted in the project region. **Native forest remains standing** The deforestation agent generates no income from the property. Given the legal rights of and intentions shown by the deforestation agent to deforest the project area, the continuity of the forest as it stands is only plausible when supported by carbon finance. Therefore this is not a credible or realistic scenario. This scenario fulfils one of the alternative land uses. It describes the project activity without registering the project as an AFOLU activity. **Conversion to palm oil plantation** The deforestation agent extracts the wood from the project areas that is converted to palm oil plantation. This is a credible scenario because: It is permitted under current legislation; It is a very profitable strategy given commodity prices with low costs but requiring oil palm technology and 3 years before harvest. **Conversion to rubber plantation** The deforestation agent extracts the wood from the project areas that is converted to rubber plantation. This is a credible scenario because: It is permitted under current legislation; It is a very profitable strategy given commodity prices with low costs and technology but requiring 8 years before harvest. **Clearance and native regeneration** The deforestation agent extracts the wood from the project areas and allows native regeneration. It is permitted under current legislation; It is a very profitable strategy generating high revenues with low costs. However, this scenario does not generate equally high revenues for the agent in the longer run.

The most likely scenario follows from documentation showing the intent to deforest and subsequent conversion to agriculture and the widely implemented common practice of cattle herding. The deforestation agent has been identified. There exists

legal permissibility to deforest under Forest Law 1700/96. According to the Atlas, the land is suitable for agriculture. The deforestation agent had submitted a request for approval to deforest and convert to agricultural land. The deforestation agent had a bona fide deforestation plan and had over 30 years of carrying deforestation activities in the project area. More noticeable, the agent had began deforesting the area in early August 2011; an action that led to the partial destruction of an endangered species.

2. National law requires the FES to be fulfilled and in the absence of such a fulfillment, the property is reverted to the government. Because leaving the forest standing does not fulfill the FES, agents of deforestation who in all cases where owners prior to the project start would have lost their land to the government. Aside from this major concern, a simple cost analysis shows that the most profitable use of the land in the absence of the project would require deforestation.

   A project under methodology VM0007 is not a financially competitive land use without carbon finance. Indeed, it generates no revenue apart from carbon finance. For this reason, the proposed project activity would not be implemented without the incentive of VCS approval and subsequent sale of carbon credits. This explains why this land use is additional and not common practice in Bolivia.

   Thus, using the VCS tool "VT00001: *Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities*" shows that the project is additional. Below is the process and results obtained

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

Instance	Name	Scenario

1	ML1ASP	**Baseline Scenario** The deforestation agent extracts the wood from the project areas that is converted to pastures. This is the most credible scenario because: It is permitted under current legislation; It is the most profitable strategy generating high revenues with low costs and technology; It is widely adopted in the project region. **Native forest remains standing** The deforestation agent generates no income from the property. Given the legal rights of and intentions shown by the deforestation agent to deforest the project area, the continuity of the forest as it stands is only plausible when supported by carbon finance. Therefore this is not a credible or realistic scenario. This scenario fulfils one of the alternative land uses. It describes the project activity without registering the project as an AFOLU activity. **Conversion to palm oil plantation** The deforestation agent extracts the wood from the project areas that is converted to palm oil plantation. This is a credible scenario because: It is permitted under current legislation; It is a very profitable strategy given commodity prices with low costs but requiring oil palm technology and 3 years before harvest. **Conversion to rubber plantation** The deforestation agent extracts the wood from the project areas that is converted to rubber plantation. This is a credible scenario because: It is permitted under current legislation; It is a very profitable strategy given commodity prices with low costs and technology but requiring 8 years before harvest. **Clearance and native regeneration** The deforestation agent extracts the wood from the project areas and allows native regeneration. It is permitted under current legislation; It is a very profitable strategy generating high revenues with low costs. However, this scenario does not generate equally high revenues for the agent in the longer run.

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

All the above scenarios comply with applicable laws and regulations: The Forest Law 1700.

Sub-step 1C: Selection of the baseline scenario

Instance	Name	Baseline Scenario
1	ML1ASP	The deforestation agent extracts the wood from the project areas that is converted to pastures. This is the most credible scenario because: It is permitted under current legislation; It is the most profitable strategy generating high revenues with low costs and technology; It is widely adopted in the project region.

Sub-step 2A: Determine appropriate analysis method

The simple cost analysis is used because the project activity can only benefit from carbon related income.

Sub-step 2B. – Option I. Apply simple cost analysis

An overview of the project costs is available for review by the validator.

All the instances of the project activity only generate income from the sale of carbon credits. The most significant cost arises from the labour of the preparation of the project design and the program to enrich the project area with endangered and vulnerable species

Therefore, the project activity satisfies the investment analysis for additionality.

Step 3. Barrier analysis.

This step does not need to be completed.

Step 4. Common practice analysis

Sub-step 4a: Analyse other activities similar to the proposed project activity.

There is one similar project underway in the area being carried out by FAN Bolivia: *Programa Indígena de REDD en la Amazonia Boliviana.* It also operates in a similar region in the Departments of Beni and Pando.

Sub-step 4b: Discuss any similar options that are occurring

The similar activity in Sub step 4a has an essential distinction: the project is devoted to indigenous communal properties that are distinct both at law and common practice from private properties. Therefore there is no overlap between projects. Also the scale of the similar project (given the land in possession by these indigenous communities) is much larger than the proposed activities. It is worth noting that as opposed to private landowners, indigenous communities tend to view their land as their heritage rather than as a business plan.

VM0007 is not a financially competitive land use without carbon finance. Indeed, it generates no revenue apart from carbon finance. For this reason, the proposed project activity would not be implemented without the incentive of VCS approval and subsequent sale of carbon credits. This explains why this land use is additional and not common practice in Bolivia.

However, the project proponent hopes that successful projects will encourage the protection of native forests using of carbon finance by landowners, thereby protecting biodiversity and carbon sinks in Bolivia.

3. The table bellow shows the changes in carbon stocks in the without project scenario. In this scenario, the deforestation agent converts the totality of the forest in the project area into pastures to by used for livestock farming. All the emissions result from the biomass burning.

Years	**Total**: Estimated GHG emission (tCO2e)
2011	71,102

The deforestation driver of the project area is the conversion to pastures for cattle grazing.

The above calculation can be found in the VCS Project Description. Please see section CL1.1 and CL2.3 for the outline of calculations, data used and assumptions made that were used in the analysis discussed in this indicator. The assumptions made in the calculation can be found in the tables in section G1.4 above.

The non-CO2 emissions are included in this estimate as they are greater than 5% of the total emissions. In addition, the carbon sink that would have resulted in the

presence of the forest is estimated to be 3448.5 tCO2e/hectare/year. All estimations where carried out following the VCS methodology VM0007: REDD Framework (planned deforestation VMD00006).

This carbon stocks do not include the annual contribution from pastures that can amount to 30tCO2e/hectare/year.

The rate of deforestation is 100% for the year 2011. This is justified from actual deforestation plans submitted with the deforestation permit application made to the Authority of Forests and Lands ("**ABT"**) as required under article 35 of the Forestry Law.

4. The without project scenario would not affect the communities significantly. The communities adjacent to the instances to be deforested would relinquish no resources. This is because they do not duel on property that is not their own and limit their activities to their land only. However, in the without project, employment would be generated which would be in great measure taken up by community members. For example, employment would be generated for the deforestation task itself and generally, a family would take up living in the property after deforestation to take care of the property and its cattle.

   The communities adjacent to the instances to be logged would not be affected at all because again they do not duel on property that is not their own and limit their activities to their land only. However, they would loose the opportunity of gaining income resulting from the instance's deforestation.

   In the project scenario, the communities would have greater employment. For example a family would still be present to take care of the property and the forest. In addition, community members would be employed to produce and plant saplings of endangered or vulnerable species. The amount of man-hours from the project scenario would be greater than that of the without project scenario because the latter would only have employed 20 or so people for less than 3 months.

   The without project scenario would not produce changes in water, soil and other locally important ecosystem services. The services that the ecosystem provides is only for provisioning all other three (regulating, supporting and cultural) are absent in the project. This follows from the definition in "*Millennium Ecosystem Assessment (MEA). 2005. Ecosystems and Human Well-Being: Synthesis*". Provisioning (water and fish) is done by the river Genesguay which would be unaffected as a result of the lack of erosion due to pasture sowing immediately after deforestation and a 50m band next to the river which would not be deforested as required by law 1700 and Supreme Decree 24453 and as evidenced in section VI of the deforestation plan. The 50m band lies in government land.

5. The main species threatened in the without project scenario is the endangered *Amburana cearensis* along with the vulnerable *Cedrela odorata* which carry the best prices over their merchantable volume.

   The landscape for deforested instances would be transformed to pastures. The evident destruction of the ecosystem and habitat used by a plethora of plant and animal species would be unavoidable. In addition, there would be a high risk of erosion that would follow if the land would remain unattended after burning.

G3. Project Design and Goals

1. The project goal is to find a novel solution to the coexistence of forests and communities through the increase in biodiversity. The project will use carbon finance to keep the carbon stock changes to a minimum level. This in itself would bring no benefit to the surrounding communities which would otherwise benefit in the without project scenario.

   By choosing to increase biodiversity of endangered and vulnerable tree species, the biodiversity of the project area would be improved. Tree planting requires labor that would be supplied by members of the adjacent community.

   The project objectives are to

   a) Improve climate conditions by eliminating the carbon emissions arising from deforestation.

   b) Improve biodiversity by increasing the number of endangered and vulnerable species listed in section G1.8.

   c) Increase the income of nearby communities by providing them with labor that is required to plant the tree species and improve biodiversity.

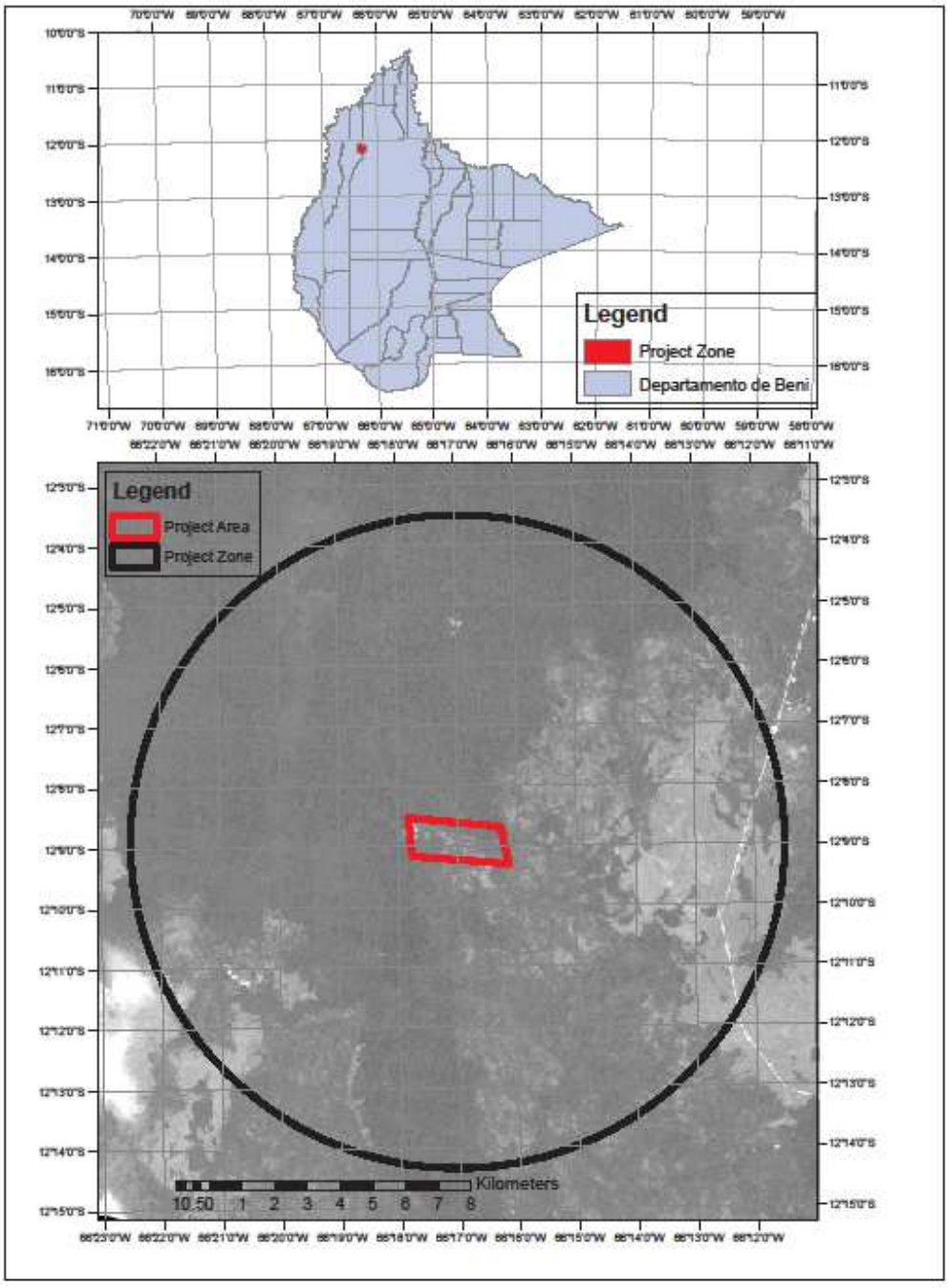
   A major obstacle for the development of communities is employment. By significantly increasing employment (through the production and planting of saplings) the community will increase their access to food supplies and healthcare.

2. The project activity in the ML1ASP instance is to avoid deforestation and employ community members to enrich the project area with endangered and vulnerable species. The first activity is to stop deforestation. This activity has already been implemented and has prevented the emission of GHG as shown in section G2.3 above. The second activity, enrichment, is to improve biodiversity by increasing the number of endangered and vulnerable species listed in section G1.8 above. This activity is waiting for the seeds to become available after blossom. Once the seeds become available, they will be planted in polyethylene bags until the saplings

become ready to be transplanted into the project area. This activity will require labor that will be provided by the nearby communities. The last stage of this activity will be the transplantation of the samplings that will require even more labor. This enrichment activity therefore benefits the biodiversity and community simultaneously. In addition it also serves as a sink for carbon emissions.

The first activity will preserve biodiversity and remove GHG emissions. It will also reduce employment in the community but only slightly (according to the deforestation plan 20 or so people employed for less than 3 months). The second activity will increase employment well beyond the man hours lost as a result of the first activity. In addition, it will increase biodiversity as well as increase the size of the carbon sink.

3. In all instances, the project activities will take place in the totality of the instance's project area. No activity will take place in the project zone that is not part of the project area and no impact (both positive and negative) is expected to affect the surrounding locations outside the project area. The maps below show the project zone within the Beni Department and the project zone and project area limits in Landsat-5 image from August 13 2011.



The leakage arises from the deforestation agent deforesting land other than the project area. The deforestation agent cannot and dons not own land in the project zone that is a prerequisite to being able to deforest land. In addition, land registry

documents show that the deforestation agent does not own land that can be legally deforested.

4. The project lifetime and GHG accounting are one and the same and span 30 years since project start date 20 October 2011. The project instances will be monitored for GHG emissions every 5 years or less and until the end of the project. The project will be implemented immediately insofar as the GHG emissions are concerned because the project proponent takes ownership of the instances as they are incorporated into the project and thus avoid the immediate deforestation of the area. The project has already purchased the seeds of endangered and vulnerable species and is in the process of producing saplings that will be transplanted in the instances project area starting in the rain season of November of 2012. This will start the enrichment process and community members will be hired to carry out the transplantation. The hiring will continue, especially during the dry season the year following to ensure that weeds do not encroach the transplanted trees.

   The same timeframes and milestones will be applied to new instances.

5. According to the Atlas of Bolivia produced by the National Government Agency Udapro, the instance is characterized by “highlands” and is not subject to flooding. The risk of fire is low. Population density in the project zone is very low and people living near the instance have their own resources and do not need to encroach the instances’ project area.

   Two vital resources during the dry season is fish and game. The project allows the incursion of neighbors seeking to fish and hunt in the instance. This good neighbor policy ensures that neighbors will be a presence dissuading illegal logging, Thus illegal logging is highly unlikely to take place and if otherwise, to be insignificant.

   However, in order to avoid the unlikely events described above, there will be a part time forest engineer in the city of Riberalta to supervise the instance supervisor’s work. These permanent employees will be responsible for each instance. When two or more instances are within a 15 kilometer radius and their combined area is less than 2500 has, the instance supervisor’s will have responsibility over all those instances falling within that circle. The instance supervisor’s will reside at the instance and will be tasked with monitoring the instances to ensure that human activity that can lead to degradation is minimal, alert to the presence of fire and coordinate actions to put out fires. The instance supervisor’s will also be responsible for managing the project to enrich with endangered and vulnerable species. S/he will also be liaising with seed and saplings suppliers as well as local neighbors who will be employed to carry out the physical task of planting the saplings. An accounting and administration team based in the city of Riberalta will aid this team.

6. High conservation values identified in section G1.8 will be enhanced by the procedure described in points 1 and 2 of this section. The High conservation values identified in section G1.8 will not be affected by the project activities other than in a positive way. The deforestation avoidance activity will ensure their continuance and that of their habitat. This would not be possible under the most likely scenario described in section G2.1. The enrichment activity will ensure that the number of endangered or vulnerable species increases significantly. Therefore it provides a positive impact to the HCV described in section G1.8.

   The only HCV of this project fall under under section G1.8.1.b of the CCB standard because there are vulnerable and endangered tree species. The measure that will serve to enhance and maintain the HCV is enrichment and avoided deforestation respectively. The avoided deforestation will secure the HCV's habitat and ensure that they are not cut down. The former will ensure that the HCV count and therefore their biomass will only increase as a result of the project. The same will occur in new instances: enrichment and avoided deforestation will secure the HCV's habitat and ensure that they are not cut down. The former will ensure that the HCV count and therefore their biomass will only increase as a result of the project.

7. With the help of carbon finance, the project will continue beyond the 30 years and continue to use the formula of enriching the project areas to produce employment and increase carbon stocks of all its instances. The project proponent will extend the project as allowed under the VCS standard another 70 years in a 30-year cycle and a 40-year cycle. For this, the project proponent will renew the project as allowed under section of 3.9 of the VCS Standard V3.0 three times. The first time will be for 30 years and second will be for 40 years.

   Through the extension of the project, the carbon stocks will continue to increase as a result of the forest growth. The biodiversity will also continue to increase as a result of the increase in biomass of vulnerable and endangered species. In addition, as a result of the continued carbon finance, funds will be available to employ people who will continue to safeguard the forest and increase the number of endangered and vulnerable species through their labor in the enrichment activity.

   New instances will be treated in the same manner.

8. Although the lack of negative impact of the project on communities, there has been consultation with the surrounding community members who have been invited to make suggestions as well as outlining the procedure to complaint about problems arising from the project. They have been invited to make suggestions on how to improve the project, especially when it comes to deciding the species used for enriching the project area. Non-conformities will be address directly by the project proponent ensuring that there is a hands-on management and a flat reporting structure on any and all situations that can lead to a potential loss of carbon stock

and potential conflict with or affliction to the communities. All employees including those enriching the forest will have direct access to the project proponent to ensure these important aspects are fulfilled.

The stakeholders of the project are identified as the communities within the project zone. The project proponent has also issued written letters to the stakeholders describing the project and the benefits it expects to achieve with the community. Furthermore, the project proponent regularly visits these communities and interacts with them to learn about their thoughts and needs. The stakeholders have also been notified on the mechanisms available to resolve disputes that may arise and of the flat reporting structure available for them to send feedback in ways to improve the project and minimize adverse effects to climate, biodiversity and community.

New instances will be treated in the same manner.

9. All affected communities have been contacted through their representatives and have been invited to give their submissions of comments to the CCBA and have been given the telephone, email and address of the CCBA to do so.

   No public meetings were held because community leaders deemed it inappropriate to hold public meetings with the project proponent. The communities and the project proponent have several methods of contract including regular visit to the community by the project proponent, regular visits to the community by the project's team staff, access by the community to the instance manager, access by the community to project staff in Riberalta

10. All community representatives will be given direct access to the project proponent. The community representatives can choose any means to communicate their grievances including directly to the project proponent’s admin team in the city of Riberalta. The community representatives have been given letters to this effect. The project proponent will then address the matter and reply in writing to the community representative within 14 days with a paragraph in bold letters and in clear language stating the name of the mediator that can be contacted to start the mediation process. The mediation of conflicts will not include land disputes or property rights that will be address only by the Rural tribunal, the only competent authority to deal with this matter.

11. The project annual costs are estimated at 5,000USD. The project would not become viable without carbon finance only if the price of the carbon credit falls below USD 0.86. If the price or the carbon credit falls bellow USD 0.86, the project would be supported at the expense of the project proponent through financing of his own. This would ensure that the project proponent has the needed financial assets to support the project during the entirety of its lifetime.

G4. Management Capacity and Best Practices

1. The current owner is the project proponent and is responsible for the design and implementation.

2. The size of the project is small and the number of communities involved is also very small. Given the size of the key technical skills required are as follows

    a. Ability to measure and monitor carbon stocks.
    b. Ability to protect, increase and monitor the endangered and vulnerable species listed in section G1.8
    c. Ability to engage the community and manage the labor pool.

    The project proponent has carried out the measurement and monitoring of carbon stocks in the project area with the assistance and support of a PhD in biology with experience in research and field work in measuring and monitoring carbon stocks.

    The project has already hired people with local experience to engage the communities in the project zone and at a higher level with the representatives of cluster of communities. As for the enrichment activity, a part time forest engineer has been hired as a consultant to fill any gaps as well as to ensure that the instance manager is carrying out its forestry duties within expectations.

3. The project employees responsible for the instance supervision, site managers, will be required to

    a. Monitor the area for illegal logging and document through photography.
    b. Monitor the area for fires and document through photography.
    c. Monitor the area of any other natural disturbances and document through photography.
    d. Monitor the area for deforestation activities and document through photography.
    e. Report any of the above to headquarters
    f. Take measures to prevent the expansion of fires and other natural disturbances
    g. Report to the police any illegal logging or deforestation.
    h. Liaise with the community and community members working to enrich the project area.

    A forest engineer will train the employees in points a .to g. Administrative staff from the office in Riberalta will train the employees in point h. It should be noted that the regional Captain representing the communities in the project zone has office in Riberalta and that unexpected major issues would be dealt with the regional Captain directly.

    Employees involved in the enrichment process will be trained to carry out transplantation. The chief gardener of the project who is responsible for growing the sapling from seeds will train them.

    There are no minorities or underrepresented groups in the communities that make the sole labor pool of the project.

Local capacity and skills will not be lost as it lies with professionals outside the labor pool and within the project proponent's team. These professionals will train the community members to ensure that the skill set and capacity is never depleted from the communities.

4. Community members from the project zone will be hired for both the avoided deforestation activity and the project activity. The avoided deforestation activity requires a site manager to be from the community. This has been fulfilled and now a member of the Takana-Cavineno community is permanently employed as instance manager and is living in the instance with his family as of 1 November 2011. When the enrichment activity starts, people will be hired from the communities in the project zone. The labor pool will be required to be 50% male and 50% female and over the age of 18. The labor law of Bolivia will be respected in all its aspects. People from outside the project zone will not be hired for the enrichment activity.

   People will be chosen for positions bases on a first come first served basis provided they fulfill the minimum requirements for the job but regardless of sex. However, traditionally, women do not work in the field so women showing willingness to work will be given priority.

5. The relevant law covering the worker's rights in Bolivia is the Ley General del Trabajo of 1939 that has suffered various modifications throughout the years. Prior to commencement, the employee will be given a verbal and written document showing all the relevant rights regarding work safety and national contributions. The employee will be given basic training on the activities s/he will have to carry out and will be given all the necessary equipment to carry it out and to ensure their safety. This will be documented. In addition, all employees will be registered with the government labor department and their national contributions duly paid as required by law.

6. The employee's main risk is forest fire. This in itself is a very low occurrence event. The employee will be trained by a registered forest engineer on how to deal with this matter. However, the primary task the employee is to carry out in this situation is to alert the neighbors, authorities, and the project's headquarters in that order.

7. The training, safety measures and national contributions have been budgeted into the project and analyzed in point G3.11.

G5. Legal Status and Property Rights

1. The project will comply with all the following relevant laws.
   a. Forest Law 1700/1996 and all ministerial resolutions under it.
   b. National Agrarian Reform Law 1715/1996, its modification Law 3435/2006 and ministerial resolutions under them.

The avoided deforestation activity complies with the Forest Law because it protects the forest as envisaged in its article 1. It also complies with the law 1715/96 because it takes place in private property with a “titulo ejecutorial” (executorial title).

The enrichment activity also complies with the Forest Law because it protects the forest as envisaged in its article 1. It also complies with the law 1715/96 because it fulfils the economic and social function by creating employment. Thus the project as a whole fulfills all relevant laws.

2. No formal or customary approval is required for this project and none have been sought. As a result of project having generated employment, the property fulfills the Economic and Social Function (FES) required under law 1715/1997.

3. No property rights will be affected by the project. The project is limited to the project area and it is innocuous because its only purpose is to avoid deforestation only in the project area and not in the project zone outside the project area.

4. There are no people living in the project area other than those working in the project. There are no activities being carried out by the communities in the project area.

5. There are no illegal activities taken place in the project area. However, the permanent presence of employees in the instances will deter any such activities in the future.

6. Proof of title is available for validation and verification.

CLIMATE SECTION

CL1. Net Positive Climate Impacts

The project generates net positive impacts on atmospheric concentrations of greenhouse gases (GHGs) over the project lifetime from land use changes within the project boundaries.

1. The net change in carbon stocks due to the project activities estimated with the VCS methodology VM0007 REDD Framework is detailed below.

Years	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
2011	71,102	0	0	71,102
2012	0	3515.2	0	3515.2
2013	0	3515.2	0	3515.2
2014	0	3515.2	0	3515.2

2015	0	3515.2	0	3515.2
2016	0	3515.2	0	3515.2
2017	0	3515.2	0	3515.2
2018	0	3515.2	0	3515.2
2019	0	3515.2	0	3515.2
2020	0	3515.2	0	3515.2
2021	0	3515.2	0	3515.2
2022	0	3515.2	0	3515.2
2023	0	3515.2	0	3515.2
2024	0	3515.2	0	3515.2
2025	0	3515.2	0	3515.2
2026	0	3515.2	0	3515.2
2027	0	3515.2	0	3515.2
2028	0	3515.2	0	3515.2
2029	0	3515.2	0	3515.2
2030	0	3515.2	0	3515.2
2031	0	3515.2	0	3515.2
2032	0	3515.2	0	3515.2
2033	0	3515.2	0	3515.2
2034	0	3515.2	0	3515.2
2035	0	3515.2	0	3515.2
2036	0	3515.2	0	3515.2
2037	0	3515.2	0	3515.2
2038	0	3515.2	0	3515.2
2039	0	3515.2	0	3515.2
2040	0	3515.2	0	3515.2
2041	0	3515.2	0	3515.2
Total	71,102	105,457	0	176,560

The estimates above were obtained following the methodology VM0007 and its modules VMD0006 and MVD0001. Using permanent sampling plots, the tree diameters at breast height were measured. Relevant formulas from the methodology and modules were used to derive the existing biomass present in each sampling plot. Their average was used to derive the total biomass present in the project area that would have been destroyed with the emission of CO_2 GHG and the subsequent conversion to agricultural land. The steps to calculate baseline and project emissions are as follows

Baseline emissions

Step	Process
1	Determine area of deforestation, rate of deforestation, assume likelihood of deforestation to be 100% and determine risk of abandonment.
2	Generate a sample of random points within each instance. Using excel random function generate random coordinates within a square encompassing the project area. Discard all points outside project area. Discard all points inside project area to obtain desired number of points using the following simple rule: select the closest two points; discard northern most; repeat until number of points is reduced to the desired number. Each random point will be the south west corner of a square sample plot of side 35 meters. The sides will be parallel to the North, South East and West directions.
3	In each sample plot determine dbh: diameters at breath height (1.3 meters from ground) and record those with circumference greater than 20cm.
4	Use the allometric equation Biomass (kg) = exp (-2.289 + 2.649 x ln *dbh* - 0.021 x ln dbh^2) from Winrock International and the World Bank Biocarbon Fund. 43pp to determine biomass of all species present in each sample plot. Assume carbon fraction of dry matter is .47 t C t^{-1} d.m. and use Eq. 1 of VMD0001 to determine mean carbon stock in aboveground biomass of trees.
4	Use Eq. 2 of VMD0001 to determine Mean aboveground biomass carbon stock in stratum i
5	Assume Root to shoot ratio of .24 and use Eq.5 and 6 of VMD0001 to Mean belowground tree biomass carbon stock in stratum i.
6	Cut to the ground all woody vegetation in a square of side 1 meter within each sample plot that shares the south west corner and store in bag for drying. Expose bag to sunlight and avoid exposure to rain. Weight contents after 5 days. The weight will be the total dry weight from all sample plots.
7	Use Eq. 9 and 10 of VMD0001 to determine Mean aboveground non-tree biomass carbon stock in stratum i.
8	Assume Root to shoot ratio of .24 and use Eq. 13 and 14 from VMD0001 to Mean belowground non-tree biomass carbon stock in stratum i.
9	Conservatively assume Carbon stock in dead wood, Carbon stock in litter and Carbon stock in soil organic carbon is de minimis
10	Use results from steps 4,5, 7,8 and 9 above and use Eq. 4 to of VMD0006 and determine Carbon stock in all pools in the baseline in stratum i;
11	The post deforestation use is pastures.
12	Use Eq. 1 of VMD0013 and Eq. 6 of VMD0006 to calculate Non-CO2 emissions due to biomass burning in stratum i in year t. Conservatively assume Emission from fossil fuel combustion in stratum i in year t and Direct N2O emission as a result of nitrogen application on the alternative land use within the project boundary in stratum i in year t to be de minimis. Therefore using Eq 6 from VMD0006 Greenhouse gas emissions as a result deforestation activities within the project boundary in the stratum i in year t is determined to be zero.
13	Determine expected amount of Volume of timber extracted from within stratum *i.* Use Eq. 3 and 4 from VMD0005 to determine Carbon stock in long-term wood products pool (stock remaining in wood products after 100 years) from stratum i post deforestation assuming all is sawnwood.
14	Use steps 10, 11 and 13 along with Eq.3 of VMD0006 to determine Net carbon stock changes in all pools in the baseline in stratum i
15	Use Step 14 and 12 along with Eq 1 of VMD0006 to determine Net greenhouse gas emissions in the baseline from planned deforestation

Project emissions

Step	Process
1	Use Landsat-5 image from http://www.inpe.br/ which includes the project area the reference area and leakage belt.
2	From the imagery estimate Area of recorded deforestation in the project area stratum i converted to land use u at time t and Area of recorded deforestation in the leakage belt stratum i converted to land use u at time t.
3	Use step 14 in section 3.1 subsection VM0007 to determine Carbon stock in all pools in the baseline case in stratum I
4	Conservatively assume that post deforestation carbon stocks immediately after deforestation are de minimis. Use Eq 6 of VMD0015 to set Carbon stock in all pools in post-deforestation land use u in stratum i to zero.
5	Use step 11 in section 3.1 subsection VM0007 to determine Carbon stock in long-term wood products pool (stock remaining in wood products after 100 years) from stratum i post deforestation.
6	Use steps 3, 4 and 5 along with Eq 5 in VMD0015 to determine Net carbon stock changes in all pools as a result of deforestation in the project case in land use u in stratum i at time t
7	Use steps 2 and 6 along with Eq 3 of VMD0015 to determine Net carbon stock change as a result of deforestation in the project case in the project area in stratum i at time t
8	Complete a participatory rural appraisal (PRA) of the communities inside and surrounding the project area to determine if there is the potential for illegal extraction of trees.
9	If no degradation found in step 9 assume Net carbon stock changes as a result of degradation in stratum i in the project area at time t to be zero. Otherwise, determine the Area potentially impacted by illegal logging, area subject to degradation, in stratum i: composed of a buffer from all access points (access buffer), such as roads and rivers or previously cleared areas. The width of the buffer shall be determined by the depth of degradation penetration as defined as a PRA output. Then sample the area by surveying several transects of known length and width across the access-buffer area (equal in area to at least 1% of Adeg,i) to determine the presence or absence of new tree stumps. use Eq. 7 of VMD0015 to estimate Net carbon stock changes as a result of degradation t.
10	Use Eq. 1 of VMD0013 and Eq. 13 of VMD0015 to calculate Non-CO2 emissions due to biomass burning in stratum i in year t.
11	Use Eq 8 and 9 in VMD0015 to determine Net carbon stock changes as a result of forest carbon stock enhancement in stratum i in the project area at time t.
12	Use setp 7, step 9 step 10, step 11 and Eq 1 in VMD0015 to determine Net greenhouse gas emissions within the project area under the project scenario.

The calculations can be found in the VCS Project Description and have been provided to the validators for concurrent VCS verification.

2. The net change in the emissions of non-CO_2 GHG emissions such as CH_4 and N_2O in the *with* and *without* project scenarios is also estimated with the VCS methodology VM0007 REDD Framework and it is detailed below. These amounts were included in point 1 above.

Years	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
2011	5922			5922
2012				
2013				
2014				
2015				
2016				
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026				
2027				
2028				
2029				
2030				
2031				
2032				
2033				
2034				
2035				
2036				
2037				
2038				
2039				
2040				
2041				
Total	0	0	0	5922

Using the methodology module VMD00013 and the amount of CO_2 stocks stored in the project area, we are able to estimate the amount of non-CO_2 GHG emissions such as CH_4 and N_2O that would be emitted during the burning of the forest for conversion to agricultural land. See section GL1.1 for methodology used to calculate these emissions.

The calculations can be found in the VCS Project Description and have been provided to the validators for concurrent VCS verification.

3. There are no other GHG emissions resulting from project activities that are significant.

4. The table in point 1 of this section shows that the net climate impact of the project is positive.

5. The project area is not in a country with any cap system and the project proponent does not envisage seeking credits under the CDM framework.

   The GHG registry will be VCS.

CL2. Offsite Climate Impacts ('Leakage')

The project description required under the VCS framework quantifies GHG emissions that occur beyond the project area and are caused by project activities. The mitigation of activity shifting and market effect is addressed by project's monitoring procedures.

1. The possible sources of leakage are those associated with
   a. Activity shifting, where the agent of deforestation yields the ownership of the project area to the project proponent and then goes on to deforest another area. The methodology module Planned leakage, LK-ASP (VMD0009), of the VCS standard addresses this leakage.
   b. Market effects that lead to pressure on other areas within the host country. The methodology module Leakage market effects, LK-ME (VMD0011), of the VCS standard address this leakage.

   None of these leakages are likely to take place. It is understood from government data that the deforestation agent does not have any other rural land and therefore there cannot be any activity shifting as defined under VMD0009. In addition VMD0011 requires the existence of merchantable wood volume. However, as a result of the massive logging carried out in the late 1990's the only trees left standing are those needed to regenerate the forest. As a result it is extremely unlikely that any logging permit would be issued or that any sensible business plan would exist for the project area that would justify the actual extraction of merchantable volume.

2. The project proponent takes special care in selecting the agents of deforestation from whom it takes ownership of the project area and endeavors that those agents have either no land or no land that can be legally deforested. There are no viable mitigation strategies to curve or eliminate future leakages situations if the

deforestation agent engages in deforestation. The mitigation itself is contained within the buffer used in the methodology.

Market effects are impossible to mitigate without effective government policy. The mitigation itself is contained within the buffer used in the methodology.

3. Any leakage from activity shifting and market effects is duly quantified and subtracted from the net emission before crediting. However, as explained in CL2.1 there is no leakage at this time. The steps to calculate baseline and project emissions are as follows

Step	Process
1	Use Eq. 3 of VMD0009 to determine deforestation by the baseline agent of the planned deforestation in the absence of the project in stratum i in year t.
2	Use Eq. 4 of VMD0009 to determine New calculated forest clearance in stratum I at time t by the baseline agent of the planned deforestation where no leakage is occurring.
3	Determine the total area of deforestation by the baseline agent of the planned deforestation in stratum i at time, t and use Use Eq. 5 of VMD0009 to calculate the area of activity shifting leakage in stratum i at time t
4	Net greenhouse gas emissions due to leakage to peatlands as a result of implementation of a planned deforestation project at time t is deemed to be zero because instances cannot have peatland subject to deforestation.
5	Use Eq. 1 of VMD0013 and Eq. 6 of VMD0009 to calculate Non-CO2 emissions due to biomass burning in stratum i in year t.
6	Use Eq 1 of VMD0009 and step 6 to determine Net greenhouse gas emissions due to activity shifting leakage for projects preventing planned deforestation
7	Determine Leakage factor for market-effects calculations and estimate using Eq 2 of VMD0011 the total GHG emissions due to market- effects leakage through decreased timber harvest.

4. The module VMD0006, Planned Deforestation, does take into account any contributions arising from Non-CO_2 gases as seen from step 5 in CL2.3 above. The calculations can be found in the VCS Project Description.

   The leakage of these gases for the present instance are zero because there deforestation agent has not deforested any other areas due to lack of ownership. This should be contrasted with the calculations of baseline and project activities where the contributions of these gases is significant.

CL3. Climate Impact Monitoring

The project description contains detailed information of the monitoring plan in place to quantify and document changes (within and outside the project boundaries) in project-related carbon pools, project emissions, and non-CO_2 GHG emissions if appropriate. The monitoring plan identifies the types of measurements, the sampling method, and the frequency of measurement and adheres to the VCS module Monitoring, M-MON VMD0015.

1. The project description contains a full monitoring plan as required under the VCS module Monitoring, M-MON VMD0015.

   The following tasks will be undertaken

   1. The baseline scenario will be reviewed every ten years.
   2. Monitor carbon stocks and greenhouse gas emissions
   3. Estimation of ex-post net carbon stock changes and greenhouse gas emissions
   4. Monitor leakage and greenhouse gas emissions

Baseline scenario

Task	Description
Technical description of the monitoring task	This involves updating every 10 years the parameters which remain fixed during the following 10 years. These parameters are obtained from the literature or from changes to the legal system and or methodology.
Data to be collected: list of data and parameters	a. Total area of planned deforestation b. Carbon fraction of dry matter c. Allometric equations d. Root to shoot ratio e. Biomass conversion and expansion factor f. Fraction of wood products that will be emitted to the atmosphere between 5 and 100 years after production g. Fraction of wood products that will be emitted to the atmosphere h. Fraction of extracted biomass effectively emitted to the atmosphere during production i. Commercial volume as a percent of total aboveground volume j. Likelihood of deforestation k. Factor for calculating the biomass of dead wood created l. Factor for calculating the emissions arising from the creation of logging infrastructure m. Mean merchantable biomass as a proportion of total aboveground tree biomass for each forest type n. Volume of timber projected to be extracted from within the project boundary o. Emission factor p. combustion factor
Overview of data collection procedures	The data will be determined from IPCC guidelines whenever possible to ensure high degree of quality control and quality assurance.
Quality control and quality assurance procedure	Preference will be given to IPCC guidelines for determining values to ensure quality control and assurance.
Data archiving	All data will be digitalized and stored at different locations.
Organisation and responsibilities of the parties involved in all the above	All responsibilities will fall on the project proponent.
Frequency	The frequency will be every 10 years.

Monitoring carbon stocks

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Technical description of the monitoring task</td><td>
To monitor the carbon stocks permanent nested sample plots constructed during validation will be used. These nested plots were constructed as follows. Random points are generated. Each of these random coordinates mark the SW corner of a square plot of side 35m.The sides are parallel to the North-South and East-West directions. Relative to the SW corner, the following plots are identified
<table>
<tr><th>Plot type</th><th>Minimum CBH</th><th>Coordinates relative to the SW corner in meters</th></tr>
<tr><td>1</td><td>>=150</td><td>(0,0),(35,0),(35,35),(35,0)</td></tr>
<tr><td>2</td><td>>=60</td><td>(0,0),(20,0),(20,35),(0,35)</td></tr>
<tr><td>3</td><td>>=20</td><td>(0,0),(1.5,0),(1.5,35),(0,35)</td></tr>
<tr><td>4</td><td>Non-tree (>0)</td><td>(0,0),(1,0),(1,1),(1,0)</td></tr>
</table>
In each nested plot types 1 to 3, the DBH up to the nest's minimum DBH will be measured. Using algometric equations, the above ground biomass of each tree will be determined. Adding all of the trees biomass scaled by the following factors to account for the difference in plot area
<table>
<tr><td>CBH</td><td>Plot Area</td><td>Factor</td></tr>
<tr><td>>=150</td><td>1225</td><td>1</td></tr>
<tr><td>>=60</td><td>700</td><td>1.75</td></tr>
<tr><td>>=20</td><td>50</td><td>15.41</td></tr>
</table>
we obtain the total aboveground carbon stock of each plot and by virtue of Eq. 5 of VMD0001 we also obtain the total belowground carbon stock for each sample plot. In addition, we obtain using Eq 3 Of VMD0005 the carbon stock in the wood products.

In each nested plot type 4 we cut to the ground all woody biomass with CBH less than 5 cm. The representative samples are stored and allowed to dry for 5 days. . The combined samples are weighed to obtain the dry weight. Use of Eq. 13 Of VMD0001 allows the estimation of the belowground non-tree carbon stock.

We then construct a spatial series or array for each of the following quantities
a. carbon stock in the aboveground tree biomass
b. carbon stock in the belowground tree biomass
c. carbon stock in the wood products
d. carbon stock in the aboveground non-tree biomass
e. carbon stock in the belowground non-tree biomass
f. carbon stock change in the aboveground tree biomass
g. carbon stock change in the belowground tree biomass
h. carbon stock change in the aboveground non-tree biomass
i. carbon stock change in the belowground non-tree biomass

For each spatial series we obtain the mean and the standard deviation.
As time increases we are able to estimate the carbon stock changes in time.
</td></tr>
<tr><td>Data to be collected: list of data and parameters</td><td>
For each plot and within each nested plot the following will be collected
a. minimum allowed DHB,
b. area of nested plot
</td></tr>
<tr><td>Overview of data collection procedures</td><td>
a. The area of each nested plot will be measured using compass and measuring tape
</td></tr>
</table>

collection procedures	b. minimum allowed DHB in each nested plot will be measured using measuring tape at a height of 1.3m.
Quality control and quality assurance procedure	To ensure quality control and quality assurance the following tasks will be taken a. The coordinate of the SW corner common to all nested plots will be verified, b. The area of each nested plot will be measured, c. The integrity of the marks will be verified and repaired if necessary. d. A random set of plot corners will be measured and verified trough photography. e. A random set of trees will be measured and verified trough photography.
Data archiving	All data will be digitalized and stored at different locations.
Organisation and responsibilities of the parties involved in all the above	All responsibilities for the fieldwork will fall upon the project proponent who will be accompanied by a team of 5 additional persons to carry out this task.
Frequency	The frequency will be every 5 years or less.

Monitoring ex-post degradation

Task	**Description**
Technical description of the monitoring task	This monitoring involves two aspects. a. Degradation through fire and deforestation b. Degradation by illegal logging and illegal wood collection Their monitoring involves different technologies. The first one is monitored by satellite imagery from Landsat 5. The area deforested is initially determined by comparison between each instance's validated satellite image and that used for monitoring. The comparison is done after unsupervised classification of the images. From this comparison the affected area is measured. If the area is greater than zero than a truthing on the ground is done and the area determined using GPS measurements. The remaining carbon stocks immediately following deforestation are deemed to be de minimis and the non-CO2 emissions determined through Eq. 1 of VMD0013. For degradation by illegal logging and illegal wood collection, we first carry out a PRA to determine if such activity takes place. If it does, new sample plots are constructed in the affected areas and the change in carbon stock is measured using the same procedure used for monitoring carbon stocks.
Data to be collected: list of data and parameters	For degradation through fire and deforestation satellite imagery from Landsat-5 will be used. The data obtained from imagery will be the area deforested and/or burnt. For degradation by illegal logging and illegal wood collection a PRA will be carried out with the following questions.

	a. How far do you leave from nearest instance? b. Nearest Instance c. Do you go to Instance? d. Do you log illegally? e. Do you know someone that log illegally? f. Have you ever or plan to log in nearest instance? g. Do you know anybody that has you ever or plans to log in nearest instance? h. Do you collect wood illegally? i. Do you know someone that collect wood illegally? j. Have you ever or plan to collect wood in nearest instance? k. Do you know anybody that has you ever or plans to collect wood in nearest instance? l. If yes were does the activity take place within the instance? If 10% or more answers that there are illegal activities being carried out, the PRA will trigger the verification on the ground of such activities. The place indicated by the interviewee will be inspected and delimited. Within that area, sample plots will be constructed and the amount of carbon removed will be measured by estimated the DBH of the trees removed using the same procedure for monitoring carbon stocks. The carbon stock removed through degradation processes will be obtained.
Overview of data collection procedures	Satellite imagery will be obtained from http://www.inpe.br/ with cloud cover less than 10% over the instance. The PRA will be carried out through visitation of individuals in the surrounding area or in situ at the instance.
Quality control and quality assurance procedure	Satellite imagery will be inspected for integrity. The PRA will be conducted anonymously but location of survey will be noted and random samples verified. For carbon stocks, photography will be used to document measurements.
Data archiving	All data will be digitalized and stored at different locations.
Organisation and responsibilities of the parties involved in all the above	Imagery collection and analysis will be responsibility of the project proponent. All responsibilities for the fieldwork will fall upon the project proponent who will be supervise a team of 4 additional persons to carry out the PRA. Carbon stock monitoring in degraded areas by illegal activities will be as in the carbon monitoring task.
Frequency	The frequency of PRA and degradation through illegal logging and wood collection will be every 2 years. Degradation through deforestation and fire will be monitored every year.

Monitoring leakage

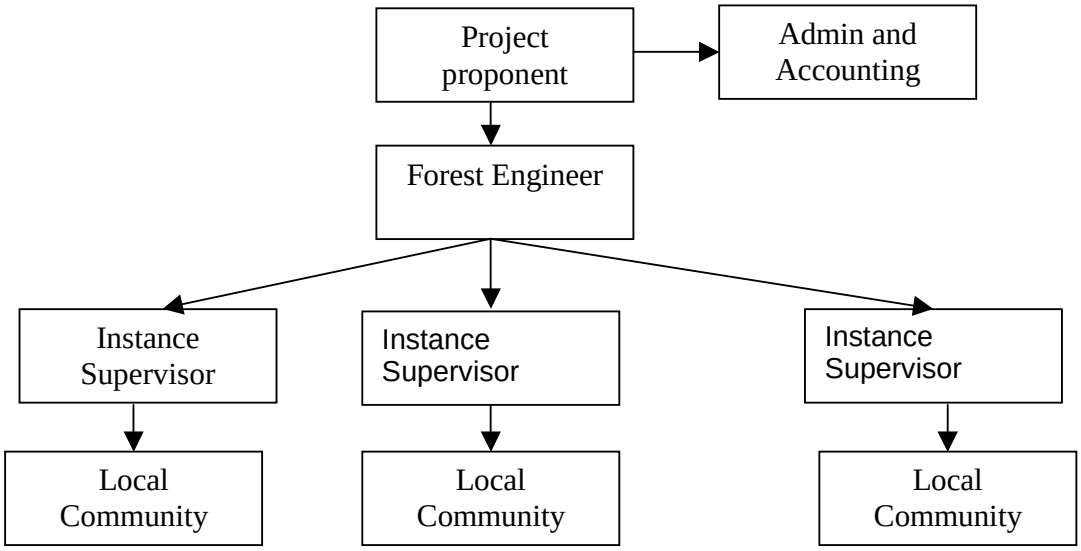
Task	Description
Technical description of the monitoring task	The monitoring involves two subtasks a. Leakage from activity shifting b. Leakage from market effects The leakage from activity shifting involves two steps. First we determine through land registries if the deforestation agent has any other "rural" properties. If so, we obtain their coordinates and monitor deforestation through satellite imagery. If deforestation occurs, we assume that any post

	deforestation carbon stock is de minimis For leakage due to market effects we monitor through proxy or directly, the percentage of merchantable carbon stock to total carbon stock and compare it to the long term ratio to determine the factor.
Data to be collected: list of data and parameters	For activity shifting we will survey land registries for rural properties in the name of relevant deforestation agents and satellite imagery for any rural property from project start date and at monitoring date. For market effect, we will survey a conservative proxy area within an instance to determine the Merchantable biomass as a proportion of total aboveground tree biomass and compare it's long term trend from peer reviewed lliterature.
Overview of data collection procedures	The land registry will be queried for records and satellite imagery will be obtained from http://www.inpe.br/ with cloud cover less than 10% over the instance. Surveys for merchantable volume will be obtained from the ABT or forest engineer will be used to survey a representative area of at least 100 hectares to determine the carbon stock of the merchantable volume. Total biomass will be conservatively determined from national estimates for similar type of forests.
Quality control and quality assurance procedure	Satellite imagery will be inspected for integrity. Documentation from the land registry will be in its original form. Surveys for merchantable volume will be obtained from the ABT or carried out by forest engineers and a random sample verified.
Data archiving	All data will be digitalized and stored at different locations.
Organisation and responsibilities of the parties involved in all the above	Imagery collection and analysis will be responsibility of the project proponent. Legal documentation will be responsibility of the project proponent. Government documentation will be responsibility of the project proponent.
Frequency	Activity shifting leakage will be monitored every 5 years. Market effects leakage will be monitored every 10 years.

There will also be a part time forest engineer in the city of Riberalta to supervise the instance supervisor's work. These permanent employees will be responsible for each instance. When two or more instances are within a 15 km radius and their combined area is less than 2500 has, the instance supervisor's will have responsibility over all those instances falling within that radius.

The instance supervisor's will reside at the instance and will be tasked with monitoring the instances to ensure that human activity that can lead to degradation is minimal, alert to the presence of fire and coordinate actions to put out fires. The instance supervisor's will also be responsible for managing the project to enrich with endangered and vulnerable species. S/he will also be liasing with seed and saplings suppliers as well as local neighbours who will be employed to carry out the physical task of planting the saplings. An accounting and administration team based in the city of Riberalta will aid this team.

Below is a diagram showing reporting lines



Non-conformities will be address directly by the project proponent ensuring that there is a hands on management and a flat reporting structure on any and all situations that can lead to a potential loss of carbon stock. All employees including those enriching the forest will have direct access to the project proponent to ensure this important aspect is fulfilled.

2. The project proponent commits to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders.

COMMUNITY SECTION

CM1. Net Positive Community Impacts

The project generates net positive impacts on the social and economic well-being of communities and ensures that the project benefits available to them are equitably shared among community members and constituent groups during the project lifetime.

1. The baseline projection would have seen the project area deforested to give way to pastures for cattle activities. This would generate unacceptable emissions. On the other hand, the deforestation would have generated jobs that would have directly benefited the surrounding community. The option not to deforest by itself then has adverse effects on the community. Perhaps one of the most unpleasant aspects of sector 14 (REDD and other) methodologies is that they reduce and or remove emissions at the price of also reducing development and employment opportunities. These are most severe in countries like Bolivia where alternative labor pools in the project zone are small or non-existent. This project is able to marry three concepts.

First, it reduces and/or removes carbon emissions. Second, the project is a labor source for surrounding local communities. Third, the labor is used to increase biodiversity with the enrichment of endangered and vulnerable species in the ICUN Red List of Threatened Species. That is this project goes beyond climate change goals and also focuses on increasing biodiversity in the project area by enriching with endangered and vulnerable species. The enrichment process generates a pool of labor that mitigates to a great degree the loss of employment that deforestation of the project area would have brought about.

The project will use a household survey methodology to measure the impacts on communities, including all constituent socio-economic or cultural groups such as indigenous peoples (defined in G1), resulting from planned project activities

The 'with project' scenario is expected to generate employment and income for the communities. The sources of income will be the avoided deforestation activity that employs an instance manager and the enrichment activity that will employ 10 persons for the seeding and transplantation of saplings over a period of 3 years. In addition, hunting and harvesting of fruits and nuts will be available in some degree or other to the surrounding communities.

The 'without project' scenario is expected to generate employment and income for the communities as well. The sources of income will be the cattle activity that would employ an instance manager and the deforestation activity that would employ 15 people over 12 weeks. Hunting and harvesting of fruits and nuts will not be available in any degree or other to the surrounding communities.

The difference (i.e., the community benefit) will be positive for the communities because under the assumption that wages are similar, the amount of income produced in the 'with project' is clearly greater than that of the 'without project'. In addition, in the 'with project' there is a positive effect from the availability of a hunting ground and harvesting of fruits and nuts which will not be available in an degree in the "without project" scenario.

2. There are no HCV's G1.8.4-6 in the project zone. So their protection is not required.

CM2. Offsite Stakeholder Impacts

The project proponents has evaluated and mitigated all possible social and economic impacts that could result in the decreased social and economic well-being of the main stakeholders living outside the project zone resulting from project activities.

1. The only impact is the non-growth of the labor pool that would have resulted from deforestation.

2. The negative impacts have been mitigated: the project will generate jobs for the purpose of enriching the project area with endangered and vulnerable species.

3. As a result of the replacement of the jobs lost, the project is not likely to result in net negative impacts on the well-being of other stakeholder groups.

CM3. Community Impact Monitoring

The project proponent has an initial monitoring plan to quantify and document changes in social and economic well-being resulting from the project activities.

The monitoring plan indicates which communities and other stakeholders will be monitored, and identify the types of measurements, the sampling method, and the frequency of measurement.

1. The initial plan is to monitor a single variable: the project's impact in the community's income. The community is the set of all the residents that live within a 10 km radius from the projects instance's headquarters. This includes among others, the community of origin Takana Cavineno. Thus the project will monitor the amount of employment it generates for the community within the project. The employment positions will include managers of the instances and those responsible for producing the saplings and their insertion in the forest.

   The monitoring plan is concerned with the generation of employment within the project area. As such, the plan will
   a. Monitor and estimate the amount of employment it generates.
   b. The method will be to measure the amount of employment is generates and the average wages paid as a result of the project activities. This will be compared with the no project scenario. The difference must be positive income.
   c. The frequency for the measurement of the employment/mean wages will be every 5 years or less.

2. The project zone does not contain any High Conservation Values related to the communities' well-being.

3. The project proponent commits to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are made publicly available on the internet and are communicated to the communities and other stakeholders.

BIODIVERSITY SECTION

B1. Net Positive Biodiversity Impacts

The project generates net positive impacts on biodiversity within the project zone and within the project lifetime, measured against the baseline conditions.

Invasive species populations will not be directly or indirectly used during the project

The project will not use genetically modified organisms (GMOs) to generate GHG emissions reductions or removals.

1. The changes in biodiversity as a result of the project in the project zone and in the project lifetime will be estimated using an inventory method. This estimate is quantified by the amount of biomass of species autochthonous and/or endangered or vulnerable in the IUCN Red List that is reintroduced into the project area. The 'with project' scenario would preserve the current biomass that would be completely lost with the baseline 'without project'. The number of tree species that are autochthonous and/or endangered or vulnerable in the IUCN Red List would also increase as a result of the enrichment activity. In addition, their biomass relative to the total biomass should increase as well. Thus the project area is expected to increase the number of species autochthonous and/or endangered or vulnerable in the IUCN Red List and therefore increase the biodiversity of the project area. The difference or net biodiversity is then positive.

   The project proponent has plans to plant several native species of trees that are listed as being vulnerable or endangered.

2. The project area contains High Conservation Values. This will be protected under the avoided deforestation activity and enriched under the enrichment activity. By avoiding deforestation, the HCV will be spared the inevitable logging or burning. By enriching the project area the vulnerable and endangered species will be increased in number making its extinction less likely.

3. The enrichment of species to be used by the project in enriching the project area are all autochthonous to the project zone and are already present in the project area, or those that are listed as endangered or vulnerable in the IUCN Red List and are autochthonous to the project zone.

   The species are *Amburana cearensis, Cedrela odorata, Bertholletia excelsa.*

   There are no non-native trees already growing on the property.

4. The project does not contemplate the use of any non-native species to achieve its goals.

5. The project proponent guarantees that no GMOs will be used to generate GHG emissions reductions or removals.

B2. Offsite Biodiversity Impacts

The project proponent has evaluated and mitigated likely negative impacts on biodiversity outside the project zone resulting from project activities.

1. There are no potential negative offsite biodiversity impacts that the project is likely to cause. The project does not operate outside the project zone. The project is only devoted to enriching the project area with tree species that are autochthonous and/or endangered or vulnerable in the IUCN Red List.

2. No mitigation is required.

3. There are no known likely unmitigated negative offsite biodiversity impacts against the biodiversity benefits of the project within the project boundaries.

B3. Biodiversity Impact Monitoring

The project has an initial monitoring plan to quantify and document the changes in biodiversity resulting from the project activities (within and outside the project boundaries). The monitoring plan identifies the types of measurements, the sampling method, and the frequency of measurement.

1. The monitoring plan is concerned with the increase in biodiversity within the project area. As such, the plan will
    a. Monitor and estimate the biomass tree species that are autochthonous and/or endangered or vulnerable in the IUCN Red List.
    b. The method will be to measure DBH of all the trees introduced into the project area and then use peer reviewed literature to determine the total biomass of each tree species included in the enrichment list. This will be compared to the total project's biomass that will be measured under the VCS module M-MON.
    c. The frequency for the measurement of the enriched biomass will be every 5 years or less. That of the project's biomass will be in accordance with the VCS monitoring plan.

    These variables were selected following the guidelines in "Measurement Guidelines for the Sequestration of Forest Carbon", Timothy R.H. Pearson, Sandra L. Brown, Richard A. Birdsey. (2007).

2. The initial plan for assessing the effectiveness of measures used to maintain or enhance High Conservation Values will be limited to the project area as it is the only area affected by the enrichment activity. In the project area the plan will
    a. Monitor and estimate the biomass tree species that are endangered or vulnerable in the IUCN Red List (as listed in section G1.8).
    b. The method will be to measure DBH of all the trees introduced into the project area and then use peer reviewed literature to determine the total biomass of each tree species included in the enrichment list. This will be compared to biomass measured in the previous monitoring period. The increase/decrease will be quantified as a percentage growth/loss.
    c. The frequency for the measurement of the enriched biomass will be every 5 years or less.

    The effectiveness of the measures will be determined by the count in the number and the amount of biomass of enriched species. The number and biomass of the enriched species must grow every year for the enrichment activity to be successful. Should this not happen, procedures will be revisited to ensure that these targets are fulfilled in subsequent years.

3. The project proponent commits to developing a full monitoring plan within six months of the project start date or within twelve months of validation against the Standards and to disseminate this plan and the results of monitoring, ensuring that they are

made publicly available on the internet and are communicated to the communities and other stakeholders.

GOLD LEVEL SECTION

GL3. Exceptional Biodiversity Benefits

The project conforming to the Standards demonstrates net positive impacts on biodiversity within their project zone. In addition, the project conserves biodiversity at a site of global significance for biodiversity conservation.

The project zone includes a site of high biodiversity conservation priority by meeting the vulnerability criteria.

Inspection of the instance ML1ASP project area has produced among others 3 *Amburana cearensis* that has a Status: Endangered A1acd+2cd.

Therefore there is a regular occurrence of a globally threatened species (according to the IUCN Red List) at the site, because there is an endangered (EN) species - presence of at least a single Individual.

In addition, the Brazil nut, *Bertholletia excelsa,* has status: vulnerable. Visual inspection of the project area at ML1ASP shows well of the 30 individuals.

Therefore there is a regular occurrence of a globally threatened species (according to the IUCN Red List) at the site, because there is a vulnerable (V) species - presence of at least 30 Individuals.

Thus, the project area, let alone the project zone, includes a site of high biodiversity conservation priority by meeting the vulnerability criteria.

Appendix 1. The Atlas

BENI

Atlas de Potencialidades Productivas del Estado Plurinacional de Bolivia 2009

CARACTERIZACIÓN GENERAL DEL DEPARTAMENTO DEL BENI

El departamento del Beni fue creado el 18 de noviembre de 1842 por D.S. del entonces Presidente, José Ballivián. Tiene una extensión aproximada de 213.654 Km2, la mayoría de su territorio está cubierto por pampas de llanura de inundación. Hacia el Suroeste están ubicados los "pie de montes" de la zona yungueña, al Este empieza la formación del escudo precámbrico, en el cual se hallan tres grandes eco regiones: el cerrado beniano, las sabanas inundables y el Sudoeste de la Amazonía. También, dentro sus límites, se tienen tres Áreas Protegidas a nivel nacional; la Estación Biológica del Beni, el Parque Nacional y Territorio Indígena Pilón Lajas, y el TIPNIS, que reúnen una riqueza de biodiversidad y de especies forestales, importante para el departamento y el país.

Al efectuar una evaluación integral de los recursos naturales que tiene el departamento, se identificaron las potencialidades productivas, siguiendo a cabalidad la metodología diseñada para el efecto, como se explica en la primera parte del Atlas. Asimismo se detectaron las amenazas naturales y antrópicas que más afectan a la región, lo cual permitirá hacer controles a través del monitoreo en las áreas de mayor potencial productivo. Para ello, es necesaria la participación de los actores sociales e institucionales, con el fin de lograr altos niveles de productividad que generen rentabilidad, progreso y desarrollo, a través del uso adecuado de sus recursos naturales renovables y no renovables.

Para identificar las potencialidades productivas se recurrió a diferentes estudios e información secundaria como la Zonificación Agroecológica, que sirvió de propuesta técnica para la elaboración del Plan de Uso del Suelo del departamento; el Mapa de Vegetación elaborado por Navarro y Ferreyra a través de la cooperación de The Nature Conservancy (TNC); Servicio Nacional de Meteorología e Hidrología (SENAMHI) con su información climática, entre otros, que sirvieron como insumos para la elaboración del mapa de potencial productivo. De esta manera, se pudieron identificar otras potencialidades que aún no son explotadas adecuadamente.

Sin embargo, es importante ver la relación que puede haber entre la aptitud máxima de uso del suelo y el uso actual del mismo. Esta correspondencia permitirá identificar los Tipos de Uso de la Tierra, las Unidades Básicas de Análisis, y así encontrar las potencialidades de las principales actividades productivas desarrolladas en el departamento.

Del mismo modo se hicieron los análisis socioeconómicos y administrativos que permitieron ver las cualidades de relación entre los centros poblados, la capacidad de infraestructura con la que cuentan (salud, educación), los servicios básicos instalados para implementar centros agroindustriales.

Cuadro Nª 32
Características Generales del Departamento de Beni

CARACTERÍSTICA	DESCRIPCIÓN
Creación	La creación del departamento del Beni se remonta al 18 de noviembre de 1842 por Decreto Supremo del entonces Presidente de la República José Ballivián.
Población	Según el último Censo de población y vivienda con proyecciones al 2009, el departamento de Beni, cuenta con 437.636 habitantes que representa solamente el 4,28% de la población del país.
Superficie	La superficie total del departamento es de 213.654 km2, haciendo un total de 21,4 millones de hectáreas. La ciudad de Trinidad es capital del departamento, fundada en junio de 1686 con el nombre de Santísima Trinidad. Cuenta con una población de 96.054 habitantes. Está a una altura de 155 m.s.n.m y su fiesta es el 18 de noviembre, en conmemoración a su creación como departamento en 1842.
División política	Este departamento cuenta con 8 provincias, 19 municipios y 45 cantones
Geografía física	Se caracteriza por tener amplias planicies cubiertas por pastizales y una serie de lagunas de formas regulares. A lo largo del territorio, se presentan ondulaciones suaves y algunos afloramientos rocosos, así como un denso bosque en la zona de pie de monte. Límites y extensión territorial: El departamento de Beni está ubicado al Noreste del Estado Plurinacional de Bolivia. Limita al Norte con el departamento de Pando y la República de Brasil; por el sur, con los departamentos de Cochabamba y Santa Cruz; por el este, con Brasil y Santa Cruz; y por el oeste, con Pando y La Paz. La capital del departamento es la ciudad de Trinidad (236 m.s.n.m.), situada a 14°45'20" de latitud Sur y 64°48' de longitud Oeste.
Relieve	El departamento del Beni es prácticamente llano en su totalidad, con algunas elevaciones montañosas en su zona Oeste. Presenta las siguientes serranías: Eva Eva y Pelado (entre los departamentos de La Paz y el Beni).

FUENTE: Bolivia en la Red. http://www.boliviaenlared.com

Cuadro Nª 32.1
Características generales del departamento de Beni

CARACTERÍSTICA	DESCRIPCIÓN
Hidrografía y cuerpos de agua	La totalidad de los ríos del Beni desembocan en la cuenca del Amazonas, siendo los principales: Mamoré, el mayor río de Bolivia, que nace en la cordillera del departamento de Cochabamba con el nombre de río Rocha; el río Iténez o Guaporé (hace frontera con la República de Brasil); Beni, hace frontera natural con los departamentos de La Paz y Pando. También están los ríos Yata, Ivón, Machupo, Itonama, Baures, San Martín, San Miguel, San Simón, Negro, Sécure, Yacuma, Maniquí, Ibare y Apere. La mayoría de ellos son navegables. Lagos: Rogagua, Rogaguado, San Luis y San Pablo. Lagunas: Huachi, Huatunas, Yusala, Huachuna, Agua Clara, Ginebra, La Dichosa, Bolivia, Navidad, Las Abras, Larga, Maracaibo, etc.
Clima	El Beni tiene un clima tropical húmedo, con una precipitación pluvial media anual que varía entre 1.000 mm y 4.000 mm. La temperatura promedio oscila entre 22 y 28 grados centigrados. En ciertas temporadas, el territorio del Beni es surcado por vientos fríos del Sur que producen descensos bruscos de temperatura. Estos vientos son conocidos como "surazos".
Actividades productivas	El departamento, por su clima y suelo, es apto para toda clase de cultivos tropicales: maíz, cacao, café, castaña, vainilla, yuca o mandioca, arroz, maracuyá, papaya, cítricos y otras frutas tropicales, goma elástica o caucho, castaña, vainilla. *Maderas:* Los bosques del Beni poseen gran variedad de maderas preciosas que van, desde la liviana madera balsa hasta el cuchi, del que se dice que es tan duro como el acero. Entre otras maderas preciosas podemos citar: Caoba o mara, ochoó, japunaqui, palmeras (cusi, totaí, chonta, motacú, sao), tacuara (tamora, tacuarembó, curi), sirari, tajibo, cubo. *Ganadería*. El número de cabezas calculado es de alrededor de 2.000.000; el pasto natural que crece en estas tierras es altamente utilizado para la ganadería. *Minería:* Se ha establecido la presencia de estaño, manganeso, plomo, platino, oro, berilio y columbita. *Pesca:* Los ríos son hábitat de una gran variedad de peces, como son: pacú, palometa, sábalo, bagre y blanquillo. Muchos de los lagos tienen una fauna ictiológica semejante a la de los ríos.
Vías de comunicación	La principal vía de comunicación la conecta con el departamento de Santa Cruz, a través de la carretera asfaltada Trinidad – Santa Cruz. Otra vía de importancia es la que vincula las poblaciones del Norte amazónico como Riberalta y Guayaramerín con Rurrenabaque que finalmente vincula con el departamento de La Paz. En el departamento se tienen muchos aeropuertos y pistas de aterrizaje debido a que en tiempo de lluvias la mayoría de los caminos son intransitables debido a las inundaciones. Por eso los únicos medios de transporte son fluvial o aéreo. El aeropuerto más importante es el de Trinidad, con frecuencias a las principales ciudades de Bolivia; Sin embargo hay aeropuertos importantes en municipios como Rurrenabaque, Riberalta, Gauyaramerín, San Borja, entre otros. Es importante la comunicación, a través de sus ríos, ya que permite el comercio y transporte de pasajeros a nivel local e interdepartamental.

FUENTE: Bolivia en la Red. http://www.boliviaenlared.com

La información para la identificación de las potencialidades productivas del departamento se determinó sobre la base de cuatro subsistemas: Administrativo, Biofísico, Social y Económico.

SUBSISTEMA ADMINISTRATIVO

División política administrativa

Beni es el segundo departamento en tamaño del Estado Plurinacional de Bolivia y está ubicado en la región oriental del país. Limita al Oeste con el departamento de La Paz, al Este con la República de Brasil al Norte limita con el departamento de Pando y el Brasil, y al Sur colinda con los departamentos de Santa Cruz y Cochabamba. Tiene una superficie de 20.406.569.0457 hectáreas. Respecto a su estructura política administrativa, Beni se halla conformado por 19 municipios distribuidos en 8 provincias, el siguiente cuadro muestra esta división:

Cuadro Nª 33
Principales indicadores demográficos del departamento de Beni, 2009

Descripción	Beni
Superficie (Km^2)	213.564
Población total	437.636
Densidad de habitantes (Habitantes por Km^2)	2,05
Porcentaje de población masculina	52,07
Porcentaje de población femenina	47,93
Tasa Media Anual de Crecimiento (En porcentaje)	1,75
Tasa Bruta de Nacionalidad (por mil)	30,23
Tasa Bruta de Mortalidad (por mil)	6,17
Tasa Global de Fecundidad (Hijos por mujer)	4,05
Edad Media de Fecundidad (Años)	27,78
Tasa de Mortalidad Infantil (por mil nacidos vivos)	39,40
Esperanza de vida al nacer total (Años)	67,22
Esperanza de vida al nacer de hombres (Años)	65,19
Esperanza de vida al nacer de mujeres (Años)	69,36

Fuente: INSTITUTO NACIONAL DE ESTADÍSTICA

Fuente: INSTITUTO NACIONAL DE ESTADÍSTICA

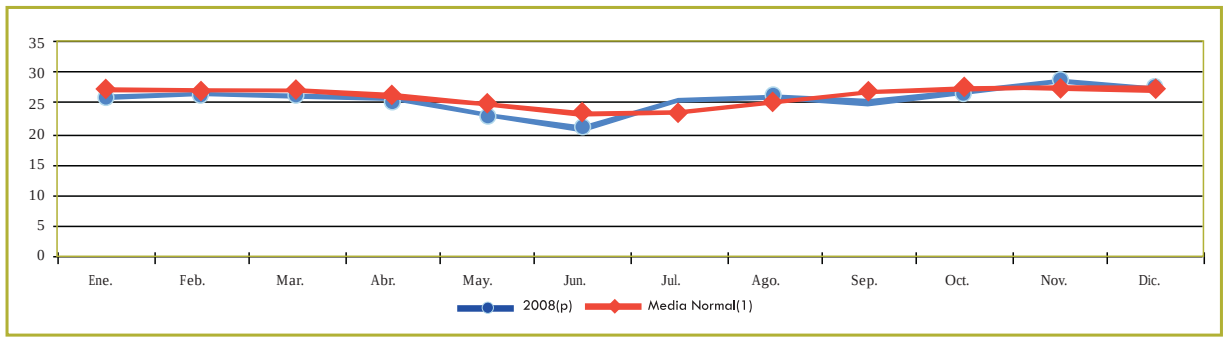
Ver Mapa de División Política

SUBSISTEMA BIOFÍSICO

Temperatura y precipitación

Dentro del subsistema biofísico, una de las principales variables es la climatológica puesto que el departamento del Beni registra temperaturas que oscilan entre los 28ºC y los 34ºC , que se incrementan a medida que se va del Sur al Norte. En cuanto a las precipitaciones, éstas decrecen conforme las temperaturas aumentan, logrando concentraciones muy cercanas a los 3.800mm de lluvia media anual en la región cercana al trópico de Cochabamba. Así, de acuerdo a la clasificación del Sistema Koeppen, a esta región se la clasifica en tres climas: el primero, Tropical siempre húmedo localizado a lo largo del curso del río Mamoré, desde el trópico de Cochabamba; un segundo tipo de clima, el tropical húmedo con corta sequía, debido a la influencia de la región amazónica de los departamentos de Pando y La Paz, y finalmente, una porción de la región de Versalles, al Este del departamento que colinda con Brasil. Gran parte de la superficie del departamento tiene un clima Tropical de sabana con invierno seco.

Gráfico No. 30
Temperatura Promedio



FUENTE: INSTITUTO NACIONAL DE ESTADÍSTICA
(P): Preliminar
(1) La media normal es el promedio de 30 años, de 1961 a 1990, establecido por la Organización Mundial de Metodología.

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

UNIDADES POLÍTICO ADMINISTRATIVAS DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004, SITAP 2009.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Pando
Riberalta
Guayaramerin
Santa Rosa
Puerto Siles
Exaltacion
San Joaquin
Magdalena
Reyes
San Ramón
Baures
Huacaraje
Santa Ana de Yacuma
San Javier
Rurrenabaque
Trinidad
San Borja
San Ignacio
Loreto
San Andrés
Santa Cruz
La Paz
Cochabamba

REPÚBLICA DEL BRASIL

Límite departamental entre Beni y Cochabamba no definido

Referencia

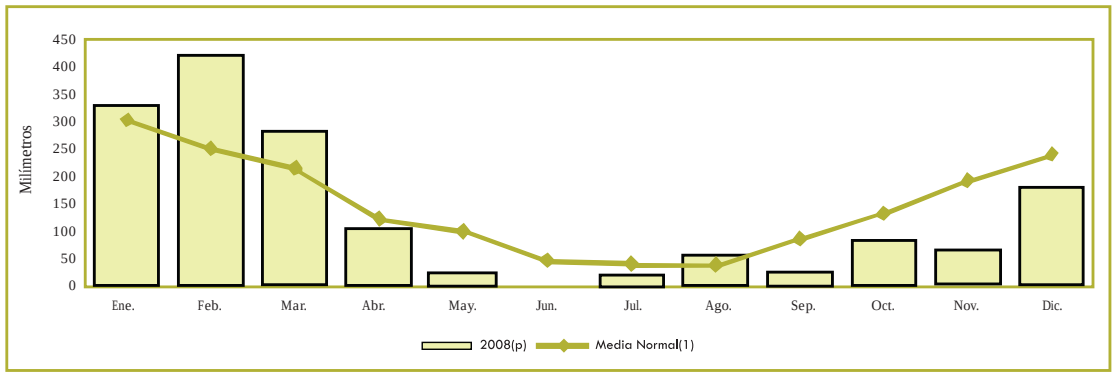
Baures	San Andrés
Exaltacion	San Borja
Guayaramerín	San Ignacio
Huacaraje	San Javier
Loreto	San Joaquín
Magdalena	San Ramón
Puerto Siles	Santa Ana de Yacuma
Reyes	Santa Rosa
Riberalta	Trinidad
Rurrenabaque	

Mapa 89: División Política

El mapa muestra una escala de temperaturas, de menos de 20ºC a temperaturas mayores a los 28ºC. Las zonas con mayor temperatura están señaladas con color rojo e incluye a los municipios del Noroeste como: Riberalta, Guayaramerín, Puerto Siles, parte de San Joaquín y Magdalena. También se observan temperaturas altas en la parte Sur del departamento, particularmente en el municipio de San Borja. El resto del departamento tiene temperaturas que oscilan entre 28 y 34ºC , hay una zona que recorre de Este a Oeste con las temperaturas más bajas del departamento, de 23 a 24ºC y que incluye a una parte de los municipios de Reyes, Norte de San Borja, Santa Ana de Yacuma y también de San Javier y San Ramón. En el mapa, esta zona se halla señalada con color amarillo. *(Ver Mapa de Temperaturas)*

Estas características climáticas hacen que la región alcance valores de evapotranspiración superiores a los 900 mm/año, sin embargo, por las características de la topografía, el coeficiente de escurrimiento es muy bajo con valores entre 20% a 30%, lo que ocasiona el rápido anegamiento de la región, en la zona central a ambas riveras del rio Mamoré.

Gráfico No. 31
Precipitación Promedio



FUENTE: INSTITUTO NACIONAL DE ESTADÍSTICA
(P): Preliminar
(1) La media normal es el promedio de 30 años, de 1961 a 1990, establecido por la Organización Mundial de Metodología.

El mapa muestra la escala de índices de Precipitación Media Anual de menos de 900mm hasta un índice mayor a 3.800mm. Las zonas con menor precipitación media anual están señaladas con un color anaranjado oscuro, que oscila entre los 1.000mm a 1.200mm e incluye al Sur del municipio de Reyes y la parte Norte del municipio de Rurrenabaque. La precipitación de 1.400mm a 1.800mm está señalada con color anaranjado y anaranjado claro, contiene a los municipios de San Ramón y Baures en el sector Este. Y en el sector Oeste comprende los municipios de Santa Rosa, y el Norte del municipio de Reyes. La precipitación más alta, de 3.400mm a 3.600mm está señalada con un color celeste claro e incluye a la parte Sur del municipio de San Ignacio, ubicada prácticamente en el Parque Isiboro Sécure. *(Ver Mapa de Precipitación)*

Cuencas hidrográficas, evapotranspiración y coeficiente de escurrimiento

La red hidrológica del departamento se caracteriza por sus ríos muy caudalosos que sirven de medios de comunicación fluvial, sobre todo en aquellas comunidades donde no hay acceso por tierra. El río principal es el Mamoré, que fluye de Sur a Norte, por la parte central del departamento. Sin embargo, en los límites tanto occidental como oriental se encuentran también dos importantes ríos: el río Beni (al Oeste) y el río Iténez (al Este). Las características de su densidad hídrica es de tipo dendrítica densa, la mayoría intermitente y además cuenta con importantes lagunas, en las cuales abundan peces e importantes especies de quelonios y saurios.

La cuenca tiene en su interior sus "*divisorias de aguas*", que delimitan a 29 microcuencas hidrográficas, las cuales descargan sus aguas al río Mamoré, y éste drena sus aguas al Río Madera.

El mapa presenta la clasificación de 29 cuencas hidrográficas señaladas con diferentes tonalidades de colores, que se sobreponen a la totalidad de los municipios que conforman el departamento. *(Ver Mapa de Cuencas Hidrográficas)*

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)

Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

TEMPERATURA MEDIA ANUAL
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Temperaturas medias anuales, elaboración propia a partir de la información del Servicio de Hidrografía y Metereología, (SENAMHI) 2009.

Referencia
- menor a 20ºC
- 20ºC a 21ºC
- 21ºC a 22ºC
- 22ºC a 23ºC
- 23ºC a 24ºC
- 24ºC a 25ºC
- 25ºC a 26ºC
- 26ºC a 27ºC
- 27ºC a 28ºC
- mayor a 28ºC

Pando
Riberalta
Guayaramerin
Santa Rosa
Puerto Siles
Exaltación
Reyes
San Ramón
Baures
Huacaraje
Santa Ana de Yacuma
San Javier
Rurrenabaque
Trinidad
San Borja
San Ignacio
Loreto
San Andrés
La Paz
Cochabamba
REPÚBLICA DEL BRASIL
Límite departamental entre Beni y Cochabamba no definido

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Mapa 90: Temperatura

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

PRECIPITACIÓN MEDIA ANUAL
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100 Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Precipitación, elaboración propia a partir de datos pag. WEB, (SENAMHI), 2009

Referencia

- menos de 900 mm
- 900mm a 1000mm
- 1000mm a 1200mm
- 1200mm a 1400mm
- 1400mm a 1600mm
- 1600mm a 1800mm
- 1800mm a 2000mm
- 2000mm a 2200mm
- 2200mm a 2400mm
- 2400mm a 2600mm
- 2600mm a 2800mm
- 2800mm a 3000mm
- 3000mm a 3200mm
- 3200mm a 3400mm
- 3400mm a 3600mm
- 3600mm a 3800mm
- mayor a 3800mm

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Pando
Riberalta
Guayaramerín
Santa Rosa
Exaltacion
Puerto Siles
San Joaquin
Magdalena
Reyes
San Ramón
Baures
Huacaraje
Santa Ana de Yacuma
San Javier
Rurrenabaque
San Borja
Trinidad
San Ignacio
Loreto
San Andrés
Santa Cruz
La Paz
Cochabamba
REPÚBLICA DEL BRASIL
Límite departamental entre Beni y Cochabamba no definido

Mapa 91: Precipitación

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

HICROGRAFIA Y CUENCAS DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: Cuencas, Servicio Nacional de Información para el Desarrollo (SNID)
UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM); actualizado por el SITAP.
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.

Referencia

- Arroyo Azul
- Arroyo Blanco
- Madera
- Río Apere
- Río Beni
- Río Benicito
- Río Biata
- Río Blanco
- Río Cotacajes- Sta. Elena
- Río Geneshuaya
- Río Grande Alto
- Río Inicua
- Río Iruyañez
- Río Isiboro Sécure
- Río Itonamas
- Río Machupo
- Río Madidi
- Río Madre de Dios
- Río Negro-Beni
- Río Niquisi
- Río Paragu
- Río Paucerna -Verde
- Río San Martin-Bajo
- Río San Martin-Medio
- Río San Martín-Alto
- Río Tuichi-Quiquibey
- Río Yacuma
- Río Yata
- Río Yata-Sta. Cruz

Pando
Riberalta
Guayaramerín
Santa Rosa
Puerto Siles
Exaltacion
San Joaquin
Magdalena
Reyes
San Ramón
Baures
Huacaraje
San Javier
Santa Ana de Yacuma
Rurrenabaque
Trinidad
San Borja
San Ignacio
Loreto
San Andres
La Paz
Cochabamba
REPÚBLICA DEL BRASIL
Límite departamental entre Beni y Cochabamba río definido

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Mapa 92: Cuencas Hidrográficas

Geología

Geológicamente, el departamento del Beni se caracteriza por estar formado principalmente por sedimentos cuaternarios correspondientes a las Llanuras Benianas. Al Sur del departamento afloran reducidas áreas de rocas con edades devónicas, carboníferas, pérmicas y cretácicas pertenecientes al período Subandino. Asimismo, se observan rocas pertenecientes al periodo Precámbrico, ubicadas al Este del departamento. Entre las unidades diferenciadas, se observan sedimentos de origen cuaternario (Q) representados por depósitos aluviales, fluvio-lacustres, coluviales y dunas, los sedimentos del neógeno (Ng) hasta el Devónico (D) representados por grupos de conglomerados, diamigtitas, areniscas, lutitas, arcilitas, limolitas, calizas y margas, también hay zonas con rocas de origen precámbrico representadas por grupos de Granitos. Por último, se identificaron grupos de Gneis con edades que varían entre los 900Ma y 2.000Ma.

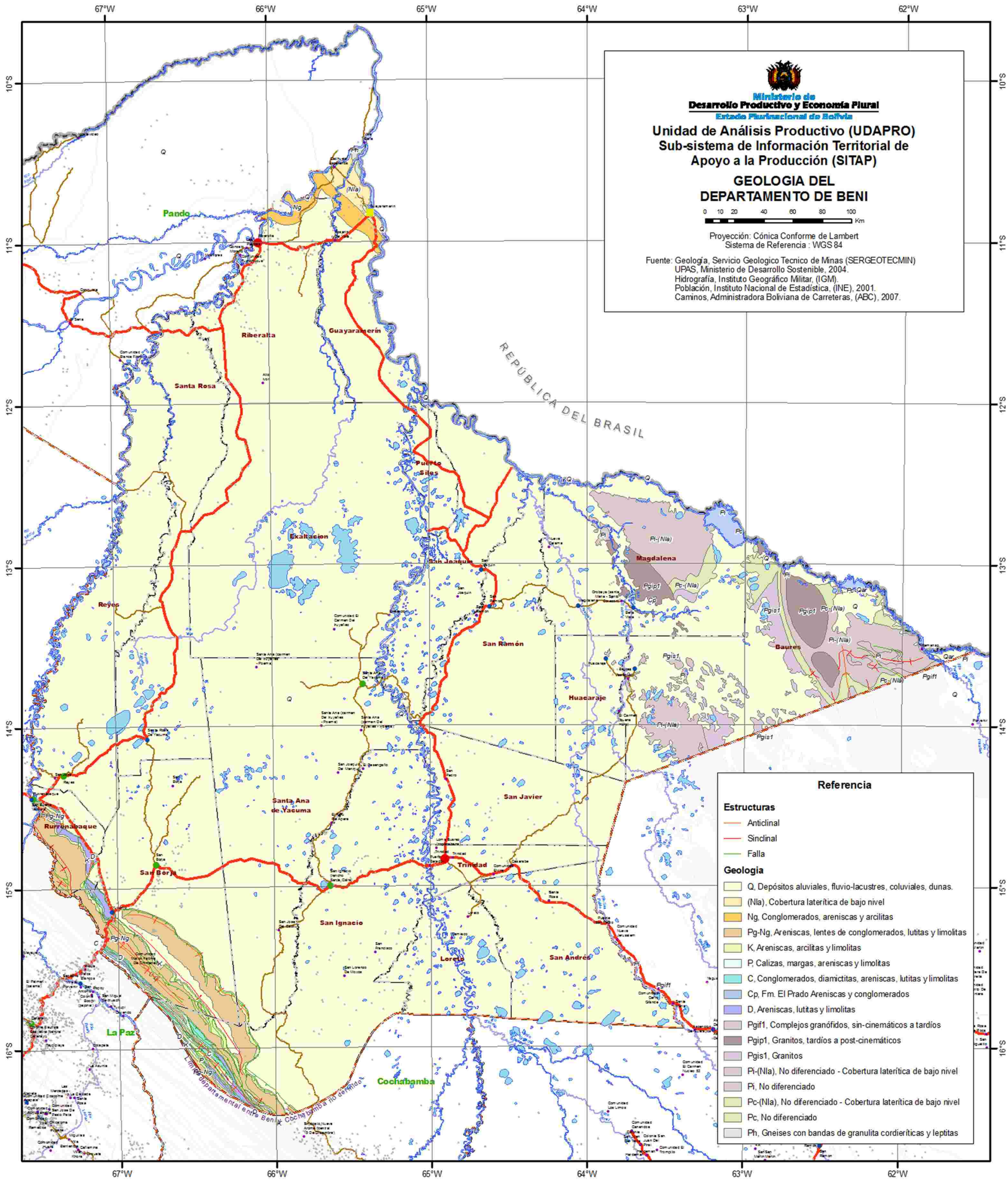
La mayoría de la superficie del departamento presenta la formación de depósitos aluviales, fluvio lacustres, coluviales y dunas, representados en el mapa por el color amarillo. En la parte Suroeste se observan conglomerados de, areniscas, lutitas y limotita, representados en el mapa por un color café-pardo. En la parte Noreste se observan formaciones de granitos, representadas en el mapa con un color plomo claro y plomo oscuro. En el sector Norte, prácticamente en el límite con la República del Brasil se hallan formaciones de areniscas y arcillitas en la parte Norte de los municipios de Riberalta y Guayaramerín, representadas en el mapa por un color café-claro. *(Ver Mapa geológico)*

Relieve

En cuanto al relieve, el departamento no presenta mayores cambios en sus pendientes, sólo presenta una región de serranías y “pie de montes” producto de la Cordillera del Subandino, al Suroeste del departamento, donde las pendientes alcanzan valores incluso de 70% (inclinación muy pronunciada), para después bajar hacia en una extensa planicie con pendientes cuya media alcanza al 2% (casi horizontal). Esta es otra causa, para que se produzcan los anegamientos debido a la saturación de los suelos.

La principal característica de la región es que el cambio de la gradiente pequeña alcanza valores aproximados de 2 a 5 centímetros cada 100 metros.

El mapa presenta una escala de pendientes de 0% a 70% o mayores. Las pendientes de 0% a 3%, están señaladas con un color amarillo que cubre prácticamente la totalidad de la superficie del departamento. En la parte Suroeste, se observa a las zonas con mayor pendiente, señaladas en el mapa con los colores carmesí y azul. *(Ver Mapa de pendientes)*



Mapa 93: Geológico

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

PENDIENTES DEL DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: Pendientes, SRTM 90 mts. de la NASA
UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.

Referencia

- 0 - 3, casi horizontal
- 3 - 7, inclinación leve
- 7 - 12, inclinación moderada
- 12 - 25, inclinación levemente moderada
- 25 - 40, inclinación pronunciada
- 40 - 70, inclinación muy pronunciada
- > 70, inclinación extremadamente pronunciada

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Pando
Riberalta
Guayaramerin
Santa Rosa
Exaltacion
Puerto Siles
San Joaquin
Magdalena
Reyes
San Ramón
Baures
Huacaraje
Santa Ana de Yacuma
San Javier
Rurrenabaque
Trinidad
San Borja
San Ignacio
Loreto
San Andrés
La Paz
Cochabamba
REPÚBLICA DEL BRASIL
Límite departamental entre Beni y Cochabamba no definido

Mapa 94: Pendientes

Clasificación de suelos del departamento del Beni

La clasificación de los suelos para el departamento del Beni, se basó en el estudio realizado por la consultora EUROCONSULT Consultores Galindo, la misma utilizó la clasificación de la USDA a nivel de órdenes y subórdenes. En este sentido se identificó que los suelos, en la mayoría de la región, son recientes (Orthent, fluvient, aquent y udox) con bastante arcilla, que es otro factor que provoca el rápido anegamiento de la región ante la saturación de las superficies. Los suelos más desarrollados (tropept) están ubicados en la parte central del departamento, pero también presentan limitantes importantes, sobre todo en los nutrientes. En algunas de las regiones existen suelos con cierta inclinación hacia los valores básicos, vale decir que son salinos, lo cual contribuye a que se puedan sembrar ciertos pastos para la actividad ganadera. Sin embargo, se debe tener en cuenta que muchos de los pastos sembrados no soportan la inundación por tiempos prolongados, lo que dificulta su utilización en estas sabanas.

El estudio del POT-Beni identificó tipos de suelo clasificándolos de acuerdo a las provincias fisiográficas. En las serranías y colinas del Subandino los suelos son poco profundos a profundos, con texturas medias a moderadamente finas y presencia de fragmentos rocosos en algunos sectores: ácidos y pobre a moderadamente fértiles, que corresponden a los subórdenes Tropepts, Orthents y Fluvents.

En la Llanura Amazónica los suelos son profundos a muy profundos, con predominancia de texturas finas por lo general compactas, húmedas y con diferentes grados de inundación; ácidos a muy ácidos y pobres en fertilidad, que corresponden a los subórdenes: Aquents, Aquepts, Tropepts, Uderts, Udalfs y Fluvents.

En el Ondulado Amazónico los suelos son poco profundos a profundos, con texturas medianas a finas, presencia de nódulos de oxido de fierro y manganeso y contactos petroférricos en algunos sectores; ácidos a muy ácidos y pobres en fertilidad, que corresponden a los subórdenes: Udox, Ustox, Udults y Tropepts.

En el Escudo Precámbrico, los suelos son muy poco profundos a profundos, con texturas gruesas a medianas y presencia de abundantes nódulos de óxido de fierro y manganeso; muy ácidos y pobres en fertilidad, que corresponden a los subórdenes: Udox, Ustox, Aquox, Aquents, Aquepts, Tropepts y Fluvents.

En el Subandino las principales limitaciones son las fuertes pendientes que incrementan los riesgos de erosión y deslizamientos, y la baja capacidad de almacenamiento de agua en suelos, por la presencia de fragmentos rocosos y material parental a poca profundidad. En las llanuras, las principales limitaciones son los riesgos de inundación y drenaje deficiente; los suelos finos (pesados y compactos) y la baja fertilidad.

En el Ondulado Amazónico y Escudo Precámbrico las principales limitaciones son: ácidos, nódulos de oxido de fierro manganeso y aluminio tóxico, contactos petroférricos, lavado de nutrientes y baja fertilidad, así como riesgos de inundación.

El mapa de suelos presenta en la Referencia una clasificación de 47 tipos de suelo que cubren la totalidad de la superficie del departamento, resaltando las características edafológicas diferentes entre las zonas Norte, Noroeste, Sur Suroeste y en la parte central del departamento. *(Ver Mapa de suelos)*

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)
CLASIFICACIÓN TAXONÓMICA DE SUELOS
(Método USDA-Soil Taxonomy)
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100 Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Clasificación taxonómica de suelos (Propuesta técnica del Paln de Uso del Suelo del departamento de Beni, EUROCONSULT, Consultores Galindo, 1999)

Referencia

- Aquent/Aquept/Aquox
- Aquent/Aquept/Udalf/Udert
- Aquept/Aquent/Udox
- Fluvent/Tropept
- Fluvent/Tropept/Aquept
- Fluvent/Udoll
- Orthent/Tropept
- Orthent/Udox
- Orthent/Tropept/Fibrist
- Orthent/Ochrept/Udalf
- Orthent/Umbrept/Tropept/Udalf
- Orthent/Udox/Tropept
- Orthent/Tropept/Ochrept
- Tropept/Fluvent
- Tropept
- Tropept/Aquent
- Tropept/Aquept
- Tropept/Orthent
- Tropept/Udalf
- Tropept/Orthent/Ochrept/Udult
- Tropept/Aquept/Aquent/Udalf
- Tropept/Fluvent/Orthent/Psamment
- Tropept/Fluvent/Udult/Psamment
- Tropept/Udalf/Aquept/Udert
- Tropept/Udalf/Udert/Aquept
- Tropept/Udert/Udalf/Aquent
- Tropept/Udox/Aquept
- Tropept/Orthent/Udalf
- Tropept/Udult/Ochrept
- Tropept/Udalf/Aquept
- Tropept/Aquept/Aquent
- Tropept/Fluvent/Aquept
- Tropept/Fluvent/Udalf
- Tropept/Orthent/Fluvent
- Tropept/Udalf/Udert
- Tropept/Udult/Aquept
- Tropept/Udult/Psamment
- Udert/Udalf/Aquept/Tropept/Ustalf
- Udox/Orthent/Udalf/Udult
- Udox/Psamment
- Udox/Tropept/Fluvent/Udult
- Udox/Aquent
- Udox/Orthent/Tropept
- Udox/Tropept
- Udult/Tropept/Udox
- Udult/Ustox
- Ustox/Udox

Mapa 95: Suelos

Cobertura vegetal del departamento

La cobertura vegetal del departamento se halla rodeada por bosques amazónicos, continúa hacia el centro del departamento con vegetación herbácea de tipo oligotróficas (que viven en medios acuáticos) en la mayoría de la región. La cobertura vegetal está conformada por complejos grupos de comunidades vegetales o de sistemas ecológicos que, por las características edáficas de la región, aparecen de forma simultánea y repetitiva en el paisaje.

El mapa presenta las nueve clases de vegetales que cubren el departamento. Se diferencia claramente los tipos de cobertura de acuerdo a la tonalidad de los colores utilizados. Sobresale la cobertura boscosa de color verde, la cobertura de herbazales de color verde claro y la cobertura de pastizales, de color amarillo claro. *(Ver Mapa de Cobertura vegetal)*

Riesgos naturales, incendios e inundaciones

El departamento del Beni presenta amenazas de posibles incendios que se pueden producir. Este estudio fue ejecutado y presentado por la Fundación para el Desarrollo Comunitario de la OXFAM, que determinó el nivel de tres grados de amenaza de incendios que se pueden dar en el departamento. El más bajo nivel de amenaza está en las áreas de los bosques amazónicos, vale decir en la parte circundante del departamento. Entretanto el grado de amenaza aumenta sobre todo en áreas donde la cobertura vegetal es de tipo herbácea, especialmente en los períodos secos (invierno seco).

Tomando en cuenta los fenómenos climáticos de los últimos años, también se identificaron las áreas con amenaza de inundación que trajeron graves consecuencias para la región. Así, se han determinado tres niveles o grados de amenaza de inundación; el grado más alto está ubicado a lo largo del río Mamoré, que puede anegarse producto del rebalse de sus aguas, además presenta un alto porcentaje de probabilidad especialmente en época de lluvias, por las características ya mencionadas del terreno. Sin embargo, generalmente, estas aguas se evaporan en períodos cortos de tiempo, salvo que se trate de un fenómeno extraordinario.

El mapa presenta las zonas vulnerables a riesgos naturales y su clasificación en alta, media y baja (amenaza). La parte central del departamento es una zona sensible a inundaciones, y está señalada en el mapa con un color azul oscuro. Las zonas con probabilidad Media de que ocurra el evento están señaladas con color azul-claro. Por último, las zonas con Baja probabilidad de amenaza están señaladas con color plomo. *(Ver Mapa de Inundaciones)*

La Referencia del mapa presenta una clasificación de tres categorías para amenaza de incendios: amenaza baja, media y alta. La mayoría de la superficie del departamento tiene una amenaza Alta de incendios, representada en el mapa con un color café oscuro. La amenaza Media está representada con un color verde y finalmente la amenaza Baja de incendios está señalada con color amarillo. *(Ver mapa de Amenaza de Incendios)*

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

COBERTURA VEGETAL
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

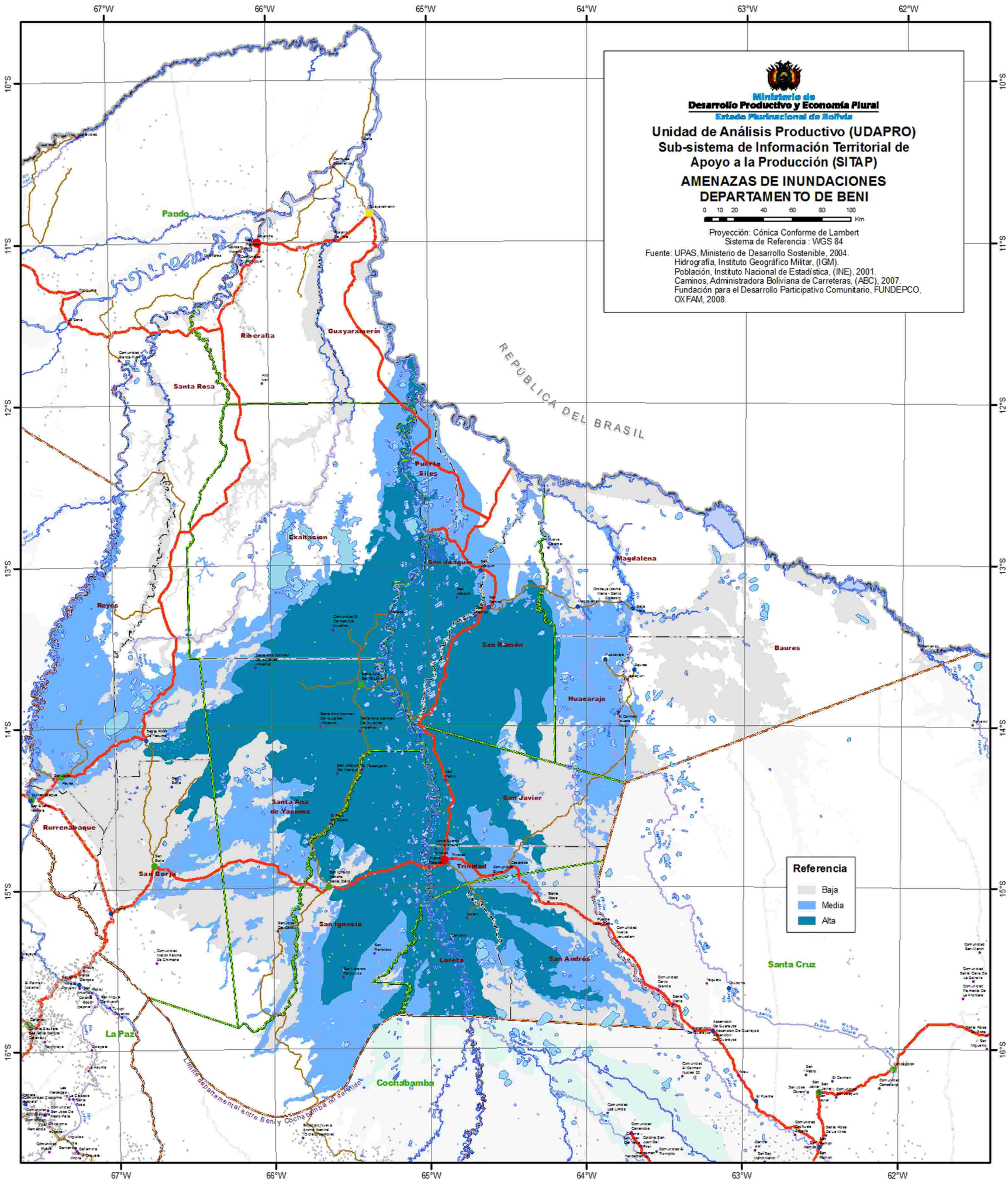
Fuente: Vegetación, Mapa de Vegetación de Bolivia, Navarro y Ferreira, 2004.
UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.

Referencia
- Arbustal
- Bosques
- Cuerpos de Agua
- Cultivos
- Herbazal
- Material rocoso en superficie
- Pastizal
- Tierras Erosionadas
- Urbanizada

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Pando
Riberalta
Guayaramerin
Santa Rosa
Exaltacion
Reyes
Rurrenabaque
San Borja
Santa Ana de Yacuma
San Ignacio
La Paz
Cochabamba
Puerto Siles
San Joaquin
San Ramón
San Javier
Trinidad
Loreto
San Andres
Magdalena
Baures
Huacaraje
Santa Cruz
REPÚBLICA DEL BRASIL
Límite departamental entre Beni y Cochabamba no definido

Mapa 96: Cobertura Vegetal



Mapa 97: Amenaza de Inundaciones

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

AMENAZAS DE INCENDIOS
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Fundación para el Desarrollo Participativo Comunitario, FUNDEPCO, OXFAM, 2008.

Referencia
Baja
Media
Alta

Mapa 98: Amenaza de Incendios

Uso actual de la tierra

La clasificación del uso actual de la tierra se basó en el análisis del Mapa de Vegetación de *Navarro y Ferreyra publicado el año 2007*, y la sobre posición de imágenes satelitales. Así, se determinó que el departamento tiene áreas clasificadas para la conservación ubicadas en zonas de bosque y con uso racional de los recursos, vale decir, un manejo adecuado. Así también se tienen áreas de protección que se mantienen en su estado original, lo cual es importante sobre todo para evitar la degradación de los suelos.

El departamento del Beni es eminentemente ganadero, muestra de ello es que gran parte de su superficie está destinada a esta actividad, sin embargo se ha clasificado como zonas de conservación y ganadería, aquellas áreas donde el uso actual es ganadero, sin embargo existen áreas de humedales que se mantienen sin la presión del ganado.

Respecto a las zonas con bosque, se ha localizado áreas de conservación y extracción que son aquellas donde hay productos no maderables que son aprovechados por las comunidades circundantes, lo mismo que las unidades clasificadas como protección y producción. Las áreas que se determinaron para conservación y producción tienen actividad ganadera y, en general, se ubican en las zonas altas.

El mapa presenta 11 categorías de uso actual de la tierra. Sobresale la categoría de uso ganadero representado en el mapa con los colores amarillo y amarillo oscuro, le siguen las zonas de extracción representadas por un color verde. Finalmente están las zonas de protección señaladas con un color carmesí. En la parte Sur, Suroeste y Este se observan zonas de conservación y extracción representadas en el mapa por el color verde-opaco. *(Ver Mapa de Uso Actual)*

Aptitud máxima de uso de la tierra

Para determinar la aptitud de uso de la tierra se utilizó el cuadro elaborado en la propuesta del Plan de Uso del Suelo del departamento, en el cual se trabajó de manera no excluyente las diferentes actividades, vale decir que una unidad podría tener diferentes aptitudes para cada actividad distinta. El mapa fue elaborado utilizando el criterio de aptitud máxima, que identifica cada unidad de terreno por aquella actividad que presenta la máxima aptitud de uso de la tierra, siendo excluyentes y asociativos. Donde se presentaban dos categorías de uso con un mismo valor de aptitud, se las asociaba con lo agropecuario, agroforestal, silvopastoril y agrosilvopastoril. Asimismo, en aquellas unidades donde se tenía una aptitud de tipo 3, vale decir marginal en todas sus actividades, se la clasificó como de protección, considerando que ninguna de las actividades tenía una aptitud moderada que pueda sostener el suelo. De esta manera se identificaron ocho tipos de aptitud de uso de la tierra: aptitud para la protección, para la ganadería uso limitado, forestería uso limitado, ganadería, forestería, agroforestal, silvopastoril y agrosilvopastoril.

El mapa presenta nueve categorías de aptitud máxima. Sobresale la aptitud máxima para ganadería representada en el mapa por el color amarillo, le sigue la zona de aptitud máxima para forestería, representada en el mapa por un color verde-oscuro, y finalmente la zona con aptitud máxima para protección, representada en el mapa por un color café. *(Ver Mapa de Aptitud de Uso de la Tierra)*

Correspondencia entre el uso actual y la aptitud de uso del suelo

Identificados los mapas de uso actual, y el de aptitud, se armó una matriz de correspondencia para conocer si se está dando el uso adecuado. Al mismo se clasificó en cuatro niveles de correspondencia: 1, Correspondencia alta, 2. Correspondencia media, 3. Correspondencia baja, y 4. Cuando no presenta correspondencia. De la matriz, se pudo descubrir que la región Noroeste, cercana a las lagunas Rogagua y Rogaguado, presenta una gran superficie que no tiene correspondencia en su uso, debido a que se la utiliza en ganadería de uso limitado, siendo que se trata de una región que de acuerdo a tablas, presenta una aptitud marginal para todas sus actividades y por eso se la clasificó como aptitud de protección.

El mapa presenta cuatro categorías de correspondencia. Sobresale la correspondencia alta y la correspondencia media, señaladas en el mapa con colores verde y amarillo, respectivamente. El área sin ninguna correspondencia está representada por un color café que cubre gran parte de la superficie del departamento. Hay baja correspondencia en la sector Oeste, parte Sur de Reyes, en las lagunas Rogagua y Rogaguado, y en el sector Norte del municipio de Riberalta, señalado con color café-claro. *(Ver Mapa de Correspondencia entre el uso actual y la aptitud de uso)*

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

USO ACTUAL DE LA TIERRA DEPARTAMENTO DE BENI

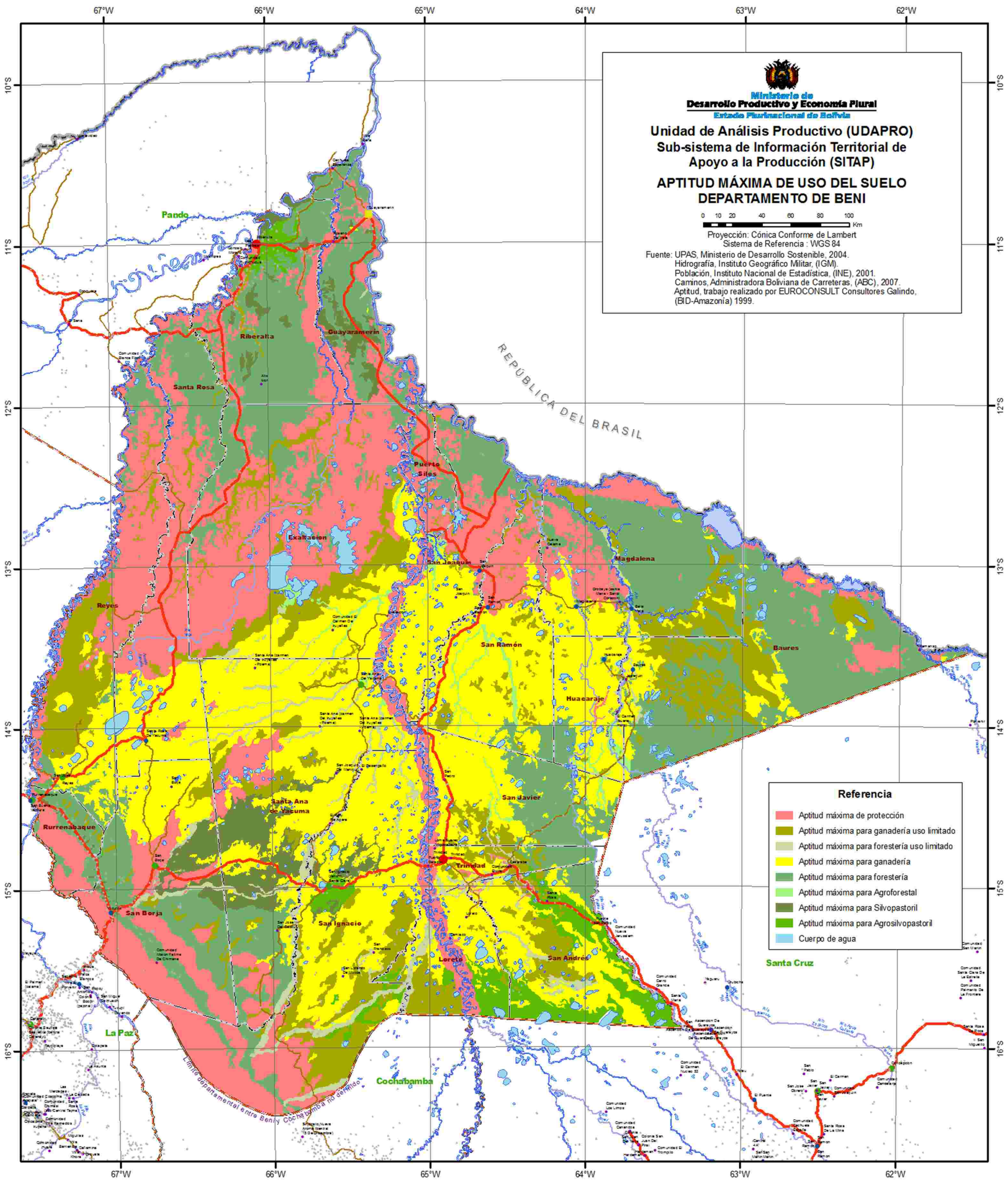
0 10 20 40 60 80 100 Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: Vegetación, Mapa de Vegetación de Bolivia, Navarro y Ferreira, 2004.
UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.

Referencia
- Conservacion
- Proteccion
- Extraccion
- Ganaderia Extensiva
- Conservacion - Produccion
- Conservacion - Extraccion
- Conservacion - Ganaderia
- Conservacion - Agricultura - Ganaderia
- Proteccion - Produccion
- Cuerpo de Agua
- Vivienda, Comercio, Servicios

Mapa 99: Uso Actual de la Tierra



Mapa 100: Aptitud de Uso de la Tierra

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

CORRESPONDENCIA ENTRE EL USO ACTUAL Y SU APTITUD DE USO DEL SUELO
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Correspondencia, elaboración propia, SITAP, 2009.

Referencia
- Alta correspondencia
- Media correspondencia
- Baja correspondencia
- Ninguna correspondencia

Mapa 101: Correspondencia entre el Uso Actual y la Aptitud de Uso

Plan de uso del suelo

La correspondencia en el uso de los suelos contradice al Plan de Uso del Suelo (PLUS) que tiene como propuesta el departamento. Es cierto que las zonas que no tienen correspondencia se han clasificado como áreas para uso de ganadería extensiva limitada, sin embargo, al no tener una aptitud del suelo que las sostenga pueden llegar a deteriorar el terreno producto del sobrepastoreo. Esto, pese a contar con reglas en el uso mencionadas en el documento del PLUS. Por ello debe haber un manejo más técnico para que se puedan utilizar adecuadamente estos suelos.

Es importante hacer notar que se tienen áreas con uso restringido en la propuesta del PLUS que, de acuerdo a su aptitud, pueden ser utilizadas para la actividad silvopastoril manteniendo nuevamente un manejo adecuado. Se recomienda que se tome en cuenta el PLUS y la correspondencia en el uso que se determinó en la matriz, para darle un uso sostenible a los recursos del departamento.

El mapa presenta las doce categorías de uso, diferenciadas con varios colores. Sobresale la categoría de uso ganadero intensivo, representada en el mapa con un color amarillo, seguido de la categoría de uso ganadero extensivo limitado representado por un color verde seco. En la parte Norte del departamento se observan zonas de uso forestal múltiple, representadas por un color verde-claro. El uso forestal maderable, señalado por un color verde oscuro, está ubicado en las zonas Sur, Suroeste y Sureste. Las áreas de uso restringido y uso agrosilvopastoril, están representadas en el mapa con un color café-claro y están ubicadas en una mínima superficie del sector Norte del departamento, concretamente en el municipio de Riberalta y en el camino de Yucumo a Rurrenabaque. *(Ver Mapa PLUS)*

SUBSISTEMA SOCIAL

El análisis del subsistema social, base importante para determinar la factibilidad de planes, programas y proyectos, determinó que, si bien el departamento de Beni tiene una gran superficie del territorio boliviano, la distribución de la población todavía es dispersa y concentrada sólo en algunos puntos del departamento. Hay lugares de baja densidad poblacional, debido posiblemente a la falta de comunicación entre las principales localidades, y a las amenazas de inundación características de la región que hacen dificultoso el acceso en época de lluvias.

De acuerdo al Censo Nacional de Población y Vivienda, INE-2001, el departamento del Beni tenía una población 374.823 habitantes, de ellos 195.056 son varones y 179.767 son mujeres. Las proyecciones del INE muestran un incremento poblacional de 437.636 habitantes al 2009.

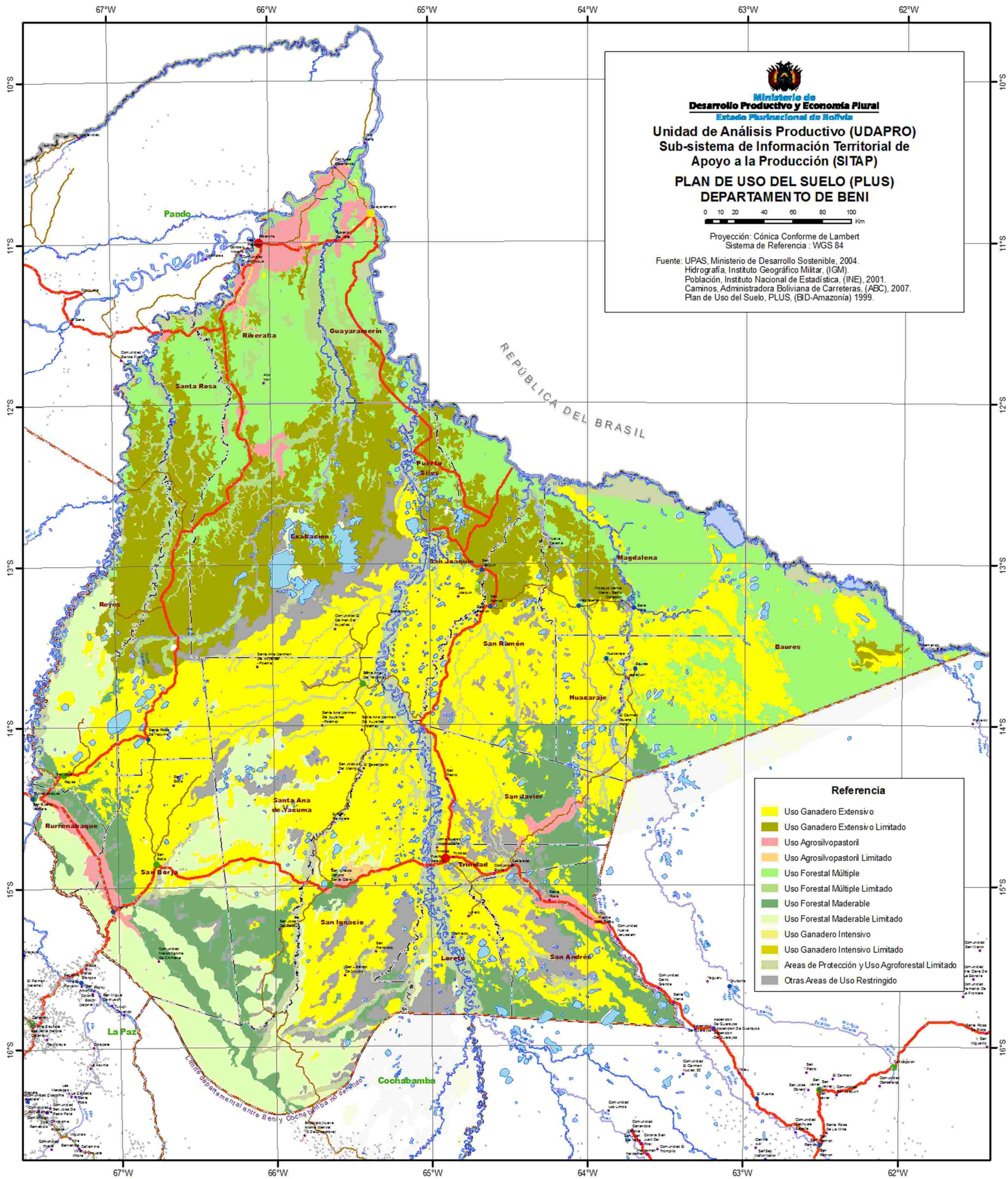
Un aspecto importante que se debe rescatar de las fichas técnicas elaboradas por la Asociación de Municipios del Beni (AMDEBENI) es la carencia de servicios básicos. En la siguiente tabla se observan los porcentajes de viviendas con servicios básicos:

Cuadro Nº 34
Número de viviendas con servicios básicos

Resumen de la ficha técnica de la Asociación de Municipios de Beni (AMDEBENI): Porcentaje de viviendas con servicios básicos (Agua por cañería, Energía eléctrica y Alcantarillado)

Provincia	Municipio	Viviendas 2001	Agua por Cañería %	Energía eléctrica %	Alcantarillado %
Cercado	Trinidad	16.482	12.856	9.395	165
	San Javier	602	60	66	6
Vaca Diez	Riberalta	14.736	6.336	3.537	147
	Guayaramerin	8.735	5.241	5.328	87
José Ballivian	Reyes	1.978	831	356	0
	San Borja	7.095	2.838	3.264	71
	Santa Rosa	1.674	619	787	0
	Rurrenabaque	2.653	1.220	1.486	186
Yacuma	Santa Ana	3.267	1.797	1.797	33
	Exaltación	1.420	227	156	14
Moxos	San Ignacio	3.793	1.138	1.214	0
Marban	Loreto	789	47	79	0
	San Andrés	2.151	151	323	0
Mamore	San Joaquin	1.018	438	204	0
	San Ramón	985	493	384	0
	Puerto Siles	233	28	0	0
Itenez	Magdalena	1.861	893	279	19
	Baures	889	373	53	0
	Huacaraje	655	262	144	0

FUENTE: AMDEBENI 2008



Mapa 102: PLUS

El rango de localidades utilizando las categorías fue elaborado por el Ministerio de Vivienda y el Instituto Nacional de Estadística (INE). De esta manera se elaboró el mapa de jerarquización de la población, a nivel de localidades y por municipios, y que se estratificó de la siguiente manera:

	Por municipios
Comunidades nucleadas: menores a 400 habitantes	Municipios con una población de 540 habitantes
Pueblos: de 401 a 2.000 habitantes	Municipios con una población de 541 a 2.000 habitantes
Centros urbanos menores: de 2001 a 5.000 habitantes	Municipios con una población de 2.001 a 5.000 habitantes
Ciudades menores: de 5.001 a 20.000 habitantes	Municipios con una población de 5.001 a 20.000 habitantes
Ciudades intermedias: de 20.001 a 50.000 habitantes	Municipios con una población de 20.001 a 50.000 habitantes
Ciudades mayores: con más de 50.000 habitantes	

Es así que para el departamento del Beni se identificaron dos ejes que concentran a la población: el primer eje que va de Este a Oeste, desde la ciudad de Trinidad hasta la población de Rurrenabaque, y el segundo eje que va de Sur a Norte, desde Rurrenabaque hasta Riberalta, esto principalmente por la comunicación entre estas ciudades.

También se puede observar que sólo en cinco municipios se tiene población con más de 20.000 habitantes: Cercado, San Ignacio, San Borja, Riberalta y Guayaramerín.

La Referencia del mapa presenta una clasificación de la ciudad, centro, pueblo y comunidad, también contiene la jerarquización de la población por cantidad de población, empezando por localidades menores 540 habitantes a más de 20.000. Los municipios que tienen ciudades con poblaciones mayores a 20.000 habitantes están representados en el mapa con el color verde. La mayor parte de los municipios tiene localidades con poblaciones de 5.000 a 2.000 habitantes y, están señalados en el mapa con color amarillo. Los municipios con localidades que tienen poblaciones de 2.000 a 5.000, están representados en el mapa con el color café claro. Un solo municipio tiene localidades con población de 541 a 2.000 habitantes, se trata del municipio de Puerto Siles, representado con color café oscuro. *(Ver Mapa de jerarquización de la población)*

Infraestructura vial, medios de transporte, salud y educación

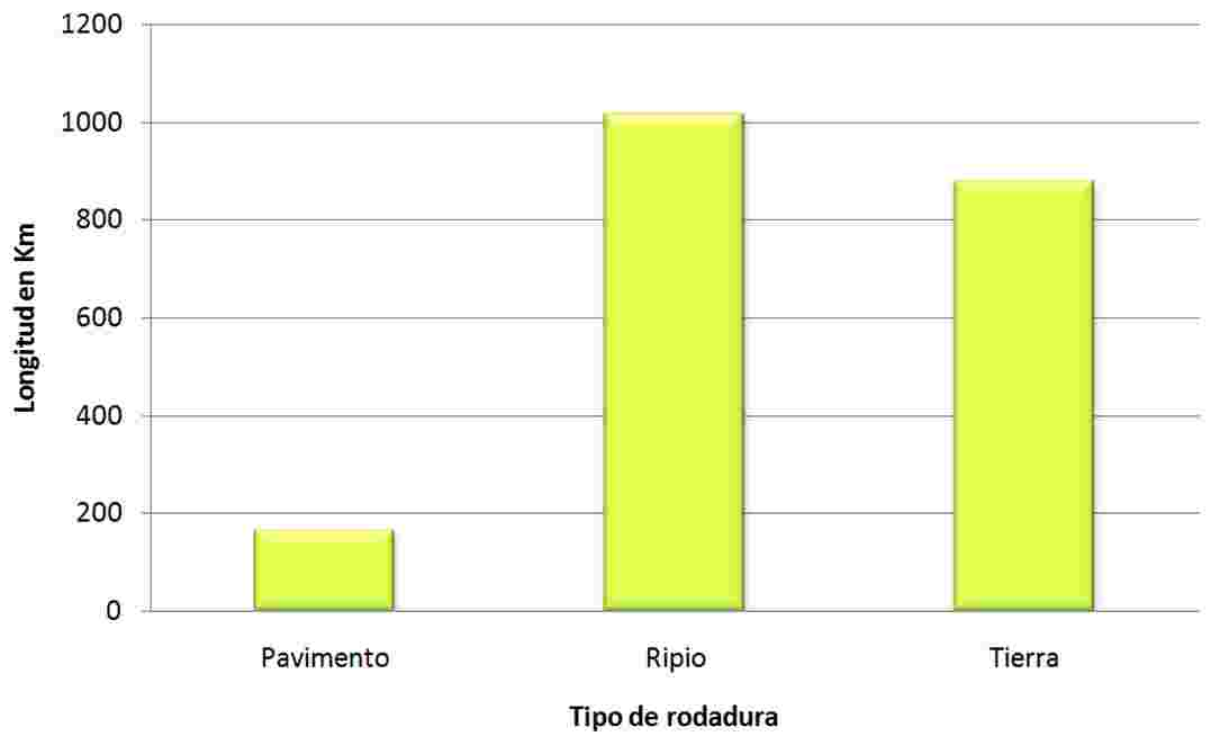
El departamento de Beni, también cuenta con una longitud importante de rutas fundamentales, superior a los 2.000 Km de distancia, siendo las rutas de ripio las que mayor cobertura alcanzan, con casi el 50%. Estas se encuentran localizadas principalmente entre las localidades de Guayaramerin y Rurrenabaque, la ruta pavimentada es aquella que conecta las ciudades de Trinidad - Santa Cruz y llega a cubrir el 8% del total de longitud en las rutas fundamentales. Asimismo las rutas fundamentales de tierra conectan las localidades de Puerto Siles y la localidad de San Borja.

El mapa de infraestructura vial fue trabajado en base al mapa de jerarquización de población. En la Referencia se identifican los lugares que poseen aeropuertos, terminales de buses, capitanías de puerto mayor y menor, distritos navales y áreas navales. Las ciudades intermedias junto a la ciudad capital brindan los servicios de aeropuertos y terminales de buses. *(Ver Mapa de infraestructura Vial)*

El mapa muestra cuatro referencias cartográficas de infraestructura, salud y educación, las cuales están clasificadas en el mapa con símbolos: centro de salud de tercer nivel, centro de salud de segundo nivel y centro de salud de primer nivel y unidad educativa. La ubicación de estos símbolos en el mapa señala la presencia de infraestructura de salud y educación. *(Ver Mapa de Salud y Educación)*

Infraestructura vial y medios de transporte

Longitud de ruta fundamental por tipo de superficie de rodadura, departamento de Beni



Departamento	Longitud	% Nacional	Pavimento	% Pavimento Dpto	Ripio	% Ripiio Dpto	Tierra	% Tierra Dpto
Beni	2.060	13%	167	6%	1.014	37%	879	32%

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)
JERARQUIZACIÓN POBLACIÓNAL POR LOCALIDAD Y POR MUNICIPIOS, SEGÚN CENSO 2001
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100 Km

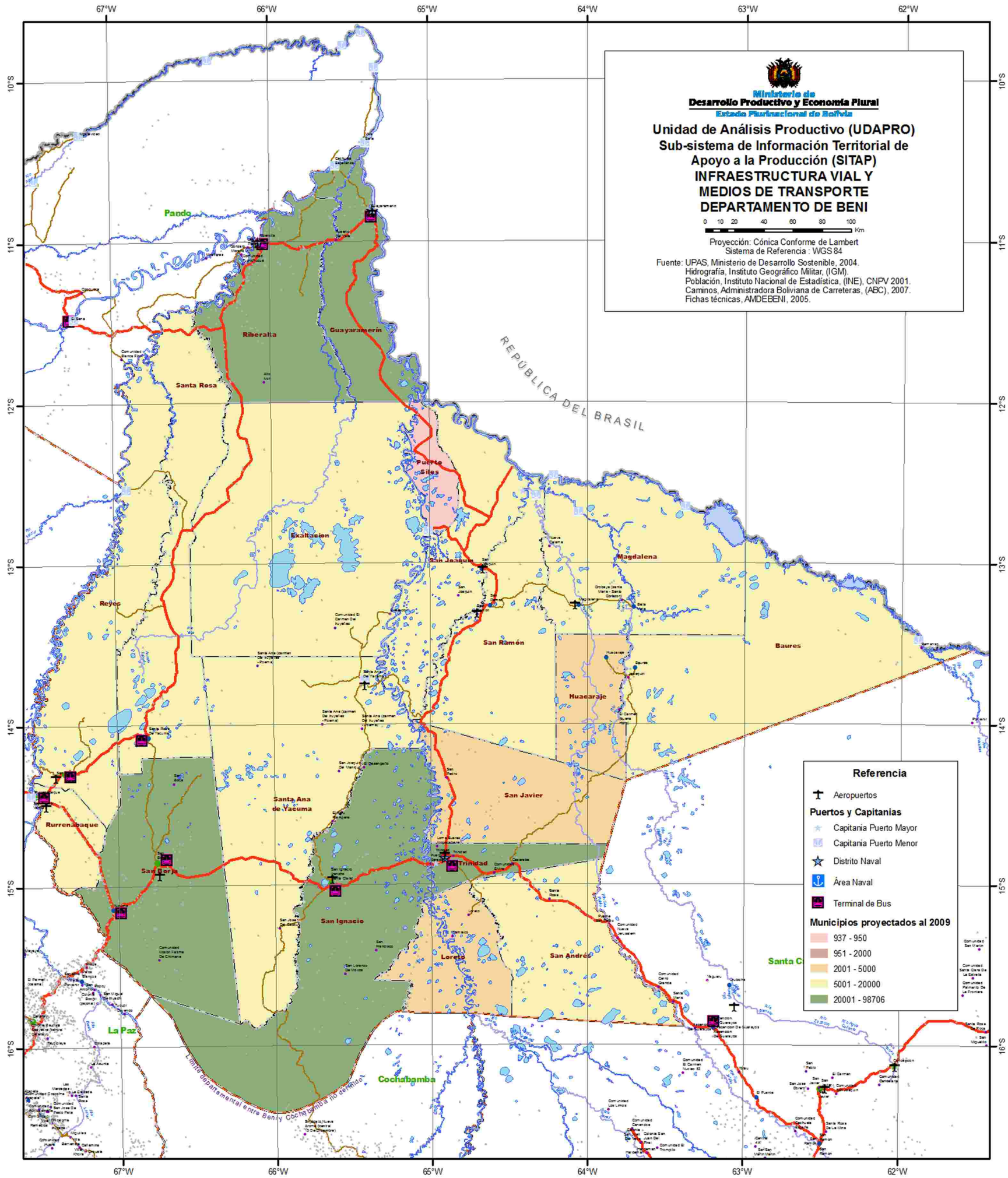
Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), CNPV 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Fichas técnicas, AMDEBENI, 2005.

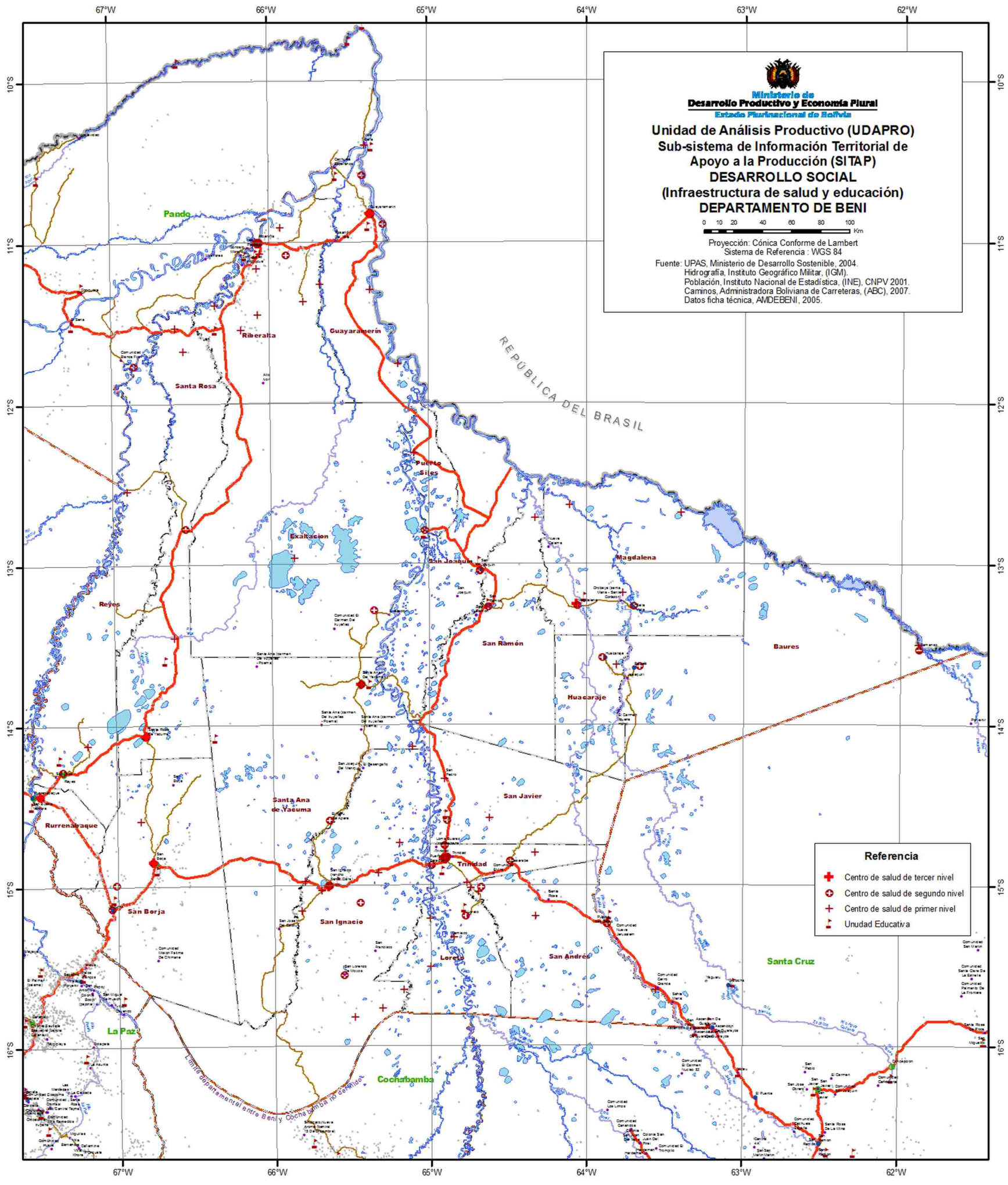
Referencia

	Jerarquización
Comunidad Núclea	
Pueblo	menos de 540
Centro Urbano Menor	541 - 2000
Ciudad Menor	2001 - 5000
Ciudad Intermedia	5001 - 20000
Ciudad Mayor	más de 20000

Mapa 103: Jerarquización de la Población



Mapa 104: Infraestructura Vial



Mapa 105: Salud y Educación

Derechos de uso de la tierra

En cuanto a los derechos de uso identificados en el departamento, es importante señalar que casi el 30% de la superficie corresponde a derechos de uso indígenas, a través de los Territorios Comunitarios de Origen (TCO). Asimismo, por las características de cobertura forestal del departamento también se tienen derechos de uso de los recursos forestales con varias concesiones forestales, que en algunos casos, se encuentran sobrepuestas a las TCO. Un aspecto importante es el de las áreas protegidas con categoría nacional que son tres, y están ubicadas en la región Suroeste, sobre el corredor Vilcabamba(Perú) – Amboró. Las Áreas Protegidas son: el Territorio Indígena Pilón Lajas, El Territorio Indígena Isiboro Sécure y la Estación Biológica del Beni, que tienen importantes y valiosas especies tanto forestales (vegetación) como de fauna. En el eje del mismo corredor ecológico Vilcabamba – Amboró se identificaron concesiones petroleras para la exploración de recursos hidrocarburíferos, pero se identificaron concesiones mineras sólo en los cursos de agua de ríos principales y en la región Este, en el municipio de Baures.

En el departamento, el proceso de saneamiento de la propiedad agraria, no concluyó en toda su superficie, sobretodo en la zona que fue afectada por los fenómenos del "El Niño, 2006-2007 y La Niña 2007-2008" específicamente en la cuenca hidrográfica del rio Mamoré.

El mapa de derechos de uso muestra concesiones mineras, concesiones petroleras, concesiones forestales y áreas protegidas. Las modalidades del estado del proceso de saneamiento, CAT SAN, SAN SIM y TCO, están representadas en el mapa por los colores café, café-claro y verde-claro, respectivamente. Debido a que el proceso de saneamiento todavía no terminó en el Beni, el proceso de saneamiento simple sobresale en el mapa. El avance de esta modalidad de saneamiento incluye las zonas Norte, Central y Sureste del departamento. La modalidad de CAT SAN incluye a toda la provincia Ballivián, la modalidad de TCO, áreas protegidas, concesiones forestales y concesiones mineras están dispersas por toda la superficie del departamento. *(Ver Mapa de Derechos de Uso de la Tierra)*

SUBSISTEMA ECONÓMICO

La información expresada en la cartografía es la que se obtuvo de las fichas técnicas de la Asociación de Municipios de Beni (AMDEBENI), y contiene información para evaluar el desarrollo social y económico del departamento hasta el año 2008.

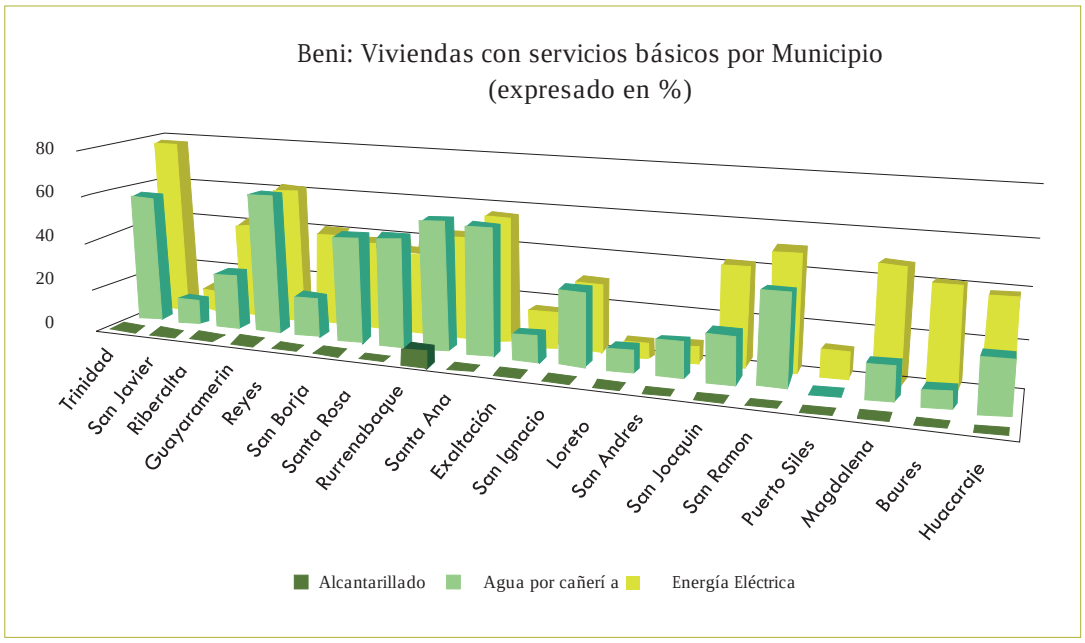
Infraestructura y servicios básicos

Aproximadamente un 50% de la población no tiene los servicios básicos, principalmente el de alcantarillado, que incluso en el municipio de Trinidad sólo llega al 10% de las viviendas.

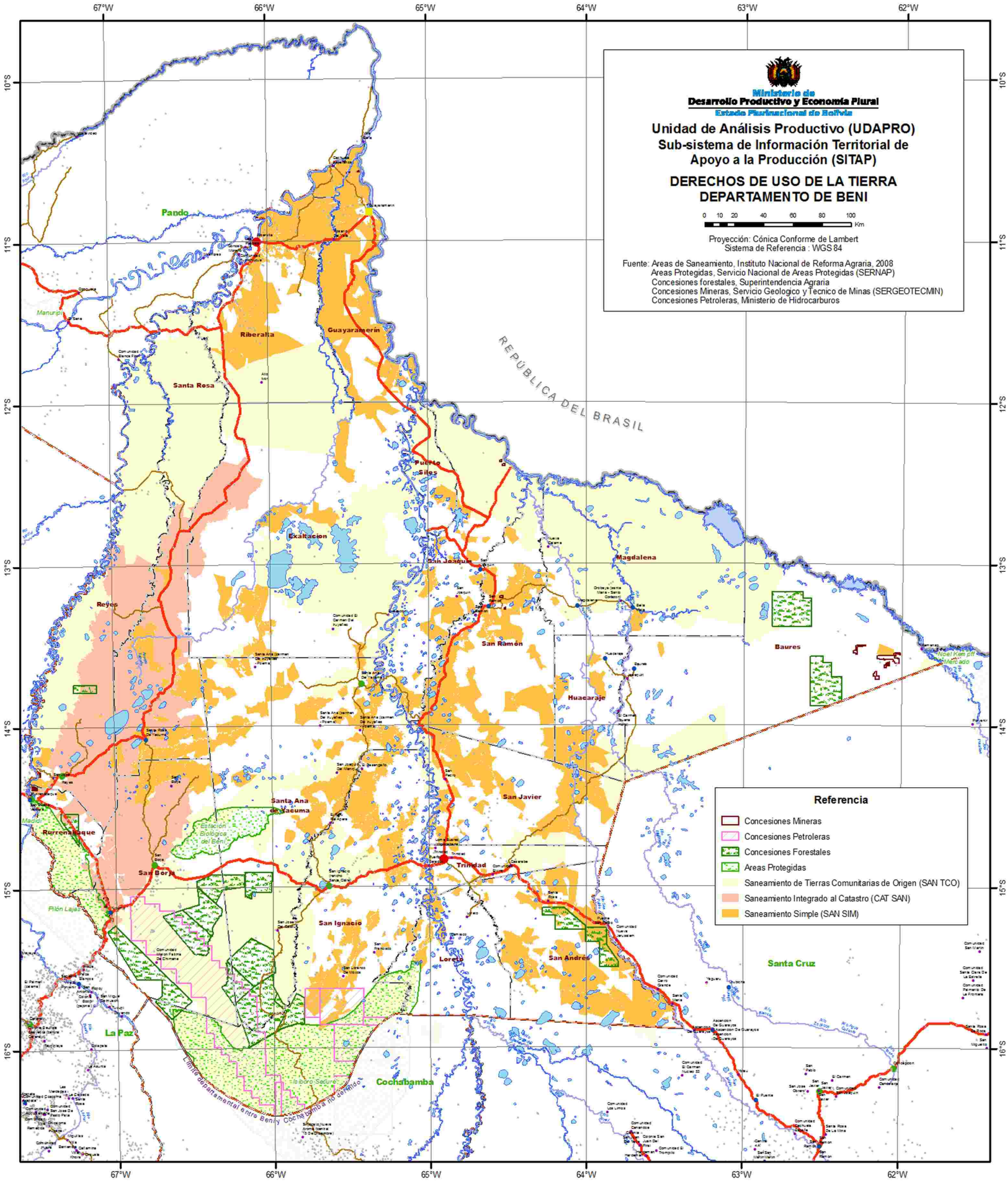
Respecto a la instalación de energía eléctrica y agua por cañería, únicamente los municipios de Trinidad, Guayaramerín y Santa Ana están por encima del 50%, lo que indica una gran deficiencia en el resto de los municipios.

Para mostrar de manera gráfica lo que ocurre en el departamento se elaboró el siguiente gráfico que muestra la capacidad de acceso a los servicios básicos por municipio, al año 2005:

Gráfico No. 32
Viviendas con Servicios Básicos



FUENTE: AMDEBENI



Mapa 106: Derechos de Uso de la Tierra

En la Referencia del mapa de infraestructura y servicios básicos se presenta con colores, los servicios que los municipios ofrecen. El servicio de agua potable está representado por una barra de color celeste, el servicio de energía eléctrica por una barra de color café, y el servicio de alcantarillado por una barra de color anaranjado. Las barras con los colores indicados están ubicadas en los municipios, el tamaño de las barras depende del número de las personas que acceden a estos servicios. Si no hay una o más barras, significa que hay carencia de ese servicio en el municipio, al lado derecho se observa una barra de color verde que representa el total de unidades de vivienda por municipio, el tamaño varía en forma proporcional de acuerdo a la cantidad de viviendas que tiene cada municipio. La leyenda del mapa tiene una referencia de color verde en forma de barra que relaciona la cantidad de viviendas con el tamaño de la barra. *(Ver Mapa de Servicios Básicos)*

La carencia de estos servicios hace que el departamento del Beni mantenga bajos sus niveles de desarrollo, tanto el índice de desarrollo humano (IDH) como el índice municipal de bienestar (IBM) que conservan a los municipios dentro las categorías de umbral de pobreza y pobreza marginal, algo que debe tomarse en cuenta, por tratarse de más del 90% de la población del departamento.

Desarrollo económico, sector primario, sector secundario y sector terciarios

El desarrollo económico del departamento del Beni se ha determinado en función de las actividades que se efectuan en cada municipio, separándolas en tres sectores principales que son: sector primario, sobretodo ganadería (producción sin transformación), sector secundario con la manufactura e industria, y el sector terciario de los servicios.

De este modo, se pudo apreciar que, con excepción de Trinidad, todos los otros municipios se dedican al sector primario sobre todo a la ganadería, agricultura y silvicultura. Sólo ocho municipios desarrollan actividades en el sector secundario, y el terciario está limitado a las principales ciudades del departamento (Trinidad, Guayaramerín, Riberalta, San Borja, Reyes y Rurrenabaque).

El mapa de desarrollo económico, sector primario, secundario y terciario, identifica las actividades productivas de los municipios. La fase primaria con color verde, la secundaria con color amarillo y el sector terciario con color rojo. En los municipios se observa la existencia o no de estos sectores productivos mediante barras con los colores mencionados. El tamaño de las barras significa la cantidad de personas por municipio que se dedica a estas actividades productivas en sus diferentes fases. *(Ver Mapa del Sector, primario, secundario y terciario)*

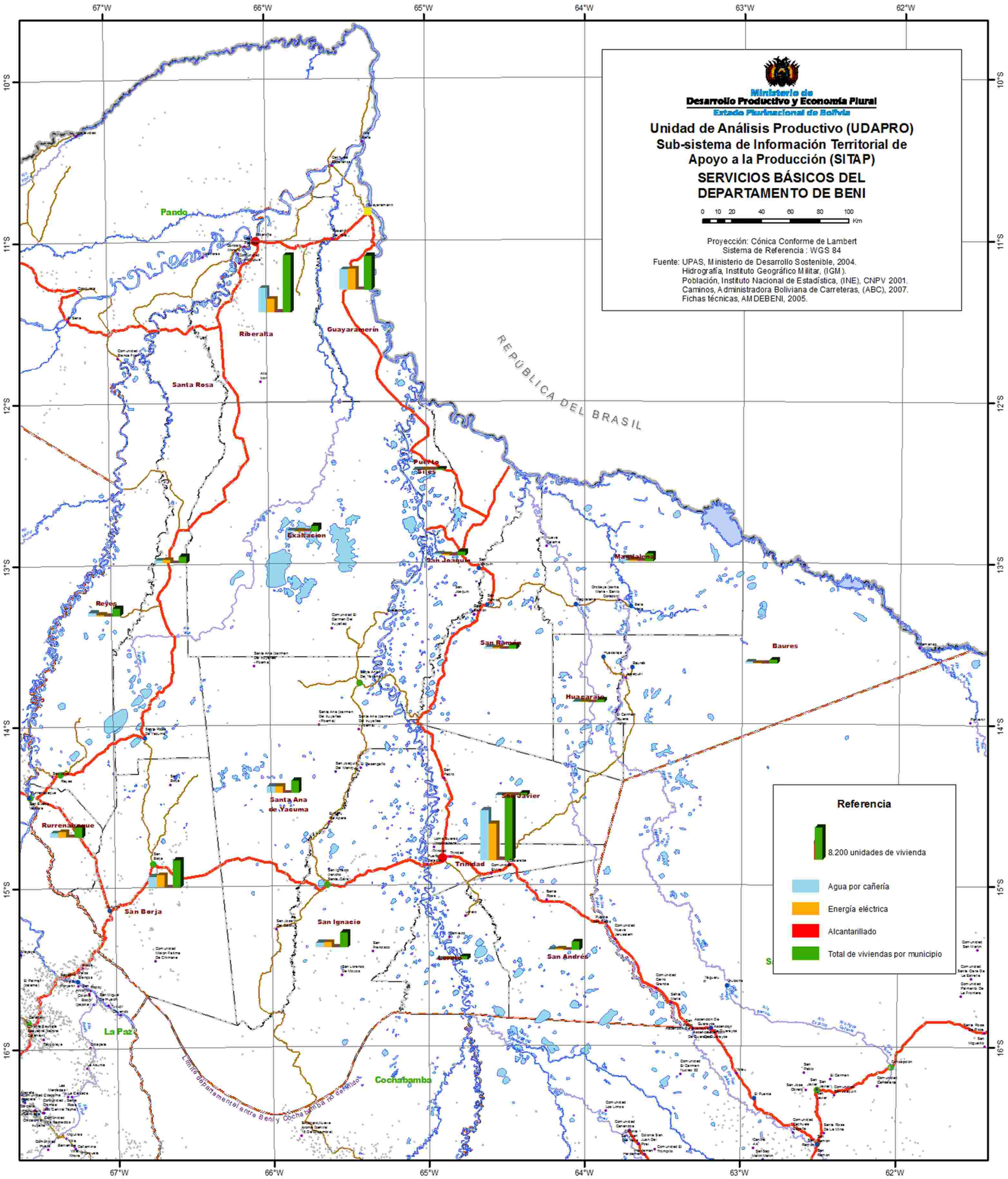
Actividades productivas

Se identificaron las principales actividades productivas del departamento por municipios y por sector: forestal, ganadería, agrícola, el turismo, la piscicultura, la industria y manufactura. Tomando en cuenta el número de municipios, se observa que si bien una de las principales actividades es la ganadería, un buen número de municipios se dedica también a las actividades forestales y agrícolas.

Es importante resaltar que el turismo es la mayor actividad desarrollada en el 84% de los municipios, lo cual convierte a este sector en un claro potencial de desarrollo para la región, por los varios atractivos que ofrece el departamento.

Otra actividad importante a considerar es la piscícola, debido a la característica hídrica y el número importante de lagunas y lagos que tiene el departamento. Así, se constituye en una actividad importante que es desarrollada actualmente por nueve de los 19 municipios.

El mapa de desarrollo económico, actividades productivas, identifica el rubro de las actividades productivas en los municipios. La actividad forestal está representada por el color verde, la agrícola con color café claro, la ganadera con color amarillo, la de turismo con color café claro, la piscícola con color celeste y la industria de manufactura con color café oscuro. En los municipios se observan unas barras con los colores antes descritos que representan la presencia o no de estos rubros productivos. El tamaño de las barras significa también la cantidad de personas por municipio que se dedica a estas actividades productivas, por rubro. Por ejemplo en el municipio de Baures sólo se observan actividades forestales y de turismo. *(Ver Mapa de Actividades Productivas)*



Mapa 107: Servicios Básicos

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)
DESARROLLO EOCNÓMICO
(Sector primario, Secundario y Terciario)
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100 Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), CNPV 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Datos ficha técnica, AMDEBENI, 2005.

Referencia
0,5
Sector primario
Sector secundario
Sector terciario

Mapa 108: Sector primario, secundario y terciario

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

ACTIVIDADES PRODUCTIVAS POR MUNICIPIO
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), CNPV 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Datos ficha técnica, AMDEBENI, 2005.

Referencia
0,5
Forestal
Agrícola
Ganadera
Turismo
Piscicola
Industria Manufacturera

Pando
Riberalta
Guayaramerin
Santa Rosa
Exaltacion
Puerto Siles
San Joaquin
San Ramón
Magdalena
Huacaraje
Baures
Reyes
Santa Ana de Yacuma
Rurrenabaque
San Javier
Trinidad
San Borja
San Ignacio
Loreto
San Andrés
Santa Cruz
La Paz
Cochabamba
REPÚBLICA DEL BRASIL
Límite departamental entre Beni y Cochabamba no definido

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Mapa 109: Actividades Productivas

POTENCIALIDADES PRODUCTIVAS DEL DEPARTAMENTO DEL BENI

Tipos de uso de la tierra, correspondencia del uso actual y la aptitud de uso del suelo

El mapa de identificación del Tipo de Uso de la Tierra (TUT), que fue elaborado realizando una intersección entre el mapa de aptitud máxima de uso del suelo y el mapa de correspondencia de uso actual del suelo, descrito anteriormente.

El objetivo de la sobreposición fue encontrar un mapa que visualice las áreas con una aptitud máxima de uso de suelo, y si actualmente se encuentra en correspondencia con su uso. Para ello, se ha clasificado en función al grado de correspondencia que presenten (alto, medio, bajo y sin correspondencia a su aptitud).

Es así que se observa, que de manera general existe un buen porcentaje de uso que no corresponde con su aptitud, lo cual significa que las actividades productivas que se están desarrollando en estas áreas se encuentran generando o podrán generar un deterioro ambiental acelerado, limitando su sostenibilidad en el tiempo.

Una vez identificadas las áreas que tienen correspondencia con su aptitud de uso de suelo, se procedió a clasificar esta correspondencia, diferenciando tres tipos: Correspondencia alta, media y baja.

El mapa identifica a 17 tipos de uso de la tierra con diferentes colores. Sobresalen las zonas con uso ganadero en correspondencia con su aptitud, representadas en el mapa por un color amarillo. Las zonas con uso forestal con correspondencia a su aptitud de uso, representado en el mapa con un color verde oscuro. También resaltan las zonas sin correspondencia entre el uso actual y la aptitud de uso, representadas en el mapa con un color café. El resto del departamento tiene zonas de diferentes colores que representan tipos de uso de la tierra. *(Ver Tipos de Uso de la Tierra)*

Unidades Básicas de Análisis (UBA)

Sobre los mapas anteriores se identificaron las Unidades Básicas de Análisis. Éste mapa se utilizó como base para la espacialización de áreas potenciales productivas y la construcción del mapa de potencialidades productivas del departamento.
Para identificar la UBA, se descartaron todas aquellas unidades de tipo de uso de la tierra (TUT) cuya correspondencia sea baja o no presente ninguna correspondencia en su uso. Así, se puede observar que sobresalen las áreas con actividad ganadera y forestal con correspondencias alta y media, esto direcciona al uso potencial mayor sobre estas actividades para el departamento.

Mapa identifica a 16 unidades básicas de análisis sostenibles, clasificadas de acuerdo a su correspondencia en: alta, media, baja y sin correspondencia. 16 UBAS están representadas en el mapa con diferentes colores, sobresalen las zonas con uso forestal representadas en el mapa con color verde claro. Las zonas de uso ganadero, representadas por un color verde-claro, las zonas sin correspondencia, o UBAS no sostenibles, no están representadas en el mapa, por eso se tienen extensas zonas de color blanco. El resto del departamento está representado con zonas de diferentes colores que representan a una UBA diferente. *(Ver Mapa de UBA)*

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

TIPOS DE USO DE LA TIERRA DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Tipos de Uso de la Tierra, Elaboración propia, (SITAP), 2009.

Referencia

- Protección con correspondencia a su aptitud
- Protección sin correspondencia a su aptitud
- Ganadero uso limitado con correspondencia a su aptitud
- Ganadero uso limitado sin correspondencia a su aptitud
- Forestal uso limitado con correspondencia a su aptitud
- Forestal uso limitado sin correspondencia a su aptitud
- Ganadera con correspondencia a su aptitud
- Ganadera sin correspondencia a su aptitud
- Forestal con correspondencia a su aptitud
- Forestal sin correspondencia a su aptitud
- Agroforestal con correspondencia a su aptitud
- Agroforestal sin correspondencia a su aptitud
- Silvopastoril con correspondencia a su aptitud
- Silvopastoril sin correspondencia a su aptitud
- Agrosilvopastotil con correspondencia a su aptitud
- Agrosilvopastotil sin correspondencia a su aptitud
- Cuerpo de agua

Mapa 110: Tipos de Uso de la Tierra

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

UNIDAD BÁSICA DE ANÁLISIS
DEPARTAMENTO DE BENI

0 10 20 40 60 80 100
Km

Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Unidades Básicas de Análisis, Elaboración propia, (SITAP), 2009.

Referencia

- Protección con correspondencia alta
- Ganadera con correspondencia alta
- Forestal con correspondencia alta
- Protección con correspondencia media
- Ganadera uso limitado con correspondencia media
- Forestal uso limitado con correspondencia media
- Forestal con correspondencia media
- Silvopastoril con correspondencia media
- Protección con correspondencia baja
- Ganadera uso limitado con correspondencia baja
- Forestal uso limitado con correspondencia baja
- Ganadera con correspondencia baja
- Silvopastoril con correspondencia baja
- Agrosilvopastoril con correspondencia baja
- Agrosilvopastoril con correspondencia baja
- Cuerpo de agua

Pando
Riberalta
Guayaramerin
Santa Rosa
REPÚBLICA DEL BRASIL
Puerto Siles
Exaltacion
San Joaquin
Magdalena
Reyes
San Ramón
Baures
Huacaraje
Santa Ana de Yacuma
San Javier
Rurrenabaque
San Borja
Trinidad
San Ignacio
Loreto
San Andrés
La Paz
Cochabamba
Límite departamental entre Beni y Cochabamba río derrame

67°W 66°W 65°W 64°W 63°W 62°W
10°S 11°S 12°S 13°S 14°S 15°S 16°S

Mapa 111: Unidades Básicas de Análisis (UBA)

Descripción de las potencialidades productivas

Para hallar la potencialidad productiva del departamento de Beni, se cruzó la información de suelos (elemento indispensable para encontrar la potencialidad de cada producto), con las unidades básicas de análisis (UBA), haciendo hincapié en las especies que caracterizan a la región. Como se describió en la metodología, en la primera parte se utilizaron los esquemas de decisión y los criterios y subcriterios para mostrar las potencialidades productivas. El subsistema económico identificó las principales actividades productivas como ser: la explotación de castaña, cacao, goma, ganadería, productos maderables, diferentes palmas, piscícolas e incluso áreas de protección cuyo principal potencial es el ecoturismo.

Otro aspecto importante a ser considerado en la potencialidad productiva es la superficie identificada, la cual dará el marco de referencia que debe seguir el departamento para lograr un desarrollo sostenible. Obsérvese en el cuadro siguiente los valores alcanzados:

Cuadro Nº 35
Áreas de las Potencialidades Productivas

Descripción de productos aptos	Superficie en ha
Ganado vacuno apto, (productos cárnicos) limitante fragilidad de suelo	282.625
Ganado vacuno apto, (productos cárnicos) limitante inundación estacional	2.787.904
Forestal apto, madera	1.575.601
Forestal apto, castaña	286.282
Ganado vacuno medianamente apto (productos cárnicos)	319.396
Ganado vacuno uso limitado medianamente apta, (productos cárnicos)	1.344.591
Forestal uso limitado medianamente apto	3.054.001
Cuerpo de agua apto, piscícola, quelonios y saurios	465.503
Sin potencial productivo (aptitud marginal para actividades de ganadería y agricultura; áreas de protección)	10.290.666

FUENTE: PROPIA - SITAP

En el mapa los colores verde y amarillo, representan los productos que más áreas tienen y que pueden ser aprovechados logrando sostenibilidad; ellos son la ganadería y la forestería de productos maderables y no maderables.

El área del mapa que tiene tonalidad gris es la zona que no tiene potencialidad moderada para cualquier actividad, o se trata simplemente de áreas de protección, las cuales deben ser destinadas a actividades de recreación.

El mapa identifica a diez tipos de potencialidades productivas. Sobresale una extensa zona sin potencial productivo debido a la no correspondencia entre el uso actual y la aptitud de uso de la tierra. En esta zona se pueden efectuar, marginalmente, actividades de ganadería y actividades agrícolas en pequeña escala que están señaladas con un color plomo. El potencial para productos cárnicos, lácteos y cuero vacuno está representado en el mapa por un color amarillo-claro. El potencial para madera y castaña está señalado con un color verde y café-oscuro, respectivamente. El resto del departamento está representado con zonas de distintos colores que representan potencialidades productivas diferentes. *(Ver Mapa de Potencialidad Productiva del Beni)*

CONSIDERACIONES FINALES

De acuerdo a los resultados alcanzados, es importante tomar en cuenta las siguientes consideraciones:

- Las zonas definidas en el Plan de Uso del Suelo del departamento del Beni, que tienen categoría de ganadería uso limitado, están ubicadas en áreas donde la aptitud para las actividades de ganadería y agricultura son de tipo marginal, lo cual originaría una degradación más rápida de sus suelos.

- Se tiene un gran potencial para las actividades piscícolas, crianza de saurios y quelonios, lo cual debe ser aprovechado para satisfacer la demanda del mercado local y nacional.

- En las tierras con potencial para la ganadería vacuna, se debe cultivar y sembrar pastos para un manejo adecuado del ganado. De esta manera, incrementar la producción de carne, cuero, leche y otros productos.

- Gran parte de la superficie del Beni se muestra como zona sin potencial productivo debido a que la aptitud que se tiene es la más baja (marginal), sobre todo en actividades de ganadería y agricultura. Por ello, estas áreas deben ser destinadas como zonas de protección y regeneración de la vegetación, o ser muy poco utilizadas para actividades ganaderas y agrícolas, pero con manejos adecuados.

- Se debe establecer un control en la utilización y extracción de los recursos forestales, ya que estos sirven de cordón protector ante las descargas de agua que provienen de las cuencas altas, al Sur del departamento.

Ministerio de
Desarrollo Productivo y Economía Plural
Estado Plurinacional de Bolivia

Unidad de Análisis Productivo (UDAPRO)
Sub-sistema de Información Territorial de Apoyo a la Producción (SITAP)

POTENCIALIDADES PRODUCTIVAS DEPARTAMENTO DE BENI

0 10 20 40 60 80 100 Km

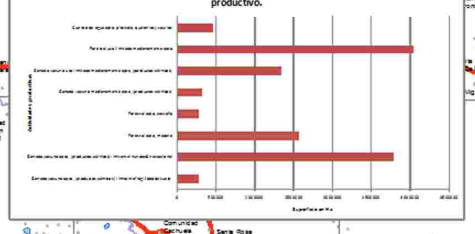
Proyección: Cónica Conforme de Lambert
Sistema de Referencia : WGS 84

Fuente: UPAS, Ministerio de Desarrollo Sostenible, 2004.
Hidrografía, Instituto Geográfico Militar, (IGM).
Población, Instituto Nacional de Estadística, (INE), 2001.
Caminos, Administradora Boliviana de Carreteras, (ABC), 2007.
Potencial Productivo, elaboración propia, (SITAP), 2009.

Referencia

- Sin potencial productivo (unidades sin correspondencia entre su uso actual y su aptitud)
- Sin potencial productivo (unidades de protección)
- Ganado vacuno apto, (productos cárnicos) limitante fragilidad de suelo
- Ganado vacuno apto, (productos cárnicos) limitante inundación estacional
- Forestal apto, madera
- Forestal apto, castaña
- Ganado vacuno medianamente apta, (productos cárnicos)
- Ganado vacuno uso limitado medianamente apta, (porductos cárnicos)
- Forestal uso limitado medianamente apto, madera
- Cuerpo de agua apto, piscicola, quelonios y saurios

Cuadrode actividades productivas del departamento de Beni, según su potencial productivo.



Mapa 112: Potencialidad Productiva *(Mapa de uso referencial, sin controles de campo)*

Appendix 2. IUCN Red List Information on Threatened and Endangered Species

Amburana cearensis

NOT EVALUATED NE | DATA DEFICIENT DD | LEAST CONCERN LC | NEAR THREATENED NT | VULNERABLE VU | ENDANGERED EN | CRITICALLY ENDANGERED CR | EXTINCT IN THE WILD EW | EXTINCT EX

Summary | Classification Schemes | Images & External Links | Bibliography | **Full Account**

Taxonomy [top]

Kingdom	Phylum	Class	Order	Family
PLANTAE	TRACHEOPHYTA	MAGNOLIOPSIDA	FABALES	LEGUMINOSAE

Scientific Name:	*Amburana cearensis*
Species Authority:	(Fr. Allem.) A.C. Smith
Common Name/s:	Spanish – Umburana Do Cheiro

Assessment Information [top]

Red List Category & Criteria:	Endangered A1acd+2cd ver 2.3
Year Assessed:	1998
Annotations:	Needs updating
Assessor/s:	Americas Regional Workshop (Conservation & Sustainable Management of Trees, Costa Rica, November 1996)

Geographic Range [top]

Range Description:	A frequent tree of caatinga, occasional in the Andes, becoming rarer further south into Argentina.
Countries:	**Native:** Argentina; Bolivia; Brazil; Paraguay; Peru

Population [top]

Population:	All stands of large trees are being or have been destroyed. Regeneration appears to be poor where adequate management is not in place.

Habitat and Ecology [top]

Habitat and Ecology:	Catinga habitat and deciduous forest.
Systems:	Terrestrial

Threats [top]

Major Threat(s):	All stands of large trees are being or have been destroyed, previously through mahogany logging and now through selective logging.
List of Threats:	2 Agriculture & aquaculture 2.3 Livestock farming & ranching 2.3.4 Scale Unknown/Unrecorded 5 Biological resource use 5.3 Logging & wood harvesting 5.3.5 Motivation Unknown/Unrecorded

Conservation Actions [top]

Conservation	Small trees grow around granite outcrops where they are safe from commercial

Actions:	exploitation.

Bibliography [top]

Centro de Datos para la Conservación. 1986. *Lista Preliminar de Plantas Especiales*. Centro de Datos para la Conservación, Limón, Peru.

Chudnoff, M. 1984. *Tropical Timbers of the World*. Forest Products Laboratory Madison, United States Department of Agriculture, Wisconsin.

Halloy, S. 1994. Annotations to the Argentina WCMC printout dated 17 Jan 1994 (unpublished).

Killeen, T. 1997. Comments on the species summaries for Bolivia.

López, J. and Little, E.L. 1987. *Arboles Communes del Paraguay*. Peace Corps, Washington DC.

Oldfield, S., Lusty, C. and MacKinven, A. (compilers). 1998. *The World List of Threatened Trees*. World Conservation Press, Cambridge, UK.

Prado, D.E. 1996. Completed data collection forms for trees of Argentina and neighbouring countries.

Prado, D.E. and Gibbs, P.E. 1993. Patterns of species distributions in the dry seasonal forests of South America. *Annals of the Missouri Botanic Garden* 80(4): 902-927.

WCMC. (comp.) 1996. Report of the Second Regional Workshop, held at CATIE, Turrialba, Costa Rica, 18-20 November 1996. Conservation and Sustainable Management of Trees project (unpublished).

Cedrela odorata

NOT EVALUATED NE | DATA DEFICIENT DD | LEAST CONCERN LC | NEAR THREATENED NT | VULNERABLE VU | ENDANGERED EN | CRITICALLY ENDANGERED CR | EXTINCT IN THE WILD EW | EXTINCT EX

Summary | Classification Schemes | Images & External Links | Bibliography | **Full Account**

Taxonomy [top]

Kingdom	Phylum	Class	Order	Family
PLANTAE	TRACHEOPHYTA	MAGNOLIOPSIDA	SAPINDALES	MELIACEAE

Scientific Name:	*Cedrela odorata*
Species Authority:	L.
Common Name/s:	English – Cigar-box Wood, Red Cedar, Spanish Cedar French – Acajou-bois, Acajou Rouge, Cedrat Spanish – Cedro Rojo

Assessment Information [top]

Red List Category & Criteria:	Vulnerable A1cd+2cd ver 2.3
Year Assessed:	1998
Annotations:	Needs updating
Assessor/s:	Americas Regional Workshop (Conservation & Sustainable Management of Trees, Costa Rica, November 1996)
History:	1997 – Not Threatened (Walter and Gillett 1998)

Geographic Range [top]

Range Description:	Large individuals have become scarce, especially in Amazonia.
Countries:	**Native:** Antigua and Barbuda; Argentina; Barbados; Belize; Bolivia; Brazil; Cayman Islands; Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; French Guiana; Grenada; Guadeloupe; Guatemala; Guyana; Haiti; Honduras; Jamaica; Mexico (Quintana Roo); Montserrat; Nicaragua; Panama; Peru; Saint Kitts and Nevis; Saint Lucia; Suriname; Venezuela

Habitat and Ecology [top]

Habitat and Ecology:	One of the world's most important timber species. It occurs in humid or dry lowland forest, preferring well-drained soils.
Systems:	Terrestrial

Threats [top]

Major Threat(s):	Exploitation has continued on a large scale over the past 200 years and the species is now widely threatened at the provenance level. Trees are often cut opportunistically while other species, such as mahogany, *Amburana* and *Machaerium*, are being sought-after. Natural regeneration is generally good, but there are reports of trees being felled before they reach maturity.
List of Threats:	5 Biological resource use 5.3 Logging & wood harvesting 5.3.5 Motivation Unknown/Unrecorded

Conservation Actions [top]

Conservation	Subpopulations are protected within national parks and agricultural landscapes. Attempts

Actions:	are being made to establish plantations throughout the tropics.

Bibliography [top]

Asociación Nacional para la Conservación de la Naturaleza. 1990. List of threatened and vulnerable plants of Panama (unpublished).

Centro de Datos para la Conservación-CDC-CVC. 1980. Lista preliminar de plantas especiales del Centro de Datos para la conservación, CDC-CVC (unpublished).

D'Arcy, W.G. 1987. Flora of Panama: checklist and index. *Monographs in Systematic Botany* 17: 1-1000.

Erfurth, T. and Rusche, H. 1976. The marketing of tropical wood. FAO, Rome.

FAO Forestry Department. 1986. Databook on endangered tree and shrub species and their provenances. FAO, Rome.

García, R.D. and Olmsted, I. 1987. Listado florístico de la Reserva Sian Ka'an. Puerto Morelos, Quintana Roo, Mexico.

Howard, R.A. (ed.) 1974. *Flora of the Lesser Antilles; Leeward and Windward Islands*. Arnold Arboretum, Jamaica Plain, Mass. 6 vols, 1974-1989.

Howard, R.A. Ferns and flowering plants of Montserrat (unpublished).

Jiménez, J. 1978. Lista tentativa de plantas de la República Dominicana que deben protegerse para evitar su extinción. Coloquio Internacional sobre la practica de la conservación, Santo Domingo. CIBIMA/UASD.

Killeen, T. 1997. Comments on the species summaries for Bolivia.

Oldfield, S., Lusty, C. and MacKinven, A. (compilers). 1998. *The World List of Threatened Trees*. World Conservation Press, Cambridge, UK.

Pennington, T.D. 1981. *Flora Neotropica: Meliaceae*. Monograph 28. New York Botanical Garden, New York.

Proctor, G.R. 1984. *Flora of the Cayman Islands*. Royal Botanic Gardens, Kew: London, HMSO.

Reynel, C. and Pennington, T. 1989. Reporte sobre los cedros y su situación en el Perú, una contribucción al conocimiento y la conservación de las Meliáceas peruanas. Universidad Nacional Agaria La Molina, Centro de Datos Para la Conservación Perú, Lima.

WCMC. (comp.) 1996. Report of the Second Regional Workshop, held at CATIE, Turrialba, Costa Rica, 18-20 November 1996. Conservation and Sustainable Management of Trees project (unpublished).

Bertholletia excelsa

NOT EVALUATED NE | DATA DEFICIENT DD | LEAST CONCERN LC | NEAR THREATENED NT | VULNERABLE VU | ENDANGERED EN | CRITICALLY ENDANGERED CR | EXTINCT IN THE WILD EW | EXTINCT EX

Summary | Classification Schemes | Images & External Links | Bibliography | **Full Account**

Taxonomy [top]

Kingdom	Phylum	Class	Order	Family
PLANTAE	TRACHEOPHYTA	MAGNOLIOPSIDA	LECYTHIDALES	LECYTHIDACEAE

Scientific Name:	*Bertholletia excelsa*
Species Authority:	H. & B.
Common Name/s:	English – Brazil-nut Tree, Para Nut French – Noix Du Brésil Spanish – Turury

Assessment Information [top]

Red List Category & Criteria:	Vulnerable A1acd+2cd ver 2.3
Year Assessed:	1998
Annotations:	Needs updating
Assessor/s:	Americas Regional Workshop (Conservation & Sustainable Management of Trees, Costa Rica, November 1996)

Geographic Range [top]

Range Description:	Large natural stands still exist in northern Bolivia and the species is locally abundant in Suriname.
Countries:	**Native:** Bolivia; Brazil (Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia); Colombia; French Guiana; Guyana; Peru; Suriname; Venezuela

Habitat and Ecology [top]

Habitat and Ecology:	A widely occurring emergent of the Amazonian forest.
Systems:	Terrestrial

Threats [top]

Major Threat(s):	The Brazil nut tree has experienced major declines in its population because of deforestation. One of the greatest concentrations of trees exists in Tocantins valley where various activities, from the construction of the trans-amazon railway to the building of a reservoir, have brought about a shrinking in the gene pool. An area of 200,000 ha in south Pará has been purchased by the government with the aim of settling landless farmers. Trees remaining in the vast cattle ranches of Pará and Acre are neglected and dying. The production of Brazil nuts more than halved between 1970 and 1980, apparently because of deforestation. Almost all Brazil nuts consumed around the world still come from wild trees. Little is known about the impact of seed gathering on regeneration, but it clearly can be detrimental under some regimes where agoutis, the natural disperser of the Brazil nut, are hunted or chased away.
List of Threats:	1 Residential & commercial development 1.1 Housing & urban areas 5 Biological resource use 5.3 Logging & wood harvesting 5.3.5 Motivation Unknown/Unrecorded 7 Natural system modifications

	7.1 Fire & fire suppression 7.1.3 Trend Unknown/Unrecorded

Conservation Actions [top]

Conservation Actions:	There are various subpopulations in protected areas and on protected corporate properties. There have been relatively few successes at establishing plantations. The sustainable harvesting of nuts by indigenous people in extractive forest reserves offers the most promising protection for the remaining natural stands.

Bibliography [top]

Chudnoff, M. 1984. *Tropical Timbers of the World*. Forest Products Laboratory Madison, United States Department of Agriculture, Wisconsin.

Clement, C.R. 1991. Amazonian fruits: a neglected and threatened, but potentially rich resource. *Diversity Magazine*

FAO Forestry Department. 1986. Databook on endangered tree and shrub species and their provenances. FAO, Rome.

IBAMA. 1992. Lista oficial de espécies da flora Brasileira ameaçadas de extinçao (unpublished).

Killeen, T. 1997. Comments on the species summaries for Bolivia.

Mori, S.A., Prance, G.T. and Zeeuw. C. 1990. *Flora Neotropica: Lecythidaceae - Part II: The zygomorphic-flowered New World genera (*Couroupita, Corythophora, Bertholletia, Couratari, Eschweilera, *and* Lecythis*)*. Monograph 21(II). Royal Botanic Gardens, Kew.

Oldfield, S., Lusty, C. and MacKinven, A. (compilers). 1998. *The World List of Threatened Trees*. World Conservation Press, Cambridge, UK.

Smith, N.J.H., Williams, J.T., Plucknett, D.L. and Talbot, J.P. 1992. *Tropical forests and their crops.* Cornell University, USA.

Van Roosmalen, M.G.M. 1985. Fruits of the Guianan Flora. Institute of Systematic Botany, Utrecht and Silvicultural Dept of Wageningen Agricultural University, Wageningen.

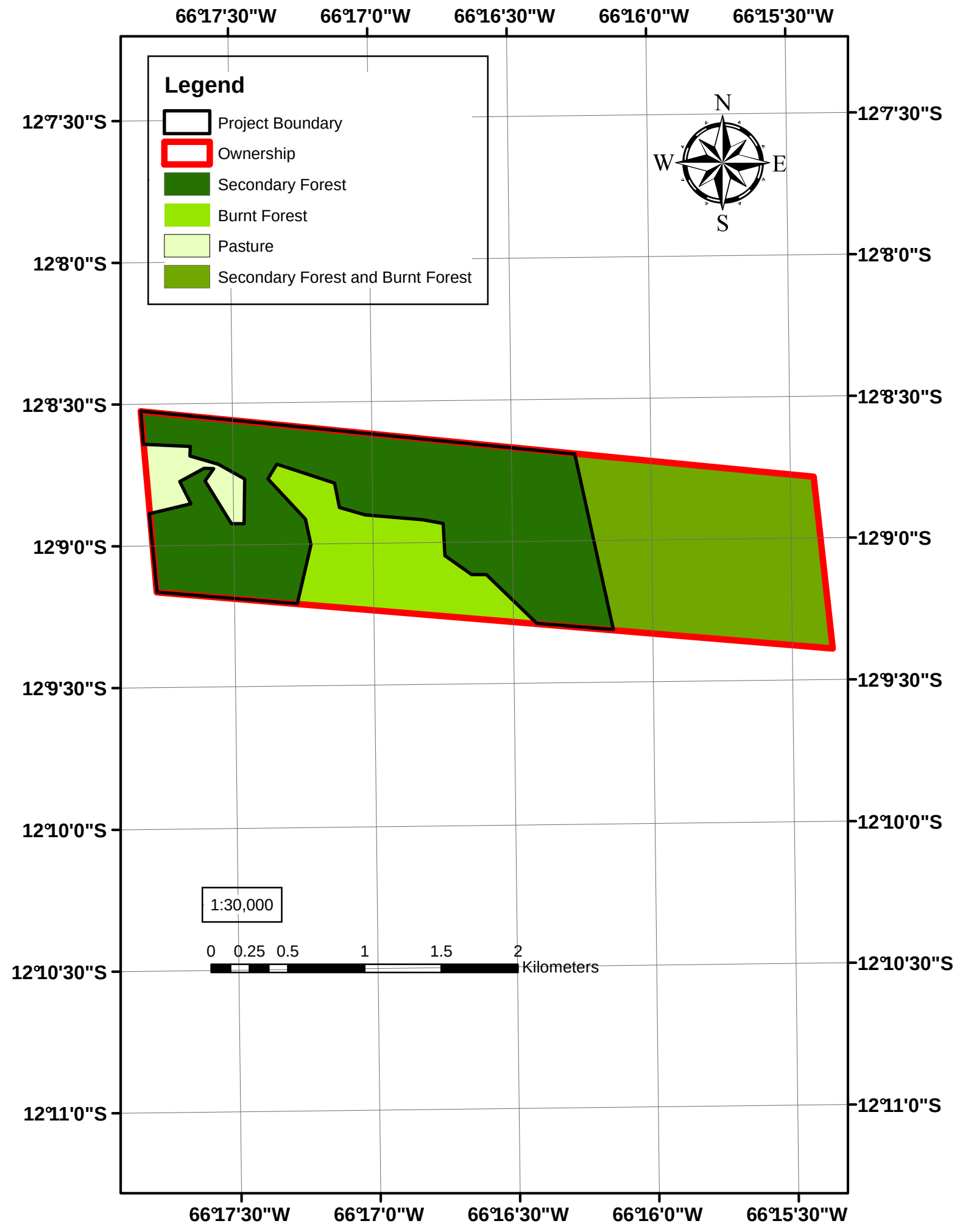
WCMC. (comp.) 1996. Report of the Second Regional Workshop, held at CATIE, Turrialba, Costa Rica, 18-20 November 1996. Conservation and Sustainable Management of Trees project (unpublished).

Werkhoven, M.C.M. 1997. Threatened trees of Suriname. A list compiled for the WCMC/SSC Conservation and Sustainable Management of Trees Project (unpublished).

Wickens, G.E. 1995. *Edible nuts*. Non-wood Forest Products 5. Food and Agriculture Organization of the United Nations.

Citation: Americas Regional Workshop (Conservation & Sustainable Management of Trees, Costa Rica) 1998. *Bertholletia excelsa*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on **27 December 2011**.

Appendix 3. Strata for Instance 1


66°17'30"W
66°17'0"W
66°16'30"W
66°16'0"W
66°15'30"W
12°7'30"S
12°8'0"S
12°8'30"S
12°9'0"S
12°9'30"S
12°10'0"S
12°10'30"S
12°11'0"S
Legend
Project Boundary
Ownership
Secondary Forest
Burnt Forest
Pasture
Secondary Forest and Burnt Forest
N
W
E
S
1:30,000
0 0.25 0.5 1 1.5 2
Kilometers