This report was produced with the aim to identify High Conservation Value (HCVA) within the context of certification of the Madeireira Vale Verde Ltda (MVV), already accredited by the Forest Stewardship Council (FSC), with register numbers GFA-FM/COC-001250 and GFA-COC-001483, both from 2008. The FSC itself contains a series of requirements that have already been successfully achieved by the company, thus it is not the aim of this report to investigate these same requirements beyond the scope of the HCVA beside those which already have a natural overlap.
Projeto Puma’s environmental management program
High Conservation Value Area (HCVA) assessment report

of
Fazenda Mundo Novo, Roraima, Brazil
Madeireira Vale Verde Ltd. (MVV), Malrimalrii Florestal Lnda/GreenWood Limited

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“For if there are out there (in the Amazon) big tree-dwelling, ground-dwelling and even aquatic mammals not known to science - a dwarf tapir, a giant peccary, a white deer, a dwarf manatee, another river dolphin, to name a few - what do we really know about its flora and fauna? Very little. About its ecology - the utterly complex web of relationships between plants and animals? Even less. Then what do we know about the sustainability of this ecosystem?” Marc G.M. van Roosmalen, Ph.D.
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Abbreviations

CI – Conservation International
CONAMA – National Council of Environment
ESEC – Ecologic Station
FEMACT/RR - Fundação Estadual do Meio Ambiente, Ciência e Tecnologia de Roraima (State Foundation for Environment, Science and Technology of Roraima)
FFI – Flora and Fauna Internacional
FMU – Forest Management Unit
FUNAI - Fundação Nacional do Índio (National Indian Foundation)
GIS – Geographic Information System
GPS – Global Position System
HCV – High Conservation Value
HCVA – High Conservation Value Area
HCVMA – High Conservation Value Management Area
IBAMA – Instituto Brasileiro de Meio Ambiente (Brazilian Institute of Environment)
ICMBIO - Instituto Chico Mendes de Conservação da Biodiversidade (Chico Mendes Institute for Conservation of Environment)
INCRA - Instituto Nacional de Colonização e Reforma Agrária (National Institute for Colonization and Rural Reform)
INPA – Instituto Nacional de Pesquisas da Amazônia (National Institute of Amazonian Research)
INPE – Instituto Nacional de Pesquisas Espaciais (National Institute of Space Research)
IUCN – União Mundial para Conservação da Natureza (International Union for Conservation of Nature)
MMV - Madeireira Vale Verde Ltda
PARNA – National Park
RR – Roraima State
SEAAB/RR – Secretary of Agriculture and Supplying of Roraima
SEPLAN – Secretary of Planning
SNUC – National System of Conservation Units
TI – Indigenous Land
TNC – The Nature Conservancy
UC – Conservation Unit
UFAM - Federal University of Amazons
WWF – World Wildlife Fund
ZEE – Economic and Ecological Zonation of Roraima
Executive summary

This summary details the main results of the High Conservation Value assessment (HCV) conducted by Projeto Puma in the Forest Management Unit (FMU) Fazenda Mundo Novo, as a partial requirement for continuity of FSC certification.

The FMU belongs to Madeireira Vale Verde (MVV), located at the municipality of Caracaraí, State of Roraima, and extending for 17,205.4 hectares.

In this summary the High Conservation Values (HCVs) are indicate, as well as High Conservation Value Areas or Forests (HCVA or HCVF), and the High Conservation Value Management Areas (HCVMA) which have been identified in the FMU.

<table>
<thead>
<tr>
<th>Value</th>
<th>Present</th>
<th>Absent</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV 1 Areas containing globally, regionally or nationally significant concentrations of biodiversity values</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCV1.1 Protected Areas</td>
<td></td>
<td>●</td>
<td>It does not overlay protected areas nor has a critical role for them</td>
</tr>
<tr>
<td>HCV1.2 Threatened and endangered species</td>
<td>●</td>
<td></td>
<td>It is habitat for endangered species</td>
</tr>
<tr>
<td>HCV1.3 Endemic species</td>
<td></td>
<td>●</td>
<td>Endemic species not identified</td>
</tr>
<tr>
<td>HCV1.4 Critical temporal use</td>
<td></td>
<td>●</td>
<td>The Brazil-nut tree is a key and abundant food resource for several species</td>
</tr>
<tr>
<td>HCV2 Globally, regionally or nationally significant large landscape-level areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCV2.1 The area is a large landscape-level forest</td>
<td></td>
<td>●</td>
<td>The forest is relatively small in the Amazonian context</td>
</tr>
<tr>
<td>HCV2.2 The area is an integral part of a large landscape-level forest</td>
<td></td>
<td>●</td>
<td>The landscape is important for biodiversity, but suffers anthropic pressure; protected areas already cover 68% of the State of Roraima</td>
</tr>
<tr>
<td>HCV2.3 The area maintains viable populations of most naturally occurring species</td>
<td></td>
<td>●</td>
<td>The forest maintain populations of mammals up to medium size with estimated viability of 100 years (n=50), but not for longer periods, and also not for species with large area requirements</td>
</tr>
<tr>
<td>HCV3 Areas that are in or contain rare, threatened or endangered ecosystems</td>
<td></td>
<td></td>
<td>The ecosystems in which the forest is embedded have wide distribution in the Amazonian drainage and in the Guiana</td>
</tr>
<tr>
<td>HCV4 Areas that provide basic ecosystem services in critical situations</td>
<td></td>
<td></td>
<td>The forest has a 11km margin along the Rio Branco river that, if removed, could reduce the quality of the water</td>
</tr>
</tbody>
</table>
HCV4.2 Forests critical to erosion control

- There is no risk of severe erosion with catastrophic effect

HCV4.3 Forests providing barriers to destructive fire

- The area is embedded within an extensive forested matrix that can act as a barrier for fire

HCV5 Areas fundamental to meeting basic needs of local communities

- Local communities utilize resources from their own areas; the forest is not located next to indigenous or traditional communities

HCV6 Areas critical to local communities’ traditional cultural identity

- There are not traditional communities in the surrounding area

The entire FMU was considered a HCVA, taking into account the widely distributed HCVs 1.2 and 1.4 in the forest. It is considered that the maintenance of the HCV 1.2 is less dependent on the management of selective logging (as it is currently conducted), than on the control of environmental impoverishment that is taking place at the surrounding area and invasions for poaching. For this reason it has turned out necessary to recommend a High Conservation Management Area (HCMA) on the terrestrial surroundings of the FMU (5 km radius) and in the Rio Branco (the wide river in front of the FMU), additionally to the hilltops and *igara'pé* HCMAs within the FMU. The area of each block is specified at the table below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Area ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCVA FMU</td>
<td>17,205.40</td>
</tr>
<tr>
<td>HCVA Threatened species (HCV 1.2) = FMU area</td>
<td>17,205.40</td>
</tr>
<tr>
<td>HCVA Brazil-nut (HCV 1.4) = non-flooded forest area</td>
<td>13,805.34</td>
</tr>
<tr>
<td>HCVA Alluvial forest of Rio Branco (HCV 4.1)</td>
<td>605.00</td>
</tr>
<tr>
<td>HCVA Rio Branco</td>
<td>319.00</td>
</tr>
<tr>
<td>HCVMA Surroundings</td>
<td>35,442.00</td>
</tr>
<tr>
<td>HCVMA Campinarana and Hills</td>
<td>1,463.00</td>
</tr>
<tr>
<td>HCVMA <em>Igarapés</em></td>
<td>569.00</td>
</tr>
<tr>
<td>Total HCVA</td>
<td><strong>17,205.40</strong></td>
</tr>
<tr>
<td>Total HCVMA</td>
<td><strong>37,793.00</strong></td>
</tr>
</tbody>
</table>

**High Conservation Value Management Areas (HCMA) identified:**

1. Within the FMU in the area of Campinarana and Hills (plus buffer of 200 meters) for conservation of the species giant-anteater (*Myrmecophaga tridactyla*) and giant armadillo (*Priodontes maximus*);

2. At the surroundings of the FMU (5 km radius), management with environmental education to reduce hunting pressure in the FMU and surroundings, over species such as

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1 In the indigenous language Tupi, *igara'pé* means ‘path for canue’. It refers to Amazonian watercourses of first and second order, narrow branches of rivers or canals existing in larger numbers in the Amazon basin, characterized by low depth, and by flowing in the interior of the forest.
the black or Guiana spider monkey (*Ateles paniscus*), jaguar (*Panthera onca*), and white-lipped peccaries (*Tayassu pecari*);

3. At the Igarapés Jarú and Sumaúma for protection and recording of the giant otter (*Pteronura borasiliensis*), and in the Rio Branco aiming environmental education, hunting control, and recording of the giant otter (*Pteronura brasiliensis*), Orinoco goose (*Neochen jubata*), manatee (*Trichechus inunguis*), the yellow-spotted sideneck turtle (*Podocnemis unifilis*), six-tubercled Amazon River turtle (*Podocnemis sextuberculata*), red-headed Amazon River turtle (*Podocnemis erythrocephala*), big-headed Amazon River turtle (*Peltocephalus dumerilianus*), giant South American turtle (*Podocnemis expansa*), the cetaceans Amazon pink river dolphin (*Inia Geoffrensis*) and grey river dolphin or tucuxi (*Sotalia fluviatilis*).
Management and monitoring of HCVs, HCVAs and HCVMA

The objective of the HCVA assessment in the FMU Fazenda Mundo Novo was to identify HCVs and delineate HCVAs and HCVMAs. From that, it is up to the company Madereira Vale Verde (MVV) the implementation of the monitoring program of the HCVs, and the management of the HCVMAs.

This section synthesizes which HCVs, HCVA and HCVMA should be monitored and managed, and how it should be done.

Monitoring

The company MVV has implemented a monitoring program to record changes provoked in the community of birds after selective logging in each of the 25 Units of Annual Production (UAP) present in the forest. This monitoring system has high ‘resolution’, and is dependent on the hiring of a specialized technician. The monitoring interprets the immediate impact of selective logging on the bird community, and certainly will answer questions regarding the speed in which areas recover after logging.

A monitoring program at lower resolution may be implemented to observe fluctuations on the presence of the identified HCVs over the years. All HCVs and threats to the HCVs should be monitored. Ideally, these records may be done by employees in transit within the FMU or during the performance of their duties, as long as the employee receives adequate training. This type of monitoring is efficient, and has the advantage of involving employees in certification issues.

Two types of monitoring are considered, the monitoring of HCVs, which are the High Conservation Values (HCVs), and the monitoring of the threats to these HCVs, both in the areas that contain the HCVs in the FMU (HCVAs), and in the High Conservation Management Areas (HCVMAs), which can be located either inside or in the surroundings of the FMU.

Monitoring of HCVs

The HCVs identified in the FMU are species considered to be those with level of threat equal or superior to Vulnerable (VU) or considered vulnerable locally, seasonal resources for wildlife communities, and critical areas for erosion control.

The purpose of HCV monitoring is to determine whether the HCVs maintain or improve their condition over time. Numerical changes on threatened species’ populations are generally slow in the absence of an intense short-term impact, thus are often detected only after years of observations. This requires monitoring to be continuous throughout the years.

In the presence of marked short-term impacts, however, populations and natural communities may have a fast but also observable response (decline) during this period, as demonstrated by the monitoring of birds in the FMU parcels (UAPs) after selective logging. In this case, the environment has favored the presence of birds adapted to relatively open canopy.

The steps to record HCVs 1.2 (threatened species) are as follows:
1. A program for training of employees, including subcontracted personnel, should be implemented so that they familiarize themselves with the company’s environmental policy and particularly with the HCVs. This training may be informal and conducted moments before their normal activities. For example, during the HCV assessment the author of this report has given a speech and heard the opinion of employees regarding the assessment, just after breakfast, when they are all conveniently congregated.

2. Plates of A4 or ½ A4 size with illustrations of HCVs species to be monitored should be used to identify them. Color photos of the HCVs may be printed and laminated (with plastic coating), so that they can be used during field work, or consulted after observation of a HCV.

3. The species of the flora identified as HCVs should be recorded with precise geographic coordinates to easily locate them during selective logging, which will help to avoid any harm to these HCVs.

4. A sheet of records may be attached to the Board of Messages, in the office and in the dormitory of employees. All HCVs seen may be recorded in these sheets, which should regularly be transferred to a database.

5. The database information should be analyzed annually by qualified personnel, as requested by the FSC.

6. To have a continuous and efficient monitoring program, the employees must be motivated. Besides continuous debates on the theory and practice of certification and HCVs, a practice widely used to keep motivation up is the healthy competition within the company, based on the number of HCV that each employee or department is able to record for monitoring purpose. This recognition is then divulged during a meeting with all employees. The public exposure is generally enough to stimulate productivity.

**Monitoring of HCVA**

High Conservation Value Areas (HCVA) are those that contain the identified HCVs. The entire FMU was defined as HCVA based on the fact that several HCVs were widespread in the FMU. The monitoring of HCVA thus has to do with the monitoring of the HCVs themselves, but also with the eventual threats to the HCVs within the FMU.

The monitoring of HCVs was described in the previous section. The threats to the HCVs within the FMU were identified in the form of invasions and hunting, and these threats must be monitored.

During field work intruders and hunters were identified in the northern part of the FMU, and, from direct consultation to these groups, the alleged reason for invasion was easy access (no fences or gates), and encouragement from northern neighbors that exploit small seasonal plantations. Besides that, the intruders did not have any notion of sustainable harvesting, erroneously believing that harvesting at the FMU was also conducted in a predatory way.

The monitoring of threats consists, therefore, of the continuous identification of invasions, and contacts with neighbors that may eventually be using the areas of the FMU.

The procedures to minimize these threats should be implemented as follows:
1. FMU employees should be trained for eventual contact with non-authorized people within the FMU. These encounters are unexpected and infrequent, thus the maximum advantage must be obtained during these circumstances to increase the company’s social reach. These unexpected encounters may be the only opportunity to interact with the individual, considering that northern neighbors do not have fixed households in the area, using the areas only occasionally, highlighting the importance of continuous training of employees.

2. This training may be applied as the training for identification of HCVs mentioned in the previous item, conveniently when employees are congregated just before they begin their daily tasks.

3. Employees must basically know what to communicate to the non-authorized people (intruders) found within the FMU, and what information to obtain from them.

4. The basic information to communicate has to do with the legality of the FMU ownership and notions of sustainable harvesting conducted within the FMU as a mean to restrain invasions. The idea is that intruders understand that a serious work is done in the FMU, with long-term planning, and with several employees dedicated to accomplish their tasks. If people continue to erroneously believe that harvesting within the FMU is predatory, this will stimulate them to act the same predatory way, encouraging also invasions and hunting.

5. The information obtained during these opportunist encounters with non-authorized personnel should be transferred to a sheet and afterwards to a database. The information to be compiled have to do with the identification of the intruder, place of encounter, reason for the non-authorized entrance, municipality in which the intruder reside, and area of the surroundings used by the intruder if any, or by whoever in the surrounding area that might have encouraged the non-authorized entrance. This information may be latter used for actions directed to neighbors that are potentially instigating invasions or that have distorted notions of the management in the FMU.

**Monitoring of HCVMA**

HCVMA areas are defined here as those that require a special supervision and management to enable HCVs to continue to occur within the FMU, but are not necessarily located within the FMU.

The type of management to be applied on these areas depends on the HCV to be protected, and are thus divided as follows:

1. The Hills and Campinaranas for the specific monitoring of the presence of the giant anteater (*Myrmecophaga tridactyla*) and of the giant armadillo (*Priodontes maximus*). These species should be particularly recorded during operations conducted in the mentioned areas.

2. The larger igarapés for the conservation of the giant otter (*Pteronura brasiliensis*), which should be monitored and signalized to avoid invasions by boat, especially during the period of rains (when igarapés are more easily navigated).

3. The areas of the Rio Branco neighboring with the FMU, to record the HCVs and for environmental education. The HCVs in this case are species that inhabit or potentially
inhabit the Rio Branco, the giant otter (*P. brasiliensis*), Orinoco goose (*Neochen jubata*), the chelonians yellow-spotted sideneck turtle (*Podocnemis unifilis*), six-tubercled Amazon River turtle (*Podocnemis sextuberculata*), red-headed Amazon River turtle (*Podocnemis erythrocephala*), big-headed Amazon River turtle (*Peltocephalus dumerilianus*), and the giant South American turtle (*Podocnemis expansa*), the cetaceans Amazon pink river dolphin (*Inia geoffrensis*) and grey river dolphin or tucuxi (*Sotalia fluviatilis*).

4. Terrestrial areas surrounding the FMU, for environmental education with the purpose of reducing hunting of HCVs in the interior of the FMU, particularly of white-lipped peccaries (*Tayassu pecari*) and spider monkeys, and to monitor eventual conflicts with the jaguar (*Panthera onca*) in areas of ranching that may compromise their existence in the region and thus within the FMU.

5. The area of the occurrence of *Pradosia decipiens*, within a radio of 25 meters from the parcel 36, which should not be managed until the confirmation of the species’ identification. This is the only HCV considered Critically Endangered (CR) by the IUCN (2009) that potentially occur in the FMU according to previous inventories, but its occurrence must be double-checked.

**Management of HCV 1.2**

A summary of the HCV assessment for threatened or endangered species (HCV 1.2), and management measures suggested, may be consulted at the table below.

It is suggested that species of the flora on the categories of Critically Endangered (CR) and Endangered (EN) (IUCN, 2009) *Tabernaemontana muricata*, *Inga suberosa* and *Pradosia decipiens* be reproduced in a nursery garden, and an area be assigned for their plantation. This area should preferably be near the area where the plants occur naturally. They should be marked for future identification, located with geographic coordinates, and marked with plastic cards during inventory, and all this information should be fed into a database.

The area of occurrence of *Pradosia decipiens* (parcel 36) in the extreme east of the FMU should have selective logging suspended until the occurrence of the species is confirmed. The species was so far known only by the type, collected near Manaus in 1942, quite far from the FMU. During previous inventories, an exsicata with samples collected in the FMU is known to have been stored in the herbarium of the National Institute for Research in the Amazons (INPA). The author has localized the person responsible by the herbarium and tried contact by e-mail, without reply. It is suggested here that the company insists for a confirmation by the institution, to find out whether the species collected was actually *P. decipiens*. Two other species should also be confirmed, considered that only *Tabernaemontana muricata* has been previously recorded in the State of Roraima (during the Economic and Ecological Zonation – ZEE).

A previous inventory of the fauna in the FMU indicated records of more than one species of spider monkey (*Ateles* spp.), with distribution in the Amazon Forest, but inconsistent with the distribution presented in the literature. These inconsistencies need to be verified. The reported presence of an armadillo was discarded here, the Brazilian three-banded armadillo (*Tolypeutes tricinctus*), based on the following information: 1. The species has distribution restricted to the
Brazilian northeast. 2. The evidence of the presence of the three-banded armadillo was solely based on vestiges, which should not be enough to identify armadillos at the species level. The species of the fauna may be located and their position recorded by parcel and trail (the grid system used in the FMU), and information entered into a database.

**Species assessed as HCV 1.2 or potential HCV 1.2 if present, in the categories Nearly Threatened (NT), Vulnerable (VU), and above (IUCN, 2009), and those judged to be locally threatened.**

<table>
<thead>
<tr>
<th>Species</th>
<th>HCV Management</th>
<th>Reason to revise the species’ occurrence</th>
<th>Reason for HCV</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pradosia decipiens</em></td>
<td><strong>Moratorium of logging in parcel 36 until the species identification is revised; tree marking; reproduction in nursery garden</strong></td>
<td>Distribution know only to the proximity of Manaus</td>
<td>Critically Endangered (CR – IUCN); known only by the type, collected in 1942</td>
</tr>
<tr>
<td>White-bellied spider monkey <em>Ateles belzebuth</em></td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Not recorded during field work and also not by FMU employees</td>
<td>Endangered (EN – IUCN); rare in the FMU if present</td>
</tr>
<tr>
<td>White-whiskered spider monkey <em>Ateles marginatus</em></td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Not recorded during field work and also not by FMU employees</td>
<td>Endangered (EN – IUCN); rare in the FMU if present</td>
</tr>
<tr>
<td>Giant otter <em>Pteronura brasiliensis</em></td>
<td><strong>Standard</strong>; non logging in the riparian forests of large igarapés; reduce invasion through the igarapés</td>
<td>Does not apply</td>
<td>Endangered (EN – IUCN); rare in the FMU, resources subjected to seasonal variation</td>
</tr>
<tr>
<td><em>Inga suberosa</em></td>
<td>Revise identification; tree marking; reproduction in nursery garden</td>
<td>Not known to occur in the region</td>
<td>Endangered (EN – IUCN); restricted distribution, not common in the FMU</td>
</tr>
<tr>
<td><em>Tabernaemontana muricata</em></td>
<td>Revise identification; tree marking; reproduction in nursery garden</td>
<td>Not known to occur in the region</td>
<td>Endangered (EN – IUCN); restricted distribution, not common in the FMU</td>
</tr>
<tr>
<td>Bush dog <em>Speothos venaticus</em></td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Uncommon if present</td>
<td>Near Threatened (NT); rare in the FMU if present</td>
</tr>
<tr>
<td>Giant anteater <em>Myrmecophaga tridactyla</em></td>
<td>Delimited HCV area encompassing Campinarana, Seasonal Decidual and Hills</td>
<td>Does not apply</td>
<td>Near Threatened (NT); rare in the FMU, Campinarana and Hills are poorly represented in the FMU</td>
</tr>
<tr>
<td>Jaguar <em>Panthera onca</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>Near Threatened (NT); rare in spite of the frequent signs found in the FMU; persecuted by ranchers</td>
</tr>
</tbody>
</table>
## Species

<table>
<thead>
<tr>
<th>Species</th>
<th>HCV Management</th>
<th>Reason to revise the species’ occurrence</th>
<th>Reason for HCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-lipped peccary</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>Near Threatened (NT); relatively common in the FMU, but pursued by hunters, vulnerable to hunting</td>
</tr>
<tr>
<td><em>Tayassu pecari</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orinoco goose</td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Presence possible</td>
<td>Near Threatened (NT); rare if present</td>
</tr>
<tr>
<td><em>Neochen jubata</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harpy eagle</td>
<td>Continuous record of its presence where present</td>
<td>Does not apply</td>
<td>Near Threatened (NT); uncommon</td>
</tr>
<tr>
<td><em>Harpia harpyja</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giant armadillo</td>
<td>HCVA delineation encompassing Campinarana, Seasonal Decidual and Hills</td>
<td>Does not apply</td>
<td>Near Threatened (NT); signs easy to find, but rare</td>
</tr>
<tr>
<td><em>Priodontes maximus</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazonian manatee</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Presence possible</td>
<td>Vulnerable (VU), rare</td>
</tr>
<tr>
<td><em>Trichechus inunguis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow-spotted sideneck turtle</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>common</td>
</tr>
<tr>
<td><em>Podocnemis unifilis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Six-tubercled Amazon River turtle</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>common</td>
</tr>
<tr>
<td><em>Podocnemis sextuberculata</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red-headed Amazon River turtle</td>
<td>Does not apply</td>
<td>Presence possible</td>
<td>Rare if present</td>
</tr>
<tr>
<td><em>Podocnemis erythrocephala</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big-headed Amazon River turtle</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>common</td>
</tr>
<tr>
<td><em>Peltocephalus dumerilianus</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giant South American turtle</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>Subjected to high harvesting and trading pressure, rare in the vicinities of the FMU</td>
</tr>
<tr>
<td><em>Podocnemis expansa</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazon pink river dolphin</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Presence possible</td>
<td>Rare if present</td>
</tr>
<tr>
<td><em>Inia geoffrensis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grey river dolphin</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Presence possible</td>
<td>Subjected to hunting and fishing pressure</td>
</tr>
<tr>
<td>or tucuxi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sotalia fluviatilis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Species not expected for the area, misidentified during previous studies. It may be in fact just a local coat variation of the same species. It is desirable that differences in coat variation among species be best understood to avoid identification errors.

2. The standard management for HCV is the basic monitoring, in other words, the species’ recording by FMU employees in field data sheets, with location and date.

3. Logging in riparian forests is automatically prohibited by the Brazilian legislation (see item 1.6).
Management of HCV 1.4

Management of Brazil-nut trees consist basically in avoiding that these trees be affected by roads or other infrastructure, and by selective logging. Among the measures that may be employed to minimize damage to the Brazil-nut trees, it is possible to suggest the following:

1. The companies’ environmental policy regarding HCVs should be clear to both employees of the MVV and to subcontracted employees, particularly regarding Brazil-nut management.
2. Ensure that FMU employees supervise subcontracted employees during logging.
3. Estimate Brazil-nut canopy loss in case accidents occur during logging.
4. Record all Brazil nut trees visible during inventory and during logging operation, by parcel and trail, entering that information into a database.

Companies’ collaboration with the community and with governmental organizations (environmental and social managers)

The FMU has adopted a Social Management System (SGS), directed to detailing social projects and definition of the policy for corporative relationship, with special emphasis on the management of internal and external conflicts (MVV, 2009). This system includes the communication channels with the community, and also the organization of thematic events.

The MVV is a company of considerable importance in the municipality where it operates (Caracaraí). It is desirable that the company develop an easy communication channel with the local administration, and with actors that work in the forefront of the territorial development and settlement projects.

Collaboration with the authors of settlement projects

In the southern portion of the State of Roraima, the main programs that may become partners for HCVs and HCVAs conservation in the vicinities of the FMU, and mentioned in the Plan for Sustainable Environmental Development in the Area of influence of BR-174 / Roraima, are:

PDR 01 – Incentive to harvesting of non-wood products in settlement areas, PDR 04 – Incentive to sustainable forestry harvesting, headed by the Secretary of Agriculture and Supplying (SEAAB/RR), and PRA 02 – Recovery of degraded areas and prevention of environmental liability, to be headed by the Department of Roads of Roraima (DER/RR).

On the topic of dissemination of information, it is possible to partner with the PGA-05 plan of the BR-174, which regards the Environmental Information Supervision, through the Integrated System of Settlement Monitoring and Control, headed by the Technical and Rural Extension Service (DATER) and the Secretary of Agriculture and Supplying (SEAAB/RR).

Information dissemination could be also attached to the PGA-08 Environmental Education, having the Secretary of Planning (SEPLAN) and the Department of Environment (DEMA) of Roraima as the main executive agents.
A communication bridge with INCRA, which establishes polices of rural settlement in Brazil, is also desirable. During field work, the author has noticed that northern neighbors, or their acquaintances, used, rightfully or not, the organization as shield to justify invasions. With direct dialog with the organization it is possible to settle doubts and dialogue with neighbors with more confidence.

**Cooperation with environmental agencies**

From the environmental conservation standpoint, it is necessary to provide a dialog channel with environmental agencies. During field work, the author has contacted IBAMA, which is the federal agency responsible for environmental supervision, to verify in practice what type of actions would be possible to develop in cooperation with the organization. The first impulse of the contacted officer was to check FMU activities, taking into account the use of natural resources at considerable scale by the FMU. It took a while to reach a point during the dialog by phone after which the officer realized the FMU’s conservation and management status, and that the FMU could be a potential partner for local nearby operations. This viewpoint strengthened during a meeting of the author with the officer of IBAMA.

Other acting environmental agency is the FEMATEC, with State-wide scope. During the period in which the author stayed in Roraima, the FEMATEC acted in the lower Rio Branco capturing a boat that carried giant South American turtles (*Podocnemis expansa*) that had been illegally captured. This agency could also act in partnership to maintain the HCVs present in the FMU.

**Collaboration with the neighboring community**

During field work it became clear that the neighboring community is unaware of the nature of the FMU’s operations. In a region where people avidly look for lands to invade and take, it is necessary that neighbors recognize the legitimacy of land ownership, otherwise, and as it may seem to be currently the case, they will disseminate the idea that the land is vast and unsettled. In Brazil the definitive land title is in first instance obtained only when neighbors recognize its legitimacy. In the case of the FMU, the land title is old, anterior to the arrival of current neighbors, but this fact illustrates how important the acknowledgement of neighbors is, even at the juridical level.

The FMU management personnel has conducted a few meetings and organized field days with the community. This work should be continued, but it is also suggested that some community leaders be identified and invited to see the FMU area, so that they can pass on the idea of sustainability that permeates all the activities. Neighbors that encouraged invasions or invade the FMU should be searched actively and invited for dialog. Although the notion of sustainable management may be understood by those that work in the FMU, this management model is alien to neighboring communities, which only know the exploitation and conversion system. From the community’s point of view, an untouched forest is an area invited to be settled in a ‘traditional’ way, slashed and burned for seasonal crops and cattle ranching.

It also became evident during field work that the FMU employees themselves should be motivated to understand that the management system at the FMU is a model to be followed in the Amazons, from both the environmental and economic standpoints. Economically, it guarantees the long-term, perhaps indefinite sustainability of resources, whereas other types of occupation have caused immediate exhaustion of these resources, replacing them by much less productive
and profitable systems in the long-term, and much more harming to the ecosystem. They can then act as multipliers and educators outside and inside the FMU.

From the environmental viewpoint, the presence of employees in the FMU provides an exceptional protection to the ecosystem, greater than is possible to find in the majority of the protected areas in Brazil, where a reduced number of personnel supervise large areas. Illegal logging and hunting are inhibited by the presence of employees, transforming managed areas into real wildlife reserves (e.g. Mazzolli, 2006; Mazzolli, accepted). Species requiring closed canopy may not persist on harvested parcels, as recorded for birds in the FMU (Fehlow, 2006, 2008) and for bats elsewhere in the Amazon region (Presley et al., 2008), but the rotation period (25 years) associated with the arrangement of parcels in a matrix of undisturbed forest may allow recolonization to mitigate effects of selective logging on sensitive species and maintain biodiversity on the long term.

**Inhibition of invasion and hunting**

The northern portion of the FMU revealed itself as the most vulnerable to invasion and hunting. More than one group of non-authorized people, carrying hunting guns, were observed in this area during field work.

Perhaps the main reason for invasion was the easy access, and the abundant game and Brazil-nut resources present in the FMU, possibly already scarce in the vicinities. FMU managers acknowledged this vulnerability and promptly decided to build a gate at the limits of the FMU, as well as an accommodation for vigilantes (company employees) that will try to restrain invasions in an amicable manner.

Some neighbors probably do not recognize the land ownership by the FMU as legitimate, perhaps because it has not been conducted as understood by them as occupation, that is, with tree falling and substitution by grazing areas. It is necessary that neighbors understand that settlement with forest sustainability exists and it is conducted in the FMU. It is hoped, with such an educational initiative, that the potential intruders become also multipliers of information on the legitimacy of land ownership by the FMU, and that it is an intensively managed land, increasing thus the security of the area.
1. Introduction

1.1. Forest certification by the Forest Stewardship Council (FSC) and the HCV assessment

In Brazil, out of the restricted circle of people seriously involved in the study and definition of conservation strategies and sustainable land use, a consensual opinion on the benefits of management of native forest in the maintenance of forests does not exist, even if a certified system is considered.

This situation creates impairment for managers to develop partnerships with public environmental agencies for monitoring of a managed area, or involvement and collaboration of professionals from the academic circles.

For this reason, a short introduction is necessary highlighting the endorsement of several prestigious organizations and scientists to the forest management system certified by the Forest Stewardship Council (FSC) and by the HCVA system.

The FSC certification and HCVA assessment are not only endorsed by non-governmental organizations (NGOs) of undisputed reputation in nature conservation, as the World Wildlife Fund (WWF), The Nature Conservancy (TNC), Rainforest Alliance, Conservation International (CI), Fauna and Flora International (FFI), and the International Union for the Conservation of Nature (IUCN), as these organizations actively participate in the elaboration of development tools used by the FSC and HCVA systems. A classic example of a document that has delineated the first contours of a commitment in the development of specific policies for the sector is the WWF and IUCN’s Forests for Life program (WWF, 1996).

Some scientists in the Amazon have also recognized the importance of the establishment of forest management as a way of land use and as a break to chaotic land occupation. From that, debates have taken place about which areas and strategies for the establishment of reserves that allow this type of management should be chosen (e.g. Magnusson, 2002; Veríssimo et al., 2002). Among the several details of the implementation of large-scale models for forest management in the Amazons, it is necessary that the private initiative become partner, capacitated, and committed with sustainability to exert its role in this system. In this context, the policy to support companies that fit that profile need to be revised and improved, particularly in the State of Roraima.

1.2. Interpretation of the High Conservation Values (HCVs)

Brazil does not have a national interpretation for definition of High Conservation Values (HCVs). Hence, besides being an assessment, this document aims to be a basic document for national interpretation and as far as possible, a regional interpretation, from which a national or regional interpretation can be developed when aided with subsequent contributions. To that end, some particular situations of Brazil and region under analysis, which may help to better elucidate pertinent ecological and social conditions, are contextualized either during the introduction or during analysis of each individual HCV.
This report presents the results of an independent HCV and HCVA (or HCVF) assessment and recommendations for monitoring and management of these attributes within an area where selective logging of native trees is employed, located in the Amazonian State of Roraima, in Brazil. Between 23 of September and 16 of October of 2009 Projeto Puma compiled and analyzed the necessary data for identification of HCVAs in the Fazenda Mundo Novo, an area with 17,205.40 ha of native forest, owned by the Madeireira Vale Verde Ltda (MVV), subsidiary of Malrimalrii Florestal Ltda and of GreenWood Ltd.

### 1.3. Purpose

The purpose of this assessment is to a) identify High Conservation Values (HCV), and from those, High Conservation Value Areas or Forests (HCVA or HCVF) within the area encompassed by the Fazenda Mundo Novo, managed for selective logging of native trees by the company Madeireira Vale Verde Ltda (MVV), b) propose the HCVA limits if they occur, c) suggest strategies for maintenance and improvement of the identified values, and revise the procedures under use, d) serve as a foundation to the development of a national or regional interpretation to identify HCVs and HCVA.

### 1.4. General approach

In the absence of a Brazilian interpretation to define HCVAs, during the definition of each HCV a scenario for a national interpretation was sketched (which should latter be widely discussed), based on several documents. Among them, the documents of Proforest (Oxford, UK) and Rainforest Alliance, *The High Conservation Value Forest Toolkit (parts 1,2 and 3)* (Jennings et al., 2003) and a more recent document elaborated by Proforest, *Good practice guidelines for High Conservation Value assessments: A practical guide for practioners and auditors* (Stewart et al., 2008).

Beside those documents, interpretations, interpretation drafts, and HCV projects in the rainforests of Bolivia, Indonesia, and Malaysia were used as references.

Proforest has been the greater diffuser of the advances on HCV and HCVA elaboration, through its *HCV Network* and publication of several guides. Only seven HCVA assessments are currently available in the *HCV Network*, of those, four have been done in Sumatra, Indonesia, directly by the Rainforest Alliance (e.g. Hayward et al., 2004). For this reason, and for the fact that the *HCV Toolkit for Indonesia (2008)* was elaborated by a wide consortium of NGOs (e.g. WWF, TNC, Rainforest Alliance, CI, and FFI, to mention few), this report reported to these documents as constant references for definition of each HCV. Besides those, the manuscript of Malaysia (WWF Malaysia, 2009) and a HCV guide for Bolivia (Rumiz et al., 2008) were also used.

A wide range of references on species’ and habitat distribution were consulted and cross-checked. With that it was possible, for example, to unify three different descriptions of forest typologies to describe the FMU forest cover, and to verify inconsistencies in the literature and during previous FMU assessments on the distribution of threatened species.

The field itinerary is detailed as an attachment (Appendix 1).
1.5. High Conservation Values (HCV) and High Conservation Value Areas (HCVA)

The concept of Values and High Conservation Value Areas (HCV and HCVA) (see Box 1 for definitions) was initially developed by the Forest Stewardship Council (FSC) to be used for certification in forest management, and published in 1999. Its use was next broadened for other applications, including out of FSC’s certification context. Under the ninth Principle of the FSC certification, forest managers need to identify HCVAs and manage them so as to maintain or improve the High Conservation Values identified, and monitor the success of the management (Jennings et al., 2003:7).

A singular aspect of these values is that their interpretation is in constant evolution, especially when the diversity of adaptations of national interpretations for specific situations in different geographic regions of the globe is considered. Since the production of the first specific document on these values by the Proforest in 2003, other complementary and clarifying documents have been produced that broaden the available information on the theme.

In one of these new documents, Stewart et al. (2008:4) classifies basic types of HCV and HCVA application in a very synthetic manner: 1. Used in the context of certification versus other purposes out of certification, and 2. Ecosystem management versus ecosystem conversion. Putting it briefly, the identification, monitoring, and management of HCV and HCVA in cases involving a combination of certification and selective logging have less impact, more credibility, and is more secure than those in a combination involving lack of certification and with forest conversion. In fact, forest conversion has a much more severe and irreversible impact in the biodiversity, ecological functions, and in the social systems than the management with selective logging of species (Stewart et al., 2008:6).
Fortunately, the Fazenda Mundo Novo is managed for selective logging, and the HCVA assessment is contextualized within the FSC certification, which ensures a minor impact on the identified HCVs than in the cases where clear cuts for forest conversion take place. In cases involving forest conversions it is possible to recommend that HCVAs or potential HCVAs be left untouched, submitted to a reduced impact management for non-timber products, or also have a moratorium recommended to activities in the HCVA (taking into account the greater impact of clear cuts in the remaining of the area) as suggested in a HVC assessment done in Sumatra, Indonesia (e.g. Hayward et al., 2004:57).

In cases with no forest conversion, in the other hand, HCVAs are not necessarily untouchable, unless it is demanded by the legislation or recommended by the assessment team, based on convincing arguments. In fact, ‘designating a forest (or part of a forest) as HCVF does not automatically preclude management operations such as timber harvesting. However, it does mean that management activities must be planned and implemented in a way that ensures that the values are maintained or enhanced’ (Jennings et al. Part 1, 2003:12).

The scope of an HCVA within a scheme of FSC certification does not require a reading of the current legislation, considering that this item is covered by other modules of the certification. However, it is the intention here to also furnish an overview of general environmental setting in Brazil (for national interpretation purposes), particularly for the Amazonian region, thus
environmental legislation will be mentioned in its most pertinent aspects, but will not be exhaustively revised.

1.5.1. Criteria that govern the management of High Conservation Values (HCVs)

A crucial aspect for achieving the proposed objectives is to monitor and manage the HCVs and HCVAs after they have being identified. Under the FSC certification there are four requirements of Principle 9, including identification, consultation, planning of management and monitoring of HCVFs (Box 2).

Box 2. The four criteria governing management of High Conservation Value Areas (or Forests), extracted textually from HCVF Toolkit Part 1 (Jennings et al., 2003).

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1</td>
<td>Assessment to determine the presence of the attributes consistent with High Conservation Value Forests will be completed, appropriate to scale and intensity of forest management. The purpose of this criterion is to ensure that any outstanding or critical values (i.e., HCVs) that occur within a forest management unit are identified. This will entail the demarcation of the forest necessary to maintain and enhance the value (i.e., the HCVF) on operational planning maps.</td>
</tr>
<tr>
<td>9.2</td>
<td>The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof. This criterion requires forest managers to consult with stakeholders on the options for the maintenance of any High Conservation Values that are identified. This requirement places a safeguard on the management of HCVFs as it allows stakeholders to raise significant and credible points that may be important in maintaining or enhancing the identified HCV.</td>
</tr>
<tr>
<td>9.3</td>
<td>The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary. This criterion specifies the general goal of management of HCVF – to maintain or enhance the HCV – as well as ensuring that stakeholders are informed about the proposed management regime for the HCVF.</td>
</tr>
<tr>
<td>9.4</td>
<td>Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes. Where values are of such importance that they have been designated as HCVs, there is clearly a need to ensure that the management of them is effectively maintaining them. Therefore, monitoring should be conducted to assess this.</td>
</tr>
</tbody>
</table>

1.6. Overview of environmental legislation in Brazil

Brazil has a very restrictive legislation regarding exploitation of natural resources, although its implementation is hardly followed, perhaps succeeding best in endeavors that require environmental licensing from government agencies.

Hunting is prohibited across all national territory, and licensing for large-scale forest conversion in areas with advanced successional forest stage is not issued in the Amazons\(^2\), but both activities are still illegally practiced at concerning scale.

Regarding protection of forests, besides the governmental protected areas, there are mechanisms that oblige the protection of parcels within private areas, the Legal Reserve, varying from 20 to 80% of the property (80% in forested areas of the Legal Amazons), and the Areas of Permanent Protection (APP), which include those with steep declivity, and margins of water bodies with

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\(^2\) Provisory Measure-MP 2.166-67/2001
width varying from 30 to 500 meters\(^3\). The regulatory rules for exploration of these private protected areas are not the same for all national territory or for all situations. Legal Reserves in the Amazons may opportunistically suffer selective logging (MP 2.166-67/2001), which is not possible in the Atlantic Forest Biome, for example. Selective logging is not allowed in APP areas of the Amazons though\(^4\).

Independently from this restrictive environmental legislation, the Amazon Biome in Brazil alone has recorded a conversion rate of 18,487 km\(^2\)/year in the period from 2002 to 2008. During this period the annual deforested area reached a maximum of 27,772 km\(^2\) in 2004, dropping gradually to reach 12,911 km\(^2\) in 2008. The data on annual rate of deforestation is processed by the Program for Calculation of Deforestation in the Amazons (PRODES), controlled by the National Institute of Space Research (INPE), from the Ministry of Science and Technology, whose results area available in http://www.obt.inpe.br/prodes. Data is obtained by Brazilian satellites CBERS (there are three of them), the first sent to space in October 1999. The images are available free (including images from other South American countries) in the INPE internet webpage (www.inpe.br). It is relevant to mention that Roraima is not amongst the greatest forest clearers (INPE, 2009) (Table 1).

**Table 1. Deforestation in the Brazilian Amazons by state (DETER, INPE), from 01 January 2009 to 31 August 2009.**

<table>
<thead>
<tr>
<th>State</th>
<th>Deforested area (Km(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pará</td>
<td>1,275.74</td>
</tr>
<tr>
<td>Mato Grosso</td>
<td>756.93</td>
</tr>
<tr>
<td>Rondônia</td>
<td>151.23</td>
</tr>
<tr>
<td>Maranhão</td>
<td>100.04</td>
</tr>
<tr>
<td>Amazonas</td>
<td>87.63</td>
</tr>
<tr>
<td>Roraima</td>
<td>50.07</td>
</tr>
<tr>
<td>Tocantins</td>
<td>19.91</td>
</tr>
<tr>
<td>Acre</td>
<td>10.36</td>
</tr>
<tr>
<td>Amapá</td>
<td>4.33</td>
</tr>
</tbody>
</table>

The expectation of the Ministry of Environment (MMA) is that the 2009 total rate of deforestation be kept under 9,000 km\(^2\) (Folha de São Paulo in 25 September 2009). Initiatives to cut credits to environmentally unfriendly companies by government banks, and more recently bans and moratorium by the internal market to the purchase of products from deforested areas of the Amazons (mostly cattle and soya) seemed to have been the reason for the recent reduction in deforestation rates, although some claim that 2009’s financial crisis also played its role.

In Brazil there is a case of complete protection of an entire Biome, the Atlantic Forest, which extends along a large section of the Atlantic coast and penetrates the continental area of southeast and southern Brazil. In these areas, the prohibition of logging has stimulated logging companies to exploit planted forests with exotic species. Having the Atlantic Forest Biome protected against

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\(^3\) Law 7.803 from 07/1989, law 4.771 from 10/1965, and Resolution CONAMA n° 303 from 2002

\(^4\) MP 2.166-67/2001 and Normative Instruction – IN from Ministry of Environment 02/2001
conversion, plantations have advanced over natural grasslands, a practice that has caused a lot of controversy, considering that this habitat is part of the Atlantic Forest Biome protected by law\textsuperscript{5}. The market for wood in these areas is supplied with both planted trees and by timber from native trees harvested in Mato Grosso and in the Amazons.

Regarding the protection of threatened species, Brazil has its own red list of threatened species\textsuperscript{6}, cited from here on as red list or simply list. Several Brazilian States have also their own regional lists of threatened species. In the Amazon region, though, the only state with a red list is the State of Pará, which will be used complementarily in this report as an approximation to regional conditions of species’ threat.

It is necessary, however, to consider the national references on threatened species with certain caution, as some inconsistencies may be found. As an example, the giant anteater \textit{Myrmecophaga tridactyla} appears in the IN 03/2003 of the MMA as threatened in the State of Roraima, but not in the red book (Machado \textit{et al}., 2008), where it is mentioned as vulnerable in Pará in the detailing of species, but not in the matrix by region (table nº 8, Chiarello \textit{et al}., 2008:696). Other example is the black-bearded saki \textit{Chiropotes satanas}. The red book (Machado \textit{et al}., 2008) consider the distribution of this species only to the south to River Amazonas, in contrast to other sources (Emmons, 1990; Eisenberg & Redford, 1999; IUCN, 2009 as \textit{Chiropotes chiropotes}), which show its distribution all way to Roraima.

The international categories of threat to species used by IUCN are: LC = Low Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered, DD = Data Deficient. The national list (IN 02/2003) doest not use this criteria, but the regional lists (by State) do.

1.7. Coordination of the assessment

Dr. Marcelo Mazzolli is director general of Projeto Puma, based in Brazil, since 1988, and consultant for the IUCN Cat Specialist Group since 1997. He’s main line of research encompass the study of patterns of distribution loss in mammals from anthropic modifications at several geographic scales. In practice, has analyzed environmental conditions for wild mammals in agroforestry and ranching areas; conducted several analysis of habitat for the implementation of biodiversity corridors at landscape scale, and management projects for state and national protected areas, and biodiversity analysis in areas managed for forestry; analyzed habitat conditions for large felids that have been published in national and international scientific journals. Based on his experience in several areas of forestry management, he has conviction of the importance of rational forestry management as a source of development and conservation, especially in Brazil where not enough public resources are allocated for supervision with the aim of forest conservation. The private initiative may supply that deficit if management is conducted sustainably. Among the abilities needed to conduct this assessment, the experience of over years of research in areas with different degrees of anthropization is highlighted, plus capacity to synthesize, and ability with GIS operation.

\textsuperscript{5} Federal Law nº 11.428, de 12/2006  
\textsuperscript{6} Normative Instruction - IN 03/2003
2. Organization and landscape setting of the Forest Management Unit (FMU)

2.1. Information for contact

Name of the FMU: Fazenda Mundo Novo
Manager of the FMU: Manuel Haas
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2.2. Description of the FMU

2.2.1. Land situation and extension
The Forest Management Unit (FMU) Fazenda Mundo Novo is constituted by 10 rural real states, totaling 17,205.4 hectares, propriety of the Madeireira Vale Verde Ltd., founded in 2004. It has three main buildings, the main one where the office is located, next to the Rio Branco, a main house with access from the entrance of side road 3, and a secondary accommodation in the recently managed areas.

The FMU border with Rio Branco in the west, and with forested areas all around. The access road to the east, known as side road 3, boosted human occupation, with small ranching areas and family agriculture along the road.

The area is cut by rivers and creeks called *igarapés*, with depth and existence varying according to seasonal rain and drought.

2.2.2. Location
The FMU is located in the Municipality of Caracaraí, in the Brazilian State of Roraima, by the Rio Branco, an important tributary of the Amazon River. The rivers Branco and Baruaninha practically delimit the FMU.

The access from Boa Vista to Cararacai is accomplished through a completely paved road, the BR-174. The FMU is part of the *Gleba Barauana*, with main access from side road 3 and relatively near the rural settlement of the National Institute for Colonization and Rural Reform (INCRA) denominated “Cujubim”.

FMU’s approximate central coordinates are 1° 52’ 35” N and 60° 56’ 57” W.

2.2.3. Forest management system
According with the company’s Forest Management Plan (MVV, 2009), the MVV is the first company to have a large-scale project on forest management approved in the State of Roraima. In this sense, ‘the MVV is pioneer and has a large importance and responsibility in the development of the region, through opening of job positions and social projects. Also, the company may have a role in incentivizing forest management projects’.
Regarding the impact, it may be generally categorized as having low impact (see Stewart et al., 2008: 10). Selective logging is employed in a relatively small area suitable for forestry, without rare ecosystems, and with relatively large rotation periods, and without providing access to remote areas.

The management project is financed with resources obtained by the Forest Investment Trust Ltd. (F.I.T.). The FMU total area has been subdivided into 25 Units of Annual Production (UAP) to be managed for selective logging. The UAPs were divided as to have their limits, when possible, with APPs of rivers and igarapés, or bordering with existing land boundaries. The UAPs have been explored one each year, even though it is possible to explore more than once a year, as long as the minimum rotation period of 25 years is observed, conforming to the Brazilian legislation for this type of management in the Amazons. During the first years of management it has been given priority to the UAPs with easy access.

Harvesting is conducted during the dry period, which last from October to April. Sometimes activities need to be interrupted during a rainy period and restarted during a dryer period.

The UAPs are delimited by parallel lines (trails) 50 meter distant from each other, from which divisions in squares 50x50 meters in size (parcels) are derived for identification of harvesting location.

Cutting and dragging of trees are accomplished by a third-party company. Trail clearing and timber harvesting are planned in anticipation to reduce environmental impact and waste. A tree is dragged over a defined path, and it is identified by a plastic card containing the species and timber codes. After the harvest, the timber receives identification for internal and external control of the Chain of Custody.

Although the entire FMU is considered as a managed area, areas environmentally sensitive to erosion and landslides, infrastructure, APPs, and an area of 5% defined for protection (absolute protection area) are excluded from harvesting (Table 2).

Table 2. Zonation of the FMU according with type of use.

<table>
<thead>
<tr>
<th>Zonation</th>
<th>Total (ha)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area</td>
<td>17,205</td>
<td>100</td>
</tr>
<tr>
<td>Area of Ecological Protection: hills</td>
<td>374</td>
<td>2.2</td>
</tr>
<tr>
<td>Area of Ecological Protection: Seasonally flooded (Varzea)</td>
<td>523</td>
<td>3.0</td>
</tr>
<tr>
<td>Area of Absolute Protection</td>
<td>860</td>
<td>5.0</td>
</tr>
<tr>
<td>Area of Permanent Protection (APP)</td>
<td>2,064.6</td>
<td>12.0</td>
</tr>
<tr>
<td>Permanent Infrastructure</td>
<td>258</td>
<td>1.5</td>
</tr>
<tr>
<td>Anthropized area</td>
<td>213</td>
<td>1.2</td>
</tr>
<tr>
<td>Net management area</td>
<td>12,912.4</td>
<td>75.1</td>
</tr>
</tbody>
</table>

7 IN MMA 02/2001
8 5% of the total FMU must be set aside for absolute protection, not including the APPs
9 Source: MVV (2009)
2.3. Ecological context

The climate in the FMU region is categorized as Awi – rainy tropical climate with predominating Savannas – in the KOEPPEIN classification system. It is hot and semi-humid with 5 to 6 dry months and two very distinct seasons: summer (dry period) and winter (rainy period), the first spanning from October to March and the second from April to September. Average temperature in Caracaraí is 27.3°C, the warmest month is October with average temperature of 28.7°C and the month least warm is February, with average temperature of 26.5°C. The average annual precipitation is 2038 mm. The rainiest month is June with an average precipitation of 391 mm, the driest month is December with average precipitation of 49 mm (MVV, 2009).

The State has 68.42% of its total area declared Protected, including Indigenous Lands (Fig.1). Extensive open areas of Savannas are found in the north, while forested areas concentrate in the south, with many different transitional combinations.

2.3.1. Habitats and species

Of all Amazonian States, Roraima is the one that harbor the largest number of the regions’ ecosystems, as well as the larger contrasts in vegetation (AMBTEC, 1994). Particularly interesting from the biodiversity standpoint are the contact zones of different combinations between Savanna, Seasonal Semideciduous Forest, Campinarana and Dense Ombrophylous Forest (see descriptions below).

This provides conditions to species most characteristic of open areas, such as the giant anteater (*Myrmecophaga tridactyla*) and the giant armadillo (*Priodontes maximus*), to occupy tropical humid forests, considerably increasing the diversity of species.

From the nine Phytogeographical Regions that occur in Brazil, Roraima harbors six, with names adapted to the international system: Dense Ombrophylous Forest (Humid Tropical Forest), Open Ombrophylous Forest (open-canopy variation of the Dense Ombrophylous Forest), Semideciduous Seasonal Forest (Semideciduous Tropical Forest), Campinarana (Amazonian Caatinga), Savanna (Cerrado) and Steppical-Savanna (Arid Caatinga, Roraima grasslands, Chaco).
of southern Mato Grosso) (IBGE, 2005). Of those regions three occur in the area of Caracaraí (and in the FMU), which are the Dense Ombrophyllous Forest, Seasonal Forest, and Campinarana (Appendix 2).

Forest types considered to exist in Caracaraí by the Economic and Ecological Zonation (ZEE) of Roraima (Franciscon, 2002: 111) are not exactly the same as that considered by the IBGE (2005), and recognize the presence of six main formations in the Caracaraí region, Dense Ombrophyllous Forest, Alluvial Forest, Seasonal Forest, and Open Forest, plus Savanna and Campinarana (Appendix 2).

The forest types defined in the ZEE are here used to describe the existing formations in the FMU, because they are believed to approach best the reality of the area, due to precision of examination at small scales. Mapping scale of IBGE (2005) covers the entire Brazil territory, whereas that of the ZEE covers just the State of Roraima.

The classification that has been previously used to describe the forest types in the FMU (Fig. 2) also diverge somewhat from that of the ZEE, for the same reason of scale, with greater variety of subtypes and also including the classification given by Ribeiro et al. (1999), specially regarding the nomenclature ‘Floresta de Baixio’ (a subtype of lowland forest translated here as ‘Depression Forest’). This difference may be noted also by the species that characterize each forest type. The forest types and subtypes in the FMU are briefly described below, whereas Table 3 lists the species that characterize each forest type and its subtypes as given by the ZEE (SEPLAN, 2002).

![Figure 2. Forest types in the FMU Fazenda Mundo Novo. Coordinates in UTM, SAD69, Zone 20N.](image-url)

1. Savanna - The Savanna is considered a type of vegetation with xeromorphic characteristics, with a preferential seasonal climate, characterized for presenting a dry period lasting six month.
In spite of that, it may also be found in humid climates. This vegetation type normally cover washed soils and soils with mobilized aluminum, presenting strata of hemicyrptophytes, geophytes, chamaephytes, oligotrophic phanerophytes of small size, with occurrence along all neotropical zone. It does not occur in the FMU, but there is a Contact Zone with the Savanna and the Dense Ombrophylous Forest in the western surroundings.

2. Dense Ombrophylous Forest – This type of vegetation is characterized by phanerophytes, precisely by the presence of subtypes of macro and mesophanerophytes, besides wooden lianas and epiphytes in abundance, which distinguish this formation from other types. It is the predominant vegetation type in the FMU, branching into Plateau or non-flooded Forest, Depression Forest, and Alluvial Forest.

2.2 The Plateau or non-flooded Forest is a forest formation with the highest diversity of plants and highest biomass values, and it is also the predominant formation in the FMU. It presents 35 to 40 meters high canopy and many emergent trees with more than 45 meters, highlighting Brazil-nut (*Bertholletia excelsa*), *Dinizia excelsa* and *Hymenolobium excelsum* as very typical. The denomination of this forest type would fit on the IBGE’s (2005) Submontane Dense Ombrophylous Forest nomenclature. To relate this environment with the occurrence of IUCN threatened species, this organization refers to these formations as ‘non-inundated areas of lowland forests’ (IUCN, 2009).

2.3 The Depression Forests occur in alluvial plains along the igarapés similarly as the Floodplain (Varzea) Forests of Igarapés, differing by suffering only a short period of inundation, standing on sandy soil, and flooded by rains and accumulation of sediments. It is the section of Igarapés that do not have meanders, which would favor a longer period of flooding. The forest canopy is 25 to 35 m high, with rare emergent trees, and trees with anchor roots are common. The understory is dense and contains many palm trees. In the areas of periodic flood species that are typical of floodplain forests may occur. The typical species of the Depression Forest are *Vouacapoua pallidior*, *Parkia multijuga*, *Abarema junpunba*, *Virola michelii* and *Pouteria reticulata*, among others.

2.4 The Alluvial Forest display characteristics typical of the Dense Ombrophylous Forest, different for its physiographical position (alluvial plain) and soil type, as the soils are essentially Alluvial and Gley. In the FMU this formation branches into two types, the Floodplain (Varzea) Forest and the Forest of Floodplain (Varzea) Lakes.

Flooded areas are subjected to a great variation in the community of species given the regime of waters. In the rainy period, which spawns from May to September, it is responsible for interruption of timber harvesting. The Rio Branco, limiting with the FMU in its western section, extends approximately 800 meters in width. In the dry period the river may be 9 meters below its maximum, drying most of the rivers and creeks that cut the FMU, reducing or compromising species in the interior of the FMU that depend on the Igarapés, such as the otter (*Lontra longicaudis*) and the giant otter (*Pteronura brasiliensis*), besides fish that depend on the small rivers for reproduction and for upriver migration as *Brycon sp*.

2.4.1 The Floodplain (Varzea) Forest of Igarapés occur in the alluvial plains along meandering water beds, where the terrain is plain and submitted to prolonged flood. It is a high and homogeneous forest, with the canopy reaching 35 to 40 m. It harbors a large number of large trees, all of them with anchor roots. Two arboreal species dominate the
physiognomy of this forest, *Vouacapoua pallidior* and in the understory *Rinorea racemosa*.

2.4.2 The Forest of Floodplain (Varzea) Lakes occur in flat depressions next to the Rio Branco. The river flood during rainy season, when these depressions fill with water loaded with sediments and become lakes that may last for several months. Due to the prolonged flooding, this forest formation almost does not have herbaceous strata, shrubs being rare. The forest is homogeneous and low, with canopy varying between 10 to 15 m in height. Trees are usually twisted. As typical species, *Pterocarpus rohrii*, *Cynometra* spp. and *Hydrochorea corymbosa* may be mentioned.

3. *Campinarana* – It means false grassland, it refers to the physiognomy that covers the soils Podzol Hydromorphyc and Quartzite Sands. Amazonian dwarf and rachitic ecotypes predominate in the floristic composition, with at least one monotypic endemic genus. In the FMU the ecotype present is the Arboreal Campinarana, with canopy reaching 15 to 25 meters in height and few large trees. Amongst the most common species are *Manilkara huberi* and *Goupia glabra*.

4. *Seasonal Forest* – This unit represents a relatively dense forest if compared with the Savanna formations, but open if compared with the Dense Ombrophylous Forest. Emergent trees are rare in this environment, the most frequent ones reaching median to low height, with a large number of vines or palms entangled to the vegetation that occupy the mid hillsides and valleys. Elements of this forest occur in the FMU in areas considered as Areas of Ecological Tension or Contact Zones (see below).

5. *Open Ombrophylous Forest* – It is a subgroup that, in the physiognomic-ecological concept, trees are widely spaced from one another, with or without palm trees and harboring dense shrubs strata with or without lianas, reflecting special climatic and soil conditions. This type of forest does not occur in the FMU.

6. *Areas of Ecological Tension or Contact* – The limits between two phytoecological zones are characterized by a type of transitional vegetation, representing a mosaic where two types of vegetation mix, producing as product a formation with both vegetation type (transition), known as Area of Ecological Tension.

6.1 In the FMU the *Hilltop Forests* represent an Area of Ecological Tension. It is found in the steeper landscapes, on hilltops. In the lower parts it is physiognomically more similar to the Campinarana Forest, but without the species that characterize it, and in the higher sections is more similar to Lowland Non-flooded Forest. It covers clay soils at higher altitudes and in sandy-clay soils in lower altitudes. The canopy is relatively lower than in the Lowland Non-flooded Forest, reaching from 25 to 35 m in height.

6.2 Other formation of the Area of Ecological Tension in the FMU is the *Bedrock Forest*. Represents a transition between the Hilltop Forests and some elements of Seasonal Forests. The presence of elements from the Seasonal Forests is due to the restrictive environmental constrains determined by the steep slopes, the presence of extensive rocky blocks and bedrocks and in the reduced soil thickness. This forest type occurs exclusively at the highest peaks of hills and in other sections with less elevation that have rock outcroppings and rock beds. Typical timber species of this forest type is the *Tabebuia* sp., being also common the *Apeiiba echinata*, the *Peltoigne excelsa*, the *Ecclinusa guianensis*, the *Pouteria guianensis* and the *Aniba canellila*. Specifically growing on the rock outcrops, besides the *Tabebuia* sp.,
there are other important species from the Myrtaceae and Apocynaceae family to the general forest aspect. The occurrence of the genus *Cereus* is equally of very typical, aggregating on considerable numbers over rock beds.

Table 3. Forest types used by the Economic and Ecological Zonation (ZEE) of Roraima (Franciscon, 2002), with its subtype variations and characteristic species.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Subtype</th>
<th>Most important species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense Ombrophylous Forest</td>
<td>Dense Submontane Ombrophylous Forest</td>
<td><em>Manilkara huberi, Hymeneae parviflora, Caryocar villosum, Qualea dinizi, Hieronyma alchornioides, Didimopanax morototoni,</em> and species from the genus <em>Pouteria and Chrysophyllum.</em></td>
</tr>
<tr>
<td></td>
<td>Alluvial Forest (Seasonally flooded)</td>
<td><em>Ceiba pentandra, Virola surinamensis, Tapirira guianensis, Mauritia flexuosa, Euterpe sp., Astrocaryum sp., Erithroxyllum mucronatum, Ormosia sp., Trichilla sp., Nectandra sp., Naucleopsis sp., Coccoloba sp., Aldina heterophylla and Zygia.</em></td>
</tr>
<tr>
<td></td>
<td>Dense Lowland Forests</td>
<td><em>Tapirira guianenses,</em> species from genus <em>Alchornea, Tabebuia.</em> In this formation generally species of the genus <em>Callophyllum and Ficus</em> predominate.</td>
</tr>
<tr>
<td>Campinarana</td>
<td>Arboreal Campinarana</td>
<td><em>Erisma sp., Couma utilis, Duroia sacifera, Buchenavia macrocarpa, Siparuna guianensis, Goupió glabra, Tovomita sp.</em></td>
</tr>
<tr>
<td></td>
<td>Shrub Campinarana</td>
<td><em>Tapirira guianensis,</em> <em>Licania sp., Xylopia sp.</em></td>
</tr>
<tr>
<td></td>
<td>Grassland Campinarana</td>
<td>Species mainly belonging to the families Poaceae and Cyperaceae.</td>
</tr>
<tr>
<td>Savanna</td>
<td>Arboreal Savanna</td>
<td>Dominant species: <em>Curatella americana.</em> Other species: <em>Antonia ovata, Neea sp., Andira sp., Byrsonima crassifolia, B. pachypoda, Himatanthus articulata, Connarus favosus, Xylopia aromatica, Miconia spp., Casearia sylvestris,</em> and <em>Maprounea guianense.</em></td>
</tr>
<tr>
<td></td>
<td>Grassland Savanna</td>
<td>Species from genus <em>Byrsonima</em> (Malpighiaceae) and <em>Atallea maripa</em> (Arecaceae=Palmae)*</td>
</tr>
<tr>
<td></td>
<td>Parkland Savanna</td>
<td><em>Byrsonima crassifolia</em> and <em>Curatella americana</em> as dominants. <em>Bowdichia virgilloides, Anadenathera peregrina, Neea sp., Siparuna guianense, Solanum sp., Guatteria schomburgkiana, Casearia sylvestris, Casearia spinascens e Stigmaphylmus sp.</em></td>
</tr>
<tr>
<td></td>
<td>Steppical-arboreal Savanna</td>
<td>Genus <em>Acacia, Mimoso, Cassia, Aspidosperma, Tabeuia, Schinopsis, Piptadenia, Astronium, Mora, Centrolobium, Brosimum.</em></td>
</tr>
<tr>
<td></td>
<td>Seasonal Forest</td>
<td>Genus <em>Croton, Sclerolobium, Aspidosperma, Clarisia, Pouteria, Cecropia, Caraipa and Guatteria.</em> Among the palms, the most common species are from the genus <em>Astrocaryum, Euterpe and Oenocarpus.</em></td>
</tr>
</tbody>
</table>

Besides those, there are also the Pioneer Formations, a type of primary vegetation with edaphic characteristic that occupy land enriched by successive alluvial deposits. Along fluvial plains and depressions, as lakes and swamps, they present a vegetation cover in constant succession of therophytes, cryptophytes, hemicryptophytes, chamaephytes and nanophanerophytes. Some of the most common species found in this environment are: *Sclerolobium hipoleuwm, Mauritia flexuosa, Ambelania laxa, Aldina discolar, Astrocaryum vulgare, Leopoldina pulchra, Mauritia*
martiana and Euterpe sp. This formation does not occur in the FMU in its climax form, but there are concentrations of Mauritia flexuosa in the anthropized area.

### 2.3.2. Conservation Values of threatened species

To list the threatened species and potential HCVs, the list of birds and mammals of the Fazenda Mundo Novo recorded by Heber & Benito (2005) and Fehlow (2006, 2008) was consulted, as well as the forest inventory compiled by Haas & Glauner (2004), plus the list of threatened species of Brazil mentioned in the Normative Instruction 03/2003 issued by Ministry of Environment, the Red Book of the Brazilian Fauna Threatened with Extinction of the Ministry of Environment (Machado et al., 2008), and the IUCN’s (2009) list of Threatened Species.

The distribution of species were verified by using Eisenberg & Redford (1999), Chiarello et al. (2008), IUCN (2009), the Red Book of the Brazilian Fauna Threatened with Extinction (Machado et al., 2008), and Roosmalen & Roosmalen (2003). In the case of flora, the database from the Global Biodiversity Information Facility (GBIF, 2009) was also consulted.

The neotropical fauna is much diversified. There are 16 mammal species candidates to HCV, five species of birds, five of reptiles and six of flora.

A complicating factor for the identification of species in areas of high biodiversity is the similarity between some of them. In the Fazenda Mundo Novo, for example, two species of spider monkeys have been documented (Ateles paniscus and A. marginatus) (Heber & Benito, 2005), and a third was suggested to be present (Ateles belzebuth), two of which are classified as Endangered (EN) by the IUCN, and very similar to each other (Fig. 3). It is possible that at least one of them have been result of a misidentification, considering that the species is not expected for the area (Ateles marginatus) (Eisenberg & Redford, 1999; Chiarello et al., 2008). Besides that, Nunes & Bobadilla (1997) suggest that one of the species alleged to be present in the FMU (Ateles belzebuth) does not exist at the east margin of the Rio Branco, where the FMU is located. Distribution maps of Roosmalen & Roosmalen (2003) corroborate this information, indicating the presence of a single species inhabiting the eastern margin of Rio Branco (A. paniscus) but showing an animal with white front that could easily be misidentified by A. marginatus. Such controversial information justifies the monitoring of spider monkeys in the FMU.

![Figure 3. Illustration of the three species of spider monkeys mentioned by previous assessments to occur or potentially occur at the Fazenda Mundo Novo, from left to right, Ateles belzebuth, A. marginatus, and A. paniscus. Ateles marginatus is known to occur only to the south of the Amazon River (Eisenberg & Redford, 1999; Chiarello et al., 2008).](image-url)
The appendix 3 list potential HCV species of birds, mammals and reptiles recorded or expected to occur in the FMU. Assessments were carried on the groups of mammals and birds, while the list of reptiles is based on literature and on statements by locals. See also figures of the Appendix 4, and the list of species recorded during field work in Appendix 5.

The three banded armadillo (*Tolypeutes tricinctus*) is another species that was reported to be present by an earlier inventory. Its distribution, however, is not expected for the area, and no visual or photographic record was available as evidence, resulting that its presence has been discarded.

3. Defining High Conservation Value Areas in the FMU Fazenda Mundo Novo

3.1. HCV 1

Areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, threatened species, refugia).

3.1.1. HCV 1.1 Protected Areas

Definition

All protected areas are considered HCVs in the Indonesian national interpretation (Consortium to Revise the HCV Toolkit for Indonesia, 2008) and of Malaysia (WWF Malaysia, 2009). Additionally, in the Indonesian interpretation, if one FMU is considered to provide an important function around a protected area, or act as a buffer area, than a HCV is considered present.

In the HCV Guide for Bolivia (Rumiz *et al.*, 2004), only the protected areas considered ‘important’ by the managing environmental agency are HCVs, and a list of those protected areas are attached to the document.

The legislation that governs the protected areas in Brazil is the National System of Conservation Units (SNUC), determined by Federal Law nº 9.985, of 18th of July, 2000. According to this law, several types of protected areas (Conservation Units - UCs) are considered, with different levels of protection. The UCs classified as being of direct use may have its resources harvested, and the less restrictive ones may even allow permanent human habitations and crops, whereas the UCs of indirect use have controlled visitation and research.

Taking into account the large difference in protection status between UCs in Brazil, when assembling a national interpretation for this country perhaps it should be considered that an UC may or may not be treated as an HCV according with its level of protection. The UCs with more restrictive use are stronger candidates for untouchable HCVs, and in the other extreme, UCs with less restrictive use should not necessarily classify as HCVs, or alternatively classify them as HCVs with allowed management. Using the same criteria, a FMU next to a UC may also classify as HCV, as in the *HCV Toolkit for Indonesia*.

In this scenario, a parcel of an Area of Environmental Protection (APA) may not be considered a HCV or classify as HCV with allowed management, meanwhile an UC of restricted use may be a HCV and management not allowed.
The Important Areas for Bird Conservation (IBAs) are potential HCVAs, for harboring a diversity of endemic, threatened or species of restricted occurrence. However, several of the birds found in IBAs in Roraima are not under immediate threat in this regions, and at least in this case, the classification of an FMU into a HCV as a result of the presence of an IBA should be a result of a particular assessment in the given State or region. Even if an IBA does not classify as HCV, threatened species of birds may individually classify as HCV, and a FMU that harbor a globally or regionally threatened bird species may be considered a HCV. Surprisingly, species with restricted distribution figuring in the IUCN (2009) and the species listed in Birdlife International (2003) that occur in Roraima are not listed in the Brazilian Fauna Threatened with Extinction (Machado et al., 2008).

Local context

The UCs within a 50 km radius from the center of the FMU are the Caracaraí Ecological Station (ESEC) and the Viruá National Park (PARNA), both of indirect use, and none adjacent to the FMU. These UCs are part of a large UC and Indigenous Land complex (see appendix 6).

The Caracaraí Ecological Station (ESEC) is located to the west, in the other side of the Rio Branco, which, due to its width, is a known biogeographical barrier, meaning that species that occur in one margin may not occur in the other margin. Apparently, thus, there are no direct services provided by the FMU to the conservation of the ESEC.

The PARNA of Viruá, with 227,011 hectares is 13 times larger than the FMU, it is located to the south at an approximate distance of 20 km. The area between the PARNA and the FMU is cut by the BR-174 (federal paved road), and thus with considerable anthropic influence. Based thus on the fact that the FMU is small in comparison with the PARNA, and that this UC is located at a considerable distance from the FMU and with relatively compromised ecological connection, no HCV was found to be present.

These UCs apparently do not receive much influence from the FMU to justify the presence of a HCV.

Roraima harbor three Important Bird Conservation Areas (IBAs) (Birdlife International, 2003). They are the IBA BR001 (Tepuis of Roraima), in the extreme north of the State, the IBA BR003 (Lavrados - grasslands - of Roraima) to the north, and the IBA BR004 (Prairies and Floodplains of Rio Branco).

The IBA BR004 is composed by the floodplains (varzea) of Rio Branco and by the formations of the Prairies/Campinaranas that extend from its junction with the Rio Negro, to the south, up to the protected area complex of Caracarai, to the north. That considered, there may be a certain overlay between the IBA and the FMU. The majority of the species in this IBA are considered as Least Concern (LC) by the IUCN (2009). Among the threatened species (IUCN - NT) figures the crested eagle *Morphnus guianensis*, the harpy eagle *Harpia harpyja*, the Klages's antwren *Myrmotherula klagesi*, and the Rio Branco antbird *Cercomacra carbonaria* (that has in Caracarai its southern range limit). Of those, only the harpy eagle was recorded in the FMU (Heber & Benedito, 2005; Jorge Luiz, com. pess.) and immediately outside the southern border (Hass, photographic record).

Taken into account the large extension of the several UCs in the Caracarai region, the fact that these UCs largely overlay with the IBA BR004, and considering that the IBA itself is very large
and at the same time lack concentrations of species with level of threat superior to LC, there is no reason to consider the FMU as an HCV due to its partial overlay with the IBA.

Identification of the HCV and its limits

The FMU was not defined as an area of importance for the maintenance of HCVs of the detailed protected areas, thus no HCV boundary was defined.

Exclusions (if applicable)

The FMU contributes with a small-sized territory at the landscape area encompassed by the nearby protected areas and IBA, and it does not seem to harbor the most vulnerable species of the IBA. It is not continuous with the nearest UCs.

3.1.2. HCV 1.2 Endangered or threatened species

Definition

In the *HCVF Toolkit’s* (Jennings et al., 2003) original definition, HCVAs under this item are forests that harbor a concentration of species threatened with extinction.

In the Indonesian HCV national interpretation, only species considered Critically Endangered (CR) by the IUCN, or that fit the same criteria, are considered HCV 1.2. Species on other categories of threat are grouped under HCV 1.3. The Bolivian interpretation and the Malaysia draft, in the other hand, consider 1.2 also the Endangered (EN) and Vulnerable categories. Bolivia also considers CITES as reference, and Malaysia its national legislation.

The Brazilian interpretation may, besides the IUCN and CITES references, consider as criteria to define HCVs its national list of threatened species (IN 03/2003), which do not follow IUCN categories, and regional lists that do follow the IUCN. There is also a red book featuring a compilation of all lists. Roraima, however, does not have its own list, Pará being the only Amazonian State to have a list of threatened species. For this reason, this regional list was consulted for species of wide distribution to help ascertain the regional status of these species.

It is also suggested that in Brazil the species considered Critically Endangered (CR) and Endangered (EN) by the IUCN, or included in the national list (when it adheres to the IUCN categories) and/or in the regional list, be considered HCVs. There is a general lack of information on the status of species in several regions of Brazil, Roraima included, based on which it is suggested that Near Threatened (NT) and Vulnerable (VU) species be also candidates to HCV if they are considered very rare in the FMU or region, depending thus on the local context and on the results of the HCV assessment. The interpretation in this report support the concept that there is no need to apply the CITES criteria for species that are not in the potential list of species to be traded. The CITES may in fact be more restrictive than other lists, which is quite reasonable, taking into account the impact that trade would have even on species that are under reduced level of threat. It recommended thus that the CITES criteria be applied only for species that may be potentially traded during management, in other words, species of the flora.

Regarding the status of the species of the flora within the FMU, and according to Resolution 406 of CONAMA from February 2009, a species is considered rare when it numbers less than 3 individuals per 100 hectares.
In terms of detectability, counting the fauna is much more complex than counting the flora, as they are mobile and thus their presence is related to a series of factors that frequently demand consecutive resampling. Counting requires efforts directed to each group of species, and for each habitat, and an amount of time that is often unavailable. For this reason, during field work, categorizations of the status of species were largely obtained from impressions on the field and/or statements of people with local experience. The convention used here for the fauna regarding rarity aims to translate more the relative density than the encounter rate. Signs of jaguar (*Panthera onca*) and giant armadillo (*Priodontes maximus*), for example, may be common in the FMU, but the number of these animals is believed to be small. The jaguar uses a large and almost exclusive home range, for this reason occurs at low numbers, and the giant armadillo has small extent of open areas available in the FMU to which it is usually associated.

In several situations the species are defined as HCV for other reasons than the threat criteria, such as lack of occurrence information in the FMU, and even uncertainty regarding their presence. Following the precautionary principle, a potential HCV should only be discarded if the HCV is absent (or when it is not a real HCV) beyond doubt (Stewart *et al*., 2008: 9). In these cases, the recommended management action is exactly to record and collect information on the distribution and status of the species, until enough information is available to define alternative management measures if necessary.

**Local context**

*Critically Endangered Species (CR)*

Only one CR species was identified based on previous inventories, the shrub *Pradosia decipiens*. According to O’Brien (1998), there is no population information on this species. It is only known by the type, collected by the River Tarumã near Manaus, in 1942. The author also mentions that inhabits non-inundated areas of low forests. It is suggested here that the shrub identified as *P. Decipiens* be submitted to a new evaluation for identification and confirmation. If confirmed, it is considered a HCV.

*Endangered Species (EN)*

In this category one species of monkey was informed to be recorded (Heber & Benito, 2005), and another species of monkey was considered as having potential occurrence in the FMU. They are the white-bellied spider monkey (*Ateles belzebuth*), and the white-whiskered spider monkey (*Ateles marginatus*). The first was not confirmed during field work and the employees at the FMU also did not recognize its presence, and the second species is known only to range south of the Amazon River so far (Eisenberg & Redford, 1999; Chiarello *et al*., 2008). If confirmed, this would be the first record of the species north of the Amazon River. These species thus need confirmation. In case they are present in the FMU, they would no doubt be considered as HCVs. Due to their similarities with *Ateles paniscus*, confirmed during field work at the FMU, it is necessary that this species be also considered during monitoring.

The giant otter is the third mammal species in this category. It was recorded during field work, and the employees report that it is relatively common during the period of flood within the FMU, and in the Rio Branco. However, within the FMU the species is certainly rare in terms of density for several reasons: the seasonality of the Igarapés; the existence of only two large Igarapés at the FMU which are main candidates to harbor the species, the Igarapé Jarú and the Igarapé Sumaúma; and the relatively small area of the FMU to harbor enough resources to maintain large
carnivores. Because it is a species that occur at low densities in the area, and it is listed as Endangered (EN – IUCN), the giant otter is a HCV.

Other two species of the flora are classified as Endangered (EN – IUCN), the *Inga Suberosa*, and the *Tabernaemontana muricata*. The *Inga suberosa* is occasional at the FMU, and has been recorded by the ZEE in Roraima (SEPLAN, 2002), but there is no record in the IUCN (2009) database neither in the GBIF (2009) for Roraima. The *Tabernaemontana muricata* is reported to be common in the FMU, but known in the literature only to the proximities of Manaus (IUCN, 2009). This justifies the categorization of these species into HCVs. Given the doubt about its occurrence in the region, it is recommended that the identification of these species be revised. In case they are indeed present, perhaps then their distribution span through a larger area than it was previously thought. If this is the case, than these species may require a revision of their HCV status. Meanwhile, both the *Inga suberosa* and the *Tabernaemontana muricata* may be considered HCVs.

**Identification of the HCV and its limits**

This HCV was identified in the FMU. HCV Management Areas (HCVMA) were delimited for the species *Pradosia decipiens* (CR) and giant otter (EN). The giant otter’s HCVMA are the Igarapés Jarú and Sumáuma, and that of *P. decipiens* is the only parcel in which it was found during the inventory (nº 36, with a radius of 25 m), within the FMU (Fig. 4)

![Figure 4. High Conservation Value Management Areas (HCVMA) for the species Pradosia decipiens (CR) and giant otter Pteronura brasiliensis (EN), and other points of occurrence of High Conservation Values (HCV) Tabernaemontana muricata (EN) and Inga Suberosa (EN).](image)
Nearly Threatened (NT) and Vulnerable (VU) Species

Considering the pending doubts on the records of some Critically Endangered species (CR – IUCN) mentioned earlier, some species of the NT and VU (IUCN) category that could not be confirmed during the field work, or by employees, should have their presence/absence verified, either through training of employees for data recording, or by hiring of a study to be conducted by a group of researchers with recognized ability.

Sixteen species were listed in this category. Some of them require management or monitoring, other turn out important to be mentioned when environmental education and training programs be considered inside or outside the FMU.

The presence and thus the status of the bush dog (*Speothos venaticus*) is undefined. There has been no field record, and employees have not confirmed the occurrence of this species with confidence. This is partially due to the cryptic habits of this species, and of it naturally rare occurrence in nature. It is considered threatened in Roraima by the national list (IN 03/2003). Until proven the contrary, the bush dog is a HCV.

The giant anteater (*Myrmecophaga tridactyla*) is considered uncommon in the FMU, certainly because the Dense Ombrophylous Forest is the predominant vegetation, and the species characteristically inhabits open areas and Cerrado. It seems to be common in Roraima, mostly in the Savanna region (known locally as ‘lavrado’) near Boa Vista. An individual was identified in this habitat during the trip Boa Vista-Caracarai, and was also recorded in the FMU. It is considered threatened in Roraima by the national list (IN 03/2003), and may be considered rare in the FMU. For these reasons, the species classify as HCV. Its distribution is predictable and certainly circumscribed by Campinarana, Seasonal Forest and Hills.

The jaguar (*Panthera onca*) was confirmed during field work in the road to the ‘forest inventory’ road, where timber has been last harvested. This is a preliminary indication that the forest management is not a limitation to the occurrence of the species. Its vestiges are relatively common in the FMU, but considering the species’ area requirements, it is a rare animal. The area of the FMU is approximately equivalent to the home range of a single jaguar. Besides that, ranching activities on the surroundings of the FMU and the general people’s predisposition against the presence of the jaguar represent a constant threat to its populations. In southern Brazil it is one of the first species to disappear following chaotic human occupation (Mazzolli, 2005; 2009). It is considered threatened in Roraima by the national list IN 03/2003). For these reasons, it is considered a HCV.

Vestiges of white-lipped peccaries (*Tayassu pecari*) may be easily found in the FMU and the species is not uncommon. The *buritizais* (stands of *Mauritia flexuosa* palm) have been found to be determinants on the feeding dynamics of groups (Fragoso, 1998), which in the FMU are concentrated in the anthropized area. The species is actively pursued by hunters, and the intensive persecution may cause the demise of entire groups. This is because individuals tend to form large groups that may be easily followed and ambushed. Poaching of white-lipped peccaries in the FMU was witnessed during field work. For these reasons it is considered a HCV.

The Orinoco goose (*Neochen jubata*) occurs in Roraima associated to rivers (Naka et al., 2006). In this case, it would be associated to the Rio Branco, which borders the FMU. Information on the status of the species in the area is lacking. Using precautionary approach, the species is considered as HCV, being potentially present in the surrounding areas.
Statements on the presence of the harpy eagle (*Harpia harpyja*) in the FMU have been recorded, and the species was photographed in the surrounding area of the FMU towards the side road 3. It is not considered threatened in Roraima by the national list (IN 03/2003) or by the regional list of the State of Pará. However, as a large predator, especially of arboreal species, need large forested and preserved tracks of forest to obtain enough food to supply its energetic requirements, and for this reason occurs at low densities. It is almost certain that its adaptation to more open habitats are poorly understood, such as Savanna, Campinarana and transitions of those with Moist Forests, transitions that occupy large extensions of the State of Roraima. For this reason it is considered a HCV.

Vestiges of giant armadillo (*Priodontes maximus*) are relatively easy to find, but it may have a restricted range, as its most characteristic habitat is not the Dense Forest. It is considered threatened in Roraima by the national list (IN 03/2003). It prefers, as the giant anteater, open areas and Cerrado. It is a HCV for being rare at the FMU, tending to be restricted to the Campinarana, Hills, and Seasonal Forest.

The manatee (*Trichechus inunguis*) range only by the Rio Branco. The employees of the FMU are not familiarized with the species though. According to statements obtained in the field, the manatees inhabits the Rio Branco approximately 3 km downriver from the FMU, but reach the front of the FMU during the flood period. It is considered threatened in Roraima by the national list (IN 03/2003), and Endangered (EN) in the State of Pará. It is very susceptible to hunting, thus it is considered a HCV.

The chelonians yellow-spotted sideneck turtle (*Podocnemis unifilis*), six-tubercled Amazon River turtle (*Podocnemis sextuberculata*), red-headed Amazon River turtle (*Podocnemis erythrocephala*), big-headed Amazon River turtle (*Peltocephalus dumerilianus*) and the giant South American turtle (*Podocnemis expansa*) are not considered threatened by the national list nor by the regional list of the State of Pará, but they are actively pursued as game species by fishermen, figuring in the IUCN list as Vulnerable (VU), except *P. expansa* (IUCN LR). There is local evidence that these species are suffering serious threat. A boat illegally carrying 88 chelonians, from Caracaraí, was arrested by the State Foundation for the Environment, Science and Technology (FEMACT) (newspaper *Roraima Hoje* from 15 of October 2009). According to the officer Wilson from the Chico Mendes Institute of Biodiversity Conservation (ICMBIO), the threatened species caught in the illegal trade was the giant South American turtle (*Podocnemis expansa*), more precisely the females that reach larger size and are more vulnerable than males. The officer also reported that this species are vulnerable during egg-laying period that start in December, at the margins of the Rio Branco downriver to Caracaraí, for an extension of 120 kms. This species is more demanding in terms of locals for egg-laying than other species of the genus *Podocnemis*, requiring large and raised sandbanks or beaches for egg-laying, and are also more vulnerable as they congregate in large groups. The remaining species *P. unifilis* and *P. sextuberculata* are solitary and show rusticity in the selection of places to lay eggs, being able to do it on the steep river banks (Nascimento, 2002). According to statements obtained during field work, fishermen capture the turtles during egg-laying period next to the Jarú Island, in front of the FMU. Although these turtles occur in low number near the FMU, due to their high vulnerability they may be considered HCV, as well as the other species of chelonians mentioned above.
The cetaceans Amazon pink river dolphin (*Inia geoffrensis*) and the grey river dolphin or tucuxi (*Sotalia fluviatilis*) do not occur in the FMU, being restricted to the Rio Branco. They are not in the regional or national lists, but are considered as Data Deficient (DD) by the IUCN. According with statements obtained during field work, they show up near the FMU during the floods, indicating seasonal presence, and they are not abundant. In fact, it has been shown that the species *Inia geoffrensis* migrates dozens of kilometers (Da Silva & Martin, 2000), mostly during the flood season, which are likely to represent extension of their home range (Best & Da Silva, 1989). Both dolphins have been recorded to be employed for bait to fish piracatinga, *Calophysus macropterus*, elsewhere in the Amazon Region. Until more data is available, both cetaceans are considered a HCV based on the cautionary approach.

**Identification of HCVAs, HCVMAs and their limits**

Several VU and NT species were considered HCVs. Because many of those are widely distributed in the FMU, there is enough reason to consider the entire FMU as a HCV. The Rio Branco in front of the FMU, and the Campinarana and Hill areas (plus a buffer of 200 m) were considered HCVMAs. The maintenance of the majority of the values within the FMU depend less on the restrictions of selective logging, as currently conducted, than on the reduction of hunting pressure and environmental impoverishment surrounding the FMU, a phenomenon that should be managed, as well as possible, to attenuate the effects over the identified HCVs. This management is based above all on the relationship with the neighboring community and on environmental education.

![Figure 5. HVCA (UMF) and HCVMAs (patterned lines) identified in the FMU and surroundings, including the Rio Branco.](image-url)
Exclusions (if applicable)

Just as the margay (*Leopardus wiedii*), the little spotted cat (*Leopardus tigrinus*) has not been observed during the field work nor by employees of the FMU. It is not a species easy to record and may be mistaken as an ocelot (*Leopardus pardalis*) or as a margay. It is considered threatened in Roraima by the national list (IN 03/2003), but its diet consists mainly of small mammals that are abundant in tropical forests, and it is not chased by hunters. It is not under immediate threat, thus it is not considered a HCV.

The tapir (*Tapirus terrestris*) was recorded during field work through vestiges. In southern Brazil the species is restricted to a few refugia (Mazzolli, 2005). It is not mentioned, however, in the national list of threatened species or in the regional list of Pará. It uses a home range of few hundred hectares, and it seems to be common in the FMU. There is no immediate threat, so the species is not considered a HCV.

The black or Guiana spider monkey (*Ateles paniscus*) was observed during fieldwork twice and by FMU employees’ in other occasions. Apparently is not uncommon, and is expected to occupy all forest types in the FMU. It is not considered threatened in Roraima, neither it is mentioned in the national list (IN 03/2003), nor in the regional list of Pará. For these reasons it is not considered a HCV. In spite of that, its monitoring is recommended due to misidentification with other species of spider monkeys during previous inventories in the FMU, which conflicted with information found in the literature.

3.1.3. HCV 1.3 Endemic species

**Definition**

The *HCVF Toolkit* (Jennings et al., 2003) states that endemic species are those that are confined to a particular geographic area.

The Indonesia interpretation is much broader in this item, encompassing threatened species not considered in the HCV 1.2 [e.g. species considered Endangered (EN) and Vulnerable (VU) by the IUCN (2009)]. The Bolivian definition is also broader than the original concept, including ‘concentrations of endemism and/or high diversity, relicts, and special areas’. Malaysia follows strictly the original definition, considering in this item only the endemic species, and highlighting the importance of concentrations of endemic species.

The interpretation in this report follow strictly the *HCVF Toolkit Part 2* (Jennings et al., 2003), considering only endemic species in this item. Additional features such as relicts and special areas, suggested in the Bolivia Guide, may be treated in the HCV 3, *Rare, threatened or endangered ecosystems.* Bolivia still aggregates areas with high biodiversity, independently if endemic or not. It is suggested here that this item should meanwhile be a criteria to be defined in each individual assessment, and defined

![Figure 6. Mammal species endemism by Ecoregion (Olson et al., 2001).](image-url)
more sharply during a future national interpretation. The diagnostic of Hayward et al. (2004) and the current assessment, for example, have treated the IBAS, which are concentrations of threatened species, in the HCV 1.1.

Local context

According to Olson et al. (2001) the number of endemic mammal species may be considered low in the region (Fig. 6). Regarding birds, there is an Endemic Bird Area (EBA) north of Roraima, but none identified in the FMU general region (Birdlife International, 2003).

HCV identification and its limits

No HCV has been identified and no area was delimited for this HCV.

3.1.4. HCV 1.4 Critical temporal use

Definition

This element is designed to ensure the maintenance of concentrations of important species that use the forest only during certain periods or phases of their life history. It includes sites used for reproduction, winter shelter, migration sites, migration routes, and corridors (latitudinal or altitudinal) (HCVF Toolkit Part 2).

National interpretations are very direct and converging. In the Bolivian definition, areas for foraging and reproduction of birds, fish, and extensive palm tree concentrations should be evaluated for the presence of HCV. The Indonesian interpretation states that the purpose is to identify key habitats used temporarily by individuals or species, such as reproduction and nidification areas, including caves, flooded areas, wildlife corridors that enable connection between seasonal resources, and refugia for species, in particular during prolonged droughts, floods or fire. The trait shared in common by all habitats considered under HCV 1.4 is that their disappearance would have an impact on wildlife species many times greater than the area of the habitat itself would lead one to expect (HCV Toolkit for Indonesia).

Local context

There are few and scattered records of the migratory birds jabiru (Jabiru mycteria) and osprey (Pandion haliaetus) in the FMU (Fellow 2006, 2008; Heber & Benedito, 2005). Information on concentration of these birds in the region and importance of Rio Branco for these birds were not found and probably does not exist.

The jabiru is associated with wetlands and rivers (Naka et al., 2006). It is widely distributed, occurring from the United States to Argentina. The nearest available records of nidification of jabiru are from Venezuela (Gonzalez, 1996).

The osprey has a global distribution, but the individuals that migrate to South America (from Venezuela to Argentina) do so to escape winter in North America and nidify. In a mark-recapture study, the larger number of marked eagles were recovered in the States of Amazonas and Pará (Mestre & Bierregaard Jr, in press). Apparently, the State of Roraima is not a destination where the species agglomerate.

Concentrations of these species were not recorded in the FMU or in the vicinities.
The giant South American turtle (*Podocnemis expansa*) recurrently use the same beaches during massive and widely distributed seasonal migrations. There are past records of hundreds of thousands female aggregations during egg-laying across its distribution (Ojasti, 1997). According to information obtained in the field, few individuals of turtles lay eggs during the dry season at the beaches formed near the FMU, especially next to the Jarú island. Larger concentrations are found approximately 150 km downriver, at an area protected by the IBAMA, including the Santa Fé Island (Lat 0.2375°, Long. -61.7616667°) and Tabuleiro Island (Lat. 0.4°, Long.-61.7166667°) (Nascimento 2002).

There are no critical concentrations of this species in front of the FMU.

The FMU has one of the largest populations of Brazil nut trees (*Bertholletia excelsa*) in the region (MVV, 2009). The Brazil nut tree produces the Brazil nut, common in the FMU but not at the nearby forests. It produces a seed that is highly energetic and that represent a non-neglectable seasonal resource for many species of the fauna. The nuts are initially available on the tree tops, as resources for arboreal species (primates and birds), and fall during the rainy season becoming a resource for animals that feed on the forest floor. In Brazil nut areas the agouti (*Dasyprocta leporina = D. agouti*) (Wilson and Reeder, 2005) may reach double the population size than in areas without Brazil nuts trees (Jorge & Peres, 2005).

The macaws (*Ara* spp.) may consume up to 10% of the total nut production of an area (Mandar *et al.*, 2004). The capuchin monkey (*Cebus apella*) may spend more than 30 minutes to open the outer shell (Boinski *et al.*, 2003), both a demonstration that the high energetic cost is compensated by the high nutritional value of the nut, and also suggesting that the high and prolonged noise produced possibly attracts and benefits other opportunistic species (thieves) less capable of cracking the shells.

The Brazil nut tree is highly dependent on pollination and dispersal, revealing the ecological weave behind the survival of the species. The large and complex Brazil nut flowers have a cap that prevents the majority of animals to have access to the floral organs. Only the large bees are able to lift the cap and have access to the interior of the flower. Common pollinators are the Euglossinae or orchid bees, the males of which collect the perfume of the orquids on the forest canopy to attract the females during breeding. The dependence of the Brazil nut is such that in Brazil nut plantations, where orquids do not proliferate on the canopy, the lack of pollinators has provoked the failure of plantations (Thomas & Packham, 2007).

The Brazil nut is also completely dependent of a disperser to germinate. The capsule or shells do not open by themselves, thus it is dependent on animals that open the shells to germinate. The agoutis (*Dasyprocta leporina*) are considered one of the main disperser of the Brazil nut, they will not only open the shells, but also cache them by burrowing the seeds to forage latter (eventually ‘forgetting’ some) (Thomas & Packham, 2007). The buried seeds, among other advantages, preserve moisture better and are inaccessible to many predators, increasing their chance to germinate and develop. Part of the buried seed, however, may enter the energetic chain of other species of the ecosystem when recovered by peccaries (Vander Wall, 2001), whose sense of smell is extremely sharp.

The Brazil nut seed may be the most important non-timber product in vast areas of the Amazons. In this context, it is convenient to highlight that, in areas of selective timber harvesting, the harvest must be carefully conducted as means to reduce impact on the Brazil nut tree. It has been
shown that up to 3% of all Brazil nut trees suffer damage, specially at the canopy, even at low harvesting intensity (~ 0.5 trees/ha and ~ 5 m³/ha), which may be minimized and/or avoided with adequate planning of direction of timber fall of targeted neighboring trees during harvest (Guariguata et al., 2009).

Selective tree-logging around Brazil nut trees is a pre-requisite for development and maintenance of Brazil nut population in the FMU. This concern is already adopted at the FMU, and needs to continue that way.

**Identification of the HCV and its limits**

The Brazil nut tree is a HCV that occupies the non-flooded (Plateau) forests in the FMU. The HCVA encompass the entire distribution of the species within the FMU (Fig. 7).

![Figure 7. Points of occurrence of the Brazil nut tree (Bertholletia excelsa) recorded during the inventory (Source: inventory database, MVV).](image)

3.2. **HCV2 Globally, regionally or nationally significant large landscape-level areas**

This HCV includes forests that are in (or close to) what might be called their 'natural' or undisturbed condition over large areas

**Definition**

According to the *HCVF Toolkit Part 3* (Jennings et al., 2003), this HCV encompass forests that ‘contain viable populations of most if not all naturally occurring species or important sub-
populations of very wide-ranging species. In such forests, natural disturbance regimes, forest succession, species distributions and abundance will be largely or wholly unaffected by recent anthropogenic activities.

The manuscript of Malaysia treated this HCV as corridors between large complexes of forested areas. The Guide of Bolivia is very specific by determining that this HCV must be at least 100,000 ha in size, or be crucial to the connectivity of known forest landscapes, and that harbor all the expected species from various groups that are typically rare or threatened, as well as abundance of other species. The HCV Toolkit for Indonesia is also specific by mentioning that the objective is to protect core-areas of at least 20,000 ha in size, surrounded by a forest belt at least 3 km wide. The Indonesian interpretation and its application in Sumatra (Hawyard et al., 2004) innovatively breaks this HCV into three parts: HCV 2.1 - The FMU is a large, landscape-level forest; HCV 2.2 - The FMU is an integral part of a large landscape-level forest; HCV 2.3 - The FMU maintains viable populations of most naturally occurring species. The subdivision of the HCV in three other sub-items help the analysis by providing individual screening on the three main aspects considered in this HCV. As such, it is recommended here that these subdivisions be adopted during the Brazilian interpretation. It is also highly recommended that indications for the presence of this HCV be heavily based on field observations, especially in the Amazons, and particularly in Roraima, where the landscape, species’ community composition, and the size of wildlife populations change rapidly due to the growing human occupation.

### 3.2.1. HCV 2.1 The FMU is a large, landscape-level forest

**Local context**

The FMU is relatively small when contrasted with the huge extension of protected areas in Roraima, which encompass more than 68% of the State, not matching the classification of a large area in the Amazonian context. However, it almost reaches the core-area size proposed by the Indonesian interpretation, and due to the relatively high protection that species that inhabit its area enjoy, except exactly for being smaller than 20,000 ha and by lacking a wide forest belt to protect it from border effects.

**Identification of HCV and its limits**

A HCV 2.1 is not identified here, and no area was delineated to this HCV.

### 3.2.2. HCV 2.2 The FMU is an integral part of a large landscape-level forest

**Local context**

A decree from the Ministry of Environment (MMA) nº 09, from 23 January 2007, establishes the ‘Protected Areas for Conservation, Sustainable Use and Division of Benefits of Brazilian Biodiversity’ or simply ‘Biodiversity Priority Areas’, one of them encompassing the FMU (Appendix 7).
The FMU is located north of the ‘Biodiversity Priority Area’ AM 314, considered as highly important, and limiting to the south with area AM 319, considered of very high importance.

There are reasons to justify, however, that this HCV is not present. First, the treatment received by these areas by the government may be classified as negligible, an indifference possible to observe by the illegal occupation and exploration in the vicinities of the FMU (see details in HCV5). As such, the condition of persistence of natural forests free from disturbance, as announced in the HCVFs Toolkits 2 and 3 does not exist. Second, 68.42% of the State of Roraima consist of some type of protected areas (see Fig.1), being the FMU out of this context. And last, the forest management presents a series of conditions that allow maintenance of local biodiversity, outstanding when contrasted to the surrounding areas, resulting that the FMU by itself is more protected than its surroundings. This would guarantee the indication as core-area in the HCV 2.1, except for the fact that the FMU is relatively too small to maintain viable populations of rare species or species that require large areas to live.

Identification of the HCV and its limits

There are not enough reasons to consider this HCV as present, thus the limits of this HCV have not been delimited.

3.2.3. The FMU maintains viable populations of most naturally occurring species

Local context

Species that use large home ranges spanning across tens of thousands of hectares, such as the jaguar, puma, and harpy eagle certainly occur at low numbers in the FMU, which is for this reason far from harbor viable populations of these species. Some species of primates, and tapir, on the other hand, use areas of few hundreds of hectares in size (primates: Mittermeier et al., 1988; tapir: Noss et al., 2003), and thus could reasonably reach populations sizes of 50 to 100 individuals. White-lipped peccary groups averaging 9 individuals use, in average, areas 1,871 ha in size (Keuroghlian et al., 2004), resulting that the number of individuals of this species may easily reach 100 animals in the FMU, although the viability of these populations that reach larger numbers may also be compromised on the long run (100 years or more) in case of isolation.

Perhaps this is not the case for many species of the flora, even for the most emblematic and large sized ones. For example, based on the density of trees obtained during the inventory, the Brazil-nut relict may have an estimated population size reaching tens of thousands of individuals.

The FMU harbor an adequate area to maintain significative sub-populations of some species that occur in high densities and that occupy small home range, but not to maintain the majority of species with high level of threat.

Identification of the HCV and its limits

This HCV was not identified in the FMU, and its limits were therefore not defined.
3.3. HCV3 Forest areas that are in or contain rare, threatened or endangered ecosystems

Forests within ecosystems that are naturally rare, or that are reducing rapidly in extent due to human pressures

**Definition**

The definition of this HCV is straightforward. The Malaysian interpretation define which information sources should be used to verify if an ecosystem is rare or not, with guidance similar to HCVF's Toolkits 2 and 3. The Bolivian guide defined which ecosystems may be considered HCVs in the country. The Indonesian interpretation fixed criteria for identification of rare and threatened ecosystems: 1. An ecosystem that has lost 50% or more of its original extent in the biophysiological region where it occurs; 2. An ecosystem that will lose 75% or more of its original extent in the biophysiological region where it occurs, based on the assumption that all areas currently allocated for conversion in existing spatial plans will be converted; 3. A natural ecosystem that covers less than 5% of the remaining natural vegetation cover in the biophysiological region where it occurs. These criteria may be useful to the definition of this HCV also in other countries.

The current assessment used maps from IBGE and ZEE, and criteria by the WWF Ecoregion 200 to determine if this HCV was present or not.

**Local context**

The ‘Western Arc’ of the Amazon Basin contains the largest diversity of terrestrial ecoregions (Olson & Dinerstein, 2002). The dominant vegetation in the FMU is the Dense Ombrophyllous Forest, with enclaves and transitions of Campinarana and Semideciduous Seasonal Forest. These ecosystems are widely distributed in the State of Roraima (Fig. 7). None of these forest types fit the criteria of rare or threatened in Roraima or at a larger geographical scale.

Using the WWF’s Ecoregion 200 definition, the FMU is located at the northwestern border of the Moist Forests of Rivers Uatuma-Trombetas (NT 0173) — approximately the size of California, it is considered relatively stable and intact (WWF, 2009a). The ecoregion Campinarana of Rio Negro (NT0158), near and to the west of the FMU, with 80,900 km², is also considered relatively stable and intact (WWF, 2009b). The ecoregion Savannas of Guiana (NT0707), with 104,400 km², is the only one considered vulnerable, mostly due to fire and its effects

![Figure 8. General ecosystems found in the State of Roraima. Source ZEE – SEPLAN.](image-url)
on remaining forests, which in combination with human occupation result in environmental degradation (WWF, 2009c) (Appendix 8). Observations during field work sustain that the Savanna formation is not found in the FMU or in its immediate surroundings (see also Appendix 2), and according to the ZEE this habitat predominate in the northern region of Roraima (Fig. 8).

Identification of HCV and its limits
There is no HCV identified, thus a limit for this HCV was not delineated.

3.4. HCV4 Areas that provide basic ecosystem services in critical situations

3.4.1. HCV4.1 Forests critical to water catchments

Definition
The *HCVF Toolkit Part 2* define forests critical for watershed protection when a particular forest area protects against: 1. Potentially catastrophic floods or drought; 2. Widespread loss of irreplaceable water for drinking, agriculture, hydroelectric schemes and other uses; 3. The destruction of fisheries where spawning grounds had been protected by mangroves or riparian forests; 4. Changes to the hydrology of a catchment that would seriously and irreversibly degrade a protected area. The *HCV Toolkit Part 3* interpretation is looser than the Indonesian interpretation and more restrictive than the Bolivian Guide — It states that a given FMU may not have a critical function in the watershed protection when the catchment is still largely forested, and if the FMU covers a very small proportion of the catchment.

The Malaysian manuscript defines the legislation that rules the protection of water catchments. The Bolivian Guide prescribes HCVs in periodic and permanent flooded areas. The Indonesian interpretation define this HCV as cloud forests, ridge line forests, riparian ecosystems, karst forests, and a variety of other wetland ecosystems, including mangroves, lakes, and swamps. In this interpretation any riparian ecosystem is considered a HCV 4.1. In Sumatra, the definition employed was much more limited, accounting only to ‘unique sources of water for daily use.

The definition used in this report considers the importance of the forest to the water catchment as a whole, water quality for aquatic fauna, and for human consumption and use. Important areas to the maintenance of water bodies of the FMU, such as steep areas and riparian forests, are already covered by the principle 6 of the FSC and by the national legislation.

However, forests that suffer seasonal flooding are especially fragile, and compromising its structure may provoke a great damage along areas of considerable extent. It is suggested, thus, that a riparian forest with more than 5 km in extent and subjected to flooding that reach 500 meters strip of that forest, be considered a HCV.

Local context
The majority of the creeks and igarapés that flow in the FMU spring in the property and drain into the Rio Branco, thus are not directly used by neighboring communities, except perhaps by allowing area for reproduction of fishes that inhabit the Rio Branco, specially the igarapés of larger importance in water volume, the igarapé Sumáuma, and the igarapé Jarú. Although the riparian forests along these creeks are important, they are already protected by national
legislation, and their modification or even removal would not cause irreversible and catastrophic damage as prescribed by this HCV’s definition. This issue needs, nonetheless, to be analyzed carefully outside the context of the FSC, and when forest conversion is involved.

The Rio Branco is one of the main tributaries of the Amazon River, with huge water flux. During flooding season, it reaches the Floodplain Forests and the Floodplain (Varzea) Forest of Igarapés present in the FMU. The presence of Floodplain Forests along all Rio Branco certainly has a critical function to maintain fisheries resources and to avoid damage caused by floods to the water quality.

The riparian forest of the FMU extends for 11 km along the Rio Branco, and the floodplain area, next to Rio Branco, reaches 1.3 km into the FMU. Damage caused to this Floodplain Forest along the Rio Branco may not produce catastrophic damages at the water basin level, but chances are that it would have a great impact in the fisheries and silt up the Rio Branco in the vicinities of the FMU.

Identification of the HCV and its limits

This HCV was identified in the FMU, and limited to a 500 meter strip along the Rio Branco.

3.4.2. HCV4.2 Forests critical to erosion control

Definition

The HCVF Toolkit Part 2 suggest that this HCV should be applied in cases where ‘the risks of severe erosion, landslides and avalanches are extremely high and the consequences, in terms of loss of productive land, damage to ecosystems, property or loss of human life, are potentially catastrophic’. In the HCVF Toolkit Part 3 the guideline to identify this HCV reports to areas with ‘a history of serious erosion or terrain instability or where the soils, geology and slope make the terrain vulnerable and where the impacts of severe erosion and terrain instability might include loss of productive agricultural land, damage to ecosystems or property or loss of human life’.

The Malaysian manuscript reports to the legislation that defines areas with function to control erosion, and the criteria of slope above 25 degrees. The Bolivian Guide mentions a map of potential erosion as reference, and that the great majority of these unstable areas are found above 1,800 meters in altitude. The Indonesian national interpretation furnishes several criteria to determine this HCV, particularly an analysis of erosion potential.

According to the HCVF Toolkit Part 3 this HCV may not be present when the FMU contain only a small area of vulnerable soil or slopes, and when the particular topographic situation of the FMU protects it from potentially severe, erosion inducing rains.

The definition used in this report follow the orientations of the HCVF Toolkit, which proposes a HCV only in areas of high risk. Protections of areas that may compromise the stability of soils within the FMU are regarded in the item 6 of the FSC guidelines, and in the national legislation. Similarly as the previous HCV, this definition is applied best to areas in the FSC context, where safeguards to protect riparian forest and slopes already exist.

Local context

The FMU is mainly lowland area, with few slope areas, and there are no conversion zones that may critically expose the soil. Sandy soil is specially found in Depression Forests along the
igatorapés, protected only by the vegetation and by a thin layer of organic matter, but these forests represent a reduced proportion of the FMU. Steep areas are also few and covered with rocks (Hills or Rock outcrops) (Fig. 2), where several springs are also found, and where harvesting has already been discarded in the FMU.

Identification of the HCV and its limits
This HCV was not identified, thus no limit was proposed.

Reason for exclusion (if applicable)
The majority of the FMU is located on flat terrain. Similar areas in the vicinities that have suffered deforestation, although undesirable, have not caused any catastrophic effects to the ecosystem or to human lives.

3.4.3. HCV4.3 Forests providing barriers to destructive fire

The HCVF Toolkit Part 2 and 3 state that if a FMU is within a region that is prone to serious fires, either historically or in recent years, then this could be or contain a HCVF. If the FMU is located within an area where fires historically occur, then it is taken as HCVF, unless: it is demonstrated that the FMU does not contain forest types that naturally act as a barrier to fire; the area covered by the forest is too small to act as barriers against uncontrolled destructive fire; there are no human settlements or communities within or adjacent to the FMU; there are no places of important cultural value that (e.g. sacred places, archaeological sites) within or are adjacent to the FMU; there are no protected areas that contain threatened or endangered species or ecosystems within or are adjacent to the FMU.

The Malaysian manuscript considers HCV a forested area that has been burned in the past or that is located next to settlements and crops. The Bolivian guide omitted this HCV. The Indonesian interpretation considers risk zones and provides guidelines to locate these areas. In Sumatra, a HCV was considered a natural green belt with 500 meters in width in the contact zone with areas of agriculture as a means to act as a barrier to a FMU containing conversion areas, much more vulnerable than moist forests.

In Brazil, fire maps may be obtained in the internet at the National Institute of Space Research (INPE). Fire zones are common in extensive areas of deforestation in the Amazons, of which Roraima does not participate as one of the greatest representatives. Within Roraima, the areas most prone to fires are those covered by Savannas, which concentrate in the northern area of the State.

Local context

The FMU is located within a matrix of humid forests, thus its importance as a barrier is not outstanding compared to the forest extensions of its matrix. It does not have direct contact with settlements to the south, to the west it is bordered by the Rio Branco, only in the north there are neighbor areas where small-scale agriculture is practiced seasonally. This agriculture is distant apart from the FMU by a road 5 meters wide, sufficient to contain small fires. These small agricultural areas do not produce intense fire, thus the chances that it reaches the FMU are small. Still in the north, beyond the small-scale agriculture, there is a forest belt, and beyond that, larger
scale ranching, occupying areas with hundreds to thousands of hectares. This is the zone where the risks are greater.

By inspecting the maps of INPE that show areas under risk of fire, this is exactly what is verified, that the risks of fire are greater to the north of the FMU (Appendix 9). Thus, the barrier to this potential risk is found between the small-scale agriculture and the ranching area, outside the contact zone with the FMU.

Anyhow, the FMU employs selective logging, resulting that the forest maintains characteristics very similar to unlogged forests, including at its function as barrier against fire, differently than when clear cuts are employed.

**Identification of the HCV and its limits**

No HCV was identified, thus no limit to this HCV was defined.

### 3.5. HCV5 Forest areas fundamental to meeting basic needs of local communities

**Definition**

According to the *HCVF Toolkit Part 2* (Jennings *et al*., 2003), it is necessary to define what is a ‘basic need’ and what is a ‘fundamental need’. The definitions relate to the resources needed for survival of the community, including income, in the case they do not have alternatives readily available. This HCV is different than the previous ones (but similar to HCV6) because it requires consultation with local communities.

The manuscript of Malaysia states that a forest that contain or is adjacent to a legal settlement that depends on the forest for subsistence or medicine, is considered a HCV 5. The forest is automatically considered a HCV 5 if there are settlements in the forest, especially if indigenous communities (WWF Malaysia, 2009).

The Indonesian interpretation sets a threshold dependence of at least 50% of one or more basic need met by the use of forest or another natural ecosystem (e.g., rivers or natural grassland) to define a HCV 5 as being important to a group. In practice, Hawyard *et al*., (2004) defined a minimum threshold of dependence of 25% to identify a HCV 5.

The *HCVF Toolkit Part 3* (Jennings *et al*., 2003), state that harvesting methods should be sustainable to be recognized as HCV 5. The use of traditional methods that are excessive and destroy the forest or threaten other HCV do not qualify as HCV 5. In the definition of the Bolivian manuscript, HCV 5 is present in areas of forest from which a community extract products to guarantee its survival.

Land claims and legal access are frequent points of conflict between managers and local communities. Within the context of FSC forest certification and some other standards (e.g. RSPO, RTFO etc), this aspect is dealt with explicitly but separately from HCV assessment. When outside the certification process, however, the HCV assessment should take this theme into account (Stewart *et al*., 2008).

The definition in this report considers as essential forest resources food, water, shelter, building material, fodder, firewood, and medicine. Illegal hunting and timber harvesting are not considered essential resources as they are prohibited by law, providing no guarantee of
sustainability of the harvesting process. During field work, information on overexploitation of resources was obtained, not necessarily by the neighbor community, including timber and turtles, and poaching of animals such as dolphins, manatees, and giant otters (Appendix 10).

**Local context**

The nearest indigenous community, the Yanomami, is located by the other side of Rio Branco, their area being separated from the FMU also by the Caracarai Ecological Station, located in between the Indigenous Land and the FMU. The Yanomami indigenous people have their land extending over 5 million hectares (5,764,543.31 ha) in the State of Roraima (Appendix 6), resulting that there is no dependency on the FMU or on other neighboring areas.

Communities living near the FMU are constituted by settlers that have only recently arrived from other areas, and are distributed along side roads 1, 2 and 3, and by the northern access. A rapid assessment of the basic needs of stakeholders was conducted at the older settlement (more than 10 years old) and also the one with easiest access, a settlement by INCRA (Appendix 10). Statements were also obtained from representatives of people that occasionally occupy an area at the northern limit of the FMU (Fig. 9). It was assumed that these information would adequately represent the profile of the communities.

Between the nearest INCRA settlement (side road 3) and the FMU there is a property of one thousand hectares, property of Mr. Otávio de Oliveira Jr., which function as a buffer zone. Mr. Oliveira wishes to establish selective logging in this property.

**Settlers from side roads 2 and 3**

According to the brief assessment from the side roads, the community does not have a tradition of sustainable use of timber and non-timber forest products. This in part has to do with the fact that they have not received any guidance from the agency responsible for their settlement (INCRA) or by the Secretary of Agriculture andSupplying (SAAB) on how to obtain income from their land. SAAB employees have been at the settlement this year to plow the land and incentivized the plantation of annual crops, such as corn, etc. There is no evidence of plantation or management of native species. The productive area occupies the portion of land where the forest has been removed (Appendix 11).

This fact this is surprising, as there is an Environmentally Sustainable Development Plan for the Area of Influence of BR-174 / Roraima, including the programs PDR 01: Incentive to harvesting of non-wood products in settlement areas, and PDR 04: Incentive to sustainable forest management, both having the Secretary of Agriculture and Supplying (SEAAB/RR) as the main executive actors.

Without technical orientation as how to obtain the best results from the land for their livehood, debts that have been eventually contacted to increase production will be invested into ranching and into annual, non-native crops, with high chances of failure. The newspaper *Folha de Boa Vista* from Roraima, dated from 22 of September 2009, mentioned the delivery of the first land titles by the Roraima Land Institute (Iteraima) to INCRA settlers, including those settled by the side roads accessing the FMU. In legal possession of the land, settlers may have access to credits to invest into production, but without technical support to produce within an agroforestry system.

Natural resources identified by the community as potential source of income:
• *Astrocaryum aculeatum*
• *Euterpe precatoria*
• *Oenocarpus bacaba*

Natural resources used by the community:

• Firewood and timber – Settlers have obtained authorization to cut flat only a parcel of their property, resulting that they possessed private forest resources that were under-exploited, having no need to necessarily rely on neighboring forest to obtain, for example, firewood and wood for shelter. During the field assessment it was possible to witness that the wood to build the headquarters of the Community Association was derived from the areas encompassed by the settler’s own forests.

• Fish – Fishing is a supplementary means to obtain food. During field work, fishing of *Brycon* sp. was witnessed in one of the streams that cross several properties of the settlement. Fishermen come from several places to fish in the Rio Branco (Appendix 12).

• Water – All properties had drilled water holes for water supply.

Non-sustainable use of forest resources:

• Poaching – Two citizens from the community were seen in their way to hunt pacas (*Cuniculus paca*) in nearby forests.

• Timber – Members from the community denounced the illegal harvesting of timber and the appropriation of public lands, of which they alleged not to be part of. They reported that environmental supervision has been reduced due to changes in the national environmental agency (IBAMA has been branched into IBAMA and ICMBIO). In practice, supervision of areas outside protected areas moved from the nearby Caracaráí to Boa Vista (further).

The subsistence of the community is mainly based on practices not related with forest harvesting. Timber harvesting in the vicinities of the FMU is predatory, illegal, unsustainable, but it does not seem to be related to this settled community. The community obtain the resources it needs from their own properties (firewood and water), thus a HCV is not identified here.

*Northern neighbors*

There is a strip of occupation with small, seasonal plantations in the northern border of the FMU. There is not, however, households or families in the area.

No HCV was identified, but neighbors’ information on the FMU are imprecise, from the extension of the land to the management system employed. This lack of information stimulates the access of people, which may be even encouraged by neighbors exactly by the lack of information on the management system and limits of the FMU, as perceived during the field work.

Ideally, the management system of the forest at the FMU should serve as a model to land use, acknowledged by neighbors, and with support from the INCRA and SEAAB authorities, since it is the only sustainable (native) forest business of Roraima. But this is not the case. During field work, an attempt of appropriation of public land was witnessed, near the northern access. The
intruder arrived on its own car and carried a GPS with the FMU limits in it, and was demarcating land to claim for himself. Its companions had illegally poached two white-lipped peccaries (*Tayassu pecari*) within the FMU. The land-grabber stated that Mr. Raimundo ‘niger’\(^\text{10}\), which occupies the northern border of the FMU, has mentioned that a large extension of titled lands of the FMU in the north may be invaded, as according to him, the limits were further to the south than it was indicated.

Thus, the lack of information and dialogue with neighbors, even those occupying an area with temporary plantations in the north, debilitates the FMU, instigating the action of intruders. If the neighbors had a more realistic impression of the FMU, demystifying it, incentives to intruders, as described above, perhaps would not have happened.

Another road, the side road 5, has served as access for illegal timber harvesting around the FMU.

**Identification of the HCV and its limits**

The current HCV was not identified in the FMU, thus no boundaries were delimited.

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\(^{10}\) There is another Raimundo in the area, thus the ‘niger’ nickname was used by the informant to better precise the man. It has not a injurious connotation.
3.6. HCV6 Forest areas critical to local communities’ traditional cultural identity

Definition

This HCV has basically to do with the identification of groups that have strong cultural relationship with forests. Indicators of HCV presence might include sacred or religious sites, specific areas that have historically been actively governed and regulated, specific areas with remnants from the past linked to the identity of the group (e.g., statues, megaliths, etc), frequent use of forest products/materials for artistic, traditional, and social status purposes, names for landscape features, stories about the forest, historical associations, and amenity or aesthetic value. Particularly relevant is the time during which the community has been associated with a particular forest (HCVF Toolkit Part 2).

The remaining interpretations do not present variations of those exposed above, except the manuscript of Malaysia, which is more specific regarding the time of association to the forest, considering HCV 6 only the forests that have been important to local communities (particularly indigenous) for more than two generations. Examples are burial grounds and sacred sites.

Local context

As exposed in the HCV 5, the communities and individuals at the immediate surroundings of the FMU are part of a very recent colonization process. The oldest group (settled by INCRA) was consulted to verify dependency on the FMU forest, resulting that this relationship does not exist. The natural resources they need are extracted from the forests within their privately owned properties.

The nearest indigenous community, the Yanomami, are found within an area extending for several million hectares that supply all their needs, including cultural and sacred areas. It is located at the other side of Rio Branco and sufficiently distant from the FMU to carry no dependence on it.

Vestiges of archeological sites were found about 90 km north to the FMU, indicating an old indigenous connection to that area, but no evidence was found within the FMU or immediate surroundings.

Identification of the HCV and its limits

No HCV was identified in the FMU, thus no limits were established.

4. HCVA and HCVMA boundaries in the FMU Fazenda Mundo Novo

In this section the HCV, HCVA and HCVMA proposed above were composed into a single GIS map of the FMU and surroundings.

The entire FMU was considered a HCVA, taking into account the widely distributed HCVs 1.2 and 1.4 in the forest. It is considered that the maintenance of the HCV 1.2 is less dependent on the management of selective logging (as it is currently conducted), than on the control of environmental impoverishment that is taking place at the surrounding area and invasions for poaching. For this reason it has turned out necessary to recommend a High Conservation Management Area (HCMA) on the terrestrial surroundings of the FMU (5 km radius) and in the
Rio Branco (the wide river in front of the FMU), additionally to the hilltops and *igarapés*\(^{11}\) HCMAs within the FMU. The area of each block is specified at the table below.

**Table 4. HCVAs and HCVMAs areas delimited for the FMU Fazenda Mundo Novo.**

<table>
<thead>
<tr>
<th>Tipo</th>
<th>Área ha</th>
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<tbody>
<tr>
<td>HCV Asess FMU</td>
<td>17.205,40</td>
</tr>
<tr>
<td>HCV Threatened species (HCV 1.2) = FMU area</td>
<td>17.205,40</td>
</tr>
<tr>
<td>HCV Brazil-nut (HCV 1.4) = non-flooded forest area</td>
<td>13.805,34</td>
</tr>
<tr>
<td>HCV Alluvial forest of Rio Branco (HCV 4.1)</td>
<td>605,00</td>
</tr>
<tr>
<td>HCV Rio Branco</td>
<td>319,00</td>
</tr>
<tr>
<td>HCVMA Surroundings</td>
<td>35.442,00</td>
</tr>
<tr>
<td>HCVMA Campinarana and Hills</td>
<td>1.463,00</td>
</tr>
<tr>
<td>HCVMA Igarapés(^{11})</td>
<td>569,00</td>
</tr>
<tr>
<td><strong>Total HCV</strong></td>
<td>17.205,40</td>
</tr>
<tr>
<td><strong>Total HCVMA</strong></td>
<td>37.793,00</td>
</tr>
</tbody>
</table>

High Conservation Value Management Areas (HCMA) identified:

Within the FMU in the area of Campinarana and Hills (plus buffer of 200 meters) for conservation of the species giant-anteater (*Myrmecophaga tridactyla*) and giant armadillo (*Priodontes maximus*); At the surroundings of the FMU (5 km radius), management with environmental education to reduce hunting pressure in the FMU and surroundings, over species such as the black or Guiana spider monkey (*Ateles paniscus*), jaguar (*Panthera onca*), and white-lipped peccaries (*Tayassu pecari*); At the *Igarapés* Jarú and Sumaúma for protection and recording of the giant otter (*Pteronura borasiliensis*), and in the Rio Branco aiming environmental education, hunting control, and recording of the giant otter (*Pteronura brasiliensis*), Orinoco goose (*Neochen jubata*), manatee (*Trichechus inunguis*), the yellow-spotted sideneck turtle (*Podocnemis unifilis*), six-tubercled Amazon River turtle (*Podocnemis sextuberculata*), red-headed Amazon River turtle (*Podocnemis erythrocephala*), big-headed Amazon River turtle (*Peltoccephalus dumerilianus*), giant South American turtle (*Podocnemis expansa*), the cetaceans Amazon pink river dolphin (*Inia geoffrensis*) and grey river dolphin or tucuxi (*Sotalia fluviatilis*) (Fig. 10).

\(^{11}\) In the indigenous language Tupi, *igarapé* means ‘path for canue’. It refers to Amazonian watercourses of first and second order, narrow branches of rivers or canals existing in larger numbers in the Amazon basin, characterized by low depth, and by flowing in the interior of the forest.
Figure 10. Composition of the HCVA (FMU), HCVMA of Campinarana and Hills, HCVMA of Igarapés Sumaúma and Jarú, and HCVMA of surroundings (terrestrial and Rio Branco).

5. Management and monitoring of HCVs, HCVAs and HCVMA

The objective of the HCVA assessment in the FMU Fazenda Mundo Novo was to identify HCVs and delineate HCVAs and HCVMAs. From that, it is up to the company Madereira Valer Verde (MVV) the implementation of the monitoring program of the HCVs, and the management of the HCVMAs.

This section synthesizes which HCVs, HCVA and HCVMA should be monitored and managed, and how it should be done.

5.1. Monitoring

The company MVV has implemented a monitoring program to record changes provoked in the community of birds after selective logging in each of the 25 Units of Annual Production (UAP)
present in the forest. This monitoring system has high ‘resolution’, and is dependent on the hiring of a specialized technician. The monitoring interprets the immediate impact of selective logging on the bird community, and certainly will answer questions regarding the speed in which areas recover after logging.

A monitoring program at lower resolution may be implemented to observe fluctuations on the presence of the identified HCVs over the years. All HCVs and threats to the HCVs should be monitored. Ideally, these records may be done by employees in transit within the FMU or during the performance of their duties, as long as the employee receives adequate training. This type of monitoring is efficient, and has the advantage of involving employees in certification issues.

Two types of monitoring are considered, the monitoring of HCVs, which are the High Conservation Values (HCVs), and the monitoring of the threats to these HCVs, both in the areas that contain the HCVs in the FMU (HCVAs), and in the High Conservation Management Areas (HCVMAs), which can be located either inside or in the surroundings of the FMU.

5.1.1. Monitoring of HCVs

The HCVs identified in the FMU are species considered to be those with level of threat equal or superior to Vulnerable (VU) or considered vulnerable locally, seasonal resources for wildlife communities, and critical areas for erosion control.

The purpose of HCV monitoring is to determine whether the HCVs maintain or improve their condition over time. Numerical changes on threatened species’ populations are generally slow in the absence of an intense short-term impact, thus are often detected only after years of observations. This requires monitoring to be continuous throughout the years.

In the presence of marked short-term impacts, however, populations and natural communities may have a fast but also observable response (decline) during this period, as demonstrated by the monitoring of birds in the FMU parcels (UAPs) after selective logging. In this case, the environment has favored the presence of birds adapted to relatively open canopy.

The steps to record HCVs 1.2 (threatened species) are as follows:

1. A program for training of employees, including subcontracted personnel, should be implemented so that they familiarize themselves with the company’s environmental policy and particularly with the HCVs. This training may be informal and conducted moments before their normal activities. For example, during the HCV assessment the author of this report has given a speech and heard the opinion of employees regarding the assessment, just after breakfast, when they are all conveniently congregated.

2. Plates of A4 or ½ A4 size with illustrations of HCVs species to be monitored should be used to identify them. Color photos of the HCVs may be printed and laminated (with plastic coating), so that they can be used during field work, or consulted after observation of a HCV.

3. The species of the flora identified as HCVs should be recorded with precise geographic coordinates to easily locate them during selective logging, which will help to avoid any harm to these HCVs.
4. A sheet of records may be attached to the Board of Messages, in the office and in the dormitory of employees. All HCVs seen may be recorded in these sheets, which should regularly be transferred to a database.

5. The database information should be analyzed annually by qualified personnel, as requested by the FSC.

6. To have a continuous and efficient monitoring program, the employees must be motivated. Besides continuous debates on the theory and practice of certification and HCVs, a practice widely used to keep motivation up is the healthy competition within the company, based on the number of HCV that each employee or department is able to record for monitoring purpose. This recognition is then divulged during a meeting with all employees. The public exposure is generally enough to stimulate productivity.

5.1.2. Monitoring of HCVA

High Conservation Value Areas (HCVA) are those that contain the identified HCVs. The entire FMU was defined as HCVA based on the fact that several HCVs were widespread in the FMU. The monitoring of HCVA thus has to do with the monitoring of the HCVs themselves, but also with the eventual threats to the HCVs within the FMU.

The monitoring of HCVs was described in the previous section. The threats to the HCVs within the FMU were identified in the form of invasions and hunting, and these threats must be monitored.

During field work intruders and hunters were identified in the northern part of the FMU, and, from direct consultation to these groups, the alleged reason for invasion was easy access (no fences or gates), and encouragement from northern neighbours that exploit small seasonal plantations. Besides that, the intruders did not have any notion of sustainable harvesting, erroneously believing that harvesting at the FMU was also conducted in a predatory way.

The monitoring of threats consists, therefore, of the continuous identification of invasions, and contacts with neighbors that eventually are using the areas of the FMU.

The procedures to minimize these threats should be implemented as follows:

1. FMU employees should be trained for eventual contact with non-authorized people within the FMU. These encounters are unexpected and infrequent, thus the maximum advantage must be obtained during these circumstances to increase the company’s social reach. These unexpected encounters may be the only opportunity to interact with the individual, considering that northern neighbors do not have fixed households in the area, using the areas only occasionally, highlighting the importance of continuous training of employees.

2. This training may be applied as the training for identification of HCVs mentioned in the previous item, conveniently when employees are congregated just before they begin their daily tasks.

3. Employees must basically know what to communicate to the non-authorized people (intruders) found within the FMU, and what information to obtain from them.

4. The basic information to communicate has to do with the legality of the FMU ownership and notions of sustainable harvesting conducted within the FMU as a mean to restrain
invasions. The idea is that intruders understand that a serious work is done in the FMU, with long-term planning, and with several employees dedicated to accomplish their tasks. If people continue to erroneously believe that harvesting within the FMU is predatory, this will stimulate them to act the same predatory way, encouraging also invasions and hunting.

5. The information obtained during these opportunist encounters with non-authorized personnel should be transferred to a sheet and afterwards to a database. The information to be compiled have to do with the identification of the intruder, place of encounter, reason for the non-authorized entrance, municipality in which the intruder reside, and area of the surroundings used by the intruder if any, or by whoever in the surrounding area that might have encouraged the non-authorized entrance. This information may be latter used for actions directed to neighbors that are potentially instigating invasions or that have distorted notions of the management in the FMU.

5.1.3. Monitoring of HCVMA

HCVMA areas are defined here as those that require a special supervision and management to enable HCVs to continue to occur within the FMU, but are not necessarily located within the FMU.

The type of management to be applied on these areas depends on the HCV to be protected, and are thus divided as follows:

1. The Hills and Campinaranas for the specific monitoring of the presence of the giant anteater (*Myrmecophaga tridactyla*) and of the giant armadillo (*Priodontes maximus*). These species should be particularly recorded during operations conducted in the mentioned areas.

2. The larger igarapés for the conservation of the giant otter (*Pteronura brasiliensis*), which should be monitored and signalized to avoid invasions by boat, especially during the period of rains (when igarapés are more easily navigated).

3. The areas of the Rio Branco neighboring with the FMU, to record the HCVs and for environmental education. The HCVs in this case are species that inhabit or potentially inhabit the Rio Branco, the giant otter (*P. brasiliensis*), Orinoco goose (*Neochen jubata*), the chelonians yellow-spotted sideneck turtle (*Podocnemis unifilis*), six-tubercled Amazon River turtle (*Podocnemis sextuberculata*), red-headed Amazon River turtle (*Podocnemis erythrocephala*), big-headed Amazon River turtle (*Peletocephalus dumerilianus*), and the giant South American turtle (*Podocnemis expansa*), the cetaceans Amazon pink river dolphin (*Inia geoffrensis*) and grey river dolphin or tucuxi (*Sotalia fluviatilis*).

4. Terrestrial areas surrounding the FMU, for environmental education with the purpose of reducing hunting of HCVs in the interior of the FMU, particularly of white-lipped peccaries (*Tayassu pecari*) and spider monkeys, and to monitor eventual conflicts with the jaguar (*Panthera onca*) in areas of ranching that may compromise their existence in the region and thus within the FMU.
5. The area of the occurrence of the *Pradosia decipiens*, within a radio of 25 meters from the parcel 36, which should not be managed until the confirmation of the species’ identification. This is the only HCV considered Critically Endangered (CR) by the IUCN (2009) that potentially occur in the FMU according to previous inventories, but its occurrence must be double-checked.

5.2. Management of HCV 1.2

A summary of the HCV assessment for threatened or endangered species (HCV 1.2), and management measures suggested, may be consulted at the table below.

It is suggested that species of the flora on the categories of Critically Endangered (CR) and Endangered (EN) (IUCN, 2009) *Tabernaemontana muricata*, *Inga suberosa* and *Pradosia decipiens* be reproduced in a nursery garden, and an area be assigned for their plantation. This area should preferably be near the area where the plants occur naturally. They should be marked for future identification, located with geographic coordinates, and marked with plastic cards during inventory, and all this information should be fed into a database.

The area of occurrence of *Pradosia decipiens* (parcel 36) in the extreme east of the FMU should have selective logging suspended until the occurrence of the species is confirmed. The species was so far known only by the type, collected near Manaus in 1942, quite far from the FMU. During previous inventories, an exsicata with samples collected in the FMU is known to have been stored in the herbarium of the National Institute for Research in the Amazons (INPA). The author has localized the person responsible by the herbarium and tried contact by e-mail, without reply. It is suggested here that the company insists for a confirmation by the institution, to find out whether the species collected was actually *P. decipiens*. Two other species should also be confirmed, considered that only *Tabernaemontana muricata* has been previously recorded in the State of Roraima (during the Economic and Ecological Zonation – ZEE).

A previous inventory of the fauna in the FMU indicated records of more than one species of spider monkey (*Ateles* spp.), with distribution in the Amazon Forest, but inconsistent with the distribution presented in the literature. These inconsistencies need to be verified. The reported presence of an armadillo was discarded here, the Brazilian three-banded armadillo (*Tolypeutes tricinctus*), based on the following information: 1. The species has distribution restricted to the Brazilian northeast, 2. The evidence of the presence of the three-banded armadillo was solely based on vestiges, which should not be enough to identify armadillos at the species level.

The species of the fauna may be located and their position recorded by parcel and trail (the grid system used in the FMU), and information entered into a database.
Table 4. Species assessed as HCV 1.2 or potential HCV 1.2 if present, in the categories Nearly Threatened (NT), Vulnerable (VU), and above (IUCN, 2009), and those judged to be locally threatened.

<table>
<thead>
<tr>
<th>Species</th>
<th>HCV Management</th>
<th>Reason to revise the species’ occurrence</th>
<th>Reason for HCV</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pradosia decipiens</td>
<td><strong>Moratorium of logging in parcel 36 until the species identification is revised; tree marking; reproduction in nursery garden</strong></td>
<td>Distribution know only to the proximity of Manaus</td>
<td>Critically Endangered (CR – IUCN); known only by the type, collected in 1942</td>
<td>CR - IUCN</td>
</tr>
<tr>
<td>White-bellied spider monkey Ateles belzebuth¹</td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Not recorded during field work and also not by FMU employees</td>
<td>Endangered (EN – IUCN); rare in the FMU if present</td>
<td>EN - IUCN</td>
</tr>
<tr>
<td>White-whiskered spider monkey Ateles marginatus¹</td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Not recorded during field work and also not by FMU employees</td>
<td>Endangered (EN – IUCN); rare in the FMU if present</td>
<td>EN - IUCN</td>
</tr>
<tr>
<td>Giant otter Pteronura brasiliensis</td>
<td>Standard²; non logging in the riparian forests of large igarapés³; reduce invasion through the igarapés</td>
<td>Does not apply</td>
<td>Endangered (EN – IUCN); rare in the FMU, resources subjected to seasonal variation</td>
<td>EN - IUCN</td>
</tr>
<tr>
<td>Inga suberosa</td>
<td>Revise identification; tree marking; reproduction in nursery garden</td>
<td>Not known to occur in the region</td>
<td>Endangered (EN – IUCN); restricted distribution, not common in the FMU</td>
<td>EN - IUCN</td>
</tr>
<tr>
<td>Tabernaemontana muricata</td>
<td>Revise identification; tree marking; reproduction in nursery garden</td>
<td>Not known to occur in the region</td>
<td>Endangered (EN – IUCN); restricted distribution, not common in the FMU</td>
<td>EN - IUCN</td>
</tr>
<tr>
<td>Bush dog Speothos venaticus</td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Uncommon if present</td>
<td>Near Threatened (NT); rare in the FMU if present</td>
<td>NT - IUCN</td>
</tr>
<tr>
<td>Giant anteater Myrmecophaga tridactyla</td>
<td>Delimited HCV area encompassing Campinarana, Seasonal Decidual and Hills</td>
<td>Does not apply</td>
<td>Near Threatened (NT); rare in the FMU, Campinarana and Hills are poorly represented in the FMU</td>
<td>NT - IUCN</td>
</tr>
<tr>
<td>Jaguar Panthera onca</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>Near Threatened (NT); rare in spite of the frequent signs found in the FMU; persecuted by ranchers</td>
<td>NT - IUCN</td>
</tr>
<tr>
<td>White-lipped peccary Tayassu pecari</td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>Near Threatened (NT); relatively common in the FMU, but pursued by hunters, vulnerable to hunting</td>
<td>NT - IUCN</td>
</tr>
<tr>
<td>Species</td>
<td>HCV Management</td>
<td>Reason to revise the species’ occurrence</td>
<td>Reason for HCV</td>
<td>Status</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>-----------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Orinoco goose <em>Neochen jubata</em></td>
<td>Confirm its presence/absence; record continuously if present</td>
<td>Presence possible</td>
<td>Near Threatened (NT); rare if present</td>
<td></td>
</tr>
<tr>
<td>Harpy eagle <em>Harpia harpyja</em></td>
<td>Continuous record of its presence where present</td>
<td>Does not apply</td>
<td>Near Threatened (NT); uncommon</td>
<td></td>
</tr>
<tr>
<td>Giant armadillo <em>Priodontes maximus</em></td>
<td>HCVA delineation encompassing Campinarana, Seasonal Decidual and Hills</td>
<td>Does not apply</td>
<td>Near Threatened (NT); signs easy to find, but rare</td>
<td></td>
</tr>
<tr>
<td>Amazonian manatee <em>Trichechus inunguis</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Presence possible</td>
<td>Vulnerable (VU), rare</td>
<td></td>
</tr>
<tr>
<td>Yellow-spotted sideneck turtle <em>Podocnemis unifilis</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>common</td>
<td></td>
</tr>
<tr>
<td>Six-tuberced Amazon River turtle <em>Podocnemis sextuberculata</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>common</td>
<td></td>
</tr>
<tr>
<td>Red-headed Amazon River turtle <em>Podocnemis erythrocephala</em></td>
<td>Does not apply</td>
<td>Presence possible</td>
<td>Rare if present</td>
<td></td>
</tr>
<tr>
<td>Big-headed Amazon River turtle <em>Peltocephalus dumerilianus</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>common</td>
<td></td>
</tr>
<tr>
<td>Giant South American turtle <em>Podocnemis expansa</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Does not apply</td>
<td>Subjected to high harvesting and trading pressure, rare in the vicinities of the FMU</td>
<td></td>
</tr>
<tr>
<td>Amazon pink river dolphin <em>Inia geoffrensis</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Presence possible</td>
<td>Rare if present</td>
<td></td>
</tr>
<tr>
<td>Grey river dolphin or tucuxi <em>Sotalia fluvialis</em></td>
<td>Environmental/social education work should take into account strategies for its conservation</td>
<td>Presence possible</td>
<td>Subjected to hunting and fishing pressure</td>
<td></td>
</tr>
</tbody>
</table>

1. Species not expected for the area, misidentified during previous studies. It may be in fact just a local coat variation of the same species. It is desirable that differences in coat variation among species be best understood to avoid identification errors.

2. The standard management for HCV is the basic monitoring, in other words, the species’ recording by FMU employees in field data sheets, with location and date.

3. Logging in riparian forests is automatically prohibited by the Brazilian legislation (see item 1.6).
5.3. Management of HCV 1.4

Management of Brazil-nut trees consist basically in avoiding that these trees be affected by roads or other infrastructure, and by selective logging. Among the measures that may be employed to minimize damage to the Brazil-nut trees, it is possible to suggest the following:

1. The companies’ environmental policy regarding HCVs should be clear to both employees of the MVV and to subcontracted employees, particularly regarding Brazil-nut management.
2. Ensure that FMU employees supervise subcontracted employees during logging.
3. Estimate Brazil-nut canopy loss in case accidents occur during logging.
4. Record all Brazil nut trees visible during inventory and during logging operation, by parcel and trail, entering that information into a database.

5.4. Companies’ collaboration with the community and with governmental organizations (environmental and social managers)

The FMU has adopted a Social Management System (SGS), directed to detailing social projects and definition of the policy for corporative relationship, with special emphasis on the management of internal and external conflicts (MVV, 2009). This system includes the communication channels with the community, and also the organization of thematic events.

The MVV is a company of considerable distinction in the municipality where it operates (Caracaraí). It is desirable that the company develop an easy communication channel with the local administration, and with actors that work in the forefront of the territorial development and settlement projects.

5.4.1. Collaboration with authors of settlement projects

In the southern portion of the State of Roraima, the main programs that may become partners for HCVs and HCVAs conservation in the vicinities of the FMU, and mentioned in the Plan for Sustainable Environmental Development in the Area of influence of BR-174 / Roraima, are:

PDR 01 – Incentive to harvesting of non-wood products in settlement areas, PDR 04 – Incentive to sustainable forestry harvesting, headed by the Secretary of Agriculture and Supplying (SEAAB/RR), and PRA 02 – Recovery of degraded areas and prevention of environmental liability, to be headed by the Department of Roads of Roraima (DER/RR).

On the topic of dissemination of information, it is possible to partner with the PGA-05 plan of the BR-174, which regards the Environmental Information Supervision, through the Integrated System of Settlement Monitoring and Control, headed by the Technical and Rural Extension Service (DATER) and the Secretary of Agriculture and Supplying (SEAAB/RR).

Information dissemination could be also attached to the PGA-08 Environmental Education, having the Secretary of Planning (SEPLAN) and the Department of Environment (DEMA) of Roraima as the main executive agents.
A communication bridge with INCRA, which establishes polices of rural settlement in Brazil, is also desirable. During field work, the author has noticed that northern neighbors, or their acquaintances, used, rightfully or not, the organization as shield to justify invasions. With direct dialog with the organization it is possible to settle doubts and dialogue with neighbors with more confidence.

5.4.2. Cooperation with environmental agencies

From the environmental conservation standpoint, it is necessary to provide a dialog channel with environmental agencies. During field work, the author has contacted IBAMA, which is the federal agency responsible for environmental supervision, to verify in practice what type of actions would be possible to develop in cooperation with the organization. The first impulse of the contacted officer was to check FMU activities, taking into account the use of natural resources at considerable scale by the FMU. It took a while to reach a point during the dialog by phone after which the officer realized the FMU’s conservation and management status, and that the FMU could be a potential partner for local nearby operations. This viewpoint strengthened during a meeting of the author with the officer of IBAMA.

Other acting environmental agency is the FEMA TEC, with State-wide scope. During the period in which the author stayed in Roraima, the FEMA TEC acted in the lower Rio Branco capturing a boat that carried giant South American turtles (*Podocnemis expansa*) that had been illegally captured. This agency could also act in partnership to maintain the HCVs present in the FMU.

5.4.3. Collaboration with the neighboring community

During field work it became clear that the neighboring community is unaware of the nature of the FMU’s operations. In a region where people avidly look for lands to invade and take, it is necessary that neighbors recognize the legitimacy of land ownership, otherwise, and as it may seem to be currently the case, they will disseminate the idea that the land is vast and unsettled. In Brazil the definitive land title is in first instance obtained only when neighbors recognize its legitimacy. In the case of the FMU, the land title is old, anterior to the arrival of current neighbors, but this fact illustrates how important the acknowledgement of neighbors is, even at the juridical level.

The FMU management personnel has conducted a few meetings and organized field days with the community. This work should be continued, but it is also suggested that some community leaders be identified and invited to see the FMU area, so that they can pass on the idea of sustainability that permeates all the activities. Neighbors that encouraged invasions or invade the FMU should be searched actively and invited for dialog. Although the notion of sustainable management may be understood by those that work in the FMU, this management model is alien to neighboring communities, which only know the exploitation and conversion system. From the community’s point of view, an untouched forest is an area invited to be settled in a ‘traditional’ way, slashed and burned for seasonal crops and cattle ranching.

It also became evident during field work that the FMU employees themselves should be motivated to understand that the management system at the FMU is a model to be followed in the Amazons, from both the environmental and economic standpoints. Economically, it guarantees the long-term, perhaps indefinite sustainability of resources, whereas other types of occupation have caused immediate exhaustion of these resources, replacing them by much less productive
and profitable systems in the long-term, and much more harming to the ecosystem. They can then act as multipliers and educators outside and inside the FMU.

From the environmental viewpoint, the presence of employees in the FMU provides an exceptional protection to the ecosystem, greater than is possible to find in the majority of the protected areas in Brazil, where a reduced number of personnel supervise large areas. Illegal logging and hunting are inhibited by the presence of employees, transforming managed areas into real wildlife reserves (e.g. Mazzolli, 2006; Mazzolli, accepted). Species requiring closed canopy may not persist on harvested parcels, as recorded for birds in the FMU (Fehlow, 2006, 2008) and for bats elsewhere in the Amazon region (Presley et al., 2008), but the rotation period (25 years) associated with the arrangement of parcels in a matrix of undisturbed forest may allow recolonization to mitigate effects of selective logging on sensitive species and maintain biodiversity on the long term.

5.5. Inhibition of invasion and hunting

The northern portion of the FMU revealed itself as the most vulnerable to invasion and hunting. More than one group of non-authorized people, carrying hunting guns, were observed in this area during field work.

Perhaps the main reason for invasion was the easy access, and the abundant game and Brazil-nut resources present in the FMU, possibly already scarce in the vicinities. FMU managers acknowledged this vulnerability and promptly decided to build a gate at the limits of the FMU, as well as an accommodation for vigilantes (company employees) that will try to restrain invasions in an amicable manner.

Some neighbors probably do not recognize the land ownership by the FMU as legitimate, perhaps because it has not been conducted as understood by them as occupation, that is, with tree falling and substitution by grazing areas. It is necessary that neighbors understand that settlement with forest sustainability exists and it is conducted in the FMU. It is hoped, with such an educational initiative, that the potential intruders become also multipliers of information on the legitimacy of land ownership by the FMU, and that it is an intensively managed land, increasing thus the security of the area.
6. References


Mazzolli, M. Accepted. Mosaics of exotic forest plantations and native forests as habitat for pumas. Environmental Management. Accepted in October 2009.


### 7. Appendix 1. Itinerary during field work (September 2009)

<table>
<thead>
<tr>
<th>Date</th>
<th>Location and travel</th>
<th>Specific activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th, Sunday</td>
<td>Arrival of Dr. Marcelo Mazzolli in Boa Vista, capital of Roraima</td>
<td>Continuation of information compilation, initiated in 25th of August.</td>
</tr>
<tr>
<td>5th, Monday</td>
<td>Boa Vista</td>
<td>Meeting with Mr. Manuel Haas (forest engineer), forest manager of <em>Madeireira Vale Verde Ltda</em> (MVV) and introduction to Mr. Roosevelt, field assistant at MVV, and to Ms. Lorenzi; recovery of maps in SIG, reports and species’ records, and other FMU’s basic data; scheduling of field activities.</td>
</tr>
<tr>
<td>6th, Tuesday</td>
<td>Boa Vista and drive to MMV’s FMU</td>
<td>Contact with FEMACT, SEPLAN and FAPEAM by phone, and UFAM (fauna coordinator of ZEE) by e-mail; meeting with MMV’s field personnel; field reconnaissance at the FMU; initial record of species next to the main base; Transfer of GIS to navigation GPS (forest physiognomies).</td>
</tr>
<tr>
<td>7th, Wednesday</td>
<td>FMU</td>
<td>Installing camera-trap 01 at the access road to FMU and camera-trap 02 at the varzea do Rio Branco; recording of species; recording of fisherman’s statement.</td>
</tr>
<tr>
<td>8th, Thursday</td>
<td>FMU</td>
<td>Installing of camera-traps 3 and 4; recording of species.</td>
</tr>
<tr>
<td>9th, Friday</td>
<td>FMU</td>
<td>Installing camera-trap number 5; species’ record; writing of report; short journey by boat for reconnaissance and record of aquatic and semi-aquatic fauna (day and night).</td>
</tr>
<tr>
<td>10th, Saturday</td>
<td>FMU</td>
<td>Observation of species at Rio Branco; transferring of camera-trap number 1 to igarapê Sumaúma; identification of species by the Sumaúma trail; writing of report.</td>
</tr>
<tr>
<td>11th, Sunday</td>
<td>FMU</td>
<td>Rest</td>
</tr>
<tr>
<td>12th, Monday</td>
<td>FMU and trip to Boa Vista</td>
<td>Species’ record; check-in at a hotel in Boa Vista.</td>
</tr>
<tr>
<td>13th, Tuesday</td>
<td>Boa Vista</td>
<td>Search of information (phones, addresses) to contact environmental agencies and the Institute of Rural Colonization (INCRA)</td>
</tr>
<tr>
<td>14th, Wednesday</td>
<td>Boa Vista</td>
<td>Phone contact with officers at Chico Mendes’ Institute. Scheduling of meetings.</td>
</tr>
<tr>
<td>15th, Thursday</td>
<td>Boa Vista and travel to FMU</td>
<td>Meeting with officer Francisco Wilson de Oliveira, from the Chico Mendes’ Institute in Boa Vista; travel to FMU; recording of statements from communities neighboring the FMU at the side roads 2 and 3.</td>
</tr>
<tr>
<td>16th, Friday</td>
<td>FMU</td>
<td>Continuation of species’ recording; checking of igarapês that drain into Rio Branco; recording of statements from riverine people.</td>
</tr>
<tr>
<td>17th, Saturday</td>
<td>FMU</td>
<td>Recolhimento de armadiilhas fotográficas na UMF. Reconhecimento da porção norte da UMF.</td>
</tr>
<tr>
<td>18th, Sunday</td>
<td>FMU</td>
<td>Continuation of wildlife recording; reconnaissance of the northern limits of the FMU, particularly of any irregular occupation at the surroundings for conflict management.</td>
</tr>
<tr>
<td>19th, Monday</td>
<td>Return to Boa Vista</td>
<td>Meeting with Ibama officer Mr. Francisco Wilson de Oliveira.</td>
</tr>
<tr>
<td>20th, Tuesday</td>
<td>Boa Vista</td>
<td>End of field work.</td>
</tr>
</tbody>
</table>
8. Appendix 2. Images of the study area

2.1 Interpretation of forest types in the FMU and surroundings by IBGE 2005.
2.2 Interpretation of forest types in the FMU and surroundings by ZEE 2002.
9. Appendix 3. Draft list of potential HCV species present at the FMU’s area

List of species present or potentially present at the Fazenda Mundo Novo under some level of threat. Abbreviations: Brazilian states RR = Roraima, PA = Pará; Type of records DI=direct (obtained during field work to produce this report), Record DE (statements from FMU’s employees), Record FOT (photos from the FMU’s photo database), Record IN (species inventory conducted at the FMU), Record SEC (general literature on regional species).

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Species</th>
<th>Common name</th>
<th>Status</th>
<th>Brazil¹</th>
<th>Northern states²/³</th>
<th>IUCN⁴</th>
<th>Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammalia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xenarthra²</td>
<td>Dasypodidae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Priodontes maximus</td>
<td>Giant armadillo</td>
<td>Threatened</td>
<td>RR/VU</td>
<td>Pará</td>
<td>VU</td>
<td>IN, DI</td>
</tr>
<tr>
<td></td>
<td>Myrmecophaga tridactyla</td>
<td>Giant anteater</td>
<td>Threatened</td>
<td>RR/VU</td>
<td>Pará</td>
<td>NT</td>
<td>IN, DE</td>
</tr>
<tr>
<td>Primates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atelidae</td>
<td>Ateles belzebuth</td>
<td>White-bellied spider monkey</td>
<td>Threatened</td>
<td>AM/ Not mentioned</td>
<td>EN</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>Atelidae</td>
<td>Ateles marginatus⁷</td>
<td>White-whiskered spider monkey</td>
<td>Threatened</td>
<td>PA/VU</td>
<td>Pará</td>
<td>EN</td>
<td>IN</td>
</tr>
<tr>
<td>Atelidae</td>
<td>Ateles paniscus</td>
<td>Black or Guiana spider monkey</td>
<td>Not mentioned</td>
<td>Not mentioned / Not mentioned</td>
<td>VU</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>Pitheciidae</td>
<td>Chiropotes chiropotes⁸</td>
<td>Black bearded saki</td>
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Projeto Puma’s environmental management program – HCVA assessment of Fazenda Mundo Novo
## Taxon Assessment

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<th>Taxon</th>
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<th>Common name</th>
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<th>Status Northern states²/³</th>
<th>IUCN⁴</th>
<th>Record</th>
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¹ Normative Instruction -IN 03/2003 MMA
² Northern state nearest to Roraima (RR) mentioned at IN 03/2003 do MMA, which may help to understand status of species in Roraima
³ Compilation of state red lists summarized at the Red Book of the Brazilian fauna threatened with Extinction, Ministry of Environment (Chiarello et al., 2008)

### Notes
- Distribution known so far strictly to the northeast and middle-east Brazil (Eisenberg & Redford, 1999; Chiarello et al., 2008, IUCN, 2009). If confirmed, this would be the first record of the species northern of River Amazons.
- Distribution known so far to the south of River Amazons (Eisenberg & Redford, 1999; Chiarello et al., 2008). If confirmed, this would be the first record of the species north of the River Amazons.
- Chiropotes satanas was previously classified into three subspecies (C. s. satanas, C. s. chiropotes and C. s. utahicki), raised by Silva and Figueiredo (2002) and Bonvicino et al. (2003) to species rank, having Rio Branco as a distribution barrier. This nomenclature is the one used by the IUCN. The Brazilian list (red list of threatened species) is old, thus the listed category of threat if for Chiropotes satanas. The red book (Chiarello et al., 2008) considers the distribution only to the south of River Amazonas, in contrast with Eisenberg & Redford (1999) and with data from the IUCN Red List of Threatened Species (2009).
- Dolphins populations may be declining. In Mamirauá’s Reserve for Sustainable Development (RDSM) killing of river dolphins Sotalia fluviatilis and Inia geoffrensis have been recorded. The animals are employed for bait to fish piracatinga, Calophysus macropterus, a scavenger fish, not consumed in Brazil. They are exported to neighbor countries by boat. Source: Luís Mansuêto, Vera da Silva (projeto Boto), (http://www.inpa.gov.br/noticias, 27/03/2007). The IUCN classifies both of them in the order Cetartiodactyla.
- The IUCN red book uses Certartiodactyla instead of Artiodactyla.
- Dolphins populations may be declining. In Mamirauá’s Reserve for Sustainable Development (RDSM) killing of river dolphins Sotalia fluviatilis and Inia geoffrensis have been recorded. The animals are employed for bait to fish piracatinga, Calophysus macropterus, a scavenger fish, not consumed in Brazil. They are exported to neighbor countries by boat. Source: Luís Mansuêto, Vera da Silva (projeto Boto), (http://www.inpa.gov.br/noticias, 27/03/2007). The IUCN classifies both of them in the order Cetartiodactyla.
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10. Appendix 4. Images of threatened species present or with expected distribution in the FMU

From left to right, Klages's antwren *Myrmotherula klagesi* (Image http://www.camacdonald.com/birding/birding.htm); Rio Branco antbird *Cercomacra carbonaria* (NT), with southern distribution reaching Caracarai, not recorded in at the Fazenda Mundo Novo (Image: Birdlife International); Crested eagle *Morphnus guianensis* (Image: Wikimedia); Harpy eagle *Harpia harpyja* photographed at the FMU’s southern border (Image: Manuel Haas).


Photographic record of *Tabernaemontana muricata*, species that was known so far to occur only in the proximities of Manaus (IUCN, 2009).
11. Appendix 5. Species recorded during field work from 06 to 19 of October 2009.

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<td><em>Ateles paniscus</em></td>
<td>Black or Guiana spider monkey</td>
<td>Igarapé Sumaúma road</td>
<td>12/09/2009</td>
<td>VI</td>
<td></td>
</tr>
<tr>
<td><em>Tayassu pecari</em></td>
<td>White lipped peccary</td>
<td>Next to main house</td>
<td>12/09/2009</td>
<td>DE employee Francinaldo Cardoso de Barros (Peixe)</td>
<td></td>
</tr>
<tr>
<td><em>Not identified</em></td>
<td>Turtle shell</td>
<td>Rio Branco to Igarapé Sumaúma</td>
<td>16/10/09</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Common name</td>
<td>Location</td>
<td>Date</td>
<td>Type, number recorded and/or status, source</td>
<td>Photographic record</td>
</tr>
<tr>
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</tr>
<tr>
<td><em>Pteronura brasiensis</em></td>
<td>Giant otter</td>
<td>Rio Branco in front of the FMU</td>
<td>16/10/09</td>
<td>VI</td>
<td></td>
</tr>
<tr>
<td><em>Ara ararauna</em></td>
<td>Blue-and-yellow macaw</td>
<td>Rio Branco in front of the FMU</td>
<td>16/10/09</td>
<td>VI</td>
<td></td>
</tr>
<tr>
<td><em>Trichechus inunguis, Inia geoffrensis</em></td>
<td>Manatee and pink river dolphin</td>
<td>Ilha do Jarú</td>
<td>16/10/09</td>
<td>DE Raimundo Gonzaga da Silva</td>
<td></td>
</tr>
<tr>
<td><em>Tayassu pecari</em></td>
<td>White lipped peccary</td>
<td>FMU- HCVMA Campinarana and Hills</td>
<td>13/10/09</td>
<td>AR</td>
<td></td>
</tr>
<tr>
<td><em>Myrmecophaga tridactyla</em></td>
<td>Giant anteater</td>
<td>FMU- HCVMA Campinarana and Hills</td>
<td>15/10/09</td>
<td>AR</td>
<td></td>
</tr>
<tr>
<td><em>Crax alector</em></td>
<td>Black Curassow</td>
<td>FMU- HCVMA Campinarana and Hills</td>
<td>15/10/09</td>
<td>AR</td>
<td></td>
</tr>
<tr>
<td><em>Crax alector</em></td>
<td>Black Curassow</td>
<td>Sumaúma road and north road</td>
<td>12/10/09 e 19/10/09</td>
<td>VI</td>
<td></td>
</tr>
</tbody>
</table>

Vi=Sighting, VE=Vestige, AR=Camera Trap, CA=Carcass, DE=Statement, VO=Vocalization
12. Appendix 6. Protected areas and Indigenous Land in the vicinities of the FMU.

Map of protected areas (Conservation Units) and Indigenous Land (TI) in the vicinities of the FMU. The nearest ones among them are the Caracaraí Ecological Station (ESEC) and the Viruá National Park (PARNA), and the TI Yanomami. The Brazilian government has delimited extensive reserves and TIs in the Amazonian region during recent years. The image was cropped from the map of the Amazonian Region Protected Area Program (ARPA) of the Ministry of Environment (MMA). Elaborated by the Instituto Socioambiental in July 2009.

The FMU is located within an area defined by the administrative rule of the Ministry of Environment (MMA) nº 09, from 23/01/2007 as ‘Priority areas for Conservation, Sustainable Use and Partition of Benefits of the Brazilian Biodiversity’.

Ecoregions according to ‘WWF Ecoregions 200’, available in GIS at the WWF’s internet page, as well as a complete description of each ecoregion. In light gray the nomenclature for ‘Global Ecoregions’ and in black the nomenclature and code for ‘Terrestrial Ecoregions’. The polygons were overlaid by Brazil’s boundary (in black), available in the ArcView’s (ESRI) installation disc. The FMU is located in the ecoregion NT 0173, but very near the ecoregions NT 0158 and NT 0707.
15. Appendix 9. Map for evaluation of HCV 4.3

Fire risk model at the region surrounding the FMU. Obtained in the site of INPE.
16. Appendix 10. Statements from riverine people and neighboring communities

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Location</th>
<th>Household and working situation</th>
<th>Government support for agroforestry use of land</th>
<th>Main livelihood</th>
<th>Use of natural resources (other than firewood)</th>
<th>Statement about wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adonias Ferreira da Silva, approximately 65 years old</td>
<td>07/10/09</td>
<td>Rio Branco frente à UMF</td>
<td>Fisherman, live in Caracarai, sells fish</td>
<td>It does not apply</td>
<td>Fishing</td>
<td>Small scale commercial fishing. Opportunistic use of forest resources, for example by catching a game that cross the river.</td>
<td>Presence of grey river dolphin, has not seen the pink river dolphin. The black caiman is rare. The manatee is found 3km downriver. Several giant otters.</td>
</tr>
<tr>
<td>Otávio de Oliveira Jr., approximately 30 years old</td>
<td>07/10/09</td>
<td>Road to FMU through side road 3</td>
<td>Owner of 1.000 ha. Wish to implement forest management</td>
<td>No support</td>
<td>Work in Boa Vista</td>
<td>Does not live from the land, live in Iracema</td>
<td>Not obtained</td>
</tr>
<tr>
<td>Adevanir Lopes Esteves, approximately 30 years old</td>
<td>15/10/09</td>
<td>Side road 2</td>
<td>Lives at the INCRA settlement</td>
<td>No support</td>
<td>Cattle</td>
<td>Does not use. Says that the <em>Oenocarpus bacaba</em>, native palm fruit, has agroforestry potential, besides the <em>Euterpe precatoria</em>. Uses water from a drilled water hole.</td>
<td>Not obtained</td>
</tr>
<tr>
<td>Cícero Justino de Andrade, approximately 70 years old</td>
<td>15/10/09</td>
<td>Side road 2</td>
<td>Lives at the INCRA settlement</td>
<td>No support</td>
<td>Cattle</td>
<td>Does not use forest resources. Uses water from a drilled water hole.</td>
<td>Not obtained</td>
</tr>
<tr>
<td>Domingos dos Santos (President of the community association),</td>
<td>15/10/09</td>
<td>Side road 2</td>
<td>Owner</td>
<td>No support</td>
<td>Raises goat and cattle</td>
<td>Highlights the <em>Euterpe precatoria</em>, the <em>Oenocarpus bacaba</em>, and the <em>Astrocaryum aculeatum</em> as alternatives. Says</td>
<td></td>
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</tbody>
</table>

Says that paca and white-lipped peccaries are hunted
<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Location</th>
<th>Household and working situation</th>
<th>Government support for agroforestry use of land</th>
<th>Main livelihood</th>
<th>Use of natural resources (other than firewood)</th>
<th>Statement about wildlife</th>
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<td>that has sold for buyers of <em>Oenocarpus bacaba</em> from Manaus, but a barrier on the road have impaired the transit of goods. Uses water from a drilled water hole.</td>
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<tr>
<td>João Maria da Rocha</td>
<td>15/10/09</td>
<td>Side road 2</td>
<td>Lives at the INCRA settlement</td>
<td>No support. Land grading this year for plantation of annual crops</td>
<td>Milk, chickens</td>
<td>Occasional fishing of Bat nearby creek. Harvest of wood to build the headquarters of the Community Association</td>
<td>Not obtained</td>
</tr>
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<tr>
<td>João Inácio de Oliveira (Pernambuco) (ex-president of the association), approximately 65 years old</td>
<td>15/10/09</td>
<td>Side road 3</td>
<td>Lives at the INCRA settlement</td>
<td>No support. Government has helped improving the road and SEAAB plowed the land for plantation of annual crops</td>
<td>Retired from municipality of Caracaraí. Raises cattle. States that the land is too ‘weak’ and sandy.</td>
<td>No. Uses water from the drilled water hole. Denounces the illegal harvest of wood, explaining that this is in part due to the recent arrival of people to nearby communities that do not have other alternative of living. Several trucks leaving with timber. Land grabbers. The supervision was reduced from what was before. Two citizens were seen heading to a paca hunt, with guns and riding bicycles. States that jaguars are less frequent than used to be, they do not bother the cattle anymore. One was killed for attacking the livestock 3 years ago, very near his house.</td>
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<tr>
<td>Raimundo Gonzaga da Silva (Raimundo cobra), 90 years old</td>
<td>16/10/09</td>
<td>Jarú Island, Rio Branco next to the FMU</td>
<td>Supervises the abandoned Jarú Ecotouristic Project</td>
<td>No support</td>
<td>Retired from the municipality of Caracaraí</td>
<td>Fishing. Says that has consumed eggs taken from turtles, harvested from the nearby beach when it used to be available. Has witnessed fisherman killing giant otters and dolphins because they</td>
<td>Presence of giant otter, grey river dolphin in groups (when the river is low) and pink river dolphin (when river is up). Jaguar and white-lipped peccaries</td>
</tr>
<tr>
<td>Name</td>
<td>Date</td>
<td>Location</td>
<td>Household and working situation</td>
<td>Government support for agroforestry use of land</td>
<td>Main livelihood</td>
<td>Use of natural resources (other than firewood)</td>
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<td></td>
<td>were trapped in their nets. Denounced the persecution to turtles that leave water to lay eggs, and to the manatee. Lots of outside people.</td>
<td>existed in the island before. <em>Arapaima gigas</em> still present, but much less abundant than before and hard to see.</td>
</tr>
</tbody>
</table>
17. Appendix 11. Forest conversion in the vicinities

Typical configuration of a settlement at the side road 3 during access to the FMU: pasture in front (after forest conversion) and forest at the back.
18. Appendix 12. Fishing at Rio Branco

Rio Branco, in front of the FMU. The FMU field staff should try to have a good relationship with fishermen and other people that use the natural resources in the vicinities of the FMU. In the photo the fisherman Dantas showing the product of his work to the FMU employees Francisco José Guedes and João Ventura.
19. Contacts (updated in 6th of October 2009)

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Pro-Yanomami Commission
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