## COVER PAGE

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|---|---|
| i. Project name | Gilé National Reserve REDD Project |
| ii. Project location | Mozambique, Zambézia Province |
| iii. Project proponent | **ANAC** (Administracao Nacional de Areas de Conservacao / National Mozambican public agency for conservation areas)<br><br>Contact:<br>José Diaz<br>GNR administrator<br>Musseia camp. Pebane district. Mozambique<br>+258 867 958 003<br>rngile@gmail.com |
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| v. Project start date | 1st January 2012 |
| GHG accounting period and lifetime | 20 years (1st January 2012 to 31 December 2031) |
| vi. Whether the document relates to a full validation or a gap validation | Full validation |
| vii. Document history | V2.1 |
| viii. Edition of the CCB Standards being used for this validation | 3rd Edition |
| ix. Summary of the project's expected climate, community and biodiversity benefits | Community benefits:<br>Community benefits will be achieved with the support of the project to conservation agriculture as an alternative to slash and burn cultivation (main cause of deforestation) and to the improvement of vale chain of cash crops of interest (cashew and sesame) through technical support and the guarantee better prices to producers as a counterpart for decreasing deforestation for food production. Project activities should contribute to improve communities' revenues and to assure an improved and sustainable management of natural resources to which |

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| | communities are dependant (forest and water resources through land use planning and sensitisation). |
| | Climate benefits: |
| | They are covered through the implementation of activities to reduce deforestation and degradation mainly reducing agriculture expansion and illegal logging. Only deforestation is considered as sources of GHG and only carbon stocks changes in AGB and BGB tree pools are source of $CO_2$eq emissions. Reference emissions level was calculated for the 2000-2005-2010 period with multiplication of activity data and emissions factors. In the baseline scenario, rate of deforestation in the project area is 810 ha/yr. Pre-deforestation carbon stocks used are 84.3 tC/ha and post deforestation are 12.9 tC/ha. Baseline emissions are estimated to be 1,920,420 tCO$_2$eq after 10 years in the project area. Project efficiency is expected to be of 70% of emission reduction after 10 years thanks to activities developed with communities (support to agriculture) and the Reserve. The total project emissions after 10 years are expected to be 1,136,187 tCO$_2$eq which corresponds to a climate benefit of 784,233 tCO$_2$eq (emission reductions) in comparison to the baseline scenario. |
| | Biodiversity benefits: |
| | The GNR is one of the largest piece of Miombo still existing in African and it is originally a home for large biodiversity. Biodiversity benefits will be achieved thanks to the improved management of the GNR, the creation of the buffer zone with a relevant management plan that will contribute to reduce deforestation and poaching while allowing communities subsistence activities and the reintroduction of locally extinct fauna species. Through the Project, a better control of poaching activities and of illegal logging is expected to be achieved benefiting to local biodiversity. |
| x. Which optional Gold Level criteria are being used and a brief description of the attributes that enable the project to qualify for each relevant Gold Level | Biodiversity exceptional benefits: |
| | The GNR is a national area for conservation purposes in a forested landscape. It holds exceptional biodiversity values with various species that holds the "vulnerable" and "endangered" status as defined by IUCN. The project zone includes a site of high biodiversity conservation priority on the basis of Key Biodiversity Area (KBA) framework of vulnerability and irreplaceability. It meets the vulnerability criteria through hosting at least one specific trigger species in suitable proportion: |
| | - African wild dogs (endangered): at least a single individual identified in the project zone; <br> - African elephants (vulnerable): at least 30 individuals identified in the project zone. |
| | African elephant is of particular interest for the Project that develops a specific monitoring of this population and aims at increasing the number of individual or at least prevent poaching of those already present in the Reserve and human/elephant conflicts around cultivated areas. |

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| | The fact that the project zone hosts *Swartzia madagascariensis* is also significant in terms of biodiversity, as this is probably their last viable population in Mozambique and the Project aims at reducing illegal logging toward that species. |
| xi. Date of completion of this version of the PDD, and version number, as appropriate | 20-11-2017, v2.1 |
| xii. Expected schedule for verification | 2022 |

# Gilé National Reserve REDD Project

**Document Prepared By**

Etc Terra

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|---|---|
| **Project Title** | Gilé National Reserve REDD project |
| **Version** | V2.1 |
| **Date of Issue** | 20-11-2017 this version of the document issued |
| **Project location** | Mozambique, Zambezia Province |
| **Primary project proponent** | ANAC |
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DRAFT FOR PUBLIC COMMENT - 01 December 2016

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## Glossary

| | |
|---|---|
| AGB | Aboveground biomass |
| ANAC | Administracao Nacional de Areas de Conservacao/ National administrative entity for protected areas |
| AFOLU | Agriculture, forestry and other land use |
| ASI | Agrisud International |
| BGB | Belowground biomass |
| ER-PD | Emission reduction program document |
| ER-PIN | Emission reduction program idea note |
| ETC | Etc Terra NGO |
| FFEM | Fond Français pour l'Environnement Mondial / French fund for worldwide environment |
| GNR | Reserva Nacional do Gilé / Gilé National Reserve |
| HCV | High Conservation Value |
| IGF | Fondation Internationale pour la Gestion de la Faune / International foundation for the fauna management |
| FAO | Food and Agriculture Organisation of the United Nations |
| FCPF-CF | Forest Carbon Partnership Facility - Carbon Fund |
| GHG | GreenHouse Gas |
| NTFP | Non-Timber Forest Products |
| REDD | Reduction of emissions due to deforestation and degradation of forest |
| ZILMP | Zambezia Integrated Landscapes Management Program (FCPF-CF ER Program) |

# 1. SUMMARY OF PROJECT AND BENEFITS

This PDD presents benefits on climate, communities and biodiversity of the GNR REDD project developed in Mozambique by ANAC, the administration in charge of protected areas. Activities implemented and monitoring plan are described for each component. The REDD project first aim is to reduced unplanned deforestation in the area but this is accompanied with significant benefits for communities and biodiversity.

## 1.1. Context and location of the project

The GNR REDD Project is a REDD project developed in the buffer zone of the Gilé National Reserve in Mozambique, Zambezia Province. The GNR is managed by ANAC (national agency responsible of the management of protected areas) which is therefore the project proponent. Since 2007, ANAC is beneficiating from a support of the NGO IGF financed by the FFEM to improve the management of the reserve.

The reserve was created in 1932, initially for hunting (game reserve – only black rhino and elephant were protected), and have turned into a conservation area since 2000. The central zone covers an area of 2 100 km². It is composed of Miombo forest and was previously considered as one of the richest area of Mozambique for biodiversity (for example, it contained last populations of black rhinoceros in Mozambique). However, years of uncontrolled game hunting and of political instability and war strongly reduced wildlife populations to almost zero, because of poaching and deforestation. Miombo dry forest typical of this region with presence of patches of clearings (called *dambo*) where hydromorphic soils are present. Miombo is characterised by species from the genus *Brachystegia*, *Julbernardia* and *Isoberlinia* (Campbell 1996). It is currently one of the last area in Mozambique where a relatively large abundance of the tree species *Swartzia madagascariensis* (*pau ferro*) that faces over-exploitation in the whole country. Some endangered wildlife species are also still present in the GNR (section 5.1.1), notably elephant populations that are subject to strong conservation efforts.

Forests of the buffer zone of the GNR composed the project area of the present project. It was composed of **124,145 ha of Miombo forest in 2010, before project start date (01-01-2012)**. The project is seeking for VCS and CCB validation (a specific Project Document has been prepared for each standard).

### 1.1.1. Causes of deforestation

Only town of the project zones is Gilé (22,000 inhabitants). It is accessible with a dust road from the concrete road linking Quelimane (Zambezia Province capital) to Nampula (Nampula Province capital). Nobody lives inside the central zone of the reserve but about 32,000 inhabitants live around it.

Main activity (89% of the population) is subsistence agriculture using slash and burn techniques. In the search of soil fertility and of lands facilitating field maintenance, they open crop fields by felling trees on forest areas around villages on about 1 ha per household and cultivate it for 2 to 3 years before leaving the area as a fallow. In savannahs, competition with herbaceous species implies frequent hoeing that inefficiently increases working time for lower yields. After this period of cultivation, they will cultivate other fallows or forest areas while soils fertility is restoring in fallows and come back to first field after 2 to 10 years depending on the household. Multiple cycles of cultivation on lands, and especially when fallow is short, lead to the soil depletion and to the need of conversion of new forest area. This phenomenon is

increased with demographic pressure as new households also need to settle down. Access to forest land is regulated by customary laws that present few constraints. A responsible in each village keep in memory area that are free of regulations and people can freely use forest lands, areas belonging to those that value them i.e. that slash forest for field settlement.

Hence, around villages, expansion of agriculture is the main cause of deforestation (Figure 14). In the GNR, this deforestation is concentrated in the buffer zone but at the beginning of the project, deforestation due to expansion of agriculture was gaining the central zone of the reserve (Figure 14), jeopardizing its integrity. The decrease of forest cover around the GNR is the reason of the development of the present REDD project.

In addition to expansion of agriculture, local populations are using the forest for collection of non-timber (several vegetation species that are used for alimentation, medicines or rope making – see Romann 2016 - and of animals that are hunted for meat with several types of traps or guns) or timber forest products. Pau ferro (iron wood - *Swartzia madagascariensis*) is by far the main timber forest product which is illegally exploited in the reserve and its surroundings. It is exploited by local populations that are mainly hired by Chinese entrepreneur for exportation in Asia (Mackenzie, 2006a). People select tree of interest so this lead to forest degradation (and not to deforestation). Similarly, tracks for trunks transporting logs lead to forest degradation (Figure 2). This exploitation, even though illegal is mainly located in the central zone of the reserve (yet occurs in all project zones), is highly valuable for loggers.

Charcoal production is also occurring in the area but only around urban area where this energy is easier to transport. So, in the project zone, this activity concerns the city of Gilé. According to survey done in the area, charcoal production is associated with slash and burn agriculture i.e. tree cut for charcoal production purposes are selected on areas that will be deforested for the settlement of a field the same year or the year after. So, apparently, charcoal production does not have additional impacts on deforestation or forest degradation.

These activities are leading to a mean historical deforestation level of 2,877 ha/yr (0.65 %/yr) in the reference region (Table 17) of the project between the years 2000 and 2010. This level remained stable all along the reference period. It is equivalent to a level of 810 ha/yr in the project area (Table 18).

### 1.1.2. Activities developed for the project

In order to decrease deforestation, the REDD project is developing several activities with the GNR and local populations:

- First activity of the project is the creation of the **buffer zone of the GNR** which is mandatory by the Mozambican law but had not yet been done. This creation marked the start of the REDD Project. It was published in the official journal on 30th December 2011 so Project **start date is set at 1st January 2012**. This zone will allow to improve conservation efforts of the GNR and to maintain some communities' activities which are not prejudicial for conservation. Hence, in the GNR buffer zone, according to the management plan, the gathering of NTFP is regulated and monitored, some activities are developed with communities to limit fields' expansion (agro-ecology) and decrease human-elephant conflicts. The creation of this zone allowed a more inclusive management of the GNR with the integration and management of some communities'

activities in the buffer zone. Conservation of the core area of the Reserve is also improved with the support of IGF. Main activities focus on development of anti-poaching (animals and trees) systems and on the reintroduction of locally extinct species (zebras, buffalos, …) to provide biodiversity benefits.

- Development of agro-ecology techniques on villages around the GNR in order to find alternatives to slash and burn agriculture, main cause of deforestation in the area. Agrisud International designed agro-ecological systems suited for the area and has implemented with communities. These techniques allow to improve soil fertility in fields for a longer period while diversifying cultivated crops and should reduce the necessity of itinerant agriculture. Moreover, land use plans are developed with community to sensitize to issues related to deforestation and decrease of forest resources and to sustainably plan the attribution of fields for agriculture.

- Improvement of cashew tree cultivation and of the value chain to help producers improving quality and quantity produced and to furnish a better price. The objective is to increase yields of cashew production which is historically the cash crop of the region with technical support. Moreover, a plan to develop a value chain based on a premium price for equity and sustainability of the production. Hence, these two measures should increase revenues of households around the reserve and so, decrease their dependency to subsistence agriculture.

Until now, these activities were funded by the FFEM, from 2008 until 2016. The FFEM Project financed (i) conservation support from IGF to ANAC for the GNR management, (ii) technical support from Etc Terra for the development of a strategy to reduce deforestation and to assure a REDD valorisation of the Project and (iii) small-scale agricultural support from Agrisud International to communities as a part of the strategy developed to reduce deforestation. At the validation of the REDD project, it is planned that the sale of carbon credits will allow to finance a part of the activities with communities. The objective is to reduce deforestation by 30% after 5 years and by 70% after 10 years against the reference level. Some activities will be continued with the funding of the Mozbio project as described hereafter. The Mozbio project regrouped ANAC, IGF and Etc Terra as partners.

**Continuation of activities through Mozbio project**

After the end of the FFEM project, activities on the ground will be financed for at least two additional years through the Conservation Area for Biodiversity and Development Project (Mozbio) project. The Mozbio project is a large-scale project, supported by the World Bank and focusing on selected conservation areas in Mozambique, with a total budget of USD 46.32 million (at national scale), financed by the International Development Association (IDA) and the Global Environment Facility (GEF). It is also implemented by the ANAC (REDD project proponent), with an overall objective of increasing the effective management of conservation areas and enhancing the contribution of these areas to the living conditions of surrounding communities in Mozambique. It is expected to directly benefit local people living within and around the targeted conservation areas through the promotion of sustainable livelihood activities.

The GNR and its surrounding have been identified as one of these targeted conservation areas and, as such, benefit from a specific component dedicated to piloting sustainable community livelihoods (US$ 1.35 million). Led by Etc Terra (present project partner), in consortium with IGF (present project partner also), this component includes various pilot activities that are implemented in the districts of Gile and Pebane to address the main drivers of deforestation and forest degradation and to promote sustainable forest resources management by local communities and sustainable economic development. Building on the present project, the activities carried out in Mozbio comprise: (i) law enforcement and enhanced protection

of biodiversity in and around the GNR, through capacity building and improved surveillance, in order to reduce illegal logging of precious timber species and animal poaching; specific measures to reduce wildfires are also planned; (ii) the development of community management plans for non-timber forest products such as mushrooms or snails, with the establishment of specific collecting allowances, in cooperation with CGRNs; (iii) the promotion of improved techniques for charcoal production, including the training of pre-identified charcoal producers and the establishment of plantations for energy purposes; and (iv) the promotion of a sustainable use of forest focusing on the restoration of degraded lands, with assisted natural regeneration techniques, improved management of fallows and the creation of nurseries to produce indigenous tree species seedlings.

In addition, from January 2017 onwards, agricultural activities around the GNR are all managed by Etc Terra and integrated in the Mozbio project. They include: (v) the promotion of conservation agriculture practices (technical assistance, inputs and seedling, monitoring), with agroforestry systems and locally adapted varieties; and (vi) the valorisation of the cashew value chain to increase smallholders' revenues (technical assistance to smallholders for cash crops production, including training on quality standards, and continuation of the Kohiwa information system, based on information newsletters, radio messages and text messages to inform producers on a weekly basis on the cashew market dynamics and prices).

All in all, the Mozbio project was designed and is implemented in the surrounding of the GNR so as to extend the dynamic initiated by the present project following its end, in order to ensure the continuation and further development of key activities that are contributing to reducing deforestation and forest degradation. The fact that Etc Terra and IGF are leading these activities ensures effective linkages of the activities and the promotion of long-term synergies.

## 1.2.    Climate benefits

Reference emissions level was calculated for the 2000-2005-2010 period with multiplication of activity data and emissions factors. Only deforestation is considered as sources of GHG and only carbon stocks changes in AGB and BGB tree pools are source of $CO_2$eq emissions. The VCS methodology VM0007 was followed to establish the baseline of the project.

Areas of deforestation for the reference (2000-2010) were measured with a multi-dates analyses of Landsat images that allow classification of land uses and changes with a good accuracy (section 3.1). To assure homogeneity of approaches, for the reference period, data were extracted from a map produced for the jurisdictional Emission Reduction Program, ZILMP, which is currently under development and encompass the present project. The result is a baseline deforestation rate of 810 ha/yr in the project area.

Emissions factors were established by using (i) for pre-deforestation data, results of a biomass inventory built for the ZILMP in order to guarantee homogeneity of data and, (ii) for post-deforestation, an inventory realised on 10-years fallows around the GNR. Both inventories used the same method and allometric equation to calculate biomass (section 3.1). Pre-deforestation carbon stocks used are 84.3 tC/ha and post-deforestation ones are 12.9 tC/ha. Following the methodology, after deforestation event, all aboveground tree biomass is considered as emitted while belowground tree biomass is emitted with a default rate of 10% per year.

Baseline emissions are estimated to be 1,920,420 $tCO_2$eq after 10 years in the project area. Project efficiency is expected to be of 70% after 10 years. Hence, the total project emissions after 10 years are

expected to be 1,136,187 tCO$_2$eq which corresponds to a climate benefit of 784,233 tCO$_2$eq (emission reductions) in comparison to the baseline scenario.

### 1.3. Community benefits

Mozambique is one of the countries with the lowest Human Development Index (HDI) in the world – ranked 178 out of 187 countries in 2015. In the project zone, 27 community settlements were identified (Table 3).

According with the last quantitative survey carried in 2015 on the GNR's vicinity, 98% of the population living in the Project Zone practice agriculture as main activity. The production systems are characterised by shifting cultivation, inter-cropping and a low level of agricultural inputs for the intensification of the production. Main cash crops are cashew and sesame, contributing to more than 50 % of household's income (Table 32). During the 1950's – 1980's period, Mozambique used to be one of the world main producer and exporter of cashew nuts (Rabany 2014). Since then, no attention was given back to the production of cashew nuts in the country (Lizon 2002). Moreover, communities strongly rely on NTFP for their livelihoods even if these product represent less than 10% of annual income (Romann 2016).

Local authority systems can be declined in two ways: the traditional system and the political administration system. The *regulos* are in charge of traditional ceremonies execution and for land management for the communities in the project zone. The political system's local agents are in charge of administrative fields.

Consultations of communities was realised in 2016 before submission of the PDD to standards, in order to inform communities about the consequences related to the validation of a REDD project. They were conducted in local idioms, in conjunction with community members, local leaders and other stakeholders. It has a chance to introduce all the concepts that are necessary to make the GNR's REDD Project and its implications for the communities be easily understood. This consultation was realised with posters showing the implication of without and with project scenario and it was the opportunity to detail again the dialogue process and conflict resolution mechanism between communities and Reserve (Appendix 1 and 3).

Three types of HCV were identified (see section 2.1.5): (i) areas providing basic ecosystem services which are rivers and riparian forest as water availability is critical in the project zone, (ii) the GNR buffer zone that is an area fundamental to meet community needs in terms of NTFP collection and (iii) areas essential for communities' traditions that are located in villages.

The targeted general benefits for the communities are the following:

- **Food security** will be ensured thanks to better management of soil fertility with agroecology techniques, which will enable to increase and diversify the food production and favour a wider choice of diet;
- **Climate vulnerability,** especially to droughts, of community will also be reduced with sustainable agricultural techniques (agroforestry and reduction of deforestation) as the presence of tree positively impact water availability;
- Technical support (agro-ecology and support for cashew production) and market advices on cash crops (cashew and sesame) will increase **households' incomes**;
- The availability of **essential forest resources** will be maintained or improved, through more sustainable agricultural practices (conservation of forest cover) and an improved management of the GNR (management plan for the use of NTFP);
- Crops will be better protected with adapted elephant scaring techniques in order to reduce the vulnerability of households with regards to **elephants' infringement on their fields** (see section 4.2.1).

Net project benefits for communities are summarised in Table 36.

## 1.4. Biodiversity benefits

Mozambique is one of the few sub-Saharan countries to harbour a significant portion of natural forest: 51% of its territory is covered with natural forest - that is 40 million ha. In the whole country, about 5,500 species (including 250 that are likely to be endemic), 222 species of mammals, 680 species of birds, 167 species of reptiles and 39 amphibian species have been acknowledged. Until today, 22 major vegetation types and the GNR is located within the Vegetation Type 26: "Dry Zambezian Miombo Woodland" (White, 1983).

Main vegetation types are described in Table 39. With regards to vegetation, the project zone is a diverse botanical resource with 70 identified tree species and 10 identified gramineae species (Prin, 2008). It is mainly composed of *Fabaceae* but, also, of some other species that are noteworthy because their occurrence in the GNR and its buffer zone is part of a limited range in Mozambique and in the world. The fact that the project zone hosts *Swartzia madagascariensis* (Pau-ferro in Mozambique) is significant in terms of biodiversity, as this is probably their last viable population in Mozambique (Hui, 2016). In the same way, the project zone is the only formal place at global scale to host the *Habenaria villosa* orchid (Fondation IGF, 2011). In addition, wildlife in the project zone is significant with, possibly, 75 identified species of mammals (Deffontaines, 2012) and up to 210 identified species of birds: the biological specificity rate of the GNR is high and the project zone is nationally ranked with the highest conservation priority index (FFEM, 2011). More importantly, the project zone supports 10 mammal species and 2 bird species that are considered to be threatened according to IUCN Red List. Among them, the elephant population has been drastically reduced in Mozambique since the 1960s. In project scenario, they are subject to special protection measures (see section 5.1.2 and 5.2).

The GNR core area and buffer zone comply with the definition of three HCV in terms of biodiversity: (i) area that encompasses a significant concentration of biological diversity for global, regional or national levels, (ii) large landscape-level ecosystems that contain viable populations of species in natural patterns of distribution and abundance, and (iii) the presence of threatened or endangered ecosystems, habitats or refugee.

Biodiversity in the original baseline scenario of the project zone is significant, but endangered by many threats. Those threats are linked to anthropic activities and related mainly to deforestation and degradation of the Miombo forest as well as to animal poaching especially for bushmeat.

Threats to biodiversity in the project zone rely on the following causes:
- **Deforestation** due to slash and burn agriculture that leads (i) to a loss of habitats for wildlife, (ii) to a decrease of tree diversity as assessed by inventories within regeneration area (Montfort, 2016) and, (iii) to an increase of human/elephant conflicts in cultivated areas.
- **Illegal logging** of rare tree species such as Pau ferro.
- **Poaching** especially to medium and large-sized mammals, which represent local hunters' main preys for bushmeat, and to elephant that started recently in the GNR.
- **Spread of uncontrolled wildfires** both (i) from outside the GNR, for the opening of new agricultural fields and (ii) inside the GNR for poaching purposes. However, only late fires can cause small scale deforestation/degradation as Miombo is adapted to these events (Ryan and William 2011).

Several project activities, through the management of the reserve, are oriented toward biodiversity conservation or improvement. Hence, the project will have strong benefits on biodiversity. There are summarised hereafter and in Table 45:

- The reduction of deforestation will contribute to the preservation of **habitats and of diversity in tree species**;
- **Anti-poaching measures** (daily guards patrol and patrols monitoring, monitoring of wildlife, human-elephant conflicts management through the spread of non-harming but scaring elephant techniques, monitoring of precious timber exploitation, etc) will allow to fight against illegal logging and poaching of non-authorized species for bushmeat of ivory;
- Two significant wildlife **reintroduction** operations were organized in the project zone with buffaloes, zebras and wildebeests that aim to restore initial wildlife biodiversity. During the first one in 2012, 20 buffaloes from the Marromeu National Reserve and the Gorongosa National Park have been re-introduced in the GNR. During the second one in 2014, 47 buffaloes have been restocked and 20 wildebeest and 15 zebras have been re-introduced. These operations were globally a success.
- **Early fires** will be used to prevent or minimise late and hot fires used by poachers as techniques for catching animals or initiated by slash and burn activities in order to reduce the impact on tree layer.

Those benefits will be monitored as explained in section 5.4 with (i) large anti-poaching patrol that are also in charge of the reporting of field observations on wildlife and (ii) camera traps, (iii) forest inventories, (iv) monitoring of forest cover (section 3.4) and, (v) the following of some species with GPS collar to assess their displacements in the reserve. Early results of monitoring are presented in Appendices 5 and 6.

## 1.5.    **Standardized Benefit Metrics**

| Category | Metric | Estimated by the end of first baseline period | PDD section reference |
|---|---|---|---|
| GHG emissions | Net estimated emissions removals in the project area, measured against the without project scenario | 784,233 tCO$_2$eq after 10 years | 3.2 |
| Forest cover | Number of hectares of reduced forest loss in the project area measured against the without project scenario | 3,200 ha after 10 years | 3.2 |
| Trainings | Number of community members who have improved skills and/or improved knowledge | 1,000 + 5,000 (mainly beneficiaries from agricultural support activities) | 4.2 |
| Employment | Number of people employed in the project activities | 50 each year | 2.3.11 |
| Livelihoods | Number of people with improved livelihoods or incomes generated as a result of project activities | 6,000 | 4.2 |
| Well being | Number of community members whose well-being was improved as a result of project activities | 1,000 + 5,000 (mainly beneficiaries from agricultural support activities) | 4.2 |

| Biodiversity conservation | Number of hectares significantly better managed by the project measured against the without project scenario | 436,000 ha – GNR core area and buffer zone | 5.2 |
|---|---|---|---|
| | Number of endangered species benefiting from reduced threats as a result of project activities | 1 | 5.1.2 |

# 2. GENERAL

## 2.1. Project Goals, Design and Long-Term Viability (G1)

### 2.1.1. Project Proponent (G1.1)

The primary project proponent is the national Mozambican agency for conservation of protected areas called ANAC. The project proponent is the manager of the GNR, reserve around which the REDD project is developed. This agency is working with several partners which are described in the following section.

| | |
|---|---|
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The following entities will work in strong collaboration with ANAC for the management of the project:

- Provincial REDD+ Unit, in charge of coordinating all activities related to landscape management and REDD+ in the Zambézia province under the supervision of the national REDD+ unit

- IGF (International foundation for fauna management) is supporting ANAC for the management of the reserve in the central and buffer areas

- Etc Terra is managing activities with communities around the GNR aiming at improving agriculture techniques and decreasing deforestation in and around the reserve. Etc Terra is also responsible for the MRV of the REDD project and for the redaction of the present document.

- Agrisud International designed suitable agro-ecological systems for the project area and had been supporting communities to adopt those techniques between 2014 and 2017.

| | |
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| Organization name | Agrisud International |
|---|---|
| Role in the project | Conservation agriculture support |
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### 2.1.2. Project Objectives (G1.2)

Climate objectives are to reduce carbon emissions due to unplanned deforestation of the Miombo forest in the project area that corresponds to the buffer zone of the GNR. Main cause of deforestation in the area is subsistence agriculture by slash and burn techniques. The objectives will therefore be achieved by the support of communities to find alternative to these practices. Carbon emissions will be estimated through

the evaluation of deforested areas based on satellite imagery analysis and of emissions factors with forest inventories.

Community objectives are the following:

- Raise awareness about the need to consider environmental issues to guarantee well-being and to respect GNR management plan for the conservation of biodiversity;
- Provide technical support to local communities for the adoption of agroecological techniques in order to sustain agriculture in the area and to improve yield and revenues while reducing itinerancy of fields;
- Reducing Communities' dependence to forest resources through the promotion of improved cash crop value chain (cashew nut, sesame) through technical production and market information services (information on prices and advices, development of new market with higher price for producer) support to producers that will help to diversify the means of subsistence and to develop sustainable sources of incomes.

In order to reach these goals, the project will associate local populations to the project area management and will implement participative activities as much as possible.

GNR forest being one of the last large piece of dense Miombo forest in the country, biodiversity objectives are to improve the conservation of rare flora and fauna in the GNR through support to ANAC for the management of the reserve (anti-poaching strategy, control of illegal logging and mining, fires management, etc.) and the reintroduction of species that have locally disappeared and the monitoring of their population.

### 2.1.3. Physical Parameters (G1.3)

The present REDD project is developed around the Gilé National Reserve (GNR) in the Zambézia Province at the centre of Mozambique (Figure 1). The reserve of 2,100 km² (central zone) was created in 1932, initially for hunting (game reserve – only black rhino and elephant were protected), and have turned into a conservation area since 2000. The Reserve is composed of Miombo forest and was previously considered as one of the richest area of Mozambique for biodiversity (for example, it contained the last populations of black rhinoceros in Mozambique). However, years of uncontrolled game hunting and of political instability and war strongly reduced wildlife populations to almost zero.

The Reserve is managed by ANAC that works for the conservation of forests and improvement of wildlife population of the area. Since 2007, ANAC is beneficiating from a support of the NGO IGF financed by the FFEM to improve the management of the Reserve. Biodiversity of the GNR and its surroundings is presented in details in section 5.1.1.
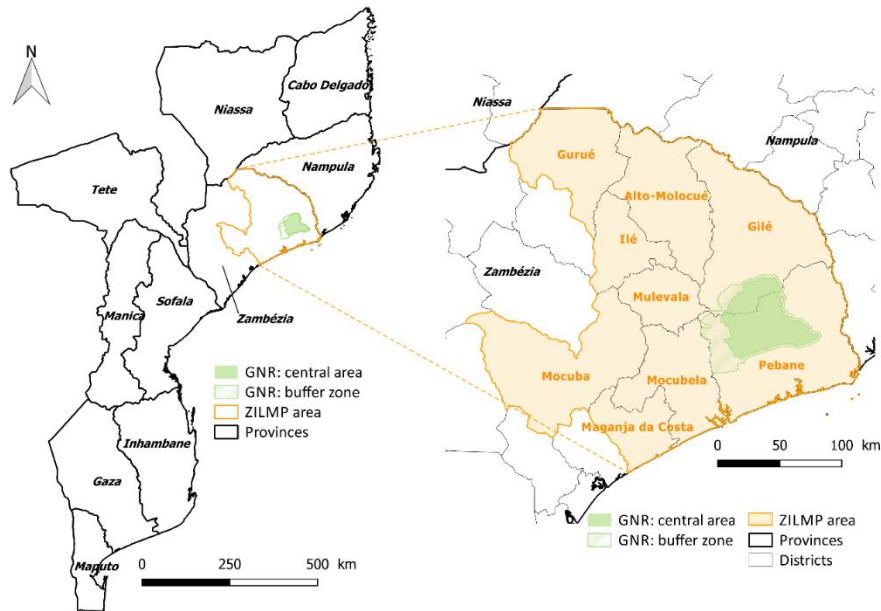
**Figure 1: location of the GNR and of the ZILMP area in Mozambique**

**Environmental conditions**

Topography and soils:

Topography is relatively flat with elevation lower than 500 m (129 m of altitude in average, stdv= 55 m) and low slopes. High elevation areas correspond to inselberg cover by small vegetation representative of dry areas.

Two types of soil are present in the area presenting different fertility: (i) white sandy soil are distributed in the south of the area and have a low fertility and water retention capacity and, (ii) brown loamy and sandy soils are present in the north with higher fertility and water retention capacity (Berton 2013).

Climate:

Climate is composed of a dry season from May to October and a humid one from November to April with mean annual rainfall between 800 and 1,000 mm. Temperatures vary from 13°C (minimum in June in average) and 37°C (maximum in October in average).

Hydrology:

Several rivers are present in the project zones. Some of them can dry during the dry season while the main ones continue flowing. Three main rivers can be mentioned: Molocué in the east of the GNR, Mulela river in the west and Malema inside the GNR. They are used by fishermen that navigate with artisanal dugouts but no transport of merchandises exists on those rivers. No lakes or permanent ponds are present in the project zone. Only dambo, humid areas with hydromorphic soils are present but they are dried out during dry season.

<u>Vegetation:</u>

Forest of the Reserve and its surroundings is Miombo dry forest typical of this region with presence of patches of clearings (called *dambo*) where hydromorphic soils are present. Miombo is characterised by species from the genus *Brachystegia*, *Julbernardia* and *Isoberlinia* (Campbell 1996)*.* About flora, the GNR is one of the last area in Mozambique where a relatively large abundance of the tree species *Swartizia madagascariensis* that faces over-exploitation in the whole country. In the project zone, the following type of vegetation were identified but dense forest types cannot be differentiated by carbon stocks (Prin, 2008):

- Dense forest with *Julbernardia globiflora* and *Dalbergia nitidula*

- Dense forest with *Dalbergia nitidula* and *Brachystegia spiciformis*

- Dense forest with *Diplorhynchus condylocarpon*, *Combrandum* and *Brachystegia bohemii*

- Riparian forests with *Pandanus livingstonianus*

- Dambos composed of herbaceous species

- Savanna with *Hymenocardia acida* and *Parinari curatellifolia*



**Figure 2: Picture of Miombo forest in the GNR**

Fauna:

With regards to wildlife, before project start, five large herbivores species were present but are now locally extinct in the project zone: black rhinoceros *(Diceros bicornis);* African buffalo (*Syncerus caffer*); eland (*Taurotragus oryx*); wildebeest (*Connochaetes taurinus);* zebra (*Equus quagga*). Nevertheless, the GNR and its buffer zone still host various species that holds the "vulnerable" and "endangered" status as defined by IUCN: African elephant (*Loxodonta Africana*), Temminck's ground pangolin (*Smutsia temminckii*), Hippopotamus (*Hippopotamus amphibius*), Southern ground hornbill (*Bucorvus leadbeateri*), Martial eagle (*Polemaetus bellicosus*), African wild dog (*Lycaon pictus*). Expected evolution of wildlife without project and measures taken in the context of the project are described in details in the section 5.1.

Population and accessibility:

Main (and only) town of the project zone is Gilé (22,000 inhabitants). It is accessible with a dirt road from the concrete road linking Quelimane (Zambezia Province capital) to Nampula (Nampula Province capital). One track allows permanently joining Gilé to the south-west of the Reserve by car.

Nobody lives inside the central zone of the Reserve (which is unique in Mozambique) but about 12,500 inhabitants[1] live in its buffer zone and 100,000 in the project zone around the GNR (see section 2.1.5). They belong to the same ethnic group (Elomwé). Main language is Lomwé with some influence of Macua in addition to Portuguese.

### 2.1.4. Social Parameters (G1.3)

The project is located in the Zambezia province which is the second most populated Province of Mozambique, with a density of 37.6 inhabitants per km² (Fusari et al., 2010). Although no dwelling exists inside the central zone GNR, about 100,000 persons live in the project zone. Main settlements are presented in Figure 3. Main town of the project zone is Gilé (22,000 inhabitants) at the North of the Reserve. According to a survey done in 2015 in this zone (n=135 interviews – see Appendix 4 for the questionnaire), in average, there are 6.1 persons per household which is composed of 2 adults (one man and one woman) and 4 minor persons (2 boys and 2 girls in average). Gender in the Pebane and Gilé districts is presented in Figure 15 (section 4.1). As presented previously, there is one ethnic group (Elomwé) and 2 main languages: Lomwé (with some influence of Macua in some areas of the project zone) and Portuguese.

The population of the project zone principally depends on farming. Agriculture is mainly for subsistence purpose, characterized by the use of manual tools and slash-and-burn techniques. Cassava and maize are the dominant crops for self-consumption. Other commodities such as cashew nuts, sesame, beans or groundnuts are marketed. Usually, farmers continuously grow one specific piece of land before leaving it for fallow, between 2 to 5 years, in average. When land fertility is too low, the field is abandoned and a new one is opened on forested lands (BAUDRON 2009). Cattle is rare, with a strong concentration on small species, mainly avian (Lizon, 2002), whereas goats are widely used in the North-West and East of project zone.

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[1] This number is a result of (i) a count of the number of dwellings in the buffer zone on recent high resolution satellites images and (ii) an estimation of the number of persons per households thanks to an survey done in 2015 around the GNR (n = 135).

Inhabitants of the Pebane and Gilé districts have a very poor access to basic social services. Gilé, which is the biggest town in the GNR's vicinity, is also the only one to possess a hospital and to be provided with electricity. Although elementary schools ("escola primária" (EP), for children between 6 to 14 years old) are relatively well spread in the project zone, secondary schools ("escolas secundárias", for young people between 14 and 19 years old) are few and too far located for the majority of young people. In average during the 2015 survey, only 2 young persons (1 girl and 1 boy) per household were going to school and only 16 (9 boys and 7 girls) young persons over the 135 households were going to secondary school.

During the survey, the level of poverty was assessed with the use of the country specific Progress out of Poverty Index (PPI[2], developed by the Grameen Foundation). From 10 simple questions, based on indicators correlated to poverty level according to a calibration done with national databases for each country, this index give a risk (in percent) of being below level of poverty. The result of this analysis is therefore a probability of being below a poverty threshold, for each interrogated household. For estimation of poverty level, it is easier for people in rural area with low level of education to answer those 10 simple questions rather than to estimate their annual revenues and charges. In the case of the project zone, during the 2015 survey (n=135), 24% and 42% of interrogated households presented a risk of being below the threshold of 1.25$/day higher than 50% and 75% respectively. This means, according to the PPI, that 66% of the population can be considered as probably very poor. 29% of the interrogated persons presented a risk between 25% and 50% to be below this threshold and only 5% of the population had a risk below 25%. This last part can be considered above the poverty threshold but it represents a low proportion of the interrogated persons.

Additional details on the population living in the project zone are presented in section 4.1.1.

### 2.1.5.  Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2)

The project area is composed of the forests of the GNR's buffer zone. The project's activities with the communities are principally implemented in the surroundings of the buffer zone, in relation to communities' high dependence on natural resources of the Reserve: deforestation fronts, human/wildlife conflict zones, cashew production spots, management of the collection of NTFP. In addition, some activities will be implemented further from the project area, particularly on the charcoal or cashew production areas. All these areas are part of the « project zone » which is defined as a buffer around the PA of 8 km. In the buffer zone, a specific area has to be defined; the "*coutada*" (CHZ: Community Hunting Zone), in the west of the GNR, where communities, through the Nokalano association, will be responsible for its management for wildlife hunting and conservation. The following map indicates the project zone, the project areas, the coutada and the communities where activities are planned or in process.

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[2] www.povertyindex.org
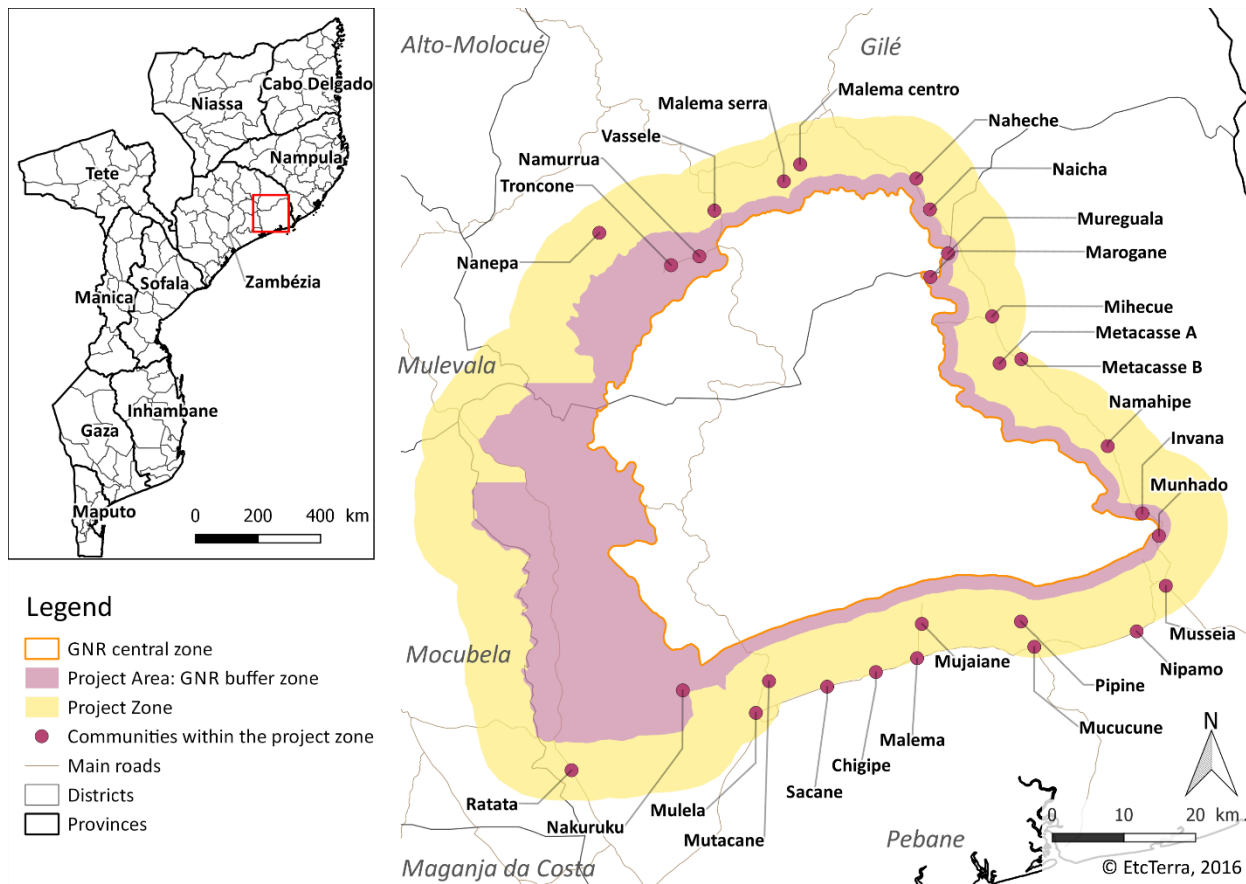
**Figure 3: map of the communities in the project zone**

The exact surface of the Project Area are the surface of the forests comprised in the GNR buffer zones. It corresponds to an area of 124,145 ha (Forest cover in 2010 - Figure 4). The project zone covers 262,396 ha among which 166,501 ha are forests (Forest cover in 2010 - Figure 4). As required, the geodetic coordinates of the extent of each GIS layer is presented in Table 1. All files are available in shp or kml formats.

**Table 1: Geodetic coordinates of the limits of each project zone**

| Zones | Western limit | Eastern limit | Southern limit | Northern limit |
|---|---|---|---|---|
| **GNR core area** | 38°04'11'' E | 38°49'05'' E | 16°50'04'' S | 16°13'59'' S |
| **Project area** | 37°55'01'' E | 38°50'06'' E | 16°55'56'' S | 16°12'50'' S |
| **Project Zone** | 37°50'31'' E | 38°54'35'' E | 17°00'16'' S | 16°08'33'' S |

Some HCVs have been identified in the project zone (see sections 4.1.2 and 5.2.4). The main rivers of the project zone could be defined as HCV4, because of regular hydric stresses annually impacting local communities. They have been delimitated as a buffer of 2 km in a radius of 5 km around each community

(see Figure 4). Various studies demonstrated the dependency of communities to natural resources of the project zone (Baudron, 2009; Chardonnet et al., 2012; Lizon, 2002; Materrula et al., 2009), particularly obvious during food shortages periods of the rainy season (January to March). However, such agricultural practices or poaching activities may eventually diminish the availability of essential resources, which should be preserved as HCV5 (section 5.2.4). Hence, as well as for the collection of NTFP or for the conservation of biodiversity, the entire GNR buffer zone (project area) can be considered as an HCV (HCV5 for community and HCV1 to 3 for biodiversity in all GNR). No sacred, historic or cultural forest sites have been identified as threatened by the communities.
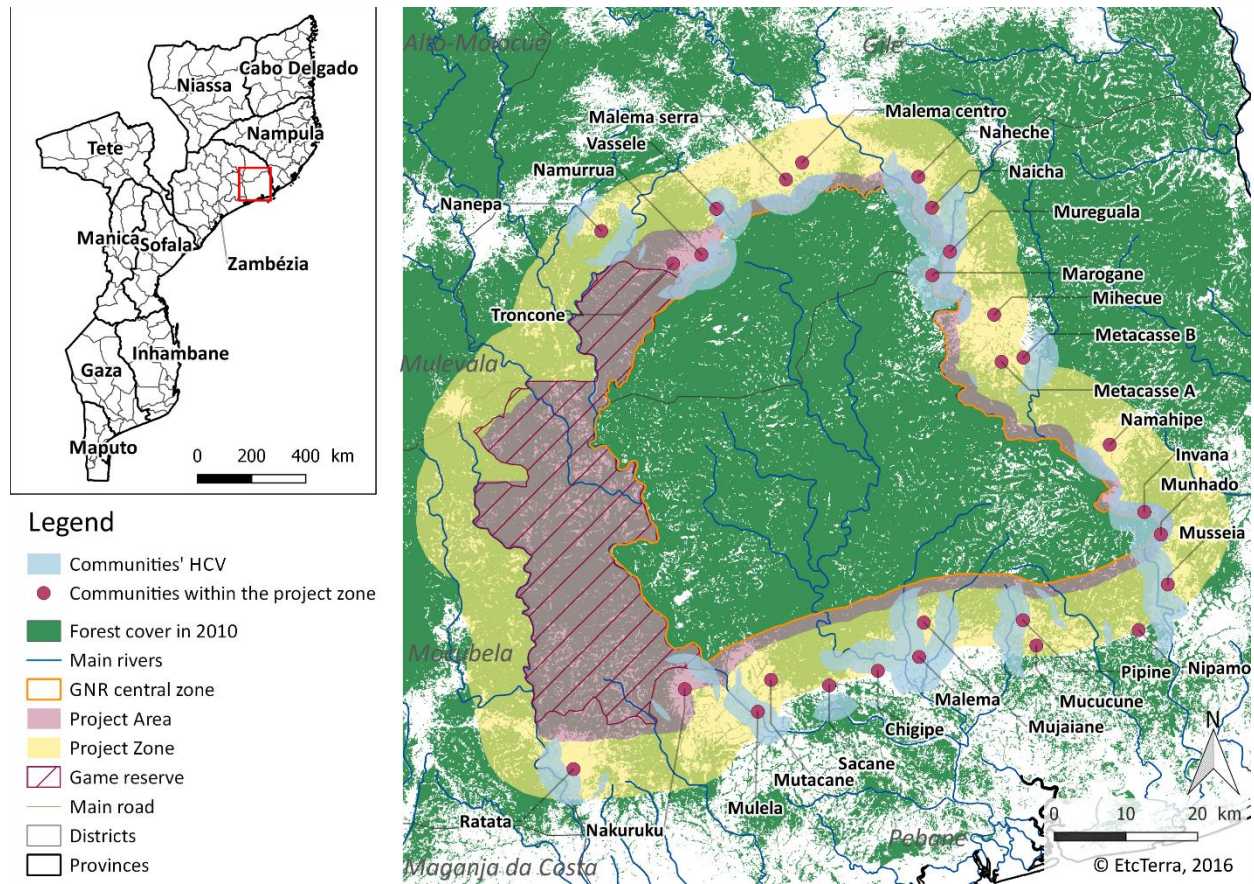


**Figure 4: map of HCV4 for community around main rivers**

### 2.1.6.  Stakeholder Identification and description (G1.5, G1.6 and G1.13)

The identification of the stakeholders (Communities, sub-groups and other stakeholders) was based on the following sources:

- Reports produced by NGOs Movimondo since 2000, IGF since 2007 and Agrisud International since 2014, on cultural, social and economic characteristics of people and settlements around the Gilé National Reserve;

- Feedbacks from some Communities, interviews of local agricultural technicians, traditional or administrative key leaders, members of the CGRN (local committees for the management of natural resources) and farmers in the Project Zone;
- The good knowledge of the project team (ANAC, IGF, Etc Terra, Agrisud International) of local conditions;
- Survey that have been conducted in 2015 in the whole project zone (135 inquiries with community members).

The table below presents an analysis of potential stakeholders and their importance to be involved in the project, according with sources cited above. Details on the presented information are provided after the table.

**Table 2: Analysis of potential stakeholders to be involved**

| Potential stakeholders | Interests in the project | Motivation to get involved | Importance for the Project achievement |
|---|---|---|---|
| Community members relying mainly on project area for resources harvesting | Croplands in the project area is the main driver of deforestation. Some of them are already supported by the project. | Strong | Significant |
| Community members relying partially on project area for resources harvesting | Croplands are located outside of the project area, but NTFP are harvested inside. Some of them are already supported by the Project. | Strong | Significant |
| Members of other communities | Dwellings outside project zone and will not be impacted by the project's activities. Croplands are not located in the project area | Weak: limited effects of the project | Low |
| Poachers and illegal timber loggers | They are mostly native of the project zone. They would have a negative influence on the project's activities achievement. | None: the Project will reduce the impacts of their activities | Low |
| Administrative or traditional local leaders | Key partners for Activities' management. | Strong | Significant |
| Local NGOs | Possible partners for the implementation of activities. | Significant | Moderate |
| Buyers on the cashew and sesame markets | Indirect beneficiaries of the income-generating activities but risks of higher concurrence among them | Weak: indirect benefits | Moderate |
| District administration and technical services | Key partners for the implementation of activities. | Strong: potential capacity improvement | Significant |

Stakeholders

In the light of these sources and the table above, field staff's knowledge and the surveys conducted with the communities, the stakeholders may be defined as all the Community members, local and traditional leaders (Régulo, Locality's chief, samassoa, buco/sangira), institutions from local to national level, who will be concerned by the project's activities or who are willing to get involved in such activities. A list is provided in the following section.

Communities

The « community » notion may be defined as a conglomerate of households, socially organized, connected by familiar links and where members are claiming the same origin or identity. Hence, in the context of the project, communities can be defined as people that are settled within the project zone and are mostly dependent on its forest resources for collection of TFPs and NTFPs, slash-and-burn agriculture, etc. Some studies detail the dependency of the GNR's neighbouring communities to forest resources (Baudron, 2009; Deffontaine, 2012; Lizon, 2002).

These communities are locally called « *bairro* » (quarter/block). They have already been spatially delimited by the Portuguese colonial administration and, later, by the Frelimo government, on the basis of traditional *regulos*' territories[3]. Today, each conglomerate of population is spread along the roads and sometimes concentrated nearby the main crosses. Further, all of them comprise a church and/or a mosque and an *Escola Primeira* (EP – the equivalent of elementary school)). The biggest ones also comprise a local market, a local representation of the Administration and a CGRN (local committees for the management of natural resources). Created in 2012 by the NGO COSV, these committees were built in the main conglomerate of households, nearby or within Project Area.

All in all, within project area and its surroundings, 27 communities are expected to be impacted by the project's activities, including the 14 communities where local committees for the management of natural resources are located. A complete list is provided in section G1.6.

Finally, « Other communities » refers to the communities who are close to the Project Area but have never been involved in the Project and that will not be affected by its activities.

According to the above definition of « communities », the 27 communities involved in the Project Zone are:

**Table 3: Districts and communities involved in the project**

| District of Gilé | | District of Pebane | |
|---|---|---|---|
| Nanepa | Mihecue | Nipamo | Mulela |
| Namurrua | Marogane | Mucucune | Nakurugo |
| Vassele | Nuregala | Pipipine | Ratata |
| Troncone | Metacasse | Malema | |
| Malema-serra | Namahipe | Mujaiane | |
| Malema-centro | Invana | Sacane | |

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[3] Called *regulados*. Description of traditional regulos' territories is provided in part CM1.1

| Naheche | Musseia | Chigipe | |
| Nahicha | Munhado | Mutacane | |

Groups and sub-groups

In the light of the sources mentioned above, no precise groups could be distinguished on the basis of any specific source of income, means of subsistence or language. The communities as a whole belong to the same ethnic group (called Elomwé) and speak the same idiom (Lomwé), even though a few vocabulary differences can be noticed between the North and the South of the project zone, due to the influences of the Macua language. Further, in project area, there are no indigenous people claiming for any particular right or cultural identity. The most recent migration flows date back to the end of the civil war (1991) with a movement from the coast to the lands and from forests to the actual villages. More recently, in the last two decades, the development of trade alongside the main roads conduct some communities to settle progressively closer to the roads. Hence, no particular migrant group or specific population displacement can be distinguished.

Women are generally part of the local decision making process. Local consultation and project trainings always pay attention to the women's participation. Although some subsistence activities are gendered, there is no strict specialization. Women are more engaged than men into NTFPs harvesting and fishing, and men hunt more frequently, but some hunting techniques or NTFPs harvesting involve both men and women. Furthermore, both are engaged in agriculture activities, participate to all stages and will benefit to technical improvement and support in conservation agriculture activities. Even though the majority of the identified beneficiaries are men – as traditional household representatives –, activities will benefit to the whole households. Consequently, two groups can be distinguished among the communities:

- Households living in the Project Zone, whose agricultural fields and main subsistence resources are located in Project Area (Buffer Zone). They are the most concerned by the project activities that particularly supports them.
- Households living within or in the surroundings of the Project Zone, who gather resources but do not own any agricultural field in Project Area. They will be less affected by the Project's restrictions.

Other stakeholders

Other stakeholders don't live within the project zone but can be impacted by or involved in the project activities. They refer to:

- Offsite communities;
- Buyers of cashew nuts and sesame. Most of them are living in the towns of Gilé, Naburi, Pebane or Nampula, capital of the Northern Province. Indirectly, they will be positively impacted by quantity and quality improvement of the cashew production. However, their implication in the Project will remain low, the Project focussing more on producers than resellers. That is why the impact on project achievement is expected to be moderate (Table 4);
- Illegal miners, loggers and poachers, whose activities will be negatively impacted by the Project as one of its aims is to decrease those illegal activities. However, it is highly difficult to reach these stakeholders as their activities are illegal and can be strongly repressed. For this reason, their implication in the Project will remain low and it is not possible to say if they were targeted in consultation or sensitization processes because they will not declare their illegal activities;
- The members of the administration: Gilé and Pebane districts' administration, Gilé and Pebane's District Services of Economic Activities (SDAE, *Serviço Distrital das Atividades Económicas*);

- Local NGOs working in the Project Zone's vicinity;

### 2.1.7. Project Activities and Theory of Change (G1.8)

Accordingly, with the objectives of the project that were presented above (section 2.1.2), the following activities will have impacts on communities:

- **The introduction of conservation agriculture in the deforestation fronts, as well as agriculture diversification**, based on sustainable practices to keep or restore soil fertility thus reducing the need of farmers to cut down forest to open new field. This will lead to less deforestation and meet populations' long-term subsistence needs by increasing annual yields and diversifying crops production. Moreover, some support is provided to livestock management (goats) in order to reduce divagation and crops damages in the fields around the houses and thereby trying to reduce the expansion of fields in forest area far from the villages. Currently, 815 households in the project zone are directly supported by Agrisud International (one of the project partners – see section 2.1.1 – contracted for 3 years (2014-2017) by ANAC, IGF and Etc Terra in the framework of the FFEM project in order to develop alternative activities with community in the aim of reducing deforestation linked to expansion of slash and burn) and this number will increase all along the project lifetime. Another objective of this activity is to elaborate, through a community participative process, agronomic land use plan to support communities (6 plans have been realized so far) identifying agronomic practices regarding characteristics of their territories. These plans allow to guarantee the sustainability of land use for agriculture and conservation of delimitated forests. They are realised in a participatory manner with technicians and community members and then distributed in the concerned communities (Figure 5).
  - *If soil fertility is managed through conservation agriculture practices, agriculture will become more settled and yields will increase. The productions, also more diversified, will help to ensure food security for the households involved. This alternative to slash and burn agriculture with short rotation should lead to a decrease of deforestation as soil fertility will be better managed.*

- **Support to local income-generating activities, through the strengthening of the technical and marketing offer for sustainable cash crops** (cashew, sesame, etc.). A Market information system via local community radio (Gilé) and cell phone text messages on the evolution of raw cashew nut prices has been put in place to diffuse information to cashew producers on a weekly basis in order to help them to sell their product at the adequate time and reinforce their negotiation's capacities. This system has proved its efficiency in other countries[4]. Moreover, on the value chain, markets will be identified to guarantee higher price to producers that meet the project objectives in terms of reduction of deforestation and for the quality of the productions of cashew nuts. 5000 households should be supported through market information services, cashew tree cares and access to cashew seedlings. Apart of them is also supported in conservation agriculture practices (see paragraph above), improved charcoal techniques and forest regeneration techniques (see paragraph below).
  - *If the local cashew nuts and sesame productions are technically well supported and if producers get the key understandings of the mechanisms of local and international market prices' formation, production will increase and will be sold more efficiently.*

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[4] http://nkalo.com/

- **Management of GNR in order to maintain forest resources and to assure conservation of biodiversity**. The GNR management plan to work in a participative maner with communities for better NTFPs management, management of fires in the reserve to decrease their impact, and elimination of destructive hunting techniques illegal logging and mining. To reach this objective, ANAC is supported by the NGO IGF (see section 2.1.1) that have a strong experience in protected area management to ensure poaching control and wildlife monitoring in the reserve. Moreover, some animal species locally extinct will be reintroduced all along the project. Currently, the project has reintroduced 3 species in 2012 and 2014: buffaloes, zebras and wildebeests.
  o *If communities are aware of (i) the consequences of destructive hunting techniques and such activities are efficiently restricted, and of (ii) the impact of unsustainable agricultural or charcoal production techniques in terms of forest degradation and deforestation, loss of forest resources and of others ecosystem services' availability, alternative means of subsistence and forest resources management plan could be encouraged and implemented more efficiently. Further, if charcoal producers and farmers are trained to tree regeneration techniques on non-forest areas (or conservation of trees of interest), impacts of agriculture and charcoal production will be lowered and forest will stop getting increasingly further located from dwellings. These activities will help to reduce the depletion of communities' essential forest resources.*

- **The creation of a game hunting zone (Coutada) manage by a local community in the west part of the GNR buffer zone.** This scheme exists in other protected area in Mozambique and proved to be efficient. The anti-poaching fight of this area should be managed by communities with support of the GNR and the benefits from the hunting activity (hunting fees, accommodation, etc.) will be shared between the managing association, communities and GNR.
  o *If local communities have a financial interest in the management and conservation of wildlife, they will probably be more involved in the regulation of poaching activities. Moreover, this will increase incomes for households of this area.*

- **The provision of tools and strategies to enable and empower communities to adequately defend their crops from elephants.**
  o *If volunteers are formed and supported by GNR rangers on techniques meant to scare elephants away, the amount of crops destroyed will reduce and the impact of human/elephant conflicts on households' subsistence will diminish. This will participate to the permanence of climate benefits thanks to the reduction of leakage.*

**Figure 5: images of land use plan realised by Agrisud International in a community of the project**

These activities will not only enable the reduction of deforestation, forest degradation and greenhouse gas emissions but also ensure the communities and biodiversity a wide range of results and positive impacts, which are described below:

**Table 4: Theory of change by activities**

| Activities | Achievements: planed or in process | Expected results | Positive impacts |
|---|---|---|---|
| **Agricultural component** | **Conservation agriculture** | | **Food security enhancement for communities in Project Area** |
| | Day-to-day technical support | Improvement of production, enrichment of fallows and longer agricultural cycles | |
| | Direct incentives through access to specific tools and seeds | | |
| | Actual implementation of conservation agriculture techniques by households | | |
| | **Agriculture diversification** | | |
| | Technical support to out-of-season production | Wider choice of food products for traditional diet | |
| | Direct incentives with diverse seeds | | |
| **Income-generating opportunities** | **Cash crop** | | **Improvement of livelihood thanks to diversified sources of income** |
| | Day-to-day technical support with field extension agents | Increase of production | |
| | Seed distribution for cashew nuts production | | |
| | Supports on honey production | | |
| | Regular advices on local and internationals market prices | | |

| | | | |
|---|---|---|---|
| | Support to the organization of the sales with producer groups | Improved marketing for cashew and sesame products | |
| **Forest resources management** | **NTFP management** | | Reduction of communities' essential forest resources depletion (TFPs and NTFPs) |
| | Awareness raising on the consequences of unsustainable harvesting and logging for communities livelihood | Successful implementation and use of a natural resources management plan | |
| | Elaboration by the communities involved and for their own use of a management plan concerning forest resources | | |
| | **Charcoal production** | | |
| | Training of producers within dedicated groups headed by « charcoal trainers » | Reduction of the quantity of trees that need to be cut to produce the same quantity of charcoal | |
| | Technical trainings on investment-less improved carbonization techniques | Saving of both time and effort for the same level of production | |
| | **Destructive hunting practices** | | |
| | Elimination of hemming fire and wolf-traps use | Reduction of the impact of wildfires related to hunting practices and elimination of wolf-traps | |
| | Awareness raising on the impacts of unsustainable hunting practices on dwellings, forests and forest resources | | |
| | Effective GNR's rangers control and taxing of illegal hunting practices | | |
| **Wild/Human conflicts mitigation** | **Techniques meant to scare elephants away** | | Effective protection of agricultural fields with no damage on elephant populations |
| | Provision of basic information on wildlife behavior | Successful training of extension agents and local volunteers on Elephants/Humans conflict mitigation around the GNR | |
| | Promotion of improved traditional fences: traditional beehives, prickly bush with dry chili (*piri-piri*), etc. | | |
| | Effective elephants holding off with chili guns and bombs | | |
| | Promotion of farmland blocks in order ease agricultural fields protection | | |

### 2.1.8. Climate, Biodiversity and Community Benefits Assessment Period (G1.9)

The project start date for GHG emissions accounting corresponds to the date of creation of the buffer zone around the GNR which is the first activity to reduce deforestation in the project area: the 1st January of 2012 (see GNR REDD Project VCS PDD). The crediting period is 20 years (until the year 2031) and the project lifetime (over which the project activities will be implemented as described in the present document) is 50 years which is the minimum credible duration for project activities that ask for deep changes in local practices.

Project activities started from this date but, as explained in the present document, consultations of communities for the creation of the buffer zone and biodiversity monitoring started earlier, in 2008 when negotiations for the creation of the buffer zone started with the support of IGF to ANAC.

Both VCS and CCB PDD were developed in 2016. Monitoring period for GHG emissions is planned every 5 years, so first verification is in 2017. It is proposed to keep the same frequency for community and biodiversity benefits. However, as (i) consultations of communities for the REDD project (different from those for the GNR buffer zone) occurred at the same time of the development of the PDDs (see section 2.3) and (ii) first alternative activities with communities really started in 2014, first monitoring period for CCB will be 2017-2022.

### 2.1.9. Implementation Schedule (G1.9)

As explained previously, work for the preparation of the REDD project started in 2008 with the support of IGF to ANAC with funding from FFEM and the REDD project started in 2012 just after the official creation of the buffer zone (publication in the official journal the 30th December of 2011). First period mainly focused on conservation issues and from 2011 and even more from 2014, a stronger implication of communities started in order to decrease deforestation in the project area (GNR buffer zone) and improved communities' livelihoods. From this date, all necessary activities (carbon accounting, community consultations, biodiversity monitoring, etc) for the development of VCS and CCB PDDs were implemented as well as alternative activities (see section 2.1.7) with communities and other stakeholders to start decreasing deforestation rates.

| Date | Milestone(s) in the project's development and implementation |
|---|---|
| 2008 | Beginning of the reinforcement of conservation strategy on the GNR and starting of negotiations for the delimitation of the buffer zone |
| December 2011 | Official publication of the limits of the GNR buffer zone and production of a management plan including this zone. |
| 2012 | Start of the REDD Project (and on the first monitoring period for VCS) |
| 2014 | Development of alternative activities with communities and several studies for the development of PDDs |
| 2016 | Consultations of communities about the REDD project and finalisation of PDDs |
| 2017 | Validation of VCS and CCB PDD and first verification for VCS (GHG emissions). Start of the monitoring period for CCB. Start of the Mozbio Project. |
| 2021 | Verification for VCS and CCB sections |

| 2026 | Verification for VCS and CCB sections |
| 2031 | Verification for VCS and CCB sections and end of the crediting period |

### 2.1.10. Risks to the Project (G1.10)

According to the CCB Standards and guidance, this section should present the likely natural and human-induced risks to the expected benefits during the project lifetime, including risks related to continued community willingness to participate in the project and risks related to the ability to adapt to climate change.

Accordingly, risks to the project benefits can be classified in 3 groups:

- Natural risks linked to seasonality and bush fires;
- Evolution of the socio-political context;
- Assimilation of the project's technical advices.

**Natural risks:**

- The main natural risk identified in the project zone is the occurrence of fires. Each year, fires occur at several points in the project zone, may they be natural or triggered by human activities (for hunting purpose or loss of control when burning of a new field through slash and burn agricultural practices). Depending on when exactly they happen during the dry season, fires can reach different intensities, which vary with the quantity of available dry herbaceous. Their impact on forest cover depends on this intensity (Ryan and William, 2011) but it is not systematically significant – there is no systematic death of trees resulting in a loss of carbon stocks: this can be explained by the fact that Miombo forest is adapted to this pressure. The impact of fires is higher on regeneration potential, since they prevent seedlings from growing. However, the high capacity of Miombo species to coppice (Williams et al., 2008) ensures the maintenance of high regeneration rates. Still, in order to limit the impact of fires on forest cover in the GNR and its surrounding, the project management team voluntarily starts low intensity fires at the beginning of the dry season in order to immediately burn the dry vegetation and limit the intensity of future fires that could occur at the end of the dry season. This mitigation measure was launched at the beginning of the project and proved its efficacy, as no significant loss of tree carbon stocks because of fires was registered. Risk linked to fires on agriculture is very limited because fields are protected from fires that occurs before the sowing period.

- Extreme weather that could affect trees include long drought (due to the increase of the dry season period) but, until now, such extreme conditions did not lead to tree death as Miombo forest is adapted to them (while it is observed in other types of forests ecosystem, such as the Mediterranean one). The vulnerability of forest to drought could increase if the dry season frequently and significantly lasts longer, due to climate change (Tadross 2009; Warner et al. 2015). However it is difficult to predict the intensity and frequency of tree mortality in such conditions. This type of event will probably affect traditional crop cultivation more than forest. The lack of rain, time lag or flooding may constrain the planting period, destroy crops or limit seeds growth. The years 2015 and 2016 were successively marked by heavy rains, flooding and drought, caused by rainy season time lag (Berton, 2013). The agricultural proposed advices to communities will help to mitigate this risk by adapting practices to drought risks through crop diversification and conservation agriculture practices (cover cropping, compost application and mulching for a better

management of soil fertility and moisture sequestration and, crop associations), will reduce impacts of weather events. Hence, climatic risks on project benefits for communities linked to agriculture will remain low. Moreover, various bridges and roads that were destructed around the Project Zone have not yet been repaired, making displacements and technical support to Communities be harder to achieve especially for seeds and material distribution. Their distribution could be scheduled several months before the start of the rainy season (until November) in order to reduce such delay. It is also very important that the vehicles used for project activities be adapted for field constrains and that fuel shortages are anticipated.

- Further, the Disaster Risk Assessment in Mozambique classify the risk in Pebane and Gilé districts as low to moderate (GRIP and UNDP, 2011).

- Cyclones regularly occur in Mozambique, and were registered during the reference period (Fitchett and Grab, 2014) without any significant impact on carbon stocks of the project zones. Moreover, if the risk of cyclones could increase with climate change, there is no clear evidence regarding the historic period and this does not appear as a risk for carbon stocks within the project area.

- Flood is another risk linked to climatic hazard in Mozambique that regularly occurs but according to the bibliography, the risk is considered as low to moderate in the districts of intervention (Warner et al., 2015; GRIP and UNDP, 2011).

As a conclusion, natural risks to project benefits remain low and are mitigated through appropriate measures to limit impacts of fires on forests and biodiversity (early fires) and of drought on cultivation practices (traditional practices could suffer from drought but advices on agro-ecological practices target adaptation to such climatic hazard).

**Local political and economic context:**

Instability between the governmental political party (FRELIMO) and the main opposition political party (RENAMO) can create local tensions, limit market access and weaken security on the main roads. It could have some consequences on the global country economy as well as on households' incomes, especially on those generated by sales on the international market, such as cashew and sesame productions. Fortunately, the Project Zone is and is likely to remain stable, removed from the majority of the conflicts, occurring further South and technical staff and extension agents use to give notice of them dislocations. However, economic instability could favour an increase of illegal logging and destructive poaching techniques. Yet, as previously stated, project activities are designed to diversify and increase households' revenues (e.g. through support to cashew market in the Province) reducing risk of economic instability. National politics should accompany the project by applying regulations in favour of cashew producers. The Project works also as an adviser to national politics in order to guarantee the account for households' interest in the Project Zone.

Moreover, Mozambique has been benefiting from the support of the FCFP, through its Readiness fund, for the development of a REDD+ jurisdictional Emission Reductions Program in Zambezia Province, the Zambézia Integrated Landscape Management Program (ZILMP). The present GNR REDD Project is included in this program that will provide a strong support for the Project strategy as the program aims to up-scale the activities developed around the GNR. The ER-PD will be submitted to the FCPF-Carbon Fund in late 2017.

**Long-term implication:**

The project scenario relies on the expansion of subsistence agriculture that is, by far, the main economic activity in the area, as previously described. All the activities proposed by the project with regards to communities aim at increasing their revenue and/or at sustaining agricultural practices. Moreover, the development of communities' subsistence activities is not constrained, except for some specific hunting techniques. All proposed activities linked to agricultural practices are only incentives. Hence, in any case, the proposed alternatives will be more profitable for communities than the current practices and allow climate change adaptation. Hence, there is no opportunity costs which will guarantee long term implication.

However, bad implementation of improved techniques could restrain activities' results and benefits for Community members. Day-to-day technical support and efficient monitoring by field extension agents, based in the communities involved in the Project will prevent such failure from happening. Moreover, the size of the team of extension agents will increase with the Mozbio project to guarantee more frequent visits to households' fields and support to a higher number of households.

Finally, there is no dispute on land rights in the project area. The project area is the buffer zone of the Gilé National Reserve. Hence, it is a recognized area with a legally permanent restriction, managed by the government of Mozambique in accordance with national law. A decree formalizing the creation of this buffer zone was published in December 2011 and local communities who live around the GNR fully recognize it. Resources rights are ruled by the management plan of the GNR that is clear and also recognized by local communities – no conflicts exist with regards to the GNR and its resources. A grievance mechanism aiming at dealing with any queries and complains related to the use of natural resources does exist and is managed by the GNR management team.

Main natural and anthropic risks for project benefits are detailed in the following table.

**Table 5: Natural and anthropic risks for each activity and benefits**

| risk identified | potential impact on project benefits | actions to mitigate the risk |
|---|---|---|
| **extreme climatic events** as long droughts or heavy rainfalls on a short period or bush fires | This natural risk could have impacts on the 3 benefits targeted by the project:<br>- For communities, droughts can be a threat to harvest, reducing yields, especially with the use of slash and burn techniques for which there is no water control measures;<br>- For climate (forest cover) and biodiversity, bush fires can be detrimental but impacts are limited because the ecosystem is adapted to fires. | Diversification of food crops and soil moisture control measures (permanent ground cover, liquid compost application, adapted crop association, etc) in households' fields are main recommendations of agroecology techniques proposed in the project that will increase resilience to climatic events. Moreover, the diversification and increase of revenues for households through project activities as the support on cashew nut value chain should limit dependency of communities on forest resources. |
| **national policies** that regulate buying price of raw cashew nuts to producers and prevent the application of a premium price for sustainable production | Following proposals from industrial processors, policy makers may want to fix a maximum farm-gate price to Raw Cashew Nut (RCN) to help them supply their factories.<br><br>Low prices for RCN will not incentivise smallholders to change their slash and burn practices. | Presentation of the project strategy to the government agencies in charge of agricultural policies and discussions around cashew market (see Mercier et al., 2016) and inclusion of the Project in a jurisdictional program (ZILMP - |

| | | FCPF-CF) that will scale-up project activities and strengthen advices on national policies |
|---|---|---|
| **political crisis** that would lead to an increase of insecurity in the area or others and so, increase migrations and corruption | If events that increase insecurity in the area or its surrounding would happen, it would complicate project implementation, especially with communities. Migrations could happen from other regions to the project zone that will probably increase deforestation and jeopardise climate benefits, or in the other way. It can increase corruption and GNR funding that will reduce means to fight against illegal activities (logging and mining in the reserve) and can increase complicity with authority to favour this traffic. However, the current tendency is to peace and the Zambezia Province is calm. | Increase and diversification of households' revenues to diminish potential impacts of economic crisis on households. Security rules for Project staff. Implication of the government in the management of the area that strengthen the willingness to maintain it calm. |

### 2.1.11. Benefit Permanence (G1.11)

The project's activities are designed to guarantee the permanence of climate, community and biodiversity benefits beyond project lifetime.

First, this REDD project is implemented in the Buffer Zone of the GNR, created in 2011 with the Forest and Wildlife law (Law n°10/99, article 10, n°3 and 4 (Boletim da República, 2011). Accordingly, the project area is under protection status since 2011 and this status will remain after the end of the REDD project. ANAC (project proponent) will stay the GNR manager for its conservation. This will also guarantee the long-term implementation of GNR activities with the communities within the project zone and the biodiversity conservation and enhancement.

Second, it is worth noticing that long-term effect of the project benefits depends on the efficiency and on the appropriation by Community members of the activities to be implemented, especially for agricultural and charcoal production, cash crops value chain valorisation and timber and non-timber forest resources availability improvement through sustainable harvesting, logging, and techniques meant to scare elephants away. In order to make appropriation, replication and diffusion easier, these activities will request low capacity investment.

Thanks to regular technical supports of field extension agents during the project, farmers are expected to notice the increase of agricultural yields with better management of soils and to be able to use and disseminate conservation agriculture practices along project lifetime. Similarly, charcoal producers are likely to disseminate improved charcoal production techniques and tree regeneration practices when the efficiency of such techniques is proved. In the same way, the improvement of cashew production and related incomes thanks to more information on market prices being available is expected to favor long-term maintenance of orchards and trees. In addition, when the availability of some endangered and essential species for the communities is improved, a long-term management plan of wild resources will be applied. Finally, techniques scaring elephants away and adapted to local dynamics should still be used after the end of the project, as a guaranty of crops long-term protection. The maintenance of technic recommendations after project end will assure the permanence of forest cover conservation and benefits for the three components (climate, communities, biodiversity).

### 2.1.12. Financial Sustainability (G1.12)

The GNR REDD project and the management of the Reserve is financed by international funds until 2018: by FFEM (French Fund for Mundial Environment) from 2008 until 2016 and by Mozbio project by World Bank until 2018 (financial plan available at validation). Moreover, the Mozambican government and the IGF Foundation provide also annual funding to the Reserve. However, after the end of international funding, incomes of the Reserve will become insufficient to cover management and operational costs. From 2018, financial plan is based on the sale of carbon credits to complement funding available for the GNR. The level of activity for the years following 2018 will have to be adjusted accordingly. As the project proponent, ANAC, is a public institution and the partners, IGF and Etc Terra, are non-profit organisations meaning that all benefits are reinvested in the implementation of project activities. Financial plan is updated every year depending on the adjustment of incomes and of unexpected costs.

Costs of the project are distributed as followed:

- 54% of the budget is used for the GNR management either for human resources or operational costs.

- 42% on support to agriculture with communities for conservation agriculture or value chain organisation.

- 4% on the development of REDD activities such as the preparation of carbon accounting and PDD and the community consultation.

Incomes of the project come from:

- The first 5 years, 98 % of costs are covered by international funding. The 5 following years, this part will only represent 21% of the incomes for the GNR REDD project.

- The state budget (11,000 USD per year and 100,000 USD from the Biofund in 2017 and 2018) represent less than 5% over the 10 first years.

- During the second period of 5 years (2017-2021), carbon credits are expected to finance the project after the end of international funding. This income would represent 75% of the benefits of the GNR. Depending on the success in the sale of carbon credits, level of activities will be adjusted upward or downward.

- Additional income from eco-tourism is a plausible potential benefit but is would not occur before the end of first project period (10 first years).

## 2.2.    Without-project Land Use Scenario and Additionality (G2)

### 2.2.1.    Land-Use Scenarios without the Project (G2.1)

The project zone is organised around the central zone of the GNR with the buffer zone (REDD project area) and the surroundings of the reserve considered as a buffer around the GNR (central + buffer zone) of 5 km. In the project area, activities are limited for hunting and logging (but not for other activities leading to deforestation) while they are not outside the reserve. The land-use scenario presented here is the most likely one in the area and was built according to several sources of information: (i) inquiries led on the field (2015 survey among 135 households distributed in 13 villages over the project zone) which focused on the economic activities and agricultural techniques of the communities (questionnaire with closed questions about socio-economic conditions, education level, list of crops, number and areas of fields opened or not on forest lands, energy used, production of charcoal, etc) of households leaving in the project zone, (ii) the agrarian diagnosis realised by ASI on the project zone in order to design the agricultural support based on a good knowledge of the current practices (Berton 2013; Lamarre 2015)  and (iii) the good knowledge of the area developed by the several entities implied in the project. This scenario is the continuation of current activities, led by communities and conducting to deforestation, mainly unsustainable slash and burn activities. Other possible alternative scenarios were identified and are described in the following section (2.2.2 Additionality). However, because of level of legislation enforcement and of the degree of improved techniques dissemination, alternative scenarios are not likely to happen (see following section 2.2.2). Current land uses that are very likely to last in the absence of the Project are described hereafter.

**Expansion of agriculture**

Traditionally, people of the area are mostly living from subsistence agriculture using slash and burn techniques. According to a survey that was led with communities around the project zones (in 2015), small scale agriculture is the main activity of 89% of the population.



**Figure 6: field of slash and burn agriculture near the GNR**

In the search of soil fertility and of lands facilitating field maintenance - in savannahs, competition with herbaceous species implies frequent hoeing that inefficiently increases working time for lower yield, they open crop fields by felling trees on forest areas around villages on about 1 ha per household and cultivate it for 2 to 3 years before leaving the area as a fallow (Berton 2013; Lamarre 2015; Mercier et al. 2016). After this period of cultivation, they will cultivate other forest areas while soils fertility is restoring in fallows and come back to fallow areas after 2 to 10 years depending on the household (fallow duration is 2.2 years in average according to the survey about household practices done around the GNR). Multiple cycles of cultivation on lands, and especially when fallow is short, lead to the soil depletion and to the need of conversion of new forest area (every 6 years in average – result from the survey). This phenomenon is increased with demographic pressure as new households also need to settle down (Mercier et al., 2016).

Main crops for self-consumption are cassava and maize and cash crops are sesame (in fields after maize and cassava cultivation as sesame is not demanding for soil fertility) and cashew nuts (Lamarre, 2015 - Figure 7). Cashew trees are grown in home gardens or in old cultivation areas and so, are not a cause of deforestation (Mercier et al., 2016). Moreover, in some areas of the projects zone, households raise goats. Because of risk of crops destruction by this livestock, people need to open their field relatively far from the village. Hence, the introduction of goats increased deforestation as people had to open fields farer (Mercier et al., 2016).
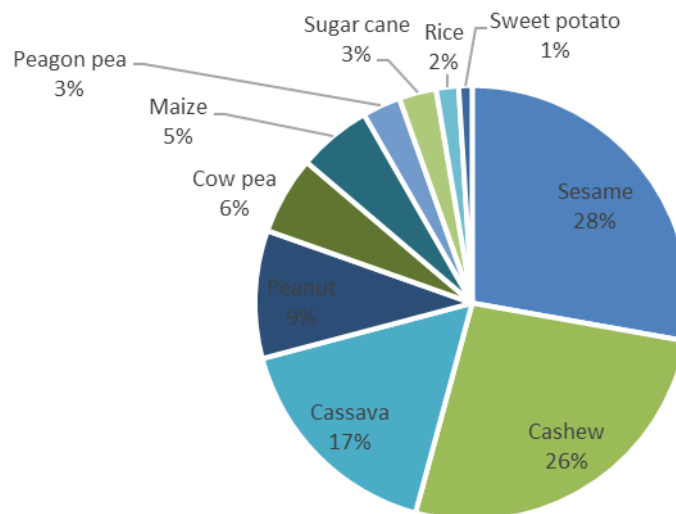


**Figure 7: Net annual revenue of small scale farmers around the GNR (survey by Agrisud International – From Lamarre, 2015)**

Land rights of use are regulated by customary laws that present few constraints. A responsible in each village keep in memory area that are free of regulations and people can freely use forest lands, areas belonging to those that value them i.e. that slash forest for field settlement.

**Hence, around villages, expansion of agriculture was (and still is) the main cause of deforestation for decades and is at the origin of circular non-forest patches around villages. At the beginning of the project, deforestation due to expansion of agriculture was gaining the central zone of the reserve, jeopardizing its integrity.**

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**Forest resources exploitation**

In addition to expansion of agriculture, local populations are using the forest for several purposes: collection of non-timber or timber forest products.

Collected non-timber forest products are composed of (i) several vegetation species that are used for alimentation (mushroom, insects, fruits, leaves, lianas, honey and roots), medicines or rope making (Romann 2016) and of (ii) animals that are hunted for meat (small mammals and medium antelopes) with several types of traps or guns whereas they are forbidden (Fusari et al. 2010). But, uncontrolled game hunting during colonialism and years of war favouring animal poaching lead to a situation at the beginning of the project where populations of rare animals were very low. Regarding emblematic fauna, populations of elephants are still present but no more rhinos are. Since the beginning of the project, ANAC and IGF are working on the reintroduction of some species with relatively good success: African buffaloes, zebras and wildebeest, which are all native species but locally extinct.



**Figure 8: Traps used for hunting by local population around the GNR**

Pau ferro (iron wood – *Swartizia madagascariensis*) is by far the main timber forest product which is illegally exploited in the reserve and its surroundings. It is exploited by local population that are hired by Chinese entrepreneur for exportation in Asia. People select tree of interest so this lead to forest degradation (and not to deforestation). Similarly, tracks for trunks transporting logs lead to forest degradation (Figure 2). This exploitation, even though illegal is mainly located in the central zone of the reserve (yet occurs in all project zones), is highly valuable for loggers. Since the beginning of 2016, regarding the risk of disappearance of the species in Mozambique because of high level of over-exploitation (mainly illegal - Mackenzie, 2006), a national ban on the exploitation and exportation of *pau ferro* was published. However, for now, since the decree is not yet applied on exportation, it does not seem to have an effect on illegal timber exploitation in the GNR.

Around the reserve, forest concession[5] and simple licences[6] are attributed for legal forest exploitation but illegal exploitation still occurs in those areas because management plans or concessions boundaries are not respected (Ekamn et al., 2013; Mackenzie, 2006; Wertz-Kanounnikoff et al., 2013). Main targeted species are: *Jambire - Millettia stuhlmannii, Umbila - Pterocarpus angolensis, Pau ferro - Swartizia madagascariensis, Pau preto - Dalbergia melanoxylon*. The presence of forest concessions does not restrain access to lands for agriculture and therefore, do not reduce deforestation (Mercier et al., 2016).

Charcoal production is also occurring in the area but only around urban area where this energy is easier to transport. So, in the project zone, this activity concerns the city of Gilé and Pebane. According to survey done in the area, charcoal production is associated with slash and burn agriculture i.e. tree cut for charcoal production purposes are selected on areas that will be deforested for the settlement of a field the same year or the year after. So, apparently, charcoal production does not have additional impacts on deforestation or forest degradation.



**Figure 9: Pictures of illegal logging (*pau ferro*) in the GNR**

**Evolution of conditions and creation of the buffer zone**

Evolutions of local activities in the reserve and its surroundings before project implementation was the following:

- Continual expansion of agriculture which gain the boundaries of the central zone of the GNR leading to increasing loss of forests cover;

- Increasing forest exploitation (for *pau ferro*) and artisanal mining;

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[5] Attributed for 50 years

[6] Attributed for 5 years

- Continuation of poaching of fauna in the reserve on the remaining populations of large animals leading to increasing loss of biodiversity.

This situation constitutes the baseline of the project.

In order to change this evolution, it was decided to create a buffer zone around the GNR. This zone was initially planned at the creation of the GNR but was never operational. Hence, a new area was designed and discussed with communities and government of Mozambique and, was officialised by decree the 30th December 2011. The aim of this buffer zone is to improve conservation of the reserve (of forest and fauna) by restraining certain activities of the communities in the area. In this area corresponding to the present project area, the following activities are forbidden:

- The use of guns, traps or dogs for hunting by local population. Only the traditional use of nets is allowed.

- The new attribution of forest exploitation licence.

- All kinds of mining.

- The collection of some non-timber forest product should be regulated after an assessment of the degree of pressure on those resources.

Slash and burn agriculture is not forbidden. Close collaboration with communities around the buffer zone and so, concerned by the project, allows the development of alternative activities such as conservation agriculture or development of cashew nut value chain aiming at reducing deforestation in the area, especially in the buffer zone (project area) to create a protection for the reserve against expansion of agriculture.

In the meantime, activities to improve the management of the whole GNR will be implemented in order to improve wildlife population. These activities follow these axes: law enforcement to reduce poaching (for fauna and flora), re-introduction of species under status of protection that were initially present in the GNR and creation of a hunting area for tourism with a sustainable management in order to furnish revenues from conservation to local populations. Some mechanism to manage conflicts between farmers and elephants are also developed. Moreover, some early fires are provoked to prevent strong fires at the end of the dry season which are prejudicial for the forest.

### 2.2.2.  Additionality (G2.2)

GNR central zone exist from a long period (1932) and, until now, it manages to keep its dense forest cover. However, recent trends of deforestation in the GNR buffer zone (see the map of deforestation between 2000 and 2005 in Figure 14 that show the deforestation progress in the GNR buffer zone) show that in the without project scenario (see section 2.2.1), this area can become more threatened by land-use changes from forest to agriculture. Facing this statement and the lack of funding from the government to assure a holistic conservation approach by integrating local communities to issues related to GNR management, the GNR team sought additional funding to improve its management. In this context, IGF started to support

ANAC for the management of the reserve with funding from the FFEM[7] in 2008. First actions were the elaboration of a management plan for the GNR (central and buffer zone - Fusari et al. 2010) and the creation of a buffer zone to the reserve. As identified in the management plan and by the GNR team, it was necessary to increase and improve work with communities to assure the permanence of conservation efforts and a second (and last) phase of funding by the FFEM started in 2011 (see section 2.1.9). This second phase allowed to start activities with communities and to reinforce conservation efforts of the GNR, which was not possible before external funding. However, these funds have a short duration and are not able to guarantee a continuation of the project activities (financial plan available at validation). They are maintained for 3 additional years thanks to the Mozbio project (activities with communities realised by Etc Terra and ANAC and for biodiversity by ANAC and IGF) but alternative sources of funds are necessary. That is why the project seeks a sustainable way of funding through the selling of carbon credits that are related to its efforts to reduce deforestation. Moreover, unlike other protected areas in Mozambique, GNR do not benefit from revenues of touristic activities[8] because of its remoteness from main roads to ease the access.

Project proponent (ANAC) and supports to the project (IGF and Etc Terra) are all non-profit organisations. Hence, it is guaranteed that all project benefits will be reinvested in project activities. The only activity of the GNR REDD project which is required by the Mozambican law, is the creation of the buffer zone of the reserve. Hence, according to Mozambican law, each protected area should have a buffer zone with a management plan. Hence, regarding historical trends around the GNR and the financial barriers after then end of international funding in 2016, it is unlikely that project activities can continue without the sustainable financial incomes through the sale of carbon credits (financial plan available at validation – see section 2.1.12).

Except of climate benefits that will be used as carbon credits (see VCS PDD), no other benefits will be used in offsetting. Additionality analysis in the VCS PD for climate benefits is summarised hereafter.

**Land uses scenarios**

For the VCS PD, an additionality analysis was led following the T-ADD tool VT0001 v3.0, adapted by VCS for AFOLU projects. The main land use causing deforestation is, by far, slash and burn agriculture, which is practiced by local farmers for, essentially, self-consumption. Without economic alternative in the region, which is remotely located, far from the main cities, it is probable that the dynamic in the area would stay the same with a similar or growing rate of deforestation along with demographic growth. Several scenarios of alternative land uses have been identified

- Scenario 1: conversion of forest land for slash and burn agriculture and charcoal production

- Scenario 2: conversion from slash and burn agriculture to small scale conservation agriculture and agroforestry outside of forest areas

- Scenario 3: extension of the protected area without external financing

- Scenario 4: extension of illegal logging and declassification of the GNR

- Scenario 5: concessions for large or small scale commercial mining

The identified scenarii are consistent with national laws and regulations and their level of enforcement. No official regulation exists to prevent slash and burn practices in agriculture. Customary rules exist for the

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[7]http://www.ffem.fr/base-projets/listerProjets.action?societe=F

[8]http://www.biofund.org.mz/base-de-dados/#area-ponta-do-ouro

attribution of new lands but they do not constrain practices and uses. Basically, lands belong to the one who valorise it in the first place. It is unlikely that this common practice stops without external intervention through a project. The poor diffusion of new techniques and the low investment capacities of local households are strong barriers for the development of alternative to slash and burn agriculture without external intervention.

The extension of a protected area would be consistent with the national regulations. The condition is the availability of funds and the assurance of their sustainability. This was not the case for national funds at the beginning of the project. However, external funds (FFEM) through the elaboration of a REDD project were available and fully compatible with national laws and regulations. Concessions and licences for timber extraction should be revised by national authorities in this scenario.

Illegal logging is per definition not respecting the law and regulations of Mozambique. However, poor law enforcement and high rates of corruption maintain this activity in the whole country (Mackenzie 2006b; German and Wertz-Kanounnikoff 2012; Wertz-Kanounnikoff S., Falcão M.P., and Putzl L. 2013b). No law enforcement may be enough to totally prevent this practice that is intense and widely spread. This would be even more difficult in the absence of the REDD project, which is expect to highly contribute to reduce illegal logging.

In the absence of the project, the most plausible baseline scenario is the one described in the previous sections, characterized by the diminution of forest cover due to the conversion of forest into agricultural plots – through slash and burn practices – and to the extension of charcoal production for cheap energy and complementary incomes. It corresponds to the direct continuation of local land uses without changes in practices. Moreover, significant barriers exist for changing local agricultural practices without project activity. Illegal logging is already prevalent in and around the GNR but it is still maintained to a specific species and, for the moment, is not expected to lead to the declassification of the Reserve.

Finally, the extension of the protected area is plausible inside a REDD project (it corresponds to one of the project activities) but seems difficult outside of this framework, because of a lack of necessary funds in the long term. Indeed, this cannot be considered as a common practice.

Regarding forest conservation, since tourism activities will not be able to be implemented before, the first component will only be a source of costs for at least the 10 first years of project implementation. At first, it will not generate any income through any economic activity.

As for the other components, the totality of the financial and economic benefits generated by project's activities will be directly shared to households around the project area, through investment on agricultural support leading to the increase of yields and the diversification of agriculture. Benefits for cash crop value chains for exportation will be shared between communities and the venture created. This activity rather aims to improve communities' revenues than being directly linked to forest conservation in the project area. Hence, the project proponent will not make any profits from the project activities but will only support costs of implementation.

The revenues obtained by GHG credits will only serve to cover project costs and to finance the upscaling of project activities, if possible. Therefore, we proceed to a simple cost analysis – option 1.

**Common practice analysis**

As previously mentioned, the activities of the GNR REDD project rely on the improvement of the conservation of the Reserve and on the development of sustainable agricultural techniques as alternatives

to unsustainable slash and burn agriculture, associated with the elaboration and implementation of communities-based land use management plans.

In Mozambique, other national Reserves or protected areas have already developed the same kind of activities – that is, the promotion of improved agricultural techniques and/or the creation of conservation and hunting areas, with financial benefits being shared with communities. However, they are characterize by significant differences with the GNR[9]:

- Some Reserves are not located in forested areas (e.g. Marromeu, Ponta do Ouro) and, consequently, are facing different types of pressures. Other are covered by different types of forest (e.g. the protected area "Ilhas Primeiras e Segundas" contains mangroves and a largely smaller proportion of terra firme lands). In Mozambique, the GNR is the national Reserve with the largest area of intact Miombo forest and, therefore, with the most important appealing potential for slash and burn agriculture.

- Several protected areas are located in more easily accessed areas and are composed of a more diversified and significant wildlife: they attract tourists and generate additional income – outside of the scope of the State budget – for the development of their activities9 (e.g. the Niassa National Reserve, the Quirimbas National Park, the Gorongosa National Park). The GNR is difficult to access and, above all, does not yet have the necessary infrastructures for tourism (the number of tourists per year is null for the GNR).

The socio-economic, geographic and natural contexts of the GNR cannot be found in other protected areas in Mozambique. Another REDD+ project has been identified in Mozambique: the Sofala Community Carbon Project, certified by Plan Vivo and located in the buffer zones of the Gorongosa National Park and Marromeu National Reserve. The REDD component of this project is developed on 9,599 ha (according to the project PDD), which is not a comparable scale to the GNR REDD project (PA = 124,159 ha). Moreover, it proves necessitating carbon finance to sustain its activities.

Other development projects focusing on small scale agriculture also exist in Mozambique, especially in Zambezia province, but they don't have the same objective of reducing deforestation (e.g. COSV project around GNR[10], ESSOR – Escola Familiar rural[11], ICEI – Eco Ilhas[12], etc). Moreover, they receive short term financing that limit their scale of action.

Even if the financing of the elaboration of the GNR REDD project is maintained until 2016, the costs analysis presented on the previous section shows that long-term activities will require additional funds on the long term, making GHG credits be necessary additional revenues for the continuation of the project after 2016.

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[9] http://www.biofund.org.mz/en/base-de-dados/

[10] http://www.cosv.org/conservation-of-natural-resources-in-the-national-reserve-of-gile-and-its-peripheral-areas-through-the-strengthening-of-economic-and-productive-activities-of-rural-communities/?lang=en

[11] http://www.essor-ong.org/pt/programas/no-mocambique/renforcement-de-7-efr.html

[12] http://www.icei.it/icei/en/project/sviluppo-eco-sostenibile-di-sistemi-di-gestione-agro-silvo-pastorali-e-della-pesca-artigianale/

## 2.3. Stakeholder Engagement (G3)

### 2.3.1. Stakeholder Access to Project Documents (G3.1)

Project documentation is mainly composed of:

- Survey and mission reports;
- Description of planned activities and monitoring of their results;
- Annual or bi-annual activity reports (progress reports);
- Intern evaluation and external audit;
- Information material to facilitate the public's understanding of the project activities

It is worth noticing that the diffusion of information on the activities involving communities can be difficult due to literacy and Portuguese-speaking issues, related to poor access to education in the project zone. Consequently, communication material as posters and outreach documents were widely used (Appendix 2 and Appendix 3).

Since 2008, information campaigns have been organized with communities and stakeholders, firstly in the context of the buffer zone creation, in order to define its boarders and broadcast its legislation and, then, as part of the project development. Thanks to the day-to-day support of local extension agents, activities have systematically been proposed and introduced to community members through community encounters led in the *lomwé* local language and previously prepared with local leaders, the administration and the GNR authorities when necessary. In this context, documentation on technical strengthening activities, mainly on conservation agriculture, charcoal and cashew productions, will also be disseminated.

In addition, in 2016, a second consultation phase, based on various communication tools, was realised: it aimed to present the main REDD project's objectives, benefits and constraints to the 27 communities involved before PDD validation (minutes of consultations meetings are available on demand). During the consultation of communities, 2 meetings at with local government of the districts of Gilé and Pebane were organised to present the GNR REDD project and its local expected impacts. Similarly, the continued presence of GNR/communities relationship officer in the Project Zone will help the diffusion of future project documentation.

### 2.3.2. Dissemination of Summary Project Documents (G3.1)

Two phases of consultations with the communities were necessary to communicate the essential information on project activities, targeted benefits, potential costs and risks. First one was organized before the creation of the Buffer Zone in 2008-2009 and the second in 2016 before the REDD Project validation.

The first step of project implementation consisted in the creation of the Buffer zone, at the end of the year 2011. The Mozambican Wildlife and Forestry Law requires all Natural Reserves in Mozambique to establish a Buffer Zone, of which the delimitations have to be defined in collaboration with community members as well as with the relevant authorities at provincial, district and local levels (Fusari, 2009). Accordingly, in 2007, the GNR initiated a continuous outreach work and, in 2008, launched consultations with the Communities in order to get them fully informed on the ins and outs of the creation of the Buffer Zone (meaning, forest resources management plan, local opportunities and challenges) and to give them the opportunity to express their doubts and queries. The other project activities started after the creation of the Buffer Zone. Most of the activities that involve the communities are part of the agricultural component

(conservation agriculture), forest resources management and techniques to scare elephants away. They are supported by local extension agents, geographically based in the communities.

The second phase of consultations was launched in 2016 before submission of the PDD to standards, in order to inform communities about the consequences related to the validation of a REDD project. In tune with the FPIC guidelines (Lebuis and King-Ruel, 2010; Springer and Retana, 2014), they were conducted in local idioms, in conjunction with community members, local leaders and other stakeholders. It has a chance to introduce all the concepts that are necessary to make the GNR's REDD Project and its implications for the communities be easily understood:

- Raise awareness on deforestation issues and on significant notions such as ecosystem services, greenhouse gas emissions and climate change;
- Introduce the REDD principles and functioning and inform on monitoring, validation, certification and verification processes;
- Present the REDD project activities and benefits for the communities involved;
- Explain why the costs and risks of the project are very low for the communities, showing that the Buffer Zone of the GNR was created five years earlier with few limitations on land tenure and resources.
- Detail the dialogue process and conflict resolution mechanism between communities and Reserve (Appendix 1)

Details on the community consultation (27 communities) are provided in section 2.3.6. Communities were warned of the consultation meetings (2 days-long meetings in each community reunion) 2 weeks before the consultation team visit. The information about the visit was given to the official and traditional representatives and to the agricultural technicians. They were then in charge of forwarding the invitation to the entire population (everybody was invited) or to suggest people to send representatives. Transportation for community members was eased by the Project when necessary and meals were offered because consultations lasted all days long. During the first day, the whole wilful community members as well as local and district administration were invited and legitimate community leaders and representatives were chosen (votes) for the second day (Appendix 3). The consultations took place on a location chosen by the communities (Figure 10) and were conducted in local languages, respecting the local forms of decision making, mobilizing didactic material (such as sensitization posters, drawn by a Mozambican painter native of the region - Appendix 2) and maps, designed in a participative manner during the previous Agro-Environmental Action Plans (Figure 5).

**Figure 10: Pictures of the consultation process in 2016 © Etc Terra**

All documents related to the project validation and verification are available in Museia camp in the GNR. However, these documents are in English which is not spoken by local communities. Hence, after each verification and before the distribution of benefits between the different project activities, results will be presented to all communities included in the project on posters presenting specific maps of the deforestation around the concerned community and consequences for the project in terms of activities, financial fluxes and impact on climate and biodiversity. Results on the implementation of the project on all communities will also be shared to inform households about results on all the project scale. This presentation will be done in Portuguese with a local translator if necessary.

### 2.3.3. Community Costs, Risks, and Benefits and, consultation channels (G3.2 and G3.5)

The community costs, risks and benefits were identified by the several partners of the Project during the definition of Project and GNR management strategies and during the several consultations when communities shared their comments and preoccupations. Moreover, households' surveys (before the elaboration of the management plan and in 2015) and agrarian diagnosis (Berton 2013; Lamarre 2015; Mercier et al. 2016) helped to acquire a good knowledge of the communities' constraints in their socio-economic development. The benefits and risks and taken mitigation measures are presented in section 4.2. The several consultation processes are summarised hereafter and in section 2.3.6.

In 2008, the first community consultation involved, from the national to the local level: the Gilé and Pebane Administrations, the main Administrative post and Localities of the GNR surroundings as well as 9 communities of the Gilé and Pebane districts. These consultations were realized in the context of the creation of the GNR Buffer Zone and followed intensive surveys during the year 2007, which aimed to design its boundaries, accordingly with the communities' necessities and their economic development expectations (Fusari, 2009; IGF, 2011). These consultations were also the opportunity for all voluntary communities' members to share their queries about the Buffer Zone and its implications. In 2009, the Buffer Zone was approved at the Provincial level and in 2011 it was endorsed at Governmental level.

Further, the 2012-2021 GNR management plan suggests to tighten relationship with communities thanks to a « GNR-communities' relationship officer », whose mandate is to improve communication level and communities participation. Since 2015, he makes sure that the GNR activities respect an appropriate level of community participation. He is an important element for other community consultations. Since 2012, the GNR and its partners have been closely involved with the communities and other stakeholders at District, Provincial and National scale. Since the start of the Project, continuous studies and consultations on the agricultural sector and on humans/elephants conflicts mitigation involved the communities in the project activities.

The consultation about the submission of the GNR REDD project's PDD involved the 27 Quarters of the Project Zone. It aimed to explain REDD+ opportunities, to detail the future activities to be implemented and their expected benefits for rural households. In order to ensure a good level of understanding and information dissemination and to efficiently involve all stakeholders in the consultations, the applied methodology relies on:

- The implication of all voluntary communities' members during the first part of the consultation and, after, various representative members who are freely chosen by the community members (farmers and craftsmen, administrative, religious and traditional leaders, witch-doctors, wised elderly, etc.);
- The introduction of the GNR REDD Project, its benefits, its opportunities and its implications through participative tools. Posters will be clipped in every CGRN in order to be visible for all community members;
- The support of all other stakeholders: GNR and ANAC representatives, local NGOs and project partners, District Administration and technical services.

### 2.3.4. Information to Stakeholders on Validation and Verification Process (G3.3)

In order to introduce the validation, certification and verification processes to the communities in the Project Zone, information was transmitted during the community encounters that were organized at the end of the year 2016. They concerned all REDD+ activities, benefits for the communities, potential costs and risks. The team in charge of their realization was composed of members of the project staff, the community-project relationship officer, administration representative and facilitators of a local association. Emphasis was placed on close participation of community members through their legitimate representatives, in order to share information to Communities members as a whole. Validation and verification was discussed during the second and last part of encounter in order to clarify the processes and their calendar and to explain how local leaders were able to get involved during the audit. The discussions were steered by the local intra-communitarian forms of communication, respecting the traditional speaking slots, using local languages and didactic material (Appendix 2 and Appendix 3). Several days before the consultations and before the audit, a member of the Project team (officer in charge of relationship of the project with the communities from ANAC) went in each village to inform communities through their local traditional and official authorities that a meeting will take place about the REDD project. People present during the visit of the auditor was available and able to talk with them and to answer questions.

### 2.3.5. Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

The officer in charge of relationship of the project with the communities, who also locally represents ANAC (project proponent), was responsible for informing Community members – by visiting all concerned villages - on the early start of the audit so that relationships are eased between auditors and local representatives. All community members that participate or not in the implementation of project activities can be met but, first, a visit of the auditors to local authority is required in order to respect local costumes. The field visit of the auditors occurred between the 4th and the 7th April of 2017. Visits were conducted in the following communities: Musseia, Namahipe, Malema and Mujaiane. Local translators from Portuguese to Lomwé were available for auditors if necessary.

### 2.3.6. Stakeholder Consultations (G3.4)

As explained previously, two consultation phases were planned to introduce the project and its opportunities to the communities involved. The first, realized in 2008 detailed the benefits and possible costs of the Buffer Zone, whereas the second realized in 2016 explained REDD+ opportunities, detail the future activities to be implemented and present the Project Area.

As previously stated, the creation of the Buffer Zone followed a thorough participative approach, collecting points of view of communities and authorities from the local, district and provincial level (Fusari, 2009). It involved all community members, in order to respect the expectations of all stakeholders and reply to the questions that were stressed. Therefore, the community consultations enabled (i) to explain and clarify the legal aspects, meanings and functions of the Buffer Zone; (ii) to discuss its delimitations so as to maximize its ecological and socio-economical values; (iii) to take into account the concerns that were expressed by local leaders and community members. The main questions addressed related to: sustainable access to natural resources for food, traditional medicine and fields for agricultural purposes; agricultural techniques improvement and the implementation of new income-generating activities; man/elephant conflicts management. All in all, it clearly appears that project activities directly address Communities' social and economic concerns. All received comments concern activities that are currently implemented by the Project. However, those comments can give other directions or scales for the activities. For example,

communities are convinced by the elephant scaring techniques but judge that there are not enough technicians available to implement this technique. Hence, ANAC and IGF will think on how make their staff more available for this activity during the harvesting period. The regulations applicable in the GNR buffer and the difference with those of the GNR core area were reminded in order to answer to questions about the uses of forest resources. The complaint mechanism was also reminded. Questions about agricultural supports confirm the interest of communities for the activities developed. The Project aims at targeting as much person as possible giving the financial and human capacities. It will work on the training of farmers that will be responsible to train other farmers in order to touch more households and so, to respond to the communities demand for support.

The second phase of consultations aimed to introduce the GNR REDD project through a participative process including, during the first part, the whole wilful community members as well as local to disctrictal administration and, during the second part, legitimate community leaders and representatives, chosen during the first part (Appendix 3). The consultations took place on a location chosen by the communities and were conducted in local languages, respecting the local forms of decision making, mobilizing didactic material (such as sensitization posters, drawn by a Mozambican painter native of the region - Appendix 2) and maps, designed in a participative manner during the previous Agro-Environmental Action Plans (Figure 5). The communities who were selected for the consultations are those whose daily economic activities depend on the forests of the project area and who may therefore be impacted by the project. This selection was based on the project team's knowledge on the activities of local communities, thanks to its work with the communities and the realization of several enquiries since the beginning of the project. The communities had been assembled according to geographic criteria to reduce the number of meetings when they were located close to each other. Individuals who had previously been selected by the whole population during the first meeting to which they were all invited represented each group during the consultations as presented previously.

Both the Agro Environmental Action Plans and the second consultations phase follow the same implication with the communities. They aim to:

- Include all community groups and members - especially religious ones (monotheists and traditional) and those from the locals Comities for the Management of Natural Resources - and all essential stakeholders - provincial, district, administrative and traditional leaders, GNR staff, project extension agents and facilitators;
- Promote a broader vision on forest natural resources management in order to limit and reduce their depletion, especially for those with high significance for communities' subsistence;
- Enable Project staff to support the management of local natural resources and HCVs, previously identified by the communities accordingly with their own vision of the landscape;
- Make the consequences of deforestation for communities' livelihood be more explicit and the concept of climate change clearer;
- Work with legitimate representatives on the information to be forwarded as a priority, in order for community members to know about the information cited above, to diffuse the means of communication with the project staff and to share conflicts resolution mechanisms.

Beside consultations of communities, two meetings were organized by the project team (GNR administrator, President of the local organization and Etc Terra) with the district government of Gilé and Pebane which gather all the existing state services at district level (Agriculture, Forests, Land use planning, Economical activities, Health, Education etc) to present the REDD project and activities, validation and

verification processes, communities consultation program. At the end of these two meetings, the two district representatives and concerned states services, in particular SDAE (Serviço Districtal das Atividades Económicas, District Service for Economic Activities in charge of agriculture) have officially validated and supported the REDD Project.

### 2.3.7. Stakeholder Participation in Decision-Making and Implementation (G3.6)

The project involves stakeholders and community members at different time of project lifetime, may it be at project conception, before and during activities implementation and for their monitoring. Participation to activities is always based on the volunteering. The agricultural activities (development of agroecology techniques) with communities are all designed based on the traditional techniques studied during the agrarian diagnosis. The proposed support furnishes improvement of the existing agricultural techniques while asking for a low level of supplementary work time but leading to the improvement of yields and to the decrease of the need for field rotation thanks to the management of soil fertility (and so, decreasing deforestation by unsustainable slash and burn techniques). As a consequence, a majority of communities' members want to participate to those activities. For each volunteer for agricultural support, a list of different techniques is proposed and the farmer is free to choose which one he or she wants to apply (all of them if he/she wants). For the application of the GNR management plan in the buffer zone, as explained, this is based on several consultations during which all communities were consulted and gave their agreement to the enforcement of the plan.

In 2008, the consultations on the delimitation of the Buffer Zone were organized with 9 communities focused on voluntary community members, local leaders and representatives from the Gilé and Pebane district administration. In 2016, 12 consultations were organized with 29 communities. For this last consultation, as explained previously, on the first day all communities' members were invited and they were asked to choose (vote) for the second day legitimate representatives of each Quarter to select the activities to be implemented in their own community and to ensure the dissemination and understanding of the project implications, in order to guarantee the full participation of all communities.

During the development of project's activities, stakeholders' participation is ensured by selecting community members willing to get involved. Selection is realised by the Project team (coordinator and technicians of ASI for agricultural support for example) according to their estimation on the needs and the chances of success (number of fields, techniques already applied, agrarian constraints, work force, risk management capacities, etc) in the application of the techniques by the farmer and to the budget available (determining the number of farmers that can be supported). The voluntary households will decide by themselves which activity to develop and will be technically supported by local extension agents, also in charge of collecting their feedback. Similarly, researches, participative fieldwork and monitoring processes are systematically realized in close collaboration with traditional leaders and community members.

In 2016, women represented 16% of the households involved in the conservation agriculture component (IGF/ANAC, 2016). However, because the project and its activities are implemented at the household scale, activities are considered to be benefiting the whole household, men and women.

### 2.3.8. Anti-Discrimination Assurance (G3.7)

The Mozambican labour law (Lei 23/2007) in its Article 4 establishes the key principle of non-discrimination of employee for reasons of gender, racial or ethnic origins, health. The same apply for public servant.

ANAC as a public entity is vigilant in the application of the law. The staff employed by the Project is mainly composed of Mozambican and come from several Provinces or Districts in the country. Some international technical advisors are employed by the partners NGOs. Moreover, the teams of all entities working for the Project are composed of men and women.

### 2.3.9. Feedback and Grievance Redress Procedure (G3.8)

According to the complaints received by the GNR and REDD Project staff and the "Dialogue process between communities and the Gilé National Reserve" (Appendix 1), conflicts in project area are mainly related to:

- The activities of the GNR itself: workforce, salaries, etc.
- Land use and natural resources: farming, logging, harvesting, etc.
- Human/wildlife conflicts, mainly with elephants.

In order to receive and provide an adequate answer to each complaint and solve them at the earliest stage possible, the following procedures are to be followed:

- The query should be written and addressed to one of the three camps of the GNR (Namurrua, Musseia or Mulela). If people cannot write, they can ask help to local elites or friends or they can come in person to the Museïa camp to give their complaint orally (which will be written by the Reserve staff). All queries are equally treated whatever they come from men or women. When necessary, rangers can record complainants' personal information (name, contact and place of residence) as well as local leaders' information and open a new request. A copy should be delivered to the complainant, describing the procedures and the location and date of the procedure.

- An answer should be sent within 15 days after reception of the query by the GNR authority. The GNR's Administrator or its representatives and, depending of the query, officers in charge of the relationships with the communities, responsible of infrastructure and workforce or the law enforcement officer or their representatives, will decide if the complaint is legitimate and if it should be handled by the GNR. If it is, the GNR staff will identify possible solutions and contact the complainant to set a meeting. The meeting will include the GNR staff in charge of complaint resolution, the complainant and local authority representative in order to respect the traditional and recognized authority structure meant to deal with conflict resolution.

- The GNR will always try to find amicable resolution. All interviews should be entirely recorded by a GNR staff member. If the parties find an agreement, they should be provided with a hard copy describing it. If the query is dismissed or if no agreement is found, the complainant has the right to request a second meeting which may be fixed within 15 days, with a neutral third party as local government representative (Localidade or Posto administrativo). If, again, no resolution is to be found, the query cannot be resolved at the GNR's level and shall be forwarded to the relevant authorities:
    - o SDPI for land uses (Serviço Distrital de Planificação e Infrastructuras, District Service for Planning and Infrastructures)
    - o SDAE for forest uses and human/wildlife conflicts (Serviço Distrital das Atividades Económicas, District Service for Economic Activities)

o PRM for Crimes and corruption issues (Polícia da República de Moçambique Police Authority)
o District's administration for GNR's activities.

All requests and procedures can be consulted at the Musseia main camp where they are compiled in the GNR office.

### 2.3.10. Worker Training (G3.9)

Technical and capacity strengthening is a priority for project staff and local partners, CGRNs and community members. In addition to the project staff, partners of the project for that purpose are both local NGOs (RADEZA) and international NGOs (ADRA, COSV, CARE, WWF, ASI) and national institutions (SDAE, ANAC). Trainings and formation sessions are mainly realized in three places:

- At the Musseia GNR's main camp, for supervision staff or seasonal staff;
- In communities for the agricultural component and human/elephant conflicts issues;
- In partners' offices.

According to the GNR's yearly or bi-annual reports since 2012 (IGF, 2013, 2012, 2011, IGF/ANAC, 2016, 2015a, 2015b, 2014), the following table synthetizes the trainings involving the Project's field staff, partners, CGRNs and community members since 2012 for:

- The improvement of agricultural practices for voluntary households;
- Technical supports on human/elephants conflicts mitigation, for the most vulnerable households whose crops are regularly destroyed by elephants;
- Capacity strengthening of local and relevant service providers in the cashew sector.

**Table 6: Historic of trainings since the project start**

| Year | Topics of training content | Staff |
|------|---------------------------|-------|
| 2012 | Continued training on law enforcement techniques and GNR-communities mediation | Rangers & eco-guards<br>Guards |
|      | GPS and telemetry devices for wildlife monitoring (in particular re-introduced species) (1/3) | Eco-guards |
|      | Forest fires prevention and security on fire line | Eco-guards<br>Seasonal workers |
|      | Rights and duty of Nokalano Association's members for better management of the Community Hunting Zone | CGRN of Namurrua, Nanepa, Nakurugu and Ratata |
| 2013 | One staff member financed to pursue a degree on natural environment management | Eco-guard |
|      | GPS and telemetry devices for wildlife monitoring (in particular re-introduced species) (2/3) | Eco-guards |

| | | |
|---|---|---|
| **2014** | Elephant behavior, causes of conflicts with dwellers and techniques to scare elephants away (1/2) | Rangers & eco-guards<br>Guards<br>Agriculture extension agent<br>Extension agents of Project NGO partners<br>Voluntary representatives of concerned communities |
| | GPS and telemetry devices for wildlife monitoring (in particular re-introduced species) (3/3) | Eco-guards |
| | Conservation agriculture practices and promotion | Agriculture extension agents<br>Extension agents of Project NGO partners |
| **2015** | Training of the GNR-communities relationship officer | Ranger |
| | Skill development and anti-poaching course | Rangers - Guards |
| | Cashew treatment and production improvement | Service providers |
| | Monthly technical and methodology strengthening | Agriculture extension agents |
| | Day-to-day support and regular technical trainings provided on conservation agriculture | Voluntary households (farmers, cashew producers) |
| | Awareness raising for communities and CGRN on outputs of collaboration | CGRNs |
| **2016** | Elephant behavior, causes of conflicts with dwellers and techniques to scare elephants away (2/2) | Rangers & eco-guards<br>Guards<br>Agriculture extension agents<br>Extension agents of Project NGO partners<br>Voluntary representatives of concerned communities |
| | Deforestation and climate change awareness and REDD+ mechanism understanding | GNR-communities relationship officer<br>Extension agents of Project NGO partners<br>CGRNs<br>Voluntary representative of communities |
| | Cashew production improvement | Agriculture extension agents |
| | Monthly technical and methodology strengthening on conservation agriculture | Agriculture extension agents |
| | Day-to-day support and regular technical trainings provided on conservation agriculture, cashew market and/or improved charcoal production | Voluntary households (farmers, charcoal producers, cashew producers) |

Regular trainings related to project objectives and technical purposes and field staff's feedbacks are key elements to improve their conscientiousness, their capacities and their personal implication in communities' livelihood improvement process. Furthermore, trainings and frequent courses enhance the collaboration between partners, engaging the GNR staff and the communities in a continuous dialogue, which is crucial for community members to stay involved at all stages of Project development.

In order to avoid to lose any capacity in case of staff turn-over, pair working involving previously trained staff and new staff and supported by coordinators and technical assistants are useful for skills and experience sharing. Such working pairs have already been successfully tested.

### 2.3.11. Community Employment Opportunities (G3.10)

One of the objectives of the project is to foster local jobs opportunities, to provide professional trainings and to improve the skills of local community members. Accordingly, the number of field staff member increased since 2012, as detailed in the following table:

**Table 7: Evolution of the number of staff member since 2012, according to the GNR's yearly or bi-annual reports**

| Field staff | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| Agriculture extension agents | 0 | 0 | 3 | 6 | 12 |
| Local service provider | 0 | 0 | 0 | 6 | 6 |
| Rangers & eco-guards | 30 | 29 | 29 | 27 | 27 |
| Guards & local trackers | 4 | 4 | 4 | 5 | 5 |
| Local seasonal workforce | 18 | 30 | | | |

Different types of jobs are proposed to local population, depending on their qualifications. Those opportunities encompass:

- Seasonal workforce (50% of seasonal worker are selected by the GNR responsible, 50% are designed by local chief) for roads and bridges maintenance, construction[13], forest fire management and material or water logistic. Although men and women all come from local communities, the offer of seasonal jobs is not balanced: the communities living closer to the camps of the GNR are advantaged, due to logistical issues and distance constraints. The project aims to provide more jobs further located from the camps of the GNR.
- All local trackers, guards and service providers are native of the communities located in the GNR's vicinity.
- Eco-guards and rangers have been formed on anti-poaching techniques, fauna monitoring and surveillance and are particularly mobilized in case of elephant invasion and crop destruction. Further, as *lomwé* speakers and natives of the region, they are important assets for the GNR-communities relationship.
- All technical extension agents, including one-third of women, come from the Zambézia or Nampula Provinces and are *lomwé* and/or *macua* speakers. They studied in one of the nearby main towns (Chimoio, Nacala, Mocuba, Ribawe or Lichinga). Their recruitment process focused on young and motivated professionals. They receive monthly trainings to increase their technical capacities.
- Technical and administrative staff members and officers are mainly Mozambican, with a strong proportion of people native of the region.

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[13] Seasonal jobs on road and bridge repair and maintenance are concentrated after the rainy season, rains being the main cause of infrastructure destruction.

### 2.3.12. Relevant Laws and Regulations Related to Worker's Rights (G3.11)

Some of the workers (rangers, park warden) are public servant and they are contracted under the 'Estatuto e Regulamento dos funcionarios e agentes do Estado'. Others workers are contracted under private contract by organisation dully registered in Mozambique. These contracts follow the Mozambican labour law: Lei do trabalho de Moçambique 23/2007.

### 2.3.13. Occupational Safety Assessment (G3.12)

Table below identifies the tasks for which significant risks for staff members' security exist. Most of the dangerous situations are confined within the GNR boundaries and linked with:

- The high proportion of poachers;
- The dangers inherent to navigation in forest lands;
- Low access to emergency services, in particular during the rainy season.

**Table 8: Synthesis of risks to worker safety according to tasks**

| Task | Localization | Risks | Staff exposed |
|---|---|---|---|
| Infrastructure rehabilitation and opening of new roads | GNR | o Stepping on a trap<br>o Getting lost in forest | o Seasonal workforce<br>o Guards |
| Surveillance patrols and intervention against poachers and illegal loggers | GNR<br>Project Area | o Exchange of fire with poachers<br>o Stepping on a trap (for hunting)<br>o Snake bite<br>o Vehicle breakdown, without communication means<br>o Getting lost in forest | o Eco-guards and rangers |
| Field work for flora or fauna study purposes | GNR<br>Project Area | o Exchange of fire with poachers<br>o Stepping on a trap (for hunting)<br>o Snake bite<br>o Vehicle breakdown, without communication means<br>o Getting lost in forest | o Technical staff member |
| Elephant-scaring in case of crop invasion | Project Zone | o Getting attacked by elephants | o Eco-guards and rangers<br>o Extension agents<br>o Volunteers among the community members |
| Forest fire management | GNR<br>Project Area | o Fire exposure | o Seasonal workforce<br>o Guards<br>o Eco-guards and rangers |
| Day-to-day technical support | Project Zone | o Stepping on a trap<br>o Snake bite<br>o Lack of water during the dry season<br>o Isolation, higher risk of flooding and malaria pick during the wet season<br>o Accidents on poorly maintained public roads | o Agricultural extension agents<br>o Technical staff member |

| Displacements outside the Project Zone | Main national roads | o Attacks due to current political tensions | o Administrative and technical staff member |
|---|---|---|---|

In order to deal with the identified risks, the following measures have been defined. Project staff were informed during the regular meetings and during the worker trainings (see section 2.3.10). For foreign worker (mission officer) some information sheets on health and security risks (regarding snake bite for example) exist and are sent by email before the first field visit. The majority of them has already been adopted and followed:

**Table 9: Measures to mitigate identified risks to worker safety**

| Risks | | Measures |
|---|---|---|
| **Displacements in forest** | Facing armed poachers | o Training to Rangers and eco-guards on anti-poaching and surveillance techniques; <br> o Solitary travels are avoided; <br> o Rangers and eco-guards may be equipped with fire-arms if needed |
| | Stepping on wolf-trap | o Rangers and eco-guards are accompanied by locals, trained to tracking techniques; <br> o Traveling with kit of emergency aid; |
| | Facing herds of elephants | o Field staff is trained to techniques meant to scare elephants away. |
| | Vehicle breakdown or getting lost in forest | o Use of navigation and communication devices and repair material. |
| | Forest fire exposure | o Security rules training for the staff responsible for fire management. |
| **Healthy purposes** | Malaria, insect injuries or snake bite | o Fieldwork staff is provided with mosquito nets and benefit for transportation services in case of emergency. |
| | Diseases due to not suitable water consumption | o Extension agents are equipped with chlorine tabs |
| | Road accidents | o Relevant safety precautions such as carrying cell phones, water and kit of emergency aid, using seatbelt in the Project vehicles and protective gear for extension agents using Project motorbike. |
| **Current political tension** | Attacks on the main national roads | o Solitary travels are avoided; <br> o Travelling with communication devices and always give information about displacements. |

## 2.4. Management Capacity (G4)

### 2.4.1. Project Governance Structures (G4.1)

The REDD project and GNR management is led by ANAC, the public national administration for management of protected areas, that is in partnership (co-management) with IGF for this purpose. Both

organisations are responsible for the technical and financial management of the project and will be in charge of the sale of carbon credits if any.

The project team (ANAC and IGF that will remain the co-managers of the GNR with all the different funds available – see section 2.1.12) contracted with external partners for the management of REDD+ activities: carbon accounting, PDD development and validation and definition of a strategy to reduce deforestation with Etc Terra and technical agricultural support with Agrisud International. Until now, those entities worked under the supervision of the Project team. Agrisud International support stopped in 2017 but Etc Terra will continue activities for agricultural support (development of agroecological techniques) with the same field staff (all field technicians of ASI will be hired by Etc Terra) completed with additional technicians and for the development of cash crop value chain(s) (see section 1.1.2) through the Mozbio project (see section 1.1.2). Etc Terra will also help the project team to deal with carbon valorisation (verification, inclusion in the ER Program ZILMP if need be, revision of the baseline, etc.).

### 2.4.2. Required Technical Skills (G4.2)

Key technical skills required to implement the project will be shared between partners:

- **Project management and conservation specialists:** Biodiversity management and monitoring will be carried out by ANAC and IGF co-management of the reserve. The team is composed of a reserve administrator, head of the local team, hired by ANAC and a technical assistant from IGF. Both experts supervise all works necessary for the reserve management, including the organisation of rangers' daily agendas and the intervention of associated members of IGF or ANAC or technical specialists from external organisation for biodiversity monitoring. Rangers have a para-military training. They are based in Museia camp of the reserve and also assure the **global supervision of the REDD project**. The IGF's team in France (around 5 persons) also provide support to the management team of the reserve. Technical skills required for the biodiversity monitoring are expertise in wildlife ecology, especially in dry Africa ecosystems. Consultants with the required skills are hired for biodiversity monitoring events and the IGF team has the capacity to capitalize on the consultants' work.
- **Carbon accounting and monitoring (climate benefits)** will be implemented by Etc Terra technical team that is composed of the following experts (see section 3.4.1.7):
  - o Impact assessment and carbon monitoring experts (2 persons) based in France that will supervised all the monitoring process including forest inventory plan and the updating of deforestation maps and of the monitoring of areas affected by fire. These experts will also work with the remote sensing team of the association based in Madagascar and that usually assures the deforestation mapping work. Required technical skills are linked to forest ecology, remote sensing expertise and REDD methodology knowledge.
  - o Inventory and survey technician based in Gilé in Mozambique will assure field work with teams recruited locally when necessary. With daily presence in the field, he will also be responsible of the warning if exceptional anthropic or natural disturbances lead to deforestation or forest degradation and of the estimation of affected areas with the support of the two others technical assistants presented previously.
  - o Etc Terra team will be in charge of elaborating verification documents.
- **Community relationship and benefits monitoring** will be assured by a responsible of community relationship hired by the GNR (ANAC and IGF), based in Museïa camp. This staff performs a permanent dialogue with communities, receives complaints or grievance when necessary and manages community consultations. He also supervises the trainings for elephant scaring

techniques and monitor the elephant/human conflicts. This job requires good quality in human relationship and a strong knowledge of local context and social sciences. For community consultation, the responsible of community relationship is supported by an expert in social science hired by Etc Terra association for this specific purpose and based in Gilé. This expert participates to all other studies aiming at improving knowledge of community organisation and knowledge. Required technical skill is an expertise in social sciences or anthropology.

- **Agricultural support** is implemented by technicians (also called *extensionists* in Mozambique) based in several communities around the GNR in order to furnish a daily support to beneficiaries of the project and to guarantee a high efficiency of project alternative activities. These technicians were initially hired by the NGO Agrisud International and supervised by a technical assistant based in Naburi (from 2008 by 2016) and were after (2016) supervised by Etc Terra team based in Gilé. Technical support furnished for cashew plantations management and associated value chain is carried out by Rongead NGO[14] with their specialists of international markets of cashew nuts and of their information system for small producer about fare selling prices (www.nkalo.com). Their support will start with Mozbio Project in 2017. Required technical skills are expertise in practical agriculture, agronomy - especially in the management of orchards - and international markets. All these skills are already present in the team composed of several agronomists and economists.

The GNR technical assistants will assure that data and methods used are consistent with those used in the present document. If changes are done, they will be documented and justifications will be done on how changes do not affect the consistency of results. All results will be communicated for approval before diffusion to ANAC, the project proponent on the behalf of the Mozambican Government.

### 2.4.3. Management Team Experience and partnerships (G4.2)

ANAC is the national administration in charge of the management of protected areas. Even if financial means of the agency are limited, this organisation have a strong experience in managing protected areas and conservation project. However, in order to complement its capacity, ANAC has partnered with IGF for the co-management of the Reserve.

The International Foundation for Wildlife Management (IGF Foundation) was established in 1976 in Paris, France. The IGF Foundation is an international Non-Governmental Organization and was given recognition as a charitable non-profit organization of public interest by a French Decree of January 14th, 1977. Its vision is "*Conserving wildlife in a developing world*" and its objectives are to support the conservation of nature in general and wildlife in particular, all over the world with particular emphasis on developing countries; to contribute to sustainable development in general, especially to foster harmonious cohabitation of Human and wildlife; to promote the rational management and sustainable use of renewable natural resources as powerful tools for nature conservation and human development; ant to encourage the conservation of the world's wildlife heritage for the well-being of humanity, now and for future generations.

Etc Terra is involved in the project for REDD management and especially carbon accounting and activity strategy to target agents of deforestation and develop activities with communities. The NGO was created on 2012. It has significant experience in the development and management of renewable energy, forest conservation, agro-ecology and waste re-use projects. It is developing several projects about natural resources management and specifically REDD+ projects in Madagascar, Mozambique and Ivory Coast.

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[14] www.rongead.org

Etc Terra has been involved since the beginning of the project for the elaboration of REDD strategy and documents and will continue for REDD monitoring. The association will also manage agricultural activities with communities from 2017.

Agrisud International has a strong experience, of 20 years, in helping poor people to create viable and sustainable small family businesses, especially in the farming sector (production of vegetables, fruits, breeding, product processing, etc.). They develop projects with direct support to small scale farmers in order to improve practices toward agroecology techniques for environmental and economic sustainability. Agrisud has contributed to the launch of 44 900 small agricultural family businesses in 20 countries of Africa, Asia or South America, and most recently in France. At a village, city or territory scale, real changes have taken place to help the poorest populations while increasing food security for families and in local markets – in quantity and quality. ASI has been involved in the project for agricultural support to small scale farmers between 2013 and 2017.

### 2.4.4. Financial Health of Implementing Organization(s) (G4.3)

ANAC is a public entity funded by the State Budget and as a consequence its financial sustainability is guaranted. IGF is a financialy healthy foundation, its accounts are audited yearly and documentation could be provided on demand. The activity reports of the two other NGOs (Etc Terra and ASI) intervening for the project can be found on their respective website showing that no profits are done from projects such as the GNR REDD Project but that long term financial viability is guaranteed.

### 2.4.5. Avoidance of Corruption and Other Unethical Behavior (G4.3)

Today, the GNR (ANAC and IGF) and its partners (Etc Terra, Agrisud International) are nearly exclusively funded by international donors (AFD, FFEM, World Bank, IGF Foundation – only a small proportion comes from national funds, see section ). All those funds are audited on a yearly basis in order in particular to prevent any form of corruption. The financial audits of the NGOs accounts realised by the donors or by French NGOs auditors are available on demand.

### 2.5. Legal Status and Property Rights (G5)

### 2.5.1. Statutory and Customary Property Rights (G5.1)

In Mozambique, land belongs to the State. Usually, Communities' leaders are locally considered as the sole owners of Communities' land rights of uses: *regulos* actually are responsible for land tenure and have the power to allocate the rights of uses of lands to native and foreign people and to authorize the acquisition and opening of new fields on wild lands.

However, in most cases, new fields can be opened, lent or exchanged without any consultation with the *regulo*. This is notably true for fallows or for lands comprising fruit trees, for which right of uses have to be purchased to the owner family (Baudron, 2009).

It means that, although most lands can be appropriated and kept by specific lineages, with planted trees and slashed lands being characterized by familiar property, forest trees are, generally speaking, considered as common resources. Land use rights are automatically attributed to the households that cultivate it. These specific rights don't interfere with each other.

It is worth noticing that both foreign and native people have the same rights on land properties and resources. Land appropriation may nevertheless still exist, particularly:

- Northwest of the project zone, where lands located along the shoreline may be kept by specific families in order to ensure an easy access to water wells in case of water scarcity.
- Few zones on southeast of the project zone, where people use to buy forest lands, which is becoming scarce.

Non-timber forest products (NTFPs) in the project zone are mostly mushrooms, caterpillars, bush meat, honey and termites (Romann 2016); they are considered as common resources. They are more intensely collected during the rainy season. All the families living nearby the project zone are involved in the gathering process, may they be men, women or children. Specialization may apply for some products: honey, for instance, usually is gathered by men only, whereas mushrooms are harvested by women and children.

### 2.5.2. Free, Prior and Informed Consent (G5.2)

The Mozambican Wildlife and Forestry law, which defines the protection standards and the terms of use for wildlife resources, stipulates that all protected areas have to encompass a Buffer Zone (1999, article 10 n° 3 and 4). As a Natural Reserve, the GNR proposed, in 2008, several maps for its Buffer Zone, in accordance with ecological necessities, management queries and Communities' needs. The administrative authorities of the Provincial, District and local level were consulted in order to gain their support. At local scale, nine consultations were also organized with all Communities members and traditional and administrative leaders, in order for them to be informed and explained the necessity of such regulation, its implications for community members and to discuss its delimitations in accordance with local people's land uses and tenure, communities' expectations and the actual needs for the GNR management (Fusari et al., 2010). Smaller than the area that was initially proposed, the Buffer Zone was nevertheless approved by the Council of Ministers in 2011 (Boletim da República, 2011), hence legally established with the support of both national and local authorities. It does not infringe on private lands[15] properties (DUAT) or on any Community land that would have been despoiled (Sitoe et al., 2012).

The agreement of local communities was a prerequisite for the Buffer Zone to be created. In order to optimize their understanding of the Project's implications and to enhance their participation during the entire project lifetime, consultations were organized in two phases, 8 years apart: the first phase was conducted three years before the creation of the Buffer Zone and the second one five years after, before the submission of the present document (see section 2.3.7). These two phases were intersected with regular local consultations and encounters at all stages of project implementation.

The first phase of consultations meant to inform local populations on law requirements as well as on the objectives of a buffer zone, its constraints on forest resources availability and its opportunities in terms of

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[15] By law, land is State property and cannot be sold. However, the DUAT (Direito de Uso e Aproveitamento da Terra) is a land-use right certificate. A DUAT « can be acquired through inheritance and by peaceful occupation of individuals and rural communities for at least 10 years according to traditional norms and customs » (Sitoe et al. op. cit., p. 28) or by request to administration. However, absence of title « does not affect the recognition of the right acquired by individuals and local communities, which is not subject to time limits » (ibid.). For economic purposes, a DUAT has a validity for 50 years, subject to renewal.

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development. It was also useful to introduce some activities that were about to be implemented. Thanks to intense studies and to the participation of local leaders and voluntary community members, projects boundaries were jointly defined before being submitted to Provincial authorities in 2009 and to the Council of Ministers in 2011. Since then, the Project has been supporting Communities on elephant conflicts mitigation issues, agriculture strengthening and off-farm jobs opportunities. Consultations were crucial for each activity, particularly for those relying on technical supports and training or based on the construction of new infrastructures. When necessary, they involved all local leaders and all categories of stakeholders, from local to national level, as well as voluntary community members.

The second phase of consultations was launched in 2016. As explained in section 2.3.3, in order to:

- Raise awareness on deforestation issues and on its impacts on Communities' livelihood (access to clear water, lack of TFPs and NTFPs, future agricultural necessities, etc.);
- Inform stakeholders at local and district level on the REDD+ Project: duration, future activities and supports, economic, social and environmental benefits as well as potential negative impacts;
- Provide information on certification, validation and verification processes, monitoring, mitigation measures, grievance and conflicts resolution.

These consultations were conducted with the support of the community members and their legitimate representatives, freely chosen during the first half-day of each consultation (see sections 2.3.3 and 2.3.7). Representatives can be voluntary community members as well as people who are used to be involved in the local decision-making process (traditional and religious headmen, Zones and Quarters administrative leaders, wised elderly, etc.).

### 2.5.3. Property Rights Protection (G5.3)

The objectives of the GNR REDD Project are based on incentives for local populations to adopt more sustainable activities that are expected to improve livelihood in project area. Housing is therefore allowed in the project zone and some communities, such as Vassele or Namurrua, are located inside the project area. Hence, the few restrictions in terms of forest resources exploitation for logging, harvesting and hunting techniques are not expected to infer any population relocation. No people have been relocated for the purposes of the project. Communities are still settled on their historic places.

Finally, deforestation reduction is not expected to limit sustainable agriculture. Conversely, the project urges the adoption of conservation agriculture techniques in order to diminish slash-and-burn agriculture and the conversion of forestlands. It should provide for new sources of incomes, especially with value-chain improvement on the cashew and sesame markets and with agroforestry systems enabling the association of food crops and cash crops (cashew trees).

### 2.5.4. Illegal Activity Identification (G5.4)

In the project zone and its surroundings, the main illegal activities are poaching, commercial timber logging and mining as provided by the Mozambican law applying to reserves and the GNR management plan (Fusari et al. 2010; Mercier et al. 2016).

Poaching activities are very different according to their geographical application and techniques. Although hunting is authorized outside project area, it is more intense in project area itself, which is closer to the GNR where wildlife is richer. As long as sustainable techniques are used, subsistence hunting and

commercial hunting in the project area may nevertheless still be authorized, if it involves local community members and provide a small income. Because of their negative impact on wildlife and resources, the use of fire guns, wolf-traps and hemming fires are logically prohibited (Fusari et al., 2010). The hunting of some species of reptiles and amphibians, of specific species benefiting from international protection status (such as elephants) and of locally endangered species that have suffered from a too-high hunting rate, is also prohibited (*ibid*). Development of the community hunting zone (CHZ / *coutada de Mulela*) through a partnership between the Nokalano association[16], holder of land-use rights and private safari operator, will also improve direct and indirect economic benefits for the members of the 4 communities involved in the CHZ (Fusari, 2011). These benefits will compensate the community members' opportunity costs, favour a better management of forest resources through economic incentives and help to maintain basics ecological services. However, if high poaching level are maintained in this area, benefits for local communities will be jeopardised.

Timber logging is permitted in the project area for communities' necessities, such as the construction of houses and wooden handicraft furniture. Commercial exploitation, however, is not. The commercial exploitation of wood outside forest concessions and without any management plan is also prohibited (*ibid*). Moreover, a national ban prevents from the exploitation of *pau ferro* in the whole country[17].

Mining is illegal within the GNR buffer zone as well as out of the GNR within the project area without a formal authorization. Generally mining activities area realized along the river by digging the sediments, there is very few impacts in terms of deforestation but indirect impacts as increased poaching or natural resources harvesting in the mining area. Because logging and hunting are both traditional and subsistence practices for local populations and because they could also turn more commercial, more professional and therefore more profitable at short term for rural communities, it is expected that some local groups could attempt to delegitimize the project that implies regulation or prohibition of such activities – even though those objectives are pursued through the improvement and diversification of local means of subsistence. Mining is not a traditional activity and is clearly for commercial purpose. This situation could have potential negative impacts on the appeal of project activities and on their benefits, particularly if livelihood improvement through project activities implementation does not exceed incomes generated by illegal activities: few community members would accept to get involved in the project, with low expectations, partial adoption only of the proposed techniques and few actual positive benefits for the communities.

In order to reduce the impacts of poaching and illegal logging and mining, three kinds of activities are planned in project scenario and will start at the end of the year 2016: (i) first law enforcement and increased patrolling efforts in the GNR and its surroundings, including the project area, should ensure the efficiency of unsustainable techniques prohibition; (ii) second, communities are expected to start being sensitized on the impact of deforestation and unsustainable hunting techniques right from the beginning of community consultations; (iii) finally, an action plan on the sustainable use of NTFPs will be designed in order for communities to regulate their access to endangered species and to limit the use of fire guns, wolf-traps and hemming fires. (Fusari, 2012, 2011).

Those activities are expected to improve the livelihood of involved households though the creation of new sources of incomes, the improvement and diversification of the agricultural production and the improvement of regeneration. In the meantime, the on-going depletion of community's essential forest

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[16] These communities are Namurrua, Nanepa, Impaca and Nakurugo

[17] The DM 10/2016 banned *pau-ferro* from logging for 5 years. The law entered into force on January 1st, 2016. The same document decrees closed in exploration of the species that produce the first class wood for 5 years period too.

natural resources will be reduced. Thanks to conservation agriculture, agro-ecology and semi-confinement goat breeding, land forests will remain close to dwellings and agricultural fields will also be closer located.

Conversely, if the illegal activities listed above were to be maintained, they would directly reduce the expected benefits of project activities: forest will continue getting further and further located, natural resources would continue to run out (especially antelopes) and households' incomes revenues would be one single source of income, based on the over-exploitation of forest and wild animal species. On the long-term, this will result in an increasingly higher pressure on essential forest resources and will negatively impact household's livelihood.

### 2.5.5.   Ongoing Disputes (G5.5)

In project zone, no conflict on land tenure or resources availability has been reported or recorded since the Civil war (1976-1992). During the civil war, large migrations of the population occurred. People migrated to the coastal areas and, at the end of the war, went back to their historic settlements - around the GNR, near forests, for the case of the Project zone – at the end of the war. These migrations can be correlated to deforestation patterns between 1990 and 2000 (see Mercier et al. 2016 for the historical analysis of deforestation).

Actually, as stated before, the delimitations of the Buffer Zone (project area) were jointly defined by Communities after consultations in 2008. Its natural borders, on Eastern and Southern parts, make it easier to distinguish. North, the GNR intends to create a pathway, as a physic delimitation.

Further, the Project introduces few limitations on the use of forest resources, which are therefore not a source of conflict between communities and the GNR, the Buffer Zone taking into account the current land uses of communities as well as their needs in terms of agricultural expansion. Land access is still *regulos*' responsibility and, most of the time, it is relatively simple: traditionally, forest lands can be appropriated when they are not claimed by anyone else or can be acquired by inheritance, considered as matrilineal lands.

### 2.5.6.   National and Local Laws (G5.6)

Since the 1992 Rio Conference on Sustainable Development, the GoM has been undertaking a legal and institutional reform movement to improve the country's ability to manage environmental issue. Those efforts can be observed in local, regional and national laws and regulatory frameworks as well as in the GoM's commitment to international treaties and conventions.

**Consistency of the project with national development policies and with REDD+ Strategy**

The proposed GNR REDD Project is highly consistent with national policies and development priorities in Mozambique. Since the late 1990s and early 2000s, the adoption of various national policies and the valorization of development priorities linked to the reduction of carbon emissions, carbon stock enhancement, and sustainable management of forest and conservation areas has shown the commitment of the GoM to REDD+ initiative.

This commitment has been confirmed with the new Government, who took office in February 2015 after general elections. In the aftermath, the new administration adopted a range of significant policies, such as a Five Year Government Plan (*Plano Quinquenal do Governo* - PQG) for the 2015-2019 period, for economic and social development (Governo de Moçambique, 2015b). The PQG settles five national priorities with, in particular, the 5th strategic pillar focusing on transparent and sustainable management of

natural resources and the environment. One of the strategic objectives is to ensure the "conservation of ecosystems, biodiversity and the sustainable use of natural resources". In the same way, the National Sustainable Development Program (Governo de Moçambique, 2015a), promoted by MITADER, provides the key linkages between the country's priorities and REDD+, stressing the need to invest in resilience to climate change with emphasis on the agricultural sector[18]. The GNR REDD Project will contribute to those goals, reaching for the protection of biodiversity and the sustainable use of forest resources and economic rural development through the promotion of sustainable agricultural practices as well as of diversified agricultural production and increased efficiency of charcoal production, through a better management of wood resources, among other components.

Further, the GNR REDD Project has a strong social component and seeks to increase the participation of stakeholders in order to reduce poverty around the GNR: it is coherent with the strategic goals of the Forest Policy and Strategy (2016-2020), especially in relation with its objectives of (i) social participation and equitable benefit sharing mechanisms; (ii) environmental sustainability on the use of forest resources and (iii) increase of the economic contribution of forests to the country's development. It is also fully aligned with the Forest Investment Plan (FIP) of the Climate Investment Fund (CIF), which was approved in January 2017, with a budget of USD 47 million, and is fully integrated to the ZILMP ER Program which is currently under development in 9 districts of the Zambezi Province and encompasses the present REDD GNR Project.

Synergistic potential actions may also be identified in various sectors. For instance, the Ministry of Mineral Resources and Energy (MIREME) promotes actions linked to the production and sustainable use of biomass energy. It has been emphasized in the Strategy for Conservation and Sustainable Use of Energy from Biomass (Ministério da Energia, 2013) that lays down general guidelines for the production of biomass and its transformation into energy and sustainable use. By promoting sustainable techniques for the production of charcoal around the GNR, the GNR REDD Project contributes to this objective. In the same way, the intensification of agriculture to increase production and productivity and improve soil conservation through conservation agriculture techniques, which is an important component of the GRN REDD Project, is also defined as a priority in the Strategic Plan for the Development of the Agricultural Sector (PEDSA - 2011-2020) (Governo de Moçambique, 2011a) and, more importantly, the National REDD+ Strategy.

Approved in November 2016, the National REDD+ Strategy and its action plan promote "integrated multisectoral interventions to reduce carbon emissions associated with land use and land use change through adherence to the principles of sustainable management of forest ecosystems (natural and planted), contributing to global mitigation and adaptation to climate change and to the efforts for an integrated rural development" (MITADER, 2016a). Those coincide perfectly with the planned interventions of the GNR REDD Project, which is based on multiple actions that reflect a variety of interventions from the national REDD+ strategy in a coordinated manner. Mozambique's REDD+ Strategy comprises six strategic pillars, namely:

- Cross-cutting actions: establish an institutional and legal platform for inter-agency coordination to ensure the reduction of deforestation;
- Agriculture: promoting alternative sustainable practices to shifting cultivation, which ensure increased productivity of food and cash crops;
- Energy: increase access to alternative sources of biomass in urban areas and increase the efficiency of production and use of biomass energy;
- Conservation Areas: strengthen the system of protected areas and find safe ways of generating income;

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[18] As well as tourism and infrastructure.

- Sustainable Forest Management: promote the system of forest concessions, community management and strengthening forest governance;
- Restoration of degraded forests and planting trees: establishing a favourable environment for forest businesses, restoration of natural forests and planting of trees for various purposes, production and use of biomass energy.

Obviously, the GNR REDD Project is fully aligned with those objectives and, more specifically, with pillars n°2 (promotion of sustainable agricultural production); n°3 (promotion of improved charcoal production techniques); n°4 (protection of the GNR and the forest of its Buffer Zone); n°5 (support to community management and forest governance); and n°6 (with activities of ANR).

Both, the REDD decree and the Mozambican INDCs are currently under revision. With its permanent presence in Maputo (ANAC and Etc Terra) and its frequent discussions with MITADER, the Project team will follow the evolution of the national framework and apply to the Project any of the rules or regulations emerging from those processes. For now, no specific mention exists for private initiatives. Once the registry system for REDD initiatives will be operational, the Project will complete the procedure to avoid double counting and monitor at its scale all required indicators. The development of the REDD registry will start at the end of the year 2017.

**Compliance of the GNR REDD Project with national legislation**

The GNR REDD Project is not only in line with national development policies and strategies, including REDD+: it also fully complies with the strict national legal framework. Table 10 provides a list of the main legal instrument regulating the Environmental sector in Mozambique. As detailed below, the GNR REDD Project is well integrated to this framework.

At this stage, it should be noted that it is genuinely recognized that Mozambique has a progressive legal framework for the promotion of sustainable forest management (UT REDD+, 2015a), which seeks to balance social, environmental and economic issues, paying special attention to the role and benefits to rural communities. The very Constitution of the Republic of Mozambique of 2004 (Governo de Moçambique, 2004) specifies that the State shall adopt policies to "ensure the rational use of natural resources to safeguard its renewal capacity, ecological stability and rights of future generations" (Article 117, 2, d) as well as the "rational utilization of its natural resources" (Article 90, 2). The GNR REDD Project is fully keeping with this momentum, as it is expected to contribute to long-term sustainable management of forest in the GNR and its Buffer Zone by addressing the main drivers of deforestation and forest degradation while implementing innovative measures aiming to increase rural communities' income in the area. By doing so, the GNR REDD Project aims to initiate a virtuous circle reconciling economic development and environmental preservation.

In the same way, the GNR REDD Project is fully in line with the Conservation Areas Law (n° 16/2014), which is applying to the Gilé National Reserve. In particular, this law provides for the adoption of specific Management Plans (which was adopted for the GNR) and promotes the involvement of communities legally living inside Conservation Areas and their buffer zones in income generating activities that promote biodiversity conservation. This is a core objective of the GNR REDD Project, as already stated.

In addition, the GNR REDD Project relies on the promotion of sustainable practices, which are, for the majority, based on conservation agriculture activities. In this senses, it is not expected to generate any sort of pollution or any acceleration of erosion, desertification and deforestation, respecting the requirements of the Environmental Law (20/97). In the same way, as stated in the PDD CCB (see the Biodiversity section), the Project does not comprise the introduction of any invasive nor alien species. In order to fully comply with the Regulation for the Control of Invasive Alien Species (Decree n° 25/2008), the project does

not involve the introduction of any invasive species in the project zone, and only uses non-invasive species for the development of conservation agriculture with the promotion of agro-forestry systems based on cashew trees. Cashew trees have historically been growing in Mozambique, including in the project area, and Mozambique is considered to be a historical producer of row cashew nuts. The negative effect of cashew trees on native species is considered as inexistent: cashew trees have been growing in Mozambique for, at least, a century (Rabany, 2014) and their current repartition shows that they are not invasive species, since it is limited to areas where trees have been planted, without any natural regeneration elsewhere.

Other important legal acts with regards to land and forest management in Mozambique are the Forest and Wildlife Law (1999) - which sets the forest sector legislation - and the Land Law (1997) - which comprises procedures for land management. For these two laws, MITADER is the lead agency; it has dedicated directions focusing on these legal mandates. The laws are implemented through regulations and ministerial decrees, which provide some leeway for adjustment and improvement without further legislative action (UT REDD+, 2016).

More specifically, the 1997 Land Law created the concept of Local Community, also serving as the basic unit of natural resource occupation and use in the 1999 Forest and Wildlife Law. The "Local Community" is defined in Article 1(1) of the Land Law as follows: *"A grouping of families and individuals, living in a circumscribed territorial area at the level of a locality [the lowest official unit of local government in Mozambique] or below, which has as its objective the safeguarding of common interests through the protection of areas of habitation, agricultural areas, whether cultivated or in fallow, forests, sites of socio-cultural importance, grazing lands, water sources and areas for expansion".* Such a definition with its various elements of common interest centered on a coherent resource use strategy and system provides an ideal vehicle through which to implement REDD+ initiatives (Tanner, 2017), including the GNR REDD+ Project that focuses on behavioral change, new income sources and benefit-sharing activities and appeals to common interests. It is also coherent with the Environmental Law (n°20/97), which provides for the participation of local communities in the formulation of policies and laws related to natural resource management and the management of protected areas, such as the GNR. It has also been reinforced by the Ministerial Diploma n° 158/2011, which officially set specific procedures for consultation with local communities for the use of lands, recognizing their rights, in accordance with the Regulation of the Land Law.

Based on an extensive community consultation process and working in close collaboration with the 27 identified local communities living around the GNR and potentially impacted by the Project, the proposed GNR REDD Project is therefore fully aligned with both the Forest and Wildlife Law (1999) and the Land Law (1997), in particular with regards to the principles of local community participation in sustainable natural resources management in and outside protected areas - *for details on community consultation for the GNR REDD Project, see the PDD CCB.*

Finally, the GNR REDD Project Benefit Sharing Mechanism will also ensure that those communities receive the appropriate share of benefits resulting from the reduction of emissions as part of the Project's outcomes. These mechanisms are expected to be coherent with the Ministerial Diploma 93/2005, which established the mechanisms for channelling the 20% revenues from wildlife and forestry exploration towards the benefits of communities that inhabit the areas where the exploration of such resources is taking place. From 2017 onwards, those mechanisms will rely on the ZILMP Benefit Sharing Plan, which is currently being designed.

The following table summarized the main laws and regulations that are relevant for the GNR REDD Project or other REDD+ projects in Mozambique. It is adapted from the analyzed realized for the ZILMP ER Program.

**Table 10: Summary of the main national regulatory acts relevant for the GNR REDD project**

| Acts | Description |
|---|---|
| **Environment and biodiversity** | |
| **The Environmental Law (nº 20/97)** | The Environmental Law acts like a framework law, establishing the pillars of the system of legal protection of the environment. It aims at defining the legal basis for the improved use and management of the environment and its components to achieve a system of sustainable development in the country. The legislation prohibits the pollution of all environmental components (air, soil and water) as well as practices that may accelerate erosion, desertification and deforestation. Article 4 establishes a range of basic legal principles, including the principle of rational use and management of natural resources, with a view to further improve the quality of life of the population and the maintenance of biodiversity and ecosystems. It also provides for the participation of local communities in the formulation of policies and laws related to natural resource management and the management of protected areas. |
| **Regulation for the Control of Invasive Alien Species (Decree N°25/2008)** | This regulation provides for: (i) the protection of vulnerable and threatened species and ecosystems; (ii) the impeding of unauthorized introduction and dissemination of alien species and invasive alien species; (iii) the management and control of invasive alien species in order to prevent or minimize their damage to the environment and biodiversity; (iv) the eradication of alien species and invasive alien species that may damage ecosystems and habitats; (v) the carrying out of environmental impact studies under Decree No 45/2004 of 29 September prior to the introduction of exotic species. Although the project does not provide for the introduction of any invasive species in the area, cashew tree plantations should, if necessary, respect this regulation. |
| **The Environmental Impacts Assessment (EIA) Regulation (Decree n°54/2015)** | Mozambique has developed a comprehensive regulation to cover the EIA process, which is included in the Regulation of the Process for Environmental Impact Assessment. The regulations are in line with the international environmental and social management best practices, including World Bank recommendations and procedures. The regulation details the procedures ad criteria for ESIA and ESMP and implies the categorization of projects and subprojects (A+, A, B or C). Although the MITADER is responsible for regulating the EIA in Mozambique, it is the project proponent's responsibility to ensure that standards and identified mitigation measures are met. |
| **Forest** | |
| **The Forests and Wildlife Law (nº 10/99) and its regulations** | The objectives to be pursued under this act are to protect, conserve, develop and rationally use sustainable forest and wildlife resources for the economic, social and ecological benefit of current and future generations of Mozambicans. It promotes, *inter alia*, the protection and conservation of specific biodiversity components as well as specific flora and fauna species found in certain places. The law also identifies the principles of local community participation in |

| | sustainable natural resources management in and outside protected areas. It introduces Local Participatory Management Councils (COGEPs). |
|---|---|
| **Land** | |
| **National Land Policy (Resolution n°10/95)** | The Land National Policy defines the Land as the property of the State in compliance with the guarantee of access and use for population and investors, in full recognition of customary rights of access and management of land for rural population. |
| **The Land Law (nº 19/97) and its regulation** | The Land Law defined the regulatory procedures for land management. It provides the basis to define access rights, land use rights and procedures for the acquisition and use of land title by communities and individuals. The same law and its regulation embody key aspects defined in the Constitution in relation to the land, such as the maintenance of the land as state property, which cannot be sold. It introduces *Direitos de Uso e Aproveitamento da Terra* (DUATs), which can be acquired by occupation according to customary norms and practices, the uncontested occupation of a land over a period of ten years or the attribution of discretionary concessions by the State. The law allows local communities to hold a collective DUAT over the area within which they have jurisdiction. |
| **Technical Annex to the Regulation of the Land Law (Ministerial Diploma n°29-A/2000)** | This Annex defines the requirements for the delimitation of the areas that are occupied by Local Communities and individuals in "good faith", as well as for land demarcation in the context of the issuance of titles related to the right to use and benefit from the land. |
| **Specific procedures for the Community consultation (Ministerial Diploma n°158/2011)** | This act provides for the adoption of specific procedures for consultation with local communities for the use of lands, recognizing their rights, in accordance with Regulation of the Land Law. |
| **Creation of the Consultative Forum on Lands (Decree n°42/2010)** | This acts establishes the Consultative Forum on Land as a consultation mechanism for the GoM to discuss land and related matters. |
| **Requirements for Simple License Regimes, and the terms, conditions and incentives for the establishment of Planted Forests (Decree 30/2012)** | Definition of the requirements for logging including the scheme, terms, conditions and incentives for the establishment of forest plantations, which are part of the ER Program interventions. |
| **The Land Planning Law and its regulations (nº 19/2007)** | The Land Planning Law establishes key principles for environmental protection in the context of regional planning and establishes hierarchical responsibilities among central, provincial, district and local governments in land use planning processes. It also stipulates that expropriation for public interest will give rise to the payment of fairly calculated compensation in order to compensate for the loss of tangible and intangible goods and productive assets as well as the disruption of social cohesion. |
| **Benefit-sharing** | |
| **Ministerial Diploma 93/2005** | This key ministerial diploma established the mechanisms for channeling the 20% revenues from wildlife and forestry exploration, towards the benefits of communities that inhabit the areas where the exploration of such resources is taking place. It stipulated that beneficiaries can only receive money if their community is organized in a legalized association with a bank account. |
| **Conservation areas** | |

| | |
|---|---|
| **Conservation Areas Law (n°16/2014)** | The 2014 Law on Conservation Areas provides for the legal establishment of Conservation Area Management Boards (CGAC), which advisory bodies covering one or more CA composed of representatives of local communities, the private sector, associations and local state bodies for the protection, conservation and promotion of sustainable development and use of biological diversity. It also legalizes public-private partnerships for CA management and for concession contracts and definied specific criteria and principles for CAs' management plans. It promotes the involvement of communities legally living inside CAs and their buffer zones, in income generating activities that promote biodiversity conservation. This law is applicable to the GNR. |
| **REDD+** | |
| **Regulation on procedures for approval of REDD+ projects (Decree 70/2013)** | The purpose of this Regulation is to establish the procedure for the approval of REDD+ projects and studies, as well as the setting of the institutional framework and competences. It deals, *inter alia*, with the institutional framework, approbation and issuing of license for the marketing of carbon credits. It also discusses the procedures for the approval of REDD+ projects and place emphasis on community consultations. The REDD Regulation states that the REDD+ projects should clearly contain measures to promote and support compliance with the safeguards guidelines. All projects should provide for the distribution of benefits, including local communities under terms to be set by ministerial decree. It also creates the CTR for REDD+ and the UT REDD+. |

**International conventions and agreements**

Mozambique has also ratified various international conventions and regional protocols related to the management of the environment. It should be noted that, under line 2 of article 18 of the GoM's Constitution, the rules of international law have the same value in domestic law and once ratified by the Parliament and Government they become constitutional normative acts. As per point 1 of article 18 of the Constitution, the "*treaties and international agreements duly approved and ratified, are enacted in the Mozambican legal order*" (MITADER, 2016d). The most important acts are summarized in the table below.

**Table 11: Summary of the main international agreements ratified by the government of Mozambique and relevant for the GNR REDD Project**

| Acts | Description and relevance for ER Program |
|---|---|
| **International Convention on International Trade in Endangered Species (CITES, 1979)** | CITES is a multilateral treaty to protect endangered plants and animals, aiming to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild. It accords varying degrees of protection to more than 34,000 species of animals and plants, several of which can be found in Mozambique. |
| **African Convention on Nature and Natural Resources Conservation - ratified by the Parliament's Steering Committee through Resolution nº 18/81, of 30 December** | The Convention aims at ensuring the conservation, use and development of land, water, forest and wildlife resources of SADC Member States, bearing in mind not only the general principles of nature conservation, but also the best interests of the communities themselves. |

| | |
|---|---|
| **United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, 1992 (amended 1997)** | The Kyoto Protocol (1997) is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC, 1992). It is binding for countries that have ratified the protocol to reduce and ultimately cap their greenhouse gas emissions (GHGs). <br><br> Mozambique signed the UNFCCC on 3 November 1992, and ratified the Kyoto Protocol on 18 January 2005, and entered the protocol into force on 18 April 2005. It should be noted that Mozambique being a developing country, those acts are not biding for the country to reduce GHGs. It nevertheless demonstrates the GoM's political commitment to the reduction of carbon emissions. |
| **UN Convention on Biodiversity - ratified by Resolution nº 2/94, of 24 of August** | This international instrument advocates the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings. It is an essential foundation for the creation, development and protection of conservation areas in Mozambique. It is significant for the ER Program, given that forests in Mozambique and elsewhere are the most biologically diverse systems. Forest biodiversity is increasingly threatened as a result of deforestation and forest degradation. |
| **Protocol related to Wildlife Conservation and its application in the SADC - Ratified by Resolution nº 14/2002, of 5 of March** | This protocol establishes common approaches to conservation and sustainable use of wildlife resources relating to the effective enforcement of laws in the region and within the domestic laws of each Party State. |
| **United Nations Convention to Combat Desertification (UNCCD), 1994** | The objective of this Convention is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification. Achieving this objective will involve long-term integrated strategies that focus simultaneously, in affected areas, on improved productivity of land, and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level. |
| **COP 21 Paris Agreement on Climate – December 2015** | Mozambique is one of the 196 countries that signed and ratified the agreement to reduce greenhouse gas emissions to contain global warming to 2°C. |

### 2.5.7. Approvals (G5.7)

ANAC is a public entity officially habilitated by law to manage Parks and Reserve (including their buffer zones). By law (Conservation law 16/2004), ANAC is habilitated to develop REDD projects in the areas under its jurisdiction and sell associated carbon credits. Moreover, ANAC has the necessary rights of uses on the Project Area as provided by the national decree n°70/2011 (see following section).

### 2.5.8. Project Ownership (G5.8)

As explained previously, project area of the GNR REDD project is forests of the buffer zone of the GNR. This area was officially recognised by the ministerial council and the decree n°70/2011 presenting its official creation was published in the republic journal the 30 of December 2011. The decree specifies that all economic activities scheduled in the management plan – prepared by ANAC and IGF – are allowed. As the GNR is a national reserve and ANAC is the national administration in charge of protected areas of Mozambique, this decree gives to the project proponent (ANAC) the necessary right of use for the management of the REDD project.

## 2.5.9.   Project Benefit Crediting (G5.9)

The GNR REDD project seeks to generate carbon credits to sell on the voluntary carbon market. It is the only form of offset that will be generated by the project. Carbon credits will be generated for the first time during the validation and first verification of the VCS PDD that will occur at the same time. Hence, there will be a verification by a recognised carbon standard.

Besides, as explained previously, the project is included in a jurisdictional REDD+ program led by the government of Mozambique called ZILMP[19]. This program is still under development and will seek validation in 2017 and selling of carbon credits to the FCPF-CF. Hence, the MRV system and the benefit sharing plan of the program to avoid double counting of REDD projects like the present one are still to be elaborated. However, to respect the rules of the FCPF-CF and in the interest of the program, rules will be developed to avoid double counting and to guarantee an equitable sharing of carbon benefits between all projects and stakeholders. Moreover, if the program is validated in 2017, the GNR REDD project will align its monitoring method to be in accordance with the MRV system of the program and to assure compatibility of carbon benefits accounting. In this case, it is possible that one part of carbon credits generated by the GNR REDD project will be sold on the voluntary carbon market and, the other part, to the FCPF-CF depending on the ERPA arrangements - as the FCPF-CF will probably not buy all carbon credits issued from the ZILMP program.

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[19] All public documentation on the program is available on FCPF-CF website

# 3. CLIMATE

### 3.1. Without-Project Climate Scenario: Estimated Greenhouse Gas Emissions (CL1.1)

As the project is seeking validation from VCS and CCB, estimation of the GHG emissions inside the project area under the project scenario was done using the methodology VM007, REDD+ Methodology Framework (REDD-MF) v1.5, validated by VCS.

This methodology requires the definition of a reference area, RRD (Reference region for projecting rate of deforestation), to estimate historic areas of unplanned deforestation that will be then projected on the project area. The definition of the RRD is based on similarity criteria in terms of causes and agents of deforestation, landscape and climatic factors, accessibility and land tenure constraints. Details on similarity can be found in the VCS PDD and the different zones are presented in Figure 14. No model of localisation of future deforestation was used. Hence, activity data area projected from the RRD to the PA using a ratio of forest areas in each zone. For the baseline, simple projection of the historic average of quantity of deforestation was done. As the project start in 2011, the reference period is 2000-2010.

As explained previously, main causes of deforestation in the GNR project is the conversion of forest to agricultural land for crop production by small scale farmers that practice subsistence slash and burn agriculture. Deforestation can therefore be considered as unplanned. Baseline for greenhouse gas emissions was then estimated following the continuation of this scenario.

**Activity data: Estimation of annual areas of unplanned deforestation**

This step is to quantify the historical deforestation rate during the historical reference period within the RRD. The method described here is the one used for the VCS PD respecting the VM0007 requirements. It follows the method presented by Grinand et al. (2013). Main respected criteria are the following:

- The period of analysis is 1990 to 2013. Hence, data from 2000 to 2010 (3 years: 2000, 2005 and 2010), corresponding to the reference period of the present project, can be extracted from this map.

- Data used to produce the map are Landsat images having 30m of resolution.

- Validation of the map was done by comparison with very high resolution images of Google Earth. The overall accuracy is 81% (Mercier et al. 2016). However, this corresponds the global accuracy assessment and regarding validation of forest and non-forest classes, accuracy is respectively 94% and 87% (Mercier et al. 2016) in accordance with the methodology requirements. Results are presented in the following table.

The default approach to estimate annual areas of unplanned deforestation is simple historic; it was the one selected for the present project.

**Collection of appropriate data sources**

The historical analysis must respect the following criteria:

- Be conducted on at least 3 time points that are 3 years apart minimum on a maximum period of 12 years (the last date being no more than 2 years before project start date);

- Use remotely sensed spatial data that have medium resolution (30x30m or less);

- Produce a map with 90% accuracy in the classification of forest versus non-forest (the accuracy is assessed via high resolution data or ground truthing points on the last date analysed).

According to the methodology, if interpreted data respecting those criteria already exist, they can be used for the analysis. That is the case for the present project as an ER Program (ZILMP) is currently under development. For the preparation of the ER-PD that will be submitted to the FCPF-CF in the end of 2017, a historical deforestation map was produced respecting the methodology requirements (Mercier et al. 2016). Finally, it will not be used at the jurisdictional level but as the results were available and of good quality, it was decided to use them for the present document. Details on the preparation of the map are furnished in the background study for the development of the ER-PD (Mercier et al. 2016) and are summarised hereafter. It follows the method presented by Grinand et al. (Grinand et al., 2013a) based on a multi-dates analysis for a direct classification of land uses and changes using the algorithm *RandomForest*. The main respected criteria are the following:

- The period of analysis is 1990 to 2013. Hence, data from 2000 to 2010 (3 years: 2000, 2005 and 2010), corresponding to the reference period of the present project, can be extracted from this map.

- The data used to produce the map are Landsat images with a 30m resolution.

Accuracy assessment was specifically done for the present document on the last Forest/Non-Forest map of the reference period, in 2010, cut on the RRD. A sample of validation points were classified on Landsat images and very high resolution images available in Google Earth. The overall accuracy is 94%. For forest and non-forest categories, accuracy is respectively 95% and 94% and are in in accordance with the methodology requirements. Results are presented in Table 16.

**Table 12: Summary of the method used for the development of the REL in the ZILMP ER-PD draft**

| | |
|---|---|
| **Satellite images** | **LANDSAT images 5, 7 et 8.** Priority use of GLS (*Global Land Survey*) products dedicated to the analysis of land use changes (orthorectified images). In case of unavailability or presence of clouds on these products, archival images L1T (geo-referenced only) will be downloaded. |
| **Dates and periods** | Images for years *circa* 1990, 2000, 2005, 2010 and 2013. For more consistency, the images acquired in the same season will be preferred. The period covered goes far beyond standard requirements. Such a period was chosen to have a better understanding of long-term deforestation dynamics. |
| **Pre-processing** | If the images are not pre-processed (*e.g.* L1T level), a radiometric correction and geometric correction are performed. In case of cloud cover greater than 10% in a part of the study area, technical combinations of identical scenes on different dates are implemented to minimize the cloud cover of the final map. |
| **Supervised classification** | Use of a supervised classification method (involving the delimitation of training plots and algorithm calibration) and consideration of the 6 IPCC categories of land use (IPCC 2006) and land cover change classes. |

| | Visual inspection of *Google Earth* and/or images with very high resolution (2m or better) to assist in the delimitation of these training plots. |
| --- | --- |
| | Use of *ENVI*, *QGIS*, *Grass*, *R* software and *RandomForest* algorithm for classification. |
| | **National forest definition:** |
| | Mozambican national REDD+ framework defines the forest according to those criteria: minimum height of 5 meters, minimum tree cover of 30%. Those criteria of height and tree cover are taken into account during the photo interpretation control based on *Google Earth* images. |
| **Post-processing** | 3 post-processing levels are implemented to clean the map and meet the following Minimum Mapping Units (MMU): |
| | - Smoothing through a 3x3 majority filter. |
| | - Removal of patch of forests of less than 1 ha. |
| | - Removal of patch of deforestation of less than 0.36 ha. |
| | **National Framework:** |
| | According to Mozambican national REDD+ framework, forest minimum area is 1 ha. |
| **Validation and quality control** | **Internal validation**: Random selection of 70% of the training plots for algorithm calibration; the remaining 30% plots were used to generate the confusion matrix and quality indicators. |
| | **External validation**: photo-interpretation of forest state on a high-density random sample of points and high-resolution images to cross-validate those reference observations with the map. |
| | **Quality control:** Production of a processing chain command script using the dedicated GIS/RS free software (*R*, *Envi*, *Grass*) for checking and reapplying the method. |

**Satellite images database**

For the background study led to prepare the deforestation map of the ER-Program ZILMP, images from 1990 to 2013 were used but in order to respect the reference period defined for the Project, results for the period 2000-2010 were extracted in the present document.

The study area is covered by four LANDSAT scenes meeting the following identifiers (path/row): 165/071, 165/072, 166/071 and 166/072. The selected and processed LANDSAT scenes are presented in the following table and figure.

**Table 13: Date of selected LANDSAT images**

| Scene identification | Reference year of images | | | | | Area covered (%) |
| --- | --- | --- | --- | --- | --- | --- |
| | ~1990 (t1) | ~2000 (t2) | ~2005 (t3) | ~2010 (t4) | ~2013 (t5) | |
| USGS data | GLS 1990 | GLS 2000 | GLS 2005 | GLS 2010 | Landsat 8 L1T | |
| 166-071 | July-92 | Aug-99 | June-06 | May-09 | June-13 | 22 |
| 165-071 | July-89 | Aug-99 | Aug-05 | May-10 | March-14 | 36 |
| 166-072 | July-92 | Apr-00 | Aug-06 | May-09 | June-13 | 13 |
| 165-072 | July-89 | Apr-00 | March-05 | May-10 | March-14 | 29 |
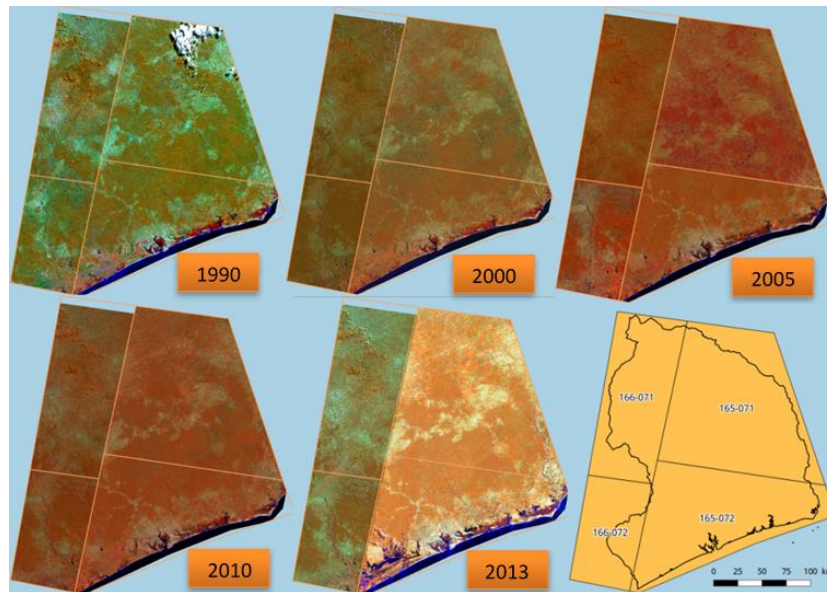
**Figure 11: Scope and references of LANDSAT scenes covering the study area**

To ensure good geometrical quality images, LANDSAT Global Land Survey products (GLS) and Level-1T (L1T) were used. According to Gutman et al. (2008), these data have sufficient radiometric and geometric qualities to perform land use change analysis. Additionally, we performed a visual inspection of each scene to check their geometric consistencies. We downloaded different images for the last date (2013) and selected the one that meet the geometric criteria. No additional geo-rectification was performed. At the end of this control phase, all images showed a discrepancy of less than 1 pixel. The scenes were then combined into mosaics using a contrast adjustment algorithm in order to reduce discrepancies between scenes, caused by contrasted atmospheric conditions. The mosaics are finally produced by reference years over the whole study area.

**Supervised classification**

After data pre-processing, the method to establish a deforestation map follows three main steps:

- Definition of land use and land cover changes classes.

- Delimitation of training plots.

- Classification with a specific algorithm.

Land use and land cover change (LULCC) classes that exist in the program areas and are detectable with Landsat imagery are the following:

- Miombo forest (F).

- Mangroves (M).

- Fallows, savannas and cultivated areas (P).

- Wetlands (H).

- Other lands (bear soils, rocks, settlements) (A).

In line with the GOFC-GOLD REDD sourcebook (GOFC-GOLD 2010), for the establishment of the ER Program REL, a "pre-classification method" of land cover changes was applied, instead of a "post-classification" (combinations of independent maps). Such a method should reduce the error in deforestation estimations, as it does not multiply the errors from the independent maps. In practice, this implies to identify stable and dynamic land cover on the multi-date stack of images at a same stage. Hence, the typology presented in the following table was adopted.

**Table 14: Typology of land use and land cover changes classes for the study**

| Numeric code for the map | Identification code in the training plots database | Description of the class |
|---|---|---|
| 11111 | FFFFF | Forest remaining forest over the 1990-2013 period |
| 11113 | FFFFP | Forest converted to fallow/cultivated land between 2010-2013 |
| 11133 | FFFPP | Forest converted to fallow/cultivated land between 2005-2010 |
| 11333 | FFPPP | Forest converted to fallow/cultivated land between 2000-2005 |
| 13333 | FPPPP | Forest converted to fallow/cultivated land between 1990-2000 |
| 33333 | PPPPP | Mosaic of cropland, fallow and savannah land since 1990 |
| 44444 | HHHHH | Wetland |
| 66666 | AAAAA | Rocks, bare soil and sand |
| 77777 | MMMMM | Mangrove forest in 2013 |

**Delimitation of training plots**

Delimitation of trainings plots is a necessary step to calibrate the classification algorithm when applying a supervised classification. The accuracy of the classification mainly depends on the quality of the delimitation of these training plots. Therefore, a standardized and rigorous photo-interpretation work was conducted. Photo-interpretation was carried on the basis of field knowledge, LANDSAT images patterns and high-resolution images from *Google Earth*. Number of polygons and area delimitated are presented in the table below.

**Table 15: Number of polygons and associated delimitated area used as training plots**

| LULCC Class ID | Number of training polygons | Cumulated area (ha) |
|---|---|---|
| AAAAA | 42 | 148.9 |
| FFFFF | 174 | 471.8 |

| | | |
|---|---|---|
| FFFFP | 78 | 131.6 |
| FFFPP | 45 | 85.9 |
| FFPPP | 76 | 227.7 |
| FPPPP | 81 | 310.9 |
| HHHHH | 45 | 177.3 |
| MMMMM | 26 | 101.2 |
| PPPPP | 162 | 742.5 |
| **Total** | 729 | 2,397.7 |

First, in order to improve the localization and determination of changes, those areas were highlighted by performing a multi-dates color composite (Figure 12). Then, training plots were located in cluster – i.e. by grouping several plots of different categories on a same landscape unit or small area. A landscape unit is defined according to the scale of study: here, it roughly represents an area of analysis below 3 km2 and/or at 1:10,000 scale. In order to reduce noise in training data and to guarantee the appropriate consideration of the forest definition, plots contours were verified by superposition on very high-resolution images available on *Google Earth*. Those images can be originated either by Quickbird or Ikonos satellites, with ground resolution around 0.6 meters. Furthermore, the respect of the national definition of forest from the national strategy (MITADER 2016) regarding tree cover (30% minimum) and tree height (5m at maturity) is also controlled on *Google Earth* high resolution images by verifying the density of tree and that the plots correspond to Miombo forest (largely main forest stratum of the ER Program area) which largely exceeds 5m at maturity and is easily recognisable for the photo-interpretation team, that knows the field (the team participated to some forest inventory), on high resolution imagery (see Figure 12 for example). As explained in Bastin et al. (2017), the identification of high trees (instead of shrubs) is also based on textural, crown diameter and shadows visual interpretation. Moreover, the photo-interpretation team checked the visual aspect (for tree height and crown cover) of inventory plots on Google images and high resolution data for comparison with calibration and validation plots, in order to assure the best inclusion of national forest definition in the classification exercise.
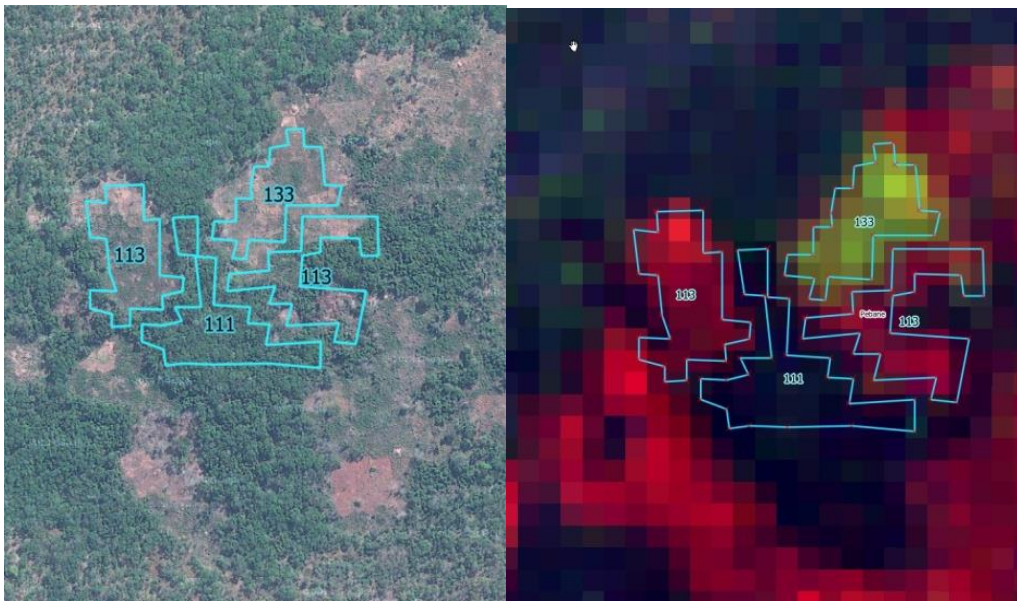
**Figure 12: Example of multi-dates colorized composition showing several LULCC classes on the right (R: Band5-2013; G: Band5-2010; B: Band5-2005).**

*Deforestation between 2005 and 2010 appears in green while deforestation between 2010 and 2013 appears in red. Forests staying forests are in blue and dark green. On the left, plots are overlaid on Google Earth image (Quickbird acquired the 12/08/2013).*

## Classification

Afterward, the training plot spatial database was correlated with the multi-date stacked image database using a statistical algorithm. The *RandomForest* algorithm, developed by Breiman (2002) and available in *R* software was used. It is a data-mining algorithm that combines bugging techniques and decision tree. It was successfully applied in similar land cover change studies in tropical forest (Grinand et al. 2013b) and more recently in the Miombo forest biome (Kamusoko, Gamba, and Murakami 2014).

*RandomForest* calibration was performed using 2/3 of randomly selected training plots. The remaining plots (1/3) were used to perform an "internal validation" by the algorithm. Based on a confusion matrix, this validation enabled the operator to identify the remaining confusions in order to add, remove or change the training plots on the GIS and redo the classification until satisfactory results were obtained.

## Post-classification treatments

After classification, some isolated pixels of forest were found, giving a noisy appearance to the map. To respect the requirements on MMU (linked to the forest definition), those pixels were removed during post-classification processing. In the present study, MMU is 1 ha for forest and 0.36 for deforestation. A majority filter with a 3x3 window was first used to remove isolated pixels. The classified image was filtered with a Grass/R script for forests and deforestation patches.

**External validation of results**

This step entails a statistical analysis of the classification results accuracy, with a points sampling approach. This validation was designed specifically for the present document. It was carried out on Forest/Non-forest map of the last date of the reference period, 2010, as provided by the BL-UP module. In order to reduce the working time to perform this analysis, the map was cut on the area of interest for the validation i.e. the RRD. Validation points were selected independently of training plots that were used for the classification (1000 validation points were spread out on the RRD). The state of the forest was visually inspected on every point and gathered in a spatial database. The inspections were based on very high-resolution *Google Earth* images and on the LANDSAT images that had been used for the classification. The result of the photo-interpretation (reference dataset) was finally compared with the map to produce a confusion matrix. This confusion matrix is used to calculate the accuracy of the map which is presented in Table 16.
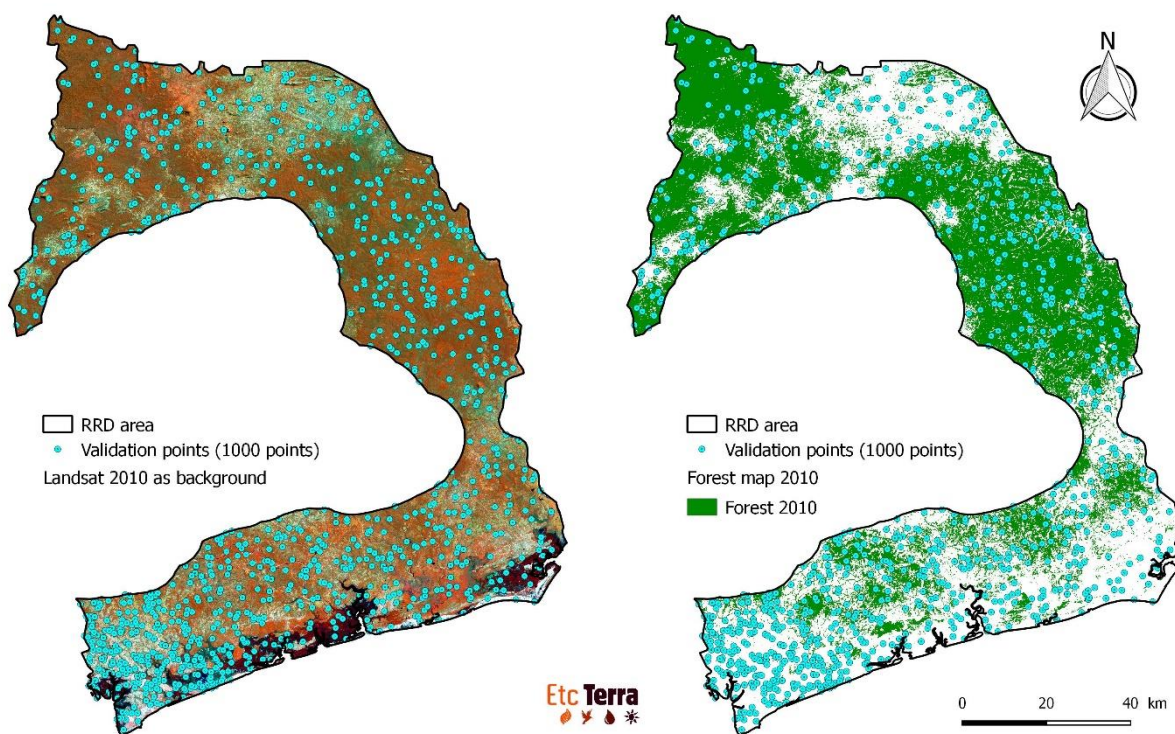


**Figure 13: Distribution of the 1000 points randomly selected for the validation sampling in the RRD on the observation data on the left (Landsat or Google Earth images) and on the reference map on the right (Forest/Non-forest map for the year 2010)**

**Table 16: Confusion matrices (number of points above and percentages below) on the external validation of the historical deforestation map (1900 to 2013) produced for the ER-PD development (Mercier et al. 2016).**

*Numbers within the matrix are the number of points of land cover between the reference dataset (points) and the prediction of the map.*

| | | Observed (Landsat/Google earth) | | | User Accuracy |
|---|---|---|---|---|---|
| | | Non-forest | Forest | Total | |
| **Predicted (Forest / Non-forest map)** | Non-forest | 596 | 39 | **635** | **94%** |
| | Forest | 18 | 347 | **365** | **95%** |
| | Total | **614** | **386** | 1000 | |
| **Producer Accuracy** | | **97%** | **90%** | | **94%** |

| | | Observed (Landsat/Google earth) | | |
|---|---|---|---|---|
| | | Non-forest | Forest | Total |
| **Predicted (Forest / Non-forest map)** | Non-forest | 93.9% | 6.1% | 100.0% |
| | Forest | 4.9% | 95.1% | 100.0% |
| **Overall accuracy** | | | | **94%** |

**Mapping of historical deforestation**

Using the results of the map produced for the ZILMP background study, deforestation map is presented in Figure 14. Cloud cover on maps was reduced to 0% on the area of interest thanks the use of multiple-date images and of appropriate calibration plots for the model *RandomForest*.

Using the ZILMP results, deforestation map is presented in Figure 14. Gross deforestation in area and in percentage on RRD is presented in Table 17.
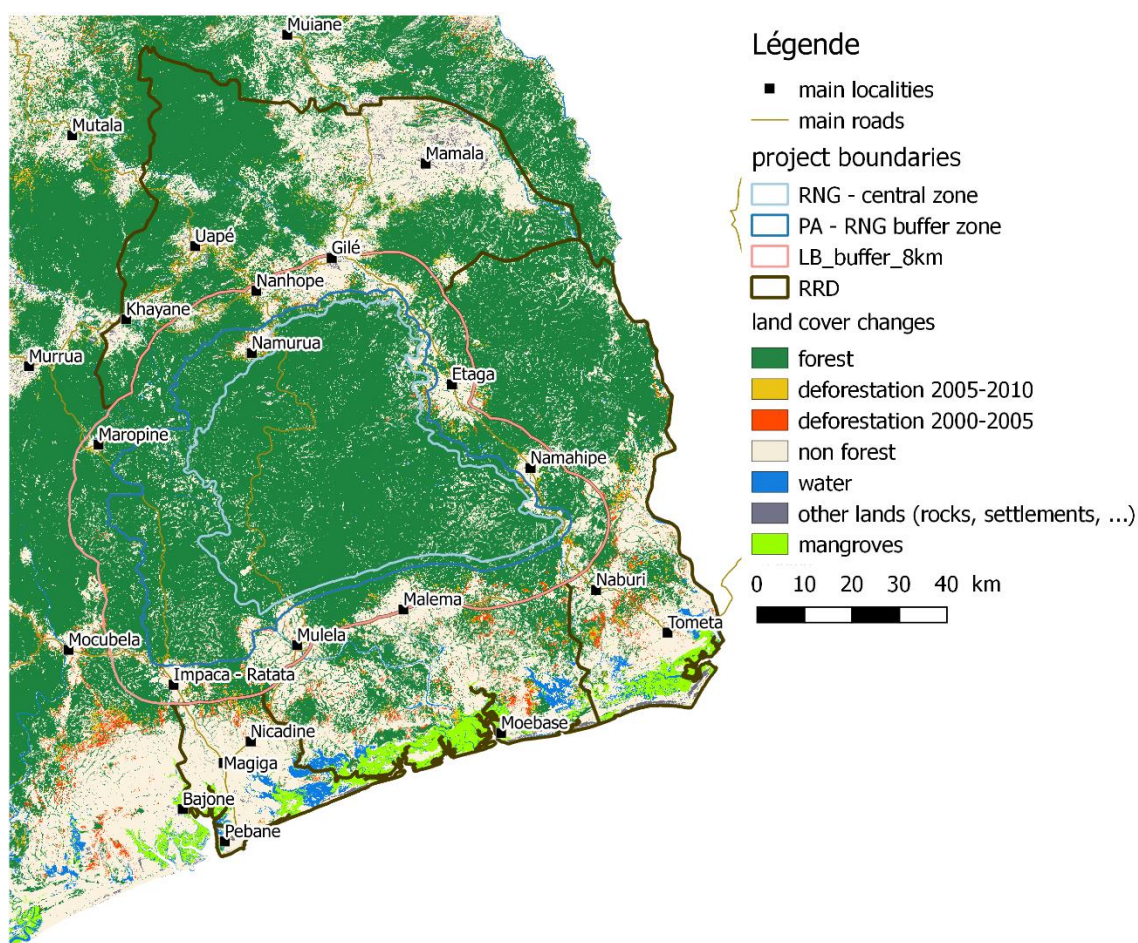
**Figure 14: deforestation maps between 2000-2005 and 2005-2010 on the RRD of GNR REDD project (from results of ZILMP background study - Mercier et al. 2016)**

**Table 17: results of historic deforestation on RRD during the reference period**

| forest area in ha | | | annual deforestation area in ha/y | | annual deforestation rates in %/y | |
|---|---|---|---|---|---|---|
| **2000** | **2005** | **2010** | **2000-2005** | **2005-2010** | **2000-2005** | **2005-2010** |
| 440,988 | 426,296 | 412,145 | 2,900 | 2,855 | 0.62% | 0.68% |

As no spatial modelling was used to locate baseline deforestation, following the VM0007 methodology, the projected unplanned baseline deforestation in the PA is estimated as follows. The annual area of deforestation in PA is **810 ha/yr** (Table 18). This result is used as the baseline for annual area of deforestation in PA as required.

$$A_{BSL,PA,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{PA}$$

Where:

| | |
|---|---|
| $A_{BSL,PA,unplanned,t}$ | Projected area of unplanned baseline deforestation in the project area in year *t*; ha |
| $A_{BSL,RRD,unplanned,t}$ | Projected area of unplanned baseline deforestation in the *RRD* in year *t*; ha |
| $P_{PA}$ | Ratio of the project area to the total area of *RRD*; dimensionless |
| *t* | 1, 2, 3, ... *t*<sup>*</sup> years elapsed since the projected start of the REDD project activity |

**Table 18: summary of annual area of deforestation for the baseline in PA and LB**

| Project zone | average historic deforestation in RRD (ha/yr) | ratio between project zone and RRD areas | baseline deforestation in project zone (ha/yr) |
|---|---|---|---|
| PA | 2,877 | 0.28 | 810 |

**Emissions factors: Estimation of carbon stock changes and greenhouse gas emissions**

Again, estimations for this part are based on the results obtained for the ZILMP ER Program development in order to be in adequacy with subnational carbon accounting initiative and because there is no reliable carbon stocks estimation available within the 2 years before project start date. Hence, carbon stocks on the area were estimated thanks the work presented in the background study (Mercier et al., 2016). Carbon stocks of Miombo forest were estimated thanks a large forest inventory of 100 plots (Mercier et al., 2016). Methodology of inventory is presented in the background study (Mercier et al., 2016). Allometric equation used is the one of Chave et al. (2014) widely recognised and applicable for dry type of forests.

The carbon pools considered here are those presented in Table 19 i.e. aboveground and belowground tree biomass for pre-deforestation strata and with aboveground non-tree biomass in addition for post-deforestation strata. Conservatively and because of difficulties to rigorously assess quantities, harvesting of long-lived wood products are not include in the baseline and so, shall not be estimated in this section. No other greenhouse gas was considered to establish the baseline.

According to the background study for the ZILMP development, only one pre-deforestation stratum was defined corresponding to Miombo forest as the forest in and around the GNR is relatively homogeneous in terms of carbon stocks with low elevation and climatic variations. Results of the ZILMP background study are presented in Table 20. Data for aboveground biomass are from field inventories and root-shoot ratio is from default data of IPCC (2006).

Post-deforestation uses of the land are agriculture – succession of fields and fallows – and savannas. It is difficult to discriminate those uses with satellites images and carbon stocks are similar on all post-deforestation land uses so we did not establish a change matrix and option 1 - simple approach - of BL-UP module was chosen. One post-deforestation stratum and long term average carbon stock of this stratum was therefore used. A biodiversity and biomass inventory was realised around the GNR in 2016 (mainly in PA) following, for biomass estimation, the same method as the one for pre-deforestation data except than plot size was 10 m of diameter. Inventories were realised on fallows of different ages but,

to remain conservative, only biomass data from fallows of 10 years are used in the present document (this stratum is represented by 18 plots). Results from this inventory are also those used in the ER-PD of ZILMP. They are presented in Table 21.

**Table 19: carbon pools considered in the GNR REDD project activities**

| Carbon Pool | Inclusion? | Justification/explanation |
|---|---|---|
| Aboveground tree biomass | Included | Mandatory for REDD project |
| Aboveground non-tree biomass | Excluded | Not significant in the forest strata. |
| Belowground tree biomass | Included | Only belowground tree biomass is included. It is a significant pool in the baseline scenario. |
| Dead wood | Excluded | Not significant and it is conservative to exclude it. |
| Litter | Excluded | Not significant and it is conservative to exclude it. |
| Soil organic carbon | Excluded | It is a significant pool and carbon stocks in forest strata but it is conservative to exclude it. |
| Wood products | Excluded | Not associated with deforestation in the area (but a cause of degradation). Moreover, forest exploitation for wood product should decrease under the project scenario so it is conservative to exclude it. |

**Table 20: summary of pre-deforestation carbon stocks in forest tree biomass for the Miombo forest according to results of the ZILMP background study (Mercier et al., 2016)**

| | Aboveground | Belowground | Total |
|---|---|---|---|
| **Carbon stocks in tC/ha** | | | |
| **Average** | **65.9** | **18.4** | **84.5** |
| **Standard deviation** | 28.3 | 7.9 | 35.9 |
| **90% CI** | 4.7 | 1.3 | 5.9 |
| **Carbon stocks in tCO$_2$eq/ha** | | | |
| **Average** | **241.6** | **67.6** | **309.8** |
| **Standard deviation** | 103.7 | 29.0 | 131.8 |
| **90% CI** | 17.1 | 4.7 | 21.8 |

**Table 21: Estimation of carbon stocks in 10 years fallows for post-deforestation classes (n=18)**

| | carbon stocks in tC/ha | | |
|---|---|---|---|
| | aboveground | belowground | Total |
| average | **9.5** | **3.4** | **12.9** |
| standard deviation | 11.6 | 3.2 | 14.7 |

| carbon stocks in tCO2eq/ha | | | |
|---|---|---|---|
| | aboveground | belowground | Total |
| **average** | **34.8** | **12.5** | **47.3** |
| standard deviation | 42.6 | 11.6 | 53.8 |

Carbon stocks changes after deforestation in the project zones are then estimated as the difference between pre- and post-deforestation strata according to the VM0007 methodology. Results are presented in the following table for the pools considered in this PDD.

**Table 22: Estimation of carbon stocks changes after deforestation of Miombo forest in project zones**

| emission factors in tCO2eq/ha | | |
|---|---|---|
| **Aboveground tree biomass** | **Belowground tree biomass** | **total** |
| $\Delta C_{AB,tree}$ | $\Delta C_{BB,tree}$ | |
| **average** **206.7** | **55.2** | **261.9** |

**Estimation of the emissions in the without-project scenario**

Among carbon pools considered in this PDD, stock changes in aboveground biomass are emitted at the time of deforestation while emissions from belowground biomass are emitted at an annual rate of 1/10 for 10 years as presented in the equations hereafter. Following this method, results are emissions of **1,920,420 tCO₂eq** for PA and of **2,575,648 tCO₂eq** for LB after 10 years of baseline period (Table 23). In the following equation, the mail parameters used are: $A_{unplanned,PA,t}$ = 810 ha/yr and $A_{unplanned,LB,t}$ = 1,086 ha/yr as presented and, $C_{AB\_tree}$ = 206.7 and $C_{BB\_tree}$ = 55.2 as presented in previous table. The other parameters are set to zero as they are not included in the baseline (see section 2.3.3).

Estimation was done over 10 years because, after this period there will be a revision of the baseline. After 10 years emissions remains stable so, without modification in the baseline, the cumulated emissions after 20 years would be: **4,041,880 tCO2eq**.

$$\Delta C_{TOT} = \sum_{t=1}^{t} \sum_{i=1}^{M} \Delta C_{BSL,i,t} \tag{23}$$

$$\Delta C_{BSL,i,t} = A_{unplanned,i,t} * (\Delta C_{AB_{tree},i} + \Delta C_{AB_{non-tree},i} + \Delta C_{LI,i})$$
$$+ \left(\sum_{t-10}^{t} A_{unplanned,i,t}\right) * \left(\Delta C_{BB_{tree},i} + \Delta C_{BB_{non-tree},i} + \Delta C_{DW,i}\right) * \left(\frac{1}{10}\right)$$
$$+ \left(\sum_{t-20}^{t} A_{unplanned,i,t}\right) * \left(C_{WP100,i} + \Delta C_{SOC,i}\right) * \left(\frac{1}{20}\right) \tag{24}$$

Where:

| | |
|---|---|
| $\Delta C_{TOT}$ | Sum of the baseline carbon stock change in all pools up to time $t^*$; t $CO_2$-e (calculated separately for the project area [PA] and the leakage belt [LB] |
| $\Delta C_{BSL,i,t}$ | Sum of the baseline carbon stock change in all pools in stratum $i$ at time $t$, t $CO_2$-e |
| $A_{unplanned,i,t}$ | Area of unplanned deforestation in forest stratum $i$ at time $t$; ha |
| $C_{WP100,i}$ | Carbon stock entering the wood products pool at the time of deforestation that is expected to be emitted over 100-years from stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{AB\_tree,i}$ | Baseline carbon stock change in aboveground tree biomass in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{BB\_tree,i}$ | Baseline carbon stock change in belowground tree biomass in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{AB\_non-tree,i}$ | Baseline carbon stock change in aboveground non-tree biomass in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{BB\_non-tree,i}$ | Baseline carbon stock change in belowground non-tree biomass in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{DW,i}$ | Baseline carbon stock change in dead wood in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{LI,i}$ | Baseline carbon stock change in litter in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $\Delta C_{SOC,i}$ | Baseline carbon stock change in soil organic carbon in stratum $i$; t $CO_2$-e ha$^{-1}$ |
| $i$ | 1, 2, 3, … $M$ strata |
| $t$ | 1, 2, 3, … $t$ years elapsed since the projected start of the REDD project activity |

**Table 23: Sum of carbon stocks changes after deforestation of Miombo forest after 10 years of baseline period in PA**

| PROJECT AREA | | emission in tCO2eq for carbon pool and total | | | |
|---|---|---|---|---|---|
| number of years (t) | year | aboveground | belowground | Total | Sum |
| 1 | 2012 | 167,471 | 4,468 | 171,938 | **171,938** |
| 2 | 2013 | 167,471 | 8,935 | 176,406 | **348,344** |
| 3 | 2014 | 167,471 | 13,403 | 180,873 | **529,217** |
| 4 | 2015 | 167,471 | 17,870 | 185,341 | **714,558** |
| 5 | 2016 | 167,471 | 22,338 | 189,808 | **904,366** |
| 6 | 2017 | 167,471 | 26,805 | 194,276 | **1,098,642** |
| 7 | 2018 | 167,471 | 31,273 | 198,743 | **1,297,385** |

| | | | | | |
|---|---|---|---|---|---|
| 8 | 2019 | 167,471 | 35,740 | 203,211 | **1,500,596** |
| 9 | 2020 | 167,471 | 40,208 | 207,678 | **1,708,274** |
| 10 | 2021 | 167,471 | 44,675 | 212,146 | **1,920,420** |

**Table 24: Sum of carbon stocks changes after deforestation of Miombo forest after 10 years of baseline period in LB**

| LEAKAGE BELT | | Emission in tCO₂eq for carbon pool and total | | | |
|---|---|---|---|---|---|
| Number of years (t) | Year | Aboveground | Belowground | Total $\Delta C_{BSL,PA,t}$ | Sum $\Delta C_{TOT,PA}$ |
| 1 | 2012 | 224,610 | 5,992 | 230,602 | **230,602** |
| 2 | 2013 | 224,610 | 11,984 | 236,593 | **467,195** |
| 3 | 2014 | 224,610 | 17,975 | 242,585 | **709,780** |
| 4 | 2015 | 224,610 | 23,967 | 248,577 | **958,357** |
| 5 | 2016 | 224,610 | 29,959 | 254,569 | **1,212,926** |
| 6 | 2017 | 224,610 | 35,951 | 260,561 | **1,473,487** |
| 7 | 2018 | 224,610 | 41,943 | 266,553 | **1,740,039** |
| 8 | 2019 | 224,610 | 47,935 | 272,544 | **2,012,584** |
| 9 | 2020 | 224,610 | 53,926 | 278,536 | **2,291,120** |
| 10 | 2021 | 224,610 | 59,918 | 284,528 | **2,575,648** |

### 3.2.    Net Positive Climate Impacts: With-Project scenario (CL2.1 and CL2.2)

In accordance with the VMD0015 M-Mon module that has to be applied following the VM0007 REDD-MF, the net GHG emissions in the project scenario are equal to the sum of carbon stocks changes due to deforestation and degradation, and other GHG emissions due to project activities minus any eligible carbon stock enhancement, as presented in the following equation. The only source of emissions considered in the GNR Project is deforestation. Carbon stocks changes due to unavoidable deforestation are presented in the present section. Details on the overall calculation are provided in VCS PD, section 3.2.

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

Where:

| | |
|---|---|
| $\Delta C_P$ | Net greenhouse gas emissions within the project area under the project scenario; t $CO_2$-e |
| $\Delta C_{P,DefPA,i,t}$ | Net carbon stock change as a result of deforestation in the project area in the project case in stratum $i$ at time $t$; t $CO_2$-e |
| $\Delta C_{P,Deg,i,t}$ | Net carbon stock change as a result of degradation in the project area in the project case in stratum $i$ at time $t$; t $CO_2$-e |
| $\Delta C_{P,DistPA,i,t}$ | Net carbon stock change as a result of natural disturbance in the project area in the project case in stratum $i$ at time $t$; t $CO_2$-e |
| $GHG_{P-E,i,t}$ | Greenhouse gas emissions as a result of deforestation and degradation activities within the project area in the project case in stratum $i$ in year $t$; t $CO_2$-e |
| $\Delta C_{P,Enh,i,t}$ | Net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline[2] in stratum $i$ at time $t$; t $CO_2$-e |
| $i$ | 1, 2, 3 …$M$ strata |
| $t$ | 1, 2, 3, … $t^*$ years elapsed since the start of the REDD project activity |

The project is built to reduce deforestation in the project area but effectiveness of activity will not be total as activity led by agent of deforestation are mainly for subsistence agriculture. In this section, we try to assess the overall effectiveness of the project to stop deforestation based on the knowledge of main threat and of the project activity plans. Activities do not all start at the beginning of the project and they will gain in scale of implementation and in adoption rate throughout the lifetime of the REDD project and so, their effectiveness will increase with time. This analysis is summarised in Table 25.

Buffer zone creation was the first activity implemented marking the beginning of the project in 2011. If its creation improved conservation awareness of the population, it will not decrease drastically deforestation as it allows the practice of agricultural activities and it does not offer alternative to populations. In the same way, improvement of GNR management will improve environmental awareness but should have a low effect on deforestation in PA. However, the creation of a hunting game section in the buffer zone of the reserve should furnish economic incomes to the populations and may lead to a decrease of deforestation if sensitization is efficient. Though, this activity will start later in the REDD project.

On the other hand, development of sustainable agricultural techniques and of cash crop value chain will furnish alternative to subsistence activities to population affected by the project as explained previously. However, to be effective, these activities require relatively long periods of demonstration to convince beneficiaries and so, to increase the rate of adoption. Hence, effectiveness of the project increase slowly. To still improve effectiveness with time to reduce deforestation, new funds of the project (through carbon credits or other) will be oriented toward new beneficiaries to improve the scale of implementation.

Regarding those considerations, the mean project effectiveness is estimating at 32% of deforestation reduction over 10 years but should raise 69% at the end of the first baseline period (in 2021). The project effectiveness is expected to remain stable after this 10 years period.

**Table 25: assessment of the evolution of project activities effectiveness along the baseline period**

| baseline period | | effectiveness of activities | | | | | |
|---|---|---|---|---|---|---|---|
| number of years | year of start | buffer zone creation 2011 | GNR management 2011 | agro-ecology 2013 | cash crop 2017 | hunting zone 2018 | total |
| 0 | 2011 | 2% | 0% | 0% | 0% | 0% | **2%** |
| 1 | 2012 | 5% | 2% | 0% | 0% | 0% | **7%** |
| 2 | 2013 | 5% | 2% | 3% | 0% | 0% | **10%** |
| 3 | 2014 | 10% | 2% | 5% | 0% | 0% | **17%** |
| 4 | 2015 | 10% | 2% | 10% | 0% | 0% | **22%** |
| 5 | 2016 | 10% | 2% | 20% | 0% | 0% | **32%** |
| 6 | 2017 | 10% | 2% | 30% | 5% | 0% | **47%** |
| 7 | 2018 | 10% | 2% | 35% | 10% | 0% | **57%** |
| 8 | 2019 | 10% | 2% | 35% | 15% | 1% | **63%** |
| 9 | 2020 | 10% | 2% | 40% | 15% | 2% | **69%** |
| 10 | 2021 | 10% | 2% | 40% | 15% | 2% | **69%** |
| average | | **8%** | **2%** | **20%** | **5%** | **0%** | **36%** |

Based on this analysis of expected project effectiveness, ex-ante project emissions due to deforestation were calculated with a direct application of the effectiveness percentage on baseline emissions in the project area. Results are presented in the following table. They show an estimation of total project emissions **after 10 years of 1,136,187 tCO₂eq that correspond to a decrease of 784,833 tCO₂eq in comparison to the baseline scenario**. All other sources of carbon or other greenhouse gas emissions are not considered as significant (below the threshold of 20%). Results are presented over a 10 years period because after, a revision of the baseline is planned (see VCS PD). Nevertheless, with a constant effectiveness from the 11th year and a constant emission rate in the baseline case, the cumulated emissions reduction **after 20 years would be 3,384,227 tCO₂eq**. Hence, the anticipated net climate impact of the project is predicted to be positive.

**Table 26: ex-ante assessment of project emissions as a result of deforestation based on project effectiveness analysis**

| baseline period | | emission due to unplanned deforestation in tCO₂eq | | | | | |
|---|---|---|---|---|---|---|---|
| number of years | years | baseline case | | project scenario | | difference between baseline and project scenarios | |
| | | annually | sum | annually | sum | Annually | sum |
| 1 | 2012 | 171,938 | 171,938 | 159,902 | 159,902 | - 12,036 | **- 12,036** |
| 2 | 2013 | 176,406 | 348,344 | 158,765 | 318,667 | - 17,641 | **- 29,676** |
| 3 | 2014 | 180,873 | 529,217 | 150,125 | 468,792 | - 30,748 | **- 60,425** |
| 4 | 2015 | 185,341 | 714,558 | 144,566 | 613,358 | - 40,775 | **- 101,200** |
| 5 | 2016 | 189,808 | 904,366 | 129,070 | 742,428 | - 60,739 | **- 161,938** |
| 6 | 2017 | 194,276 | 1,098,642 | 102,966 | 845,394 | - 91,310 | **- 253,248** |
| 7 | 2018 | 198,743 | 1,297,385 | 85,460 | 930,853 | - 113,284 | **- 366,532** |
| 8 | 2019 | 203,211 | 1,500,596 | 75,188 | 1,006,041 | - 128,023 | **- 494,554** |
| 9 | 2020 | 207,678 | 1,708,274 | 64,380 | 1,070,422 | - 143,298 | **- 637,853** |
| 10 | 2021 | 212,146 | 1,920,420 | 65,765 | 1,136,187 | - 146,381 | **- 784,233** |

Furthermore, emissions due to leakage in the LB are to be deducted from the emission reductions in the project scenario as required by the VDM0010 module (LK-ASU) of the VM0007 methodology.

The following steps have to be respected:

- Step 1: estimation of baseline carbon stock changes and GHG emissions in the LB. This step was fulfilled in section 2.4 of the VCS PD;

- Step 2: estimation of the proportions of area deforested by immigrant and local deforestation agents in the baseline;

- Step 3: estimation of unplanned deforestation displaced from the PA to the LB;

- Step 4: estimation of unplanned deforestation displaced from the PA to outside of the LB;

- Step 5: emissions from activity shifting in peatland drainage. This project is not concerned by this step as there is no peatland in any project zones;

- Step 6: emissions from leakage prevention activity;

- Step 7: estimation of total leakage due to the displacement of unplanned deforestation.

The details of these steps are described in the VCS PD, section 3.3.

The only activity implemented by the project that constrains the activities of the agents of deforestation is the creation of the buffer zone (project area). However, this will not limit the rights of population for land appropriation for agriculture (see section 2.1.4). The only existing limitations apply to the collection of some non-timber forest products and to hunting practices, restraining specific technics and defining proper periods for those activities. Moreover, the local population is not used to migrate as long as resources are sufficient (which is still the case with relatively high forest cover) and security ensured

(after the civil war, for instance, high level of migration movements were observed with people returning to their initial homes, which they had left due to outbreaks of violence).

Nevertheless, the settlements of population after the war in areas located next to elephant habitats, combined with emerging conservation initiatives aiming at protecting and increasing again the elephant population, could trigger conflicts between farmers and elephants. As a consequence, agricultural fields may be moved to areas located further from villages (no displacement of habitations) and from the Reserve (outside of the RNG buffer zone). This would contribute to a decrease of deforestation in the PA, while increasing it in the LB. To our knowledge of the area, this concerns only few villages in the south of the PA. Hence, **we estimate leakage due to displacement of the activities of deforestation agents at 5% each year of the baseline period**. The other sources of potential leakage are estimated to be null.

As a result of the estimation of the effectiveness of leakage prevention activities and of the potential leakage of unplanned deforestation due to displacement of agents of deforestation, it is evaluated that leakage would correspond to 5% of project emission baseline. It corresponds to **96,021 tCO$_2$eq** additional emissions in the LB during the 10 years baseline period (Table 25).

**Table 27: Ex-ante assessment of emissions in the leakage belt due to displacement of unplanned deforestation based on emissions estimation in the project case**

| Emission due to unplanned deforestation in tCO$_2$eq | | | |
|---|---|---|---|
| Number of years | Baseline case for LB | Baseline case for PA | Expected leakage (5% of baseline for PA) | Total emissions expected in LB with project scenario |
| 1 | 230,602 | 171,938 | 8,597 | 239,198 |
| 2 | 236,593 | 176,406 | 8,820 | 245,414 |
| 3 | 242,585 | 180,873 | 9,044 | 251,629 |
| 4 | 248,577 | 185,341 | 9,267 | 257,844 |
| 5 | 254,569 | 189,808 | 9,490 | 264,059 |
| 6 | 260,561 | 194,276 | 9,714 | 270,274 |
| 7 | 266,553 | 198,743 | 9,937 | 276,490 |
| 8 | 272,544 | 203,211 | 10,161 | 282,705 |
| 9 | 278,536 | 207,678 | 10,384 | 288,920 |
| 10 | 284,528 | 212,146 | 10,607 | 295,135 |
| Total | 2,575,648 | 1,920,420 | 96,021 | 2,671,669 |

Following the estimation of emissions due to leakage, according to the VM0007 methodology, the total net greenhouse gas emissions reductions of the GNR REDD project are calculated as follows:

$$C_{REDD,t} = \Delta C_{BSL} - \Delta C_P - \Delta C_{LK}$$

Where:

$C_{REDD,t}$ = Total net greenhouse gas emission reductions at time $t$; t $CO_2$-e

$\Delta C_{BSL}$ = Net greenhouse gas emissions under the baseline scenario; t $CO_2$-e (cf. section 3.1)

$\Delta C_P$ = Net greenhouse gas emissions within the project area under the project scenario; t $CO_2$-e (cf. section 3.2)

$\Delta C_{LK}$ = Net greenhouse gas emissions due to leakage; t $CO_2$-e (cf. section 3.3)

Results are presented in the following table. Based on the previous sections and on the calculations for the baseline in the PA, the project emissions reductions and the expected leakage, **it is expected that after 10 years of implementation, the Project will achieve net emission reductions of 685,212 tCO₂eq.**

**Table 28: Ex-ante assessment of total net greenhouse gas emission reductions for the GNR REDD project along the 10 years baseline period**

| Year | Estimated baseline emissions or removals (tCO₂eq) | Estimated project emissions or removals (tCO₂eq) | Estimated leakage emissions (tCO₂eq) | Estimated net GHG emission reductions or removals (tCO₂eq) |
|---|---|---|---|---|
| 1 | 171,938 | 159,902 | 8,597 | 3,439 |
| 2 | 176,406 | 158,765 | 8,820 | 8,820 |
| 3 | 180,873 | 150,125 | 9,044 | 21,705 |
| 4 | 185,341 | 144,566 | 9,267 | 31,508 |
| 5 | 189,808 | 129,070 | 9,490 | 51,248 |
| 6 | 194,276 | 102,966 | 9,714 | 81,596 |
| 7 | 198,743 | 85,460 | 9,937 | 103,347 |
| 8 | 203,211 | 75,188 | 10,161 | 117,862 |
| 9 | 207,678 | 64,380 | 10,384 | 132,914 |
| 10 | 212,146 | 65,765 | 10,607 | 135,773 |
| **Total** | **1,920,420** | **1,136,187** | **96,021** | **688,212** |

For the VCS PD, the expected amount of carbon credits, VCUs, is calculated after deducing a buffer due to the non-permanence risk (see VCS PD, Appendix 1 ) and uncertainties in the estimation of Project emissions (see VCS PD, section 3.4.3) as required by VCS standards and VM0007 methodology. Those buffers were estimated to be 10% and 0% respectively (see VCS PD, section 3.4). As a consequence, the ex-ante estimation of VCUs to be generated during the first 10 years is 619,391 VCUs (see VCS PD, section 3.4.4).

### 3.3.    Offsite Climate Impacts (Leakage) (CL3)

### 3.3.1.    Types of Expected Leakage (CL3.1 and CL3.3)

The only activity implemented by the project that constrains the activities of deforestation agents is the creation of the buffer zone (project area). However, this will not limit the rights of population for land appropriation for agriculture (see section 2.5). The only existing limitations under the management plan are for collection of some non-timber forest products that should remain sustainable and for hunting with selective technics and at specific periods. Moreover, migrations do not take part of the habits of local populations if resources are sufficient (which is still the case with relatively high forest cover) and if there is no security reason (after civil war, high level of migrations were observed, population returning to their initial settlements)[20]. Nevertheless, resettlements of population after the war in areas close to elephant habitats and the conservation politics of the species that should lead to an increase of the elephant populations can contribute to an increase of conflicts between farmers and elephant. As a consequence, it could be observed some displacements of fields to more remote areas from the village (no displacement of habitations) and the reserve, outside of the GNR buffer zone. This would contribute to a decrease of deforestation in PA while it increases in LB. According to our knowledge of the area, this concern only few villages in the south of PA. Hence, **we estimate that the leakage due to displacement of the activities of deforestation agents will probably be low, around 5% each year of the baseline period**.

Moreover, Zambezia Province is one of the most forested area in Mozambique with Cabo Delgado and Niassa provinces at the North of the country. Particularly, in Zambezia province, the GNR and its surrounding represent the larger piece of existing dense forest cover. Moreover, in the whole country, zones around main roads show high level of deforestation. Hence, if population of the project zone would have to migrate to practice agriculture (largely first cause of deforestation in the whole province – cf. ER-PIN), it is unlikely that they would go further than the boundary of LB. Hence, **we estimate the unplanned deforestation displacement from PA to outside LB at 0%.**

As a result of the estimation of effectiveness of leakage prevention activities and potential leakage of unplanned deforestation due to displacement of agents of deforestation, it is evaluated that leakage would correspond to 5% of project emission baseline. It corresponds to **96,021 tCO2eq** additional emissions in LB after 10 years of baseline period (Table 25). All other sources of carbon or other greenhouse gas emissions are not considered as significant (below the threshold of 20%).

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[20]According to a survey led in 15 communities around the PA (in 2015), only 2% of the interrogated persons (n=135) were recent immigrants that settled in the area less than 5 years ago. All other immigrants (7%) settled more than 15 years ago and, main proportion settled more than 30 years ago.

**Table 29: ex-ante assessment of emissions in the leakage belt due to displacement of unplanned deforestation based on emissions estimation in the project case**

| emission due to unplanned deforestation in tCO2eq | | | |
|---|---|---|---|
| number of years | baseline case for LB | baseline case for PA | expected leakage (5% of baseline for PA) | total emissions expected in LB with project scenario |
| 1 | 230,602 | 171,938 | 8,597 | 239,198 |
| 2 | 236,593 | 176,406 | 8,820 | 245,414 |
| 3 | 242,585 | 180,873 | 9,044 | 251,629 |
| 4 | 248,577 | 185,341 | 9,267 | 257,844 |
| 5 | 254,569 | 189,808 | 9,490 | 264,059 |
| 6 | 260,561 | 194,276 | 9,714 | 270,274 |
| 7 | 266,553 | 198,743 | 9,937 | 276,490 |
| 8 | 272,544 | 203,211 | 10,161 | 282,705 |
| 9 | 278,536 | 207,678 | 10,384 | 288,920 |
| 10 | 284,528 | 212,146 | 10,607 | 295,135 |
| total | 2,575,648 | 1,920,420 | 96,021 | 2,671,669 |

### 3.3.2.  Leakage Mitigation (CL3.2)

Leakage prevention activities as those implemented with communities to improve their yields and revenues in order to furnish alternative to slash and burn agriculture and so, deforestation. Main ones are the diffusion of agro-ecological techniques and support to the care of cashew tree plantation and on the value chain for exportation. They are presented with more details in section 2.1.7.

Main source of leakage would be due to an indirect impact of the project: it is related to the conservation of elephant populations that can induce field displacements outside the project area because of crops destructions by these animals. Measures to mitigate this leakage are those to decrease elephant/human conflicts with chili guns, as described in sections 4.2.2 and 5.3.1, concerned community members are formed to these techniques that allow to scare away elephants without hurting them and should prevent crop destructions as elephants will memorize the location of non-friendly areas. If not efficient enough, other technics with bees that prove their efficacy in other countries will be tested during the project.

### 3.4.  Climate Impact Monitoring (CL4)

### 3.4.1.  Climate Monitoring Plan (CL4.1)

### 3.4.1.1. Monitoring of carbon stocks

Only carbon pools included in the baseline will be monitored (see Table 19). In principle, carbon stocks included in the project should not change during the crediting period because forests of the project are mature. However, to maintain high quality information, it is planned to monitor carbon stocks of Miombo forest every 10 years (2021 and 2031). To guarantee comparability with current data, the same methodology for forest inventory as the one used for the present document will be used (see

section 3.1). As it was done for the present estimation, aboveground tree biomass will be derived from results of biomass forest inventory and the use of allometric equations and, belowground tree biomass will be estimated thanks to default values for the root-to-shoot ratio.

If the ZILMP jurisdictional program is effectively developed and performs forest inventory, results will be used for the monitoring of the GNR REDD project in order to guarantee consistency with subnational approaches.

### 3.4.1.2. Monitoring of project implementation

Information on geographic position of the project boundaries (PA and LB) and of any stratification must be provided.

As the project area is the forest cover inside the buffer zone of the GNR which boundaries are fixed by a national decree, there is no reason for this boundary to change unless there is a change of management strategy that would imply a monitoring of PA limits. In the same way, LB is based on a buffer of 8 km around PA (outside the GNR) and should not be modified if PA is not.

Finally, only one stratum, Miombo forest, is considered in the present document so, no monitoring of stratification is necessary.

### 3.4.1.3. Monitoring of land use and land cover changes

The monitoring of land use and land cover changes (deforestation) will be carry out with multi-date remote sensing analysis with the same methodology that the one used for the present document (described in Grinand et al., 2013). Medium resolution images will be used (30 m) for land cover change analysis and high resolution one (Google Earth) for calibration and validation of the maps. This analysis of deforestation will be done on PA and LB to allow the comparison of effective conditions to those estimated ex-ante for the baseline establishment in the case of the project scenario.

**At the end of each monitoring period (2016, 2021, 2026, 2031)** the following will be achieved to monitor areas of deforestation **in PA and LB**:

- Updating of the forest cover change map by detecting forest cover and land cover change over the 5 years of analysis (Grinand et al. 2013). An accuracy assessment will be realised and it will be verified that the quality of the mapping respects VM0007 requirements (see section 0)

- Extracting areas of deforestation on PA and LB for the monitoring period (5 years) and of the remaining areas of forest in PA and LB.

- Net carbon stock changes due to unplanned deforestation in PA and LB will be calculated by multiplying areas of deforestation by emission factors (net carbon stocks changes in tree biomass pool in $tCO_2eq/ha$) as presented in section 3.1.

**At the time of baseline revision (2021 and 2031)**, the same steps will be realised **in the RRD to update the forest cover benchmark maps** for the reference area. The baseline will be updated in consequence with calculation of ex-ante emissions on PA and LB.

### 3.4.1.4. Monitoring of forest degradation through wood extraction

According to VM0007 methodology, the project has to monitor significant source of emissions due to degradation of forest following M-MON module requirements.

In the case of GNR REDD project, 3 types of forest degradation through wood extraction could be accounting for:

- Illegal logging

- Harvesting wood for charcoal production

- Wood extraction for illegal mining activities

Illegal logging

Illegal logging in the project area is mainly targeted toward one species: *Pau ferro - Swartzia madagascariensis* (see section 1.1.1). M-MON module specifies that emissions from logging may be omitted if it can be demonstrated they are de minimis using T-SIG tool i.e. if they represent less than 5% of project emissions. No specific inventory was lead to assess the proportion of emissions due to illegal logging of pau ferro but this was estimated with forest inventory realised to assess carbon stocks of Miombo forest.

All inventoried *Paus ferros* were selected and the total biomass they represent was estimated following the same methodology as for tree carbon stocks estimation (using Chave et al. (2014) allometric equation). The proportion of *Paus ferros* biomass vs all other trees of the inventory was considered to represent the proportion of potential emissions due to illegal logging if all *Paus ferros* were harvested.

Over 100 forest inventory plots, 25 (1/4th) contained *Paus Ferros*. A total of 44 trees of this species were found on this plots. The represent a total of 9 tC while biomass of all inventoried trees is 1,130 tC. Hence, if all *Paus Ferros* of this inventory where cut down, this would represent emissions of 0.8 % of the biomass. Consequently, emissions due to forest degradation because of *Paus Ferros* illegal logging can be considered as not significant compared to those of unplanned deforestation and they will not be monitored.

However, regular participatory rural appraisal will be realised to assess if other species begin to be targeted for logging. If the number of species increases, a new estimation of emissions due to this activity will be done.

Charcoal production

As explained previously (section 1.1.1), few persons within the project area practice charcoal production. Main production around GNR is located in Gilé (Mercier et al., 2016) and tree selected for charcoal production are located on future field so, they will be felt down for slash and burn agriculture and charcoal production is not causing additional impact on carbon stocks decrease. Moreover, during the survey realised on villages around the project area, 6 persons over 135 (4%) were doing charcoal production at least once in a year.

This low proportion and the fact that charcoal production is associated to agricultural itineraries lead to the conclusion that charcoal production does not generate significant emissions compared to baseline.

Consequently, forest degradation due to this activity will not be monitored. However, regular survey will be realised and if the number of charcoal producers increase, a new estimation of emissions due to this activity will be done.

### 3.4.1.5. Monitoring of carbon stocks enhancement

No areas expected to be deforested in the baseline and assumed to accumulate carbon afterword have been identified for the GNR REDD project. Hence, no monitoring of carbon stocks enhancement will be realised.

### 3.4.1.6. Monitoring of project GHG emissions

Non-CO2 GHG emissions have to be estimated if they are significant (i.e. above 10 % of total emissions). Two sources of non-CO2 GHG emissions can exist for the GNR REDD project:

- Emissions from fossil fuel during the use of cars but as explained previously, emissions from this source is not significant as few distances are operated per month with 4 cars for the project distributed in the north and south-east of the project zone.

- Emissions from fires after the conversion of forest to cropland (slash and burn agriculture) and of grass in savannas or forest at the end of the dry season. Those emissions were not accounted for in the baseline as a conservative choice. First component will be monitored and included in the project emissions if they are found to be significant ex-post.

Emissions from biomass burning will be estimated following the VMD0013 module (E-PBP).

Emissions from biomass burning in the deforested lands (conversion of forest to fields):

Activity data for this part of emissions correspond to activity data for deforestation as almost all forest lands are converted for slash and burn agriculture (section 1.1.1). According to VMD0013 module, emissions will be estimated as follows:

$$E_{biomassburn,i,t} = \sum_{g=1}^{G} \left( \left( \left( A_{burn,i,t} \times B_{i,t} \times COMF_i \times G_{g,i} \right) \times 10^{-3} \right) \times GWP_g \right)$$

Where:

| | |
|---|---|
| $E_{biomassburn,i,t}$ | Greenhouse gas emissions due to biomass burning as part of deforestation activities in stratum $i$ in year $t$ of each GHG ($CO_2$, $CH_4$, $N_2O$) (t $CO_2$e) |
| $A_{burn,i,t}$ | Area burnt for stratum $i$ in year $t$ (ha) |
| $B_{i,t}$ | Average aboveground biomass stock before burning stratum $i$, year (t d.m. ha$^{-1}$) |
| $COMF_i$ | Combustion factor for stratum $i$ (unitless) |
| $G_{g,i}$ | Emission factor for stratum $i$ for gas $g$ (kg t$^{-1}$ d.m. burnt) |
| $GWP_g$ | Global warming potential for gas $g$ (t $CO_2$/t gas g) |
| $g$ | 1, 2, 3 ... $G$ greenhouse gases including carbon dioxide[1], methane and nitrous oxide (unitless) |
| $i$ | 1, 2, 3 ... $M$ strata (unitless) |
| $t$ | 1, 2, 3, ... $t^*$ time elapsed since the start of the project activity (years) |

The following default values will be used:

| variable | gas | value | source |
|---|---|---|---|
| B | - | 140.2 | Present document – section 3.1 |
| COMF | - | 0.45 | IPCC (primary open tropical forest) |
| $G_g$ | $CH_4$ | 6.8 | VMD0013 module for tropical forest |
| | $N_2O$ | 0.2 | |
| $GWP_g$ | $CH_4$ | 21 | IPCC, 2003 |
| | $N_2O$ | 310 | |

### 3.4.1.7. Organisation and responsibilities of parties involved for monitoring

Monitoring of the project will be assured by Etc Terra technical team that is composed of the following experts:

- Impact assessment and carbon monitoring expert based in France that will supervised all the monitoring process. This technical assistant will assure the design of the forest inventory plan following the method presented in the present document and the training of field agents if necessary. He will also design survey to perform participatory rural appraisal in order to assess if forest degradation is occurring in the project area. Finally, he will coordinate the different studies needed for the monitoring and collect all results produced by other experts to calculate carbon emissions and perform the entire monitoring plan.

- Remote sensing specialist also based in France will assure the updating of deforestation maps and of the monitoring of areas affected by fire. He will be responsible of the collection of appropriate data and of the treatment following the method presented in the present document. Results will be activity data for deforestation and areas affected by fires.

- Inventory and survey technician based in Gilé in Mozambique will assure field work with teams recruited locally when necessary. This technician will assure field work when necessary at each monitoring period. He will be previously trained by the carbon monitoring expert. Field work will be composed of biomass inventory and of survey for participatory rural appraisal. With daily presence in the field, he will also be responsible of the warning if exceptional anthropic or natural disturbances lead to deforestation or forest degradation and of the estimation of affected areas with the support of the two others technical assistants presented previously.

The GNR technical assistants will assure that data and methods used are consistent with those used in the present document to assure that results for project emissions are comparable to the baseline. If changes are done, they will be documented and justifications will be done on how changes do not affect the consistency of results. All results will be communicated for approval before diffusion to ANAC, the project proponent on the behalf of the Mozambican Government.

### 3.4.1.8. Data and Parameters Monitored

| Data / Parameter | $A_{def,PA,unplanned}$ |
|---|---|
| Data unit | ha/y |
| Description | Annual area of unplanned deforestation in PA during the monitoring period |
| Source of data | Map of deforestation during the monitoring period on PA |
| Description of measurement methods and procedures applied | Production forest cover change map on PA and LB by detecting forest cover and land cover change following the method described in Grinand et al. (2013), being the same method used for the ZILMP deforestation map used to establish the baseline. Images used will be from Landsat sensor to be consistent with data used for the establishment of the baseline at the dates of the monitoring periods. |
| Frequency of monitoring/recording | A deforestation map every 5 years at the dates of the monitoring period |
| Value applied: | - |
| Monitoring equipment | GIS software and Landsat satellite images |
| QA/QC procedures applied | An accuracy assessment will be realised with validation plots and a confusion matrix will be produce showing the map precision. |
| Purpose of data | • Calculation of project emissions |

| Calculation method | - |
|---|---|
| Comments | This data will also be used as activity data for the areas burnt for slash and burn agriculture in the estimation of emissions due to biomass burning during deforestation. |

| Data / Parameter | $A_{def,LB,unplanned}$ |
|---|---|
| Data unit | ha/y |
| Description | Annual area of unplanned deforestation in LB during the monitoring period |
| Source of data | Map of deforestation during the monitoring period on LB |
| Description of measurement methods and procedures applied | Production forest cover change map on PA and LB by detecting forest cover and land cover change following the method described in Grinand et al. (2013), being the same method used for the ZILMP deforestation map used to establish the baseline. Images used will be from Landsat sensor to be consistent with data used for the establishment of the baseline at the dates of the monitoring periods. If ZILMP is validated and maps are produced for the program, the GNR project will use those results according to the ER Program MRV procedures. |
| Frequency of monitoring/recording | A deforestation map every 5 years at the dates of the monitoring period |
| Value applied: | - |
| Monitoring equipment | GIS software and Landsat satellite images |
| QA/QC procedures applied | An accuracy assessment will be realised with validation plots and a confusion matrix will be produce showing the map precision. |
| Purpose of data | • Calculation of leakage |
| Calculation method | - |
| Comments | - |

| Data / Parameter | DBH |
|---|---|
| Data unit | cm |
| Description | Diameter at Breast Height |
| Source of data | Field biomass forest inventory |
| Description of measurement methods and procedures applied | In each plot of the biomass inventory, DBH of all trees is measured as a parameter of Chave equation. |

|  | Chave's allometric equation used:<br><br>$$AGB = 0.0673 \times (\rho D^2 H)^{0.976}$$<br><br>Where AGB is aboveground biomass, $\rho$ is wood density, H is tree height and D is diameter at breast height.<br><br>Wood density for each species encountered during inventories is selected from the global wood density database (Zanne et al. 2009; Chave et al. 2009). Carbon stocks from AGB is calculated thanks to carbon fraction which is estimated to be 0.47 tC/tdm (IPCC, 2003). |
|---|---|
| Frequency of monitoring/recording | Every 10 years |
| Value applied: |  |
| Monitoring equipment | DBH is measured with a measuring tape |
| QA/QC procedures applied | Forest expert will supervise field inventory and check the database. |
| Purpose of data | Calculation of baseline emissions (baseline renewal) |
| Calculation method | The parameter is used in Chave equation to calculate biomass per tree. Carbon stocks is then calculated by plot by adding all trees' biomass. |
| Comments |  |

| Data / Parameter | H |
|---|---|
| Data unit | m |
| Description | Tree Height |
| Source of data | Field biomass forest inventory |
| Description of measurement methods and procedures applied | In each plot of the biomass inventory, H of all trees is measured as a parameter of Chave equation. |

| | Chave's allometric equation used:<br><br>$$AGB = 0.0673 \times (\rho D^2 H)^{0.976}$$<br><br>Where AGB is aboveground biomass, $\rho$ is wood density, $H$ is tree height and $D$ is diameter at breast height.<br><br>Wood density for each species encountered during inventories is selected from the global wood density database (Zanne et al. 2009; Chave et al. 2009). Carbon stocks from AGB is calculated thanks to carbon fraction which is estimated to be 0.47 tC/tdm (IPCC, 2003). |
|---|---|
| Frequency of monitoring/recording | Every 10 years |
| Value applied: | |
| Monitoring equipment | Tree height is measured with an electronic clinometer |
| QA/QC procedures applied | Forest expert will supervise field inventory and check the database. |
| Purpose of data | Calculation of baseline emissions (baseline renewal) |
| Calculation method | The parameter is used in Chave equation to calculate biomass per tree. Carbon stocks is then calculated by plot by adding all trees' biomass. |
| Comments | |

| | |
|---|---|
| Data / Parameter | $C_{AB,tree}$ |
| Data unit | $tCO_2eq/ha$ |
| Description | Carbon stock in aboveground tree biomass of Miombo forest stratum |
| Source of data | Field biomass forest inventory |
| Description of measurement methods and procedures applied | Method is described in Mercier et al., 2016. Biomass will be estimated with forest inventory of the same characteristic as those used for the present document and the Chave et al. (2014) allometric equation will be used. This is the common method recommended by the VM0007 methodology. |
| Frequency of monitoring/recording | Every 10 years |
| Value applied: | $242.3\ tCO_2eq/ha$ |
| Monitoring equipment | DBH is measured with a measuring tape and tree height with an electronic clinometer |

| QA/QC procedures applied | Forest expert will supervise field inventory and check the database. |
|---|---|
| Purpose of data | Calculation of baseline emissions (baseline renewal) |
| Calculation method | Activity data are multiplied by carbon stocks changes (before and after deforestation) as presented in section 3.1 |
| Comments | Miombo forest is the only forest stratum considered in this document<br>Carbon stock in belowground tree biomass is calculated by applying a default factor from IPCC as presented in section 3.1 |

| Data / Parameter | Existence of forest degradation in PA |
|---|---|
| Data unit | - |
| Description | Assessment if forest degradation occurs in PA due to illegal logging – specification of the species targeted – and/or charcoal production or if new activities leading to degradation have been developed. |
| Source of data | Participatory rural appraisal |
| Description of measurement methods and procedures applied | Surveys degradation in communities around PA about activities leading to forest. Types of activities, location and level of pressure will be established. If a significant proportion of households declares that degradation occurs in the area, dedicated forest inventories will be realised |
| Frequency of monitoring/recording | Every 5 years from validation |
| Value applied: | - |
| Monitoring equipment | Identify equipment used to monitor the data/parameter including type, accuracy class, and serial number of equipment, as appropriate. |
| QA/QC procedures applied | - |
| Purpose of data | • Calculation of project emissions |
| Calculation method | - |
| Comments | - |

### 3.4.2. Dissemination of Monitoring Plan and Results (CL4.2)

The monitoring plan have been presented with simplification during the consultation phase and it is available at Museïa camp, the base of the project proponent team. All partners could read it and comment it before submission to validation. The project proponent is in charge of diffusing the reports to the relevant government teams.

Monitoring results will be shared with partners immediately after the monitoring events before verification and they will also be communicated to communities through field agents that are permanently present in villages with a diffusible format: small report with main figures will be prepared and distributed to field

agents. Each monitoring reports will be also available at Museia camp or on internet on the VCS project database website.


### 3.5. Optional Criterion: Climate Change Adaptation Benefits

The project is not claiming exceptional climate benefits and does not seek to be validated for climate change adaptation benefits.

# 4. COMMUNITY

### 4.1.    Without-Project Community Scenario (CM1)

### 4.1.1.    Descriptions of Communities at Project Start (CM1.1)

*Subdivision of the territory and demographic information*

In Mozambique, each province is divided into Districts, which are themselves composed of Administrative posts (*Postos administrativos*). The Administrative posts comprise several Localities, in which various Quarters are defined (*Bairro/Povoação*). Inside the Quarters, the Zones (*Zona/Povoado*), which are made up of various households.

The Project Zone is divided between two Districts, belonging to the Province of Zambézia: North, the district of Gilé and, South, the district of Pebane. In Gilé district, Gilé Sede are the only Administrative post located within the GNR's boundaries, and is divided in three localities[21] (localidade Sede, Naheche and Nanhope). In Pebane district, there is three Administrative posts within the GNR's neighborhood: Naburi (comprising the localities of Naburi Sede, Namahipe and Etaga) and Mulela (comprising the localities of Mulela Sede, Malema and Mucocoro) and Pebane sede (locality of Impaca). Accordingly, the « communities » defined and described on section 2.1.6, are administratively called « *Bairro* » or « *Povoação* ».

Along with this administrative subdivision, a more traditional one, called « *Regulado* », also exists. As described below, the *régulo* or *rainha* is a traditional headman, man or woman, who manages a variable territory (*Regulado*), generally larger than a Quarter, but smaller than a Locality.

The table below shows demographic data on a 20 km perimeter around the GNR, which includes the Project Zone and the main towns on its vicinity (Gilé, Etaga, Naburi).

**Table 30: Population in Gilé and Pebane districts**

| District | Administrative post | Locality | Population (2007) | Total population (2007) | | Projected (2012)* | Projected (2032)* |
|---|---|---|---|---|---|---|---|
| Gilé | Gilé-sede | Localidade sede | 19,882 | 34,023 | 110,819 | 125,236 | 156,801 |
| | | Naheche | 4,393 | | | | |
| | | Nanhope | 9,748 | | | | |
| Pebane | Naburi | Naburi sede | 27,580 | 37,729 | | | |
| | | Namahipe | 3,788 | | | | |

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[21]A locality encompasses several communities

| | Etaga | 6,361 | | | | | |
|---|---|---|---|---|---|---|---|
| Mulela | Mulela sede | 9,954 | 33,573 | | | | |
| | Malema | 20,273 | | | | | |
| | Mucocoro | 3,346 | | | | | |
| Pebane Sede | Impaca | 5,494 | 46 801 | | | | |

\* With regards to Gilé and Pebane's population growth, as estimated by the Mozambican National Institute of Statistics, on the basis of the last national census (INE 2007a; INE 2007b).


In 2012, the rural population around the Project Zone was estimated to be 30,000 people, mainly located on the North, South and East of the Reserve. It is expected to grow quickly. Further, in 2012, 58% of the population was less than 20 years old (Table 30): according to INE estimations, this tendency will continue for the 20 years to come.

## Population distribution according to age and gender
### Districts of Gilé and Pebane, INE estimations for 2012
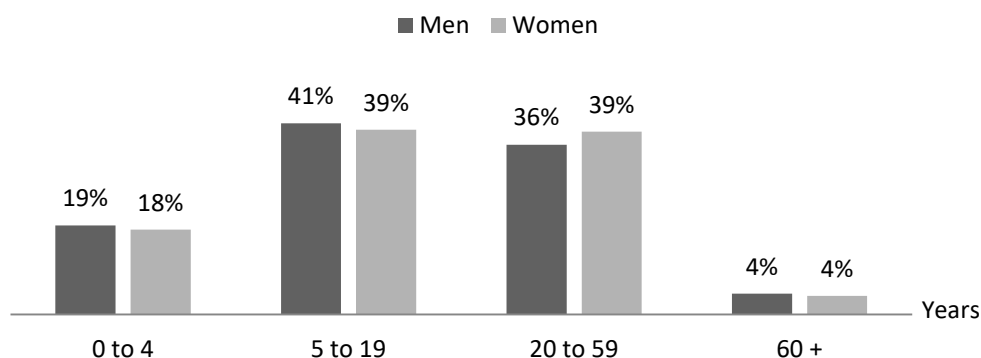


**Figure 15: Population distribution by age and gender in the districts of Pebane and Gilé**


*Recent history and migration movements*

The Portuguese administration government, who created the GNR in 1932, managed it until the independence of Mozambique in 1975. The following civil war that opposed the Frelimo (now governmental party) to the Renamo (opposition party), during almost twenty years, hugely affected the GNR and its surroundings, that became a « meat-safe » zone for local population and fighters located in the area. In parallel, it placed most dwellers in a position of extreme vulnerability and constrained them to take refuge in the nearby Pebane urban centre, alongside the coasts and inside the GNR (Lizon 2002). « *This period is remembered as one of acute shortages as insecurity in rural areas precluded the possibility of engaging in agricultural production and there were several epidemic outbreaks in the displacement camps. Malnutrition also increased, as rations were meagre* » (*ibid,* p. 12). Further, the conflict also increased the divisions within the communities, as an important part of the population participated to the war; it eroded the traditional power structures (*regulado*), by imposing a parallel power

structure affiliated to the Frelimo Government. In addition, the destruction of the main infrastructures, regional industries and plantations limited off-farm jobs opportunities, making people be increasingly dependent on forest resources (*ibid.*, p. 3).

After the war, people moved from the GNR to areas closer to the roads and/or remained in the main urban centres. More recently, new immigration movements from the Nampula Province or nearby districts are growing, mainly for logging, poaching or mining purposes.

### *Current livelihoods, constraints and opportunities*

Accoring to the CCB definition of indigenous people[22], there is no such group in the project zone. Most of the local population pertains to the same Elomwé ethnic group, one of the 20 groups recognized in Mozambique (Fusari et al. 2010). Mother tongues are shared between Lomwé and Macua, both belonging to the Bantu linguistic group. Portuguese is a widespread second or third language.

The surroundings of the GNR are composed of three main dirt roads (*estrada*), with a bad quality of maintenance, along which are located the majority of the communities. Some of them can only be reached by sandy pathways. Due to the numerous rivers, mostly on the East and South, several bridges are scattered along the roads, but they are not always operational.

Some of the infrastructures are found in most of the communities. In the project zone, 14 Quarters (*Bairro/Povoação)* possess a local Committee for the Management of the Natural Resources (CGRN or *Comité de Gestão dos Recursos Naturais*), today seen by local populations as the only community's building. The CGRN were created by the NGO COSV in order to help local communities manage their natural resources, to lower the impact of uncontrolled wildfires and to develop "Economic Concerned Groups". Their implementation was preceded by an explanation phase of their functioning and objectives, between 2008 and 2009.

In the same way, almost all of the localities and quarters have primary schools. However, secondary schools are only located in Naburi and Gilé, with limited access for the majority of households. Likewise, although health centres are well disseminated, most hospitals are located in remote areas and are not sufficient to prevent the expansion of sexual diseases and malaria, this last being one of the main causes of children mortality (despite mosquito nets being distributed by some NGOs). Access to clean water is limited, especially at the end of the dry season (September to November), particularly for households living away from water sources and fountains; stagnant water during drought also increases the risks of diseases. Although some communities have water fountains rather than traditional water wells, those are not common enough. Similarly, no community has access to electricity.

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[22] Used in a generic sense to refer to a distinct, vulnerable social and cultural group possessing the following characteristics in varying degrees: 1) Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; 2) Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; 3) Customary cultural, economic, social, or political institutions that are separate from those of the dominant society or culture; and 4) An indigenous language, often different from the official language of the country or the region.

Forests are essential to households, providing for firewood, food, medicine and spiritual functions – this is especially true at the end of the rainy season, which is often a period of food shortage. As detailed in the table below, households are particularly vulnerable between October and March, when food and water become scarcer (according to the agrarian calendar of (Berton 2013), presenting the main crops' production).

**Table 31: Agrarian calendar on the project zone adapted from Agrisud International (Lamarre, 2015)**

| | Dry season | | | | | OS* | Wet season | | | | | OS* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jully | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March | April | May | June |
| Slash & burn period | Cutting | down | | Burning | | | | | | | | |
| Cassava | | Growing | | Harvesting | | Seeding | | | | | | |
| Maize | | | | | | | | | | | | |
| Cashew tree | TR** | | | | | | | | | | | |
| Groundnut | | | | | | | | | | | | |
| Pigeon pea | | | | | | | | | | | | |
| Cow pea | | | | | | | | | | | | |
| Velvet bean | | | | | | | | | | | | |
| Lack of water | | | | | | | | | | | | |
| Food shortage | | | | | | | | | | | | |

*: Off-season

**: Treatments of cashew tree

In the Province of Zambezia, most households are living on rural areas and 93% of the 1.2 million of people are involved in agriculture activities (MITADER 2015), mainly for subsistence purposes. According with the last quantitative survey carried in 2015 on the GNR's vicinity, 98% of the population living in the Project Zone practice agriculture as main activity. The production systems are characterised by shifting cultivation, inter-cropping and a low level of agricultural inputs for the intensification of the production. Daily agricultural activities are manual. Children can be involved for harvesting (from March to June) and planting (during the first rains of December and January) as well as other family members during the slash-and-burn period (that is, the end of the dry season). Livestock is very limited - with few goats, sheep and chickens - and cattle is extremely rare. The dominant crops are cassava, maize, bean, groundnut and rice, a part being profitable, but other commodities, as cashew and sesame, contribute to more than 50 % of household's income (Table 32). During the 1950's – 1980's period, Mozambique used to be one of the world main producer and exporter of cashew nuts (Rabany 2014). However, the orchards - most of which were composed of trees that had been planted in the colonial era - were abandoned during the civil war. Since then, no attention was given back to the production of cashew nuts in the country (Lizon 2002). Although cashew production used to be a significant source of income,

today, the ageing of the trees and their poor maintenance affect yields and rural incomes. Lastly, expansion of slash and burn agriculture is expected to increasingly infringe on forests in the project zone, due to population growth: « *there is evidence that increased population pressure has led to forest clearing for agricultural purposes. Furthermore, increased agricultural production levels are being achieved through increased extensification of production given the low levels of inputs and appropriate techniques that characterise the system* » (*ibid.* p. 13).

**Table 32: Main crops and their part on households' incomes in 2014 (From Lamarre, 2015)**

|  | Cashew | Sesame | Cassava | Groundnut | Black-eyed pea | Maize | Pigeon pea | Rice | Sweet potatoes |
|---|---|---|---|---|---|---|---|---|---|
| **Proportion sold (estimation)** | 95% | 100% | 50% | 27% | 55% | 37% | 32% | 10% | 20% |
| **Price (MZN/kg)** | 10 to 15 | 30 to 35 | 5 to 7 | 10 to 15 | 8 to 10 | 4 to 6 | 8 to 10 | 10 to 12 | 3 to 4 |
| **Price (USD/t)** | 330 to 500 | 1,000 to 1,200 | 166 to 233 | 330 to 550 | 266 to 330 | 133 to 200 | 266 to 330 | 330 to 400 | 100 to 133 |
| **Period of commercialization** | Nov-Dec | July | Oct-Nov | April-May | June-July | June-July | Sept-Oct | July | July |

As a result of few off-farm opportunities, informal and unsustainable other income-generating activities are increasing on the GNR's boundaries as poaching, mining and illegal logging for precious wood. Admittedly, Mozambique is one of the countries with the lowest Human Development Index (HDI) in the world – ranked 178 out of 187 countries in 2015. In order to estimate poverty rate in the project zone, a statistic survey was conducted in 2015, with a sample of 135 households in various rural quarters around the GNR. According to the PPI (progress out poverty index[23]) livelihood indicators (Schreiner and Dezimahata Lory 2013; COSA 2014), the probability for a household of these communities to live under the 2$/day poverty line is 87.9% (2005 $/Mts exchange rate). According to a study led around the GNR, revenue from the sale of NTFP is very variable between communities but in average, it currently represents less than 10% (Romann 2016).

***Belief system***

Most of the people living in the districts of Gilé and Pebane are Christians, but the Muslim religion prevails on the coasts (Fusari et al. 2010), due to the influence of pre-colonial Muslim settlings. In addition, various forms of animism also exist, headmen called *regulos* (or *rainhas* for women) being, all at once, middlemen between the population and their ancestors and essential figures for the resolution of communities' internal issues. Consequently, local authority systems can be declined in two ways: the traditional system and the political administration system.

The *regulos* are in charge of traditional ceremonies execution, particularly when rains are late. The most common sacred sites, where deities and spirits are believed to reside, possess one particular tree called

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[23] http://www.progressoutofpoverty.org/fr

*mutholo*. Such sites are likely to be inside or close to the communities' areas. People, with the *regulo*, often make symbolic offerings (cassava or maize flour, local alcohol, etc.) to support their requests (in relation to rain shortage, disease, etc.). Others sacred sites exist along those, such as stones, rivers, sites that are linked to historical events such as the Civil War, etc. They are often associated to various holy entities (ancestors, spirit of dead chiefs, etc.) (*ibid* p. 456).

### *Land resources management and distribution of authority*

Whilst *regulos* are responsible for land management for the communities in the project zone, the political system's local agents are in charge of administrative fields. At the local level, these agents are structured according to a pyramidal hierarchy: the *sangira* (or *buco*)*,* responsible for the Zones (households' clumps called *zona/povoado*), is under the authority of the *samassoa* (community's chief), responsible for a quarter (*bairo/povoação*), of which the limits were defined both by the Portuguese colonial administration and the Frelimo administration. Thus, the locality's chief is in charge of few quarters, typically 2 or 3.

*Regulos*, village headmen, are in charge of a territory management and can act as mediators for communities' relationships with ancestral spirits and, sometimes, as judges for local problems resolution (Convery 2006). This traditional system has its roots in the Portuguese colonial regime. In order to control and tax the population, it leant on some chiefs and existing lineage power of the customary governance. In practice, *regulos* were considered as government officers, although « *[they]* *continued to represent a level of spiritual authority* » (*ibid* p. 451). Today, they still fulfil three main roles:

- Conflicts resolution (principally for theft and witchcraft);
- Land and resources allocation;
- Spiritual leadership on their own territory sometimes completed with traditional witchdoctors and healers (*curandeiros*).

In addition, a range of other authority figures also characterizes the communities. First, some of the elderly, highly respected, may take an active part in the communities' assemblies; their opinion and advises are always expected. Second, the traditional healers (*curandeiros*) assist *regulos* in the traditional ceremonies, solve moral or witchcraft issues and give advices to people and other local leaders. Third, religious leaders (Roman Catholicism, Christian's Church, Protestant Baptiste Church and Islam, especially alongside the coasts) play an adviser role and sometimes resolve social issues. Finally, a local representation of the Frelimo Party can be solicited and sometimes influence local decisions.

### 4.1.2. High Conservation Values (CM1.2)

**HCV 4: areas that provide basic ecosystem services**

**Rivers and nearby forests**

Rivers and nearby forests bring essential services to the community members. The HCV 4 refers to areas that provide basic ecosystem services to local populations in critical situations, especially in terms of supply and regulation services (Stewart, 2010; Brown et al. 2013). In the without project scenario, we should expect deep hydric stresses with serious consequences for local populations. Hence, in project scenario, the main rivers of the project zone should be defined as HCV4 and protected. This HCV is mapped on Figure 4.

Because of regular hydric stresses during the end of the dry season (from September to November), one of the main preoccupations of local communities is the access to clean water (Materrula et al. 2009). In addition to traditional water wells, some improved fountains have been built by national or international NGOs, but they still are too few and sometimes far distant. In this context, rivers are often the main access to water, although they may be dried up during the dry season. The North-western part of the Project Zone is deeply disadvantaged in terms of water access, may it be for people or livestock: rivers are scarce and fountains are far. In this context, some riversides are progressively appropriated by some of the community members with the aim of digging traditional water wells for their own family. As a consequence, community members living away from the fountains are the most vulnerable to water stress, especially when they cannot create their own water wells on riverbanks. The consequences of deforestation, in terms of clean water availability, would favour social conflicts for water access and could have severe consequences on human health.

Since local population is using the rivers located in the project area (GNR buffer zone), the project is not expected to have any negative impact on clean water availability. Indeed, reduction of deforestation will contribute to the protection of water resources.

**HCV 5: areas that are fundamental to meet needs of local communities**

**Forest resources**

HCV 5 refers to fundamental areas to meet needs of local communities, in terms of feeding, health, etc. (ibid.). According to Lizon (2002), mainly based on participatory survey techniques, wild resources constitute an important part of households' livelihood strategies:

- They may be more available than resources linked to other agriculture and consist of fuel wood, mushrooms harvesting, fresh water fisheries, honey, animal proteins through hunting and invertebrate gathering, etc;
- They enable diet diversification and adaptive strategies in times of food shortage, especially during the rainy season, when households are extremely dependent on Non-Timber Forest Products;
- They may generate local monetary incomes, in a context of limited off-farm income-earning opportunities;
- Specific animal and plant species may be used for traditional reasons (medicine or traditional ceremonies).

Such resources include firewood, timber and other construction materials, game, fresh water, fishes and medicinal plants - which are harvested all year long - as well as mushrooms, caterpillars, and honey –

which are exclusively harvested at rainy season start. According to Lizon's study, « each household consumes 330 meals per year that contain any of these resources » (2002, p.3).

Most of the resources are available in all forested areas, but the closer communities are to the GNR, the higher is their dependence on its forest resources (op.cit), especially when no other forest is available. According with Lizon (2002) and Fusari et al. (2010), the Table 33 presents a calendar of collection of the main resources harvested in forest. However, land conversion for agricultural purposes may lower the availability of wild resources in the Project Area and, consequently, threaten local populations' subsistence during food shortage periods.

Ultimately, forested areas, enabling people to harvest products that are essential to their subsistence, should be defined and managed as HCV 5. It is composed of all forest in the project area (forests which the project aims to protect) and in the surroundings of the reserve in project zone. Accordingly, a Management Plan of Forest Resources is being drafted. In project scenario, the main activities seek to dwindle pressure on forested areas.

**Table 33: Calendar of forest products collection (From Lizon, 2002)**

| Main resources | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fuel wood | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Mushrooms | ■ | ■ | ■ | | | | | | | | | ■ |
| Palm frond | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Herbs | | | | | | | | ■ | ■ | ■ | ■ | |
| Roots and tubers | ■ | ■ | ■ | ▫ | ▫ | ▫ | ▫ | ▫ | ▫ | ▫ | ▫ | |
| Honey | | | ■ | ■ | | | | | | | | |
| Caterpillar | ■ | ■ | | | | | | | | | | ■ |
| Grasshoppers | ■ | ■ | | | | | | | | | | ■ |
| Termites | ■ | ■ | ■ | ■ | | | | | | | | |
| Snails | ■ | ■ | ■ | ■ | ▫ | ▫ | ▫ | ▫ | ▫ | ▫ | ▫ | ■ |
| Amphibia | ■ | ■ | ■ | | | | | | | | | ■ |
| Wild fruits | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | |
| Bush meat | ▫ | ▫ | ▫ | ▫ | ▫ | ▫ | | ■ | ■ | ■ | ■ | ▫ |
| Fish | ▫ | ▫ | ▫ | ▫ | | | ■ | ■ | ■ | ■ | | ▫ |

■ Resource mainly harvested

▫ Other time of year when resource is available but the level of exploitation is lower

**HCV 6: areas essential for communities' traditional culture or identity**

**Sacred sites**

Due to the nature of traditional beliefs, the majority of the sacred sites (mainly particular tree species, forest areas or inselbergs) are located inside the communities or in their neighbourhood. Some of them are in the Project Area and are still used by the communities. These sacred sites are not threatened by forest degradation and deforestation: in project scenario, neither project activities nor external factors diminish their accessibility or impact the traditional believes themselves. Hence, there is no endangered HCV 6 in the project zone.

### 4.1.3.  Without-Project Scenario: Community (CM1.3)

As described below, the drivers of deforestation and forest degradation are linked to:

- Slash-and-burn subsistence agriculture;
- Breeding practices;
- Uncontrolled fires, mainly induced by hunting;
- Charcoal production.

According to the most recent deforestation maps, to studies on the drivers of deforestation (Mercier et al. 2016; Trégourès 2015), to surveys on agricultural systems (Baudron 2009; Berton 2013) and to the agro-environmental action plan and with regard to local livelihood subsistence strategies (Lizon 2002), Miombo forest cover in the project area is expected to reduce in the next decade (see VCS PDD and climate section of the present document). In the without project scenario, in a context of high population growth, essential forest resources and lands for agriculture will be increasingly scarcer, resulting in land appropriation and over-exploitation strategies. Expected negative impacts on population's livelihood are detailed below.

First, slash-and-burn agriculture and pressure on forested lands will increase. The low soil fertility and low fertility regain thanks to fallows after the second agricultural cycle lead farmers to constantly open new fields; forest lands that are suitable for agriculture will be farther located and will become rarer. Households will progressively return to fallows, less fertile areas, or remain on poor soils. In this context, the availability of non-protected forest will diminish. Consequently, crops yields would decrease, workforce will be higher and non-timber forest products will gradually be encountered on farther zones. As forests are central to local diet strategies, especially during food shortages, forest cover decline caused by agricultural pressure would directly threaten the livelihoods of local populations - the majority of the products being harvested in forests.

Second, the relocation of agricultural fields on forested lands that are located farther is also caused by the fading-out of "house fields", as a consequence of stock farm practices. Not attached, goats, for instance, damage the cultivations that are located next to the houses. Smallholders therefore decide to locate their cultures and fields in more remote areas, in previously forested zones - instead of on areas near villages that present a mix of field and fallows of various ages. This is especially true in the Northern and Eastern parts of the project zone. Time invested and physical exhaustion are greater as agriculture camps are farther. Similarly, on the South-eastern part of the Project Zone, elephant regularly destroy

crops, particularly between April and September (cultures maturation and harvesting) and October and November (slash-and-burn practices for the opening of new fields) (Bondy and Deffontaines 2016). In the without project scenario, in a context of increasing poaching and illegal logging practises, elephants are expected to continue moving on the safest zones of the South-East (close to the Musseia main camp), both inside and outside the GNR. Conflicts between communities and elephants would therefore increase, as well as food vulnerability of the community members whose crops are located in the main conflict zones.

As a consequence of the destruction and reduction of crop yields, alternative sources of income and means of subsistence are increasingly important in the without project scenario. They include incomes generated by hunting, poaching, charcoal production or illegal timber harvesting and mining. Unsustainable (and illegal) hunting techniques are expected to grow, such as the use of fire gun, wolf-traps and hemming fires. Although they all are particularly destructive for wild resources, traps and uncontrolled fires also have direct negative impacts on households who, when walking around agricultural fields or in the forest, face a very high risk of stepping on an iron trap, for instance. Further, uncontrolled fires caused by hunters or farmers regularly burn both agricultural fields and houses, particularly during the end of the dry season. Risks are higher when house fields and cashew trees are abandoned and dry grass is growing close to the dwellings. Abandoned fields are a consequence of breeding practices, as stated above, mainly on the North-eastern part of the Project Zone. Furthermore, with the decline of non-protected forestland in the without project scenario, poaching is expected to increase with hunting pressure, as alternative sources of income: this is likely to exacerbate divisions and conflicts between the communities and the GNR. Conflicts will also rise in the South of the Project Zone, where farmers are repealed on low fertile areas, due to an accentuation of humans/wildlife conflicts, mainly with elephants (IGF 2012; Bondy and Deffontaines 2016). Finally, charcoal production, as another alternative source of incomes for farmers during the dry season, could progressively be more professional with the geographical extension of Gilé, Nampula and Quelimane's energy demand. Without technical formation, this will strengthen the pressure on forestlands.

To conclude, in the without project scenario, the project zone will become more vulnerable to extreme climate events, such as unexpected longer dry periods (like in 2016) or destructive floods during the rainy season for crops, dwellings and public infrastructures (like in 2015).

### 4.2. Net Positive Community Impacts (CM2)

### 4.2.1. Expected Community Impacts (CM2.1)

In order to analyse the project's net positive impacts on the social and economic well-being of the communities, we will use 5 main capital assets of the « Sustainable Livelihood Framework », as described on SBIA part 2 (Richards and Panfill, 2011). The Table 36 compares the scenarii with and without project. The data used are from the first and second consultations, from the Agro-Environmental Action Plan and from surveys that have been conducted in the Project Zone since 2002.

The targeted general benefits for the communities are the following:
- Food security will be ensured thanks to better management of soil fertility, which will enable to increase and diversify the food production and favor a wider choice of diet;

- Technical support and market advices on cash crop areas will increase households' incomes;
- Help to improve community infrastructures through new alternative sources of incomes for the communities, thanks to development of eco-tourism in the GNR, tourism hunting in the *coutada* and carbon credit incomes;
- The availability of essential forest resources will be maintained or improved, through more sustainable practices and an improved management of the GNR;
- Crops will be better protected in order to reduce the vulnerability of households with regards to elephants' infringement on their fields.

The main hypothesis related to each activity, product, result and impact, already described on section 2.1.7 and which will be defended below, are:

- If soil fertility is managed through conservation agriculture practices, agriculture will be more sustainable (less new fields needed to be opened) and yields will increase. These productions, which will be more diversified, will help to ensure food security for the households involved.

- If local cashew and sesame cash productions are technically supported and producers get key understandings of the mechanisms of local and international market prices, their production would increase and could be more efficiently sold.

- If poaching in the GNR is reduced and basic conditions for improvement of tourism in the region are met (politic stability, maintained roads, structures for tourist reception, training of local people), flux of tourists will increase: tourism hunting in the coutada, ecotourism within the GNR (observation of birds and large mammalian herbivores, hiking, etc.), culture and historic tourism on its surroundings. Communities will benefit of trainings and economic redistribution, which will be an opportunity to develop local infrastructures like school and health centres. Moreover, there will have an additional interest on forest conservation if it becomes a new source of revenues.

- If communities are aware of the consequences (i) of destructive hunting techniques; (ii) of forest degradation through charcoal production and (iii) of deforestation due to agriculture in terms of forest resources availability, and if unsustainable hunting practices are prohibited, alternative means of subsistence and forest resources management plan could be implemented with better efficiency.

- Further, if farmers are trained on tree regeneration techniques, the impacts of agriculture on forest cover will lower. These activities will help to reduce the depletion of the communities' essential forest resources.

- If volunteers are formed and supported by GNR rangers on elephant-scaring technique, fewer crops will be destroyed, reducing the impact of human/elephant conflicts on the households' subsistence.

According to the part G1.6, the two following groups have been identified:

- Households of the Project Zone, whose agricultural fields and main subsistence resource are gathered in the Project Area (Buffer Zone). They may be the more affected by the Project's restrictions, by elephant invasions and are particularly supported by the Project's activities;
- Households living within or on the surroundings of the Project Zone, who exploit its resources but do not own agricultural fields in the Project Area. They may be less affected by the Project's restrictions.

**Financial Capital**

The rules of the project area (GNR Buffer Zone) restrain the harvesting of wild resources - particularly of endangered species - destructive hunting techniques and honey gathering (always conducting to beehive destruction and tree cut down) (Fusari et al. 2010).

In the without project scenario, commercial activities related to high-value forest products, such as timber logging and bushmeat marketing, would rapidly increase. In a context of high population growth, the over-exploitation of some endangered species (see section 5) would continue and NTFP would become scarcer, whereas traditional extensive agriculture would be likely to reduce both soil fertility and the availability of forest. In the long run, the incomes generated by agriculture and NTFP selling would eventually decrease.

In this context, the financial costs for households of the REDD+ Project are very low. The households whose crops are located within the Project Area will be able to continue their agricultural activities, benefiting from conservation agriculture techniques in order to limit their impact of forest cover. Their yields will be improved through alternative management of soil fertility thanks to the reduction of soil depletion after the first agricultural cycle. Households' empowerment will help them manage their forest resources and NTFPs in a more sustainable way. Furthermore, project activities will aim to diversify the sources of income in order to compensate for the economic losses that may arise, linked to the prohibition of some hunting techniques, illegal mining and logging. Such measures will also promote technical and market supports on cash crop products in order to ease their commercialization.

Finally, community members also benefit of frequent seasonal jobs in the GNR, mainly on maintenance, infrastructure rehabilitation and development, as detailed on Table 34 that synthetizes incomes repartition between communities in the Project's zone and its surroundings (value in MZN).

**Table 34: Income repartition in Meticals since 2012 (From GNR documentation - ANAC)**

| Communities | Received incomes 2012 | Received incomes 2013 | Received incomes 2014 | Received incomes 2015 | Received incomes 2016 (First semester) |
|---|---|---|---|---|---|
| Chigipe | - | - | 1,000 | 5,000 | - |
| Etaga | 32,179 | 49,877 | 29,405 | 44,470 | 25,770 |
| Gilé/Malema-serra | 6,530 | 8,300 | 4,500 | 52,790 | 28,880 |

| | | | | | |
|---|---|---|---|---|---|
| Invana/Munhado | - | - | 4,880 | 30,750 | 14,850 |
| Magiga | - | - | - | 3,240 | 1,500 |
| Malema | - | 27,900 | 6,880 | 17,970 | 400 |
| Mocubela | - | - | - | 500 | 1,650 |
| Mucucune/Ribawe | 12,960 | 26,835 | 10,800 | 13,780 | 12,550 |
| Mujaiane | - | - | 16,410 | 220 | - |
| Mulela | 88,050 | 85,620 | 45,200 | 150,425 | 119,920 |
| Musseia | 381,047 | 392,716 | 98,800 | 320,510 | 265,430 |
| Naburi | - | - | 12,230 | 44,775 | 63,120 |
| Naheche | - | - | - | - | - |
| Namahipe | - | - | 17,680 | 21,920 | - |
| Namurrua/Nanhope | 52,920 | 19,000 | 17,479 | 38,480 | - |
| Nipamo | - | - | 15,345 | 32,230 | 30,220 |
| Pipine | - | - | 3,040 | 5,000 | - |
| Sacane | - | - | 1,000 | 2,400 | - |
| Uapé/Nanepa | - | - | - | 108,520 | 259,064 |
| Vassele | 5,600 | 15,590 | - | - | - |
| Others | - | - | - | - | 7,700 |
| **Total** | **520,766** | **591,248** | **284,649** | **892,980** | **823,354** |

**Social Capital**

In 2012, the Italian NGO COSV created fourteen CGRN (Local Committees for the Management of Natural Resources) that are, today, central to project activities. Those CGRN will rely on capacity building and various participative activities with community members, for people to be involved in the decision, organization and implementation processes of each activity. The Agro-Environmental Action Plan, developed for the GNR by the NGO Agrisud International, and the future Non-Timber Forest Products Management Plan to be implemented by IGF, will be made in a participative manner with each CGRN, local authorities and voluntary community members. They will help to (i) improve communities' cohesion in order to limit over-exploitation of essential Non-timber forest products; (ii) to raise awareness on the impacts of deforestation on their own livelihood and (iii) to ease consultation on land tenure management, according to their own requirements.

For households who draw their income from slash-and-burn agriculture and NTFP harvesting, new revenue streams from project activities could create, at short term, significant conflicts with regards to their distribution and share. At longer term, they would impact social structures and local way-of-life and result in acculturation and loss of traditional ecological knowledge. However, in project scenario, this situation is not likely to arise because project activities only support cash crops activities that already exist, ensuring a long-term continuity with the current agricultural practices and way-of-life.

**Human Capital**

In the project area, communities are characterized by significant geographical isolation and low access to basic health services, schools, proper roads, markets and employment opportunities. This context restrains social and economic development for rural communities and results in a high poverty level.

Project's activities are expected to have small positive effects on human capital. In terms of benefits, local means of subsistence will nevertheless be enhanced, thanks to the permanent attendance of agricultural technicians and a wide range of project activities improving communities' skills in agriculture and livestock breeding, but also easing market access and sustainable management of forest resources. Crops diversification, together with a better management of soil fertility and forest resources, will directly improve food diversity and security for local communities, reducing malnutrition risks during of food shortages. In addition, farmers are expected to commit to transferring the knowledge they will have gained to other affiliated farmers, so as to benefit to the highest number of households possible.

Further, the humans/elephants conflicts in the south of the project area, as stated earlier, increase households' vulnerability for those whose crops are regularly destroyed by elephants. This is especially true for the households who are located close to the GNR and those who moved away from conflicts zones and opened their fields on old fallows or poor soils. Their vulnerability is even more exacerbated with uncontrolled fires that contribute to crops and dwellings destruction. Consequently, the mitigation of the humans/elephants conflicts is a priority for the Project, especially since it would create tensions between the GNR and local communities. Since 2014, the GNR is implementing a participative methodology on humans/elephant's conflicts mitigation and various tools drew from local techniques to scare elephants away. This strategy includes meetings with local authorities and community members and community capacity building through preventive and curative tools in order to defend crops.

A continuous work of awareness rising on the impact of uncontrolled fires will be necessary; fires could be more easily prevented with the implementation of fireguards around crops, dwellings and cashew trees, trainings on fire management and a higher number of ranger's patrols.

**Physical Capital**

The REDD+ Project will support the development of local infrastructures, meeting the requirements of community members' livelihood, mainly with regards to food transformation and agricultural practices. No local infrastructure is expected to be dismantled.

As essential components of local diet, maize and cassava flour are traditionally handy crushed. This technique, exclusive to women, is exhausting and time-consuming. Grinders would make flour production easier and faster, but their limited number is a significant constraint. New grinders are currently being built in some communities that are supported by the Project. Managed by local associations and made of bricks, they are essential to the objectives of agricultural activities strengthening and livelihood improvement. Similarly, the distribution of manual machines for groundnuts shelling – groundnuts being one of the main cash crops of project area - will help to improve the efficiency and to reduce pain associated to handy shelling and will help shell up to hundreds of kilos of groundnuts.

In order to facilitate the adoption of new agricultural practices and to reduce any possible scepticism, voluntary farmers should be supported and benefit from direct incentives, relying on seeds and common tools distribution, such as axes and machetes. Similarly, the communities living in the South of the Project Zone will be provided with materials aiming at scaring elephants away, such as chilli-guns.

However, one could argue that long-term incentives relying on tools distribution could favour opportunist strategies and shape a situation where « free » distribution is a norm. This would restrain future activities

for which no distribution is provided; it could also foster social tensions between those who benefit from distribution and the others and create unrealistic expectations linked to future distribution. In addition, stranglehold of distributed equipment by local leaders or households who do not collaborate with the project is still a possibility. In order to limit those risks, the project and the households who are supported should comply with collaboration duties: the adoption of technical advices determines future supports and incentives. In the same way, fuel and tools should be directly distributed to beneficiaries, whereas machines should remain the responsibility of agricultural « headers », characterised by their excellent results and serious work.

**Natural Capital**

In the without project scenario, traditional slash-and-burn agriculture is expected to continue throughout project area, reducing forestland availability and forest resources. Households whose agricultural fields are located close to the GNR, in the project area and in the Buffer Zone, will quickly be faced with a lack of fertile lands and NTFPs during food shortages. Households whose lands are, today, outside of the project area, are expected to extent their fields on the project area and former fallows, characterised by low fertility. In a context of high population growth, conflicts for land use and land allocation would emerge, impacting households who already are located far from forest lands. Eventually, forest cover loss will have serious consequences on environment services (soil fertility, clear water, etc.).

Humans/wildlife conflicts are recurrent between communities and kudos, crocodiles and other animals (Demichelis, 2014). However, they are marginal in comparison with conflicts with elephants. Accordingly, the GNR REDD project aims to mitigate conflicts and crop destruction through participative techniques improving local techniques meant to scare elephants away and enhancing local perception of elephants' behaviour.

Accordingly, the GNR REDD Project aims to develop sustainable alternative means of subsistence through incentives and direct technical supports and implies low restrictions on access to forestlands and forest resources. It will not rely on any measure of population relocation or on any measures aiming at limiting essential resources harvesting, as described on Table 33. It will, however, strongly improve subsistence opportunities, in comparison with the without project scenario.

### 4.2.2. Negative Community Impact Mitigation (CM2.2)

The project aims to improve net benefits for local populations. According to costs on livelihood related to the project activities, mitigation processes and alternative activities are described on the table below. They are also included in the social and well-being monitoring plan on section 4.4.

**Table 35: Mitigation measures of project negative impacts**

| SLF Capital assets | Type of negative impact | Impacted element | Project negative impacts | Impacted stakeholders | Mitigation measures |
|---|---|---|---|---|---|
| **Financial** | **Direct** | Off-farm incomes | Reduction of incomes due to higher control of illegal activities (*commercial logging, poaching, mining*) or some destructive activities (*traditional gathering of honey* | Few community members around the GNR, foreign people | Alternatives sources of income (*beekeeping activity, technical support on cash-crop products, etc*) |
| | **Indirect** | Cash-crop incomes | Strong specialization of farmers in cashew market and low expertise in risks of prices variability | Supported community members | Information broadcasting on international demand and local prices |
| | | | | | Multiple technical supports on agro-forestry |
| | | | Due to the advice to wait for better prices, producers would not succeed to sell them production if roads were blocked by early rains | Supported community members | Feedback of relevant pieces of information on producers' behaviour thanks to local extension agents |
| **Social** | **Direct** | Confidence | Conflicts between traditional leaders and local extension agents about land use and repartition | GNR and local leaders | All activities and decisions on land have to involve local and traditional leaders |
| | **Indirect** | Social cohesion | Conflicts within the communities or households due to poor repartition or usage of carbon credits incomes (*unfair sharing, appropriations*) | Communities | Carbon credits incomes mainly used to support activities |
| | | Confidence | Conflicts between the GNR and the communities due to the amount of carbon credits incomes (*unrealistic expectations, low reduction of GHG emissions*) | GNR and communities | Benefit sharing plan designed in partnership with the communities |
| **Human** | **Direct** | Gender | Risk of higher involvement of men in the proposed activities | Women | Beneficiaries technically supported at the household scale |
| | **Indirect** | Skill improvement | Knowledge kept by community members (*lack of transfer*) | Non-supported community members | The choice of beneficiaries will take account the motivation to transfer the know-how acquired |

| | | | | | |
|---|---|---|---|---|---|
| **Physical** | **Direct** | Infrastructure | Accentuation of concurrence on the cashew market | Communities of the Project Zone, Cashew sellers | Information broadcasting on cashew market, destined to producers and buyers[24] |
| | **Indirect** | Material | Appropriation or selling of direct incentives and infrastructure (seeds, tools, machines or grinders) by local people, limiting or reversing the effectiveness of the activities | Supported community members | Contracts: beneficiaries will receive technical support if incentives are used in the right way |
| **Natural** | **Direct** | Production | Food shortages due to poor production (*bad understanding or rejection of improved techniques, wrong support or inadequacy with seasonality, etc.*) | Supported community members | Extension agents based in the communities and giving frequent and individual supports |
| | **Indirect** | HCV 4 and 5 | Rebound effect (farmers and charcoal producers would deforest to increase production, thanks to provided improved techniques) | Communities of the Project Zone and its vicinity | Complementary activities aiming to reduce deforestation (*agroforestry with cashew tree*, etc.) |

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[24] See regular reports of the cashew market on the Mozbio website: http://mozbio-gile.org/

### 4.2.3. Net Positive Community Well-Being (CM2.3, GL1.4)

The table below is a comparison of the financial, social, human, physical and natural capitals of project scenario and without project scenario, with regards to the 5 SLF Capitals, project's benefits (as detailed in section 4.2.1), costs, risks and mitigation measures (as described above). In project scenario, rural communities involved in the Project Zone and its surroundings benefit from net well-being positive impact. The project will lead to a low level of restrictions in terms of subsistence activities and will propose support to small-scale agriculture through the diffusion of agro-ecological techniques (see section 1.1.2) in order to improve the management of soil fertility and to promote crop diversification. This will help communities to limit the need for expansion of slash and burn agriculture, to improve their yields and incomes, to diversify their food diet and to reduce the risk linked to monoculture. Moreover, support to the development of the cashew value chain and to the community based hunting area (Coutada) will help households to increase and to diversify their sources of revenues. Communities will therefore benefit from trainings on new techniques that will build their capacities and should limit their dependency to forest resources. Moreover, communities are associated to the land use planning on their territories (see section 1.1.2 and 2.3.6) and to the definition of the management plan of the Reserve. This also improves their capacity for land management and contributes to involve each member in the planning of communities' activities. If the project succeeds, the natural capital of communities will be preserved, limiting their potential vulnerability to environment degradation. All potential negative impacts are mitigated by a constant presence on the field to provide direct support to households, an open dialogue with communities and the diffusion of key information on the project or on the state of the market (see previous section). As a consequence, all the defined Capitals will be improved thanks to the project (see previous 4.2.1).

**Table 36: Comparison of the 5 SLF Capitals, with and without project scenario**

| | Without project scenario | Project scenario |
|---|---|---|
| **Financial Capital** | | |
| **Incomes** | o Low sustainable income-generating activities and work opportunities<br>o Low market access and knowledge about cash crops prices | o Low restrictions on subsistence activities<br>o Technical support and market advices on alternatives means of subsistence and income generating activities<br>o Market value chain improvement |
| **Social Capital** | | |
| **Participation** | o Regular participation of community members to resolve social issues within the communities | o Enhancement of local participation, for better management of natural resources |
| **Social cohesion** | o Competition for access to lands and forest resources<br>o Risk or marginalization and higher vulnerability of households farthest located from forest lands | o Common construction of land use plans<br>o Respect of local rights on land access |
| **Human Capital** | | |
| **Skills improvement** | o Persistence of unsustainable local means of subsistence | o Capacity building, technical strengthening and know-how transfers |

| | | |
|---|---|---|
| **Health and livelihood improvement** | o Forest resources depreciation and higher risks of hunger during the food shortage<br>o Crops threatened by Human/elephants conflicts and fires | o Diet and subsistence activities' diversification<br>o Reduction of food vulnerability during rainy season or drought period<br>o Households learn how to protect themselves from elephants and fires destructions. |
| **Physical Capital** | | |
| **Infrastructures** | o No public transport, poorly maintained roads, difficult access to school, health infrastructures or grinders | o Construction of permanent grinders for the whole community |
| **Material** | o Lack of tools and machines for the primary processing of raw agriculture products | o Direct incentives (tools, seedings, fuel)<br>o Distribution of manual or thermic machines for groundnut, maize and cassava transformation |
| **Natural Capital** | | |
| **Production and forest lands** | o Depreciation of forest land availability<br>o Soil depletion | o Sustainable intensification of agriculture<br>o Lengthening of agriculture cycles<br>o Stable forest cover |
| **Forest resources availability** | o Continuation of poaching through wolf-traps and uncontrolled wildfires<br>o Over-exploitation and loss of timber, endangered species or essential wild resources | o Sustainable management of NTFP by community members<br>o Control of illegal and destructive practices |
| **Environmental services** | o Climate alterations and seasonal lag (irregular and delayed rainfalls) | o Ecosystem services maintenance through water filtration by forest ecosystems, carbon storage and micro-climate stability |

### 4.2.4. High Conservation Values Protected (CM2.4)

As stated in section 4.1.2, two HCV linked to local people's subsistence have been identified in the Project Area and its surroundings:

- HCV 4: main rivers of the Project. During the dry season, people dig water wells on the rivers' bed, especially in the North of the Project Zone where rivers are scarcer.
- HCV 5: forests where people are used to gather fuel wood and NTFPs, especially at the end of the rainy season and before crop harvesting. Communities in the surroundings of the GNR exploit over than 50 different resources (Lizon 2002), mostly mushrooms, caterpillars, termites (or roots « safety net » during livelihood crises).

Similarly, in project scenario, local communities will continue using rivers located in the project area with no restriction. In order to reduce the impact of deforestation on provided forests ecosystem services, especially catchment of water flows (as identified above), forest conservation should be ensured. Although some of the areas that provide basic ecosystems are located within the GNR, enabling to control forest cover loss more easily, others are located in the wider project area. Consequently, sustainable improved agriculture techniques should be implemented, reducing impacts of slash-and-

burn agriculture on forest cover. Further, the GNR will promote community designing of Land Tenure Management Plan and awareness rising on the long-term value of forest ecosystems, maintaining HCV 4 and 5.

The project will not constraint land availability and local communities will keep their full access to the forests in the project area, including for forest resources harvesting purposes. However, in the Buffer Zone, as explained above, various hunting techniques and the use of some specific forest resources is prohibited by law, given that some of them are severely endangered. They include:

- Some species of reptiles and amphibians, which are not described by Lizon as fundamental resources for rural livelihood. As a consequence, their protection will not impact populations' livelihood. Not only are these resources getting increasingly scarcer, but they are not part of the main forest resources used by local people.
- Techniques using hemming fires and wolf-traps, considered to be too dangerous for biodiversity, forest cover, dwellings, people and forest resources that are commonly harvested.

With support of the GNR and CGRN, each community will develop its own sustainable Non Timber Forest Products Management Plan, in order to improve NTFP availability and compensate those of which the harvesting has been prohibited. Subsequently, resources management will be transferred to communities, with a constant support of GNR's staff, reinforcing HCV 5.

As explained above, no critical HCV 6 for communities' traditions or cultural identity has been identified in the project area. A wide range of sacred trees, rivers and stones (home of deities and ancestors), historic zones and tombs are scattered within the project area, the communities and their surroundings. In project scenario, those sites will not be impacted by project activities, or any other activities, and their full access will be guaranteed.

### 4.3.    Other Stakeholder Impacts (CM3)

### 4.3.1.    Impacts on Other Stakeholders (CM3.1)

The other stakeholders, who were identified in section 2.1.6, are the following:

- Offsite communities;
- Buyers on the cashew and sesame markets;
- Illegal miners, loggers and poachers;
- Members of local NGOs;
- Representatives of the Administration and SDAE at District and Provincial scales;

The project zone was delimited so as it includes all the potential stakeholders who depend on its forest resources or who could be influenced by project activities. Although highly improbable, potential impact on other stakeholders may nevertheless be identified. They are described in the following table:

**Table 37: potential impacts of project activities on other stakeholders**

| Project activities and potential impacts | | | Stakeholders |
|---|---|---|---|
| **Negative** | *Higher law enforcement within the project area* | Risks of leakage of illegal exploitation outside the Project Zone, particularly mining | Offsite communities |
| | | Loss of incomes | Illegal miners, loggers and poachers |
| | *Humans/elephants conflicts* | Despite the use of techniques to scare elephants away, risk of displacement of farmers on forested areas located outside the project zone that could create conflicts for access to cultivable lands. | Offsite communities |
| | *Cash-crop incomes* | Loss of incomes due to higher competition on cashew and sesame market | Cashew & sesame buyers |
| **Positive** | *Technical and market strengthening for cashew nuts and sesame* | Better quality, market information and economies of scale thanks to the creation of producer groups that will empowered producers in the project zone. The guarantee of higher sale prices thanks to project information can increase concurrence between buyers. | Cashew & sesame buyers |
| | *GNR and Project development* | Work opportunities and sources of incomes improved by infrastructures maintenance and the surveillance of the GNR | Offsite communities<br>Reconverted illegal diggers, loggers and poachers |
| | *Conservation agriculture and efficient charcoal production techniques* | Expansion of improved practices through know-how transfers | Offsite communities |

## 4.3.2. Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

As stated in part 4.3.1, potential negative impacts of the project could involve offsite communities and individuals who are engaged in illegal hunting, logging or mining activities in project area. Impacts on offsite communities would be twofold:

- The efficiency of the project, with regards to the interdiction of poaching, mining and logging in project zone, may lead to a displacement of such activities in further forested areas that do not benefit from any land status. This could bring poachers in offsite communities and could create

social conflicts but it is unlikely as most of forest resources (wildlife or timber) are concentrated in the GNR. However, leakage effect it is highly improbable, taking account of the low availability of forest resources outside the GNR.

- Despite the introduction of techniques meant to scare elephants away, gaming could nevertheless increase and make elephants, even if they are not hunted, seek protection in the safer Southern zones, close to the Musseia main camp ("camp effect"). This could stretch out agricultural activities on other forestlands. The populations concerned by these impacts will be targeted in priority for agricultural support in order to improve the fertility management (in order to reduce necessity for field rotation in the search of soil fertility) and to improve yields. This measure should compensate the increase pressure on cultivable lands and improve households' incomes.

Income reduction due to the interdiction of such unsustainable activities (poaching, illegal logging, etc.) will be compensated by the future development of the GNR in terms of tourism, which may provide for new work opportunities. First, the GNR needs more workforce, eco-guards, technicians and extension agents, as part of its development dynamics. First measures to develop a community based hunting area, the coutada, have been taken. The area is delimited and it is now necessary to find a promoter of the touristic activity. This activity should provide to the concerned community additional incomes which will contribute to increase their economic interest in the conservation of wildlife rather than in poaching (see section 5.2.1 for more details). Along with strong law enforcement in the GNR, as well as at district and provincial levels, such measures would contribute to reduce the attractiveness of illegal activities and the risks of leakage. Tourism may also contribute to the economic dynamism of the Gilé and Pebane districts.

### 4.3.3. Net Impacts on Other Stakeholders (CM3.3)

Based on the negative impacts described in section CM3.1 and on their attenuations described in section CM3.2, the negative impacts of project activities on other stakeholders are extremely low, improbable and partially compensated. Limitations of poaching activities will be compensated by the increase of revenues thanks to hunting tourism. Hence, the tourism activity should become more economically attractive than poaching and way more safe because legal. The impacts of humans/elephants conflicts on the displacement of fields will be compensated by support to the concerned households for the improvement of their small scale agricultural techniques limiting pressure offsite. Those offsite communities will also be supported for agriculture if pressure is too high so they will gain in crop management. In addition, the activities will indirectly benefit other stakeholders, as explained in part CM3.1, thanks to the dissemination of conservation agriculture techniques, best practices and knowledge on cashew production. Similarly, several project interventions will be extended to offsite communities.

### 4.4. Community Impact Monitoring (CM4)

### 4.4.1. Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

**Monitoring plan for community impact**

The following table provides information about the monitoring plan of the social and economic well-being of communities and community members, following the "Sustainable Livelihood Framework" approach. Each variable enables to follow and strongly document project activities and their benefits at the scale of supported households, community members and communities as a whole (each variable targets all

community groups), as described in part CM2.1. An enquiry will be realised every 5 years on a sample of households of the project zone in the identified communities (Table 3), half being beneficiaries on the Project activities and the other half not being beneficiaries in order to assess evolution, due to the project or not, of the socio-economic conditions. This enquiry will evaluate those conditions according to the Capitals defined (see section 4.1) by asking closed questions on the composition of the family, the economic activities realised and related incomes, the agricultural practices (crops, type of agriculture – slash and burn or not, number of fields, application of agricultural project activities, rotation period for fields and fallows, etc), the type and quantity of energy used, the use of non-timber and timber forest products, number of degradation by elephants, membership or belonging to specific groups or not, etc. The questionnaire will be adapted from the one used to established the baseline for communities (see Appendix 4) in the present document.

**Financial capital**

| Data Category | STATE |
|---|---|
| Data / Parameter | Incomes generated by agricultural activities |
| Data unit | Meticals / year |
| Description | Comparison of incomes from traditional agricultural techniques and agro-ecological techniques diffused by the project as an alternative to slash and burn and so, deforestation. These incomes should increase with the project. |
| Source of data | Documentation on supported households and inquiries to other households (regular enquiry about beneficiaries and no-beneficiaries every 5 years in the communities of the project zone) |
| Description of measurement methods and procedures applied | Calculation with declaration of crops yields and selling prices |
| Frequency of monitoring/recording | Every year for supported households and every 5 years for other |

| Data Category | STATE |
|---|---|
| Data / Parameter | Incomes generated by NTFP |
| Data unit | Meticals / year |
| Description | Incomes from the collect of NTPF that could increase if a value chain is developed (regular enquiry about beneficiaries and no-beneficiaries every 5 years in the communities of the project zone)<br>Analysis of the respect of dedicated collection areas |
| Source of data | Inquiries |
| Description of measurement methods and procedures applied | Calculation with declaration of collect and selling prices |

| Frequency of monitoring/recording | Every 5 years |
|---|---|

| Data Category | STATE |
|---|---|
| Data / Parameter | Wages from job opportunities of the project |
| Data unit | Meticals / year |
| Description | Monitoring of the number of persons employed and of their salary |
| Source of data | GNR financial monitoring |
| Description of measurement methods and procedures applied | Collection of the pay slips by the administrative and financial responsible of the GNR |
| Frequency of monitoring/recording | Every year |

| Data Category | STATE |
|---|---|
| Data / Parameter | Carbon incomes shared with communities |
| Data unit | Meticals / year |
| Description | Part of the benefits of carbon credits sell that are re-invested in activities with communities |
| Source of data | Project financial monitoring |
| Description of measurement methods and procedures applied | Carbon incomes shared with communities can be direct payment to households or social organisations of the communities and an investment on project activities for communities (agricultural support for example) and so, a benefit through technical assistant. Hence, carbon benefits for the partners NGOs that will be transferred to direct support for communities will be accounted for in this section. The measurements will come from the financial monitoring of the project. The part of the benefits distributed to communities, directly or through investment in activities, will be extracted from the financial statement of the project. However, the benefit sharing mechanism still has to be defined. It will be negotiated with the Mozambican government and be based on the mechanisms developed at national level and in the framework of the ZILMP jurisdictional program. |
| Frequency of monitoring/recording | At each carbon credits sale or every 5 years |

**Social Capital**

| Data Category | STATE |
|---|---|
| Data / Parameter | Formation of groups and network |
| Data unit | Number of groups |
| Description | Groups related to project activities in each community concerned by the REDD project |
| Source of data | Inquiry (regular enquiry about beneficiaries and no-beneficiaries every 5 years in the communities of the project zone) |
| Description of measurement methods and procedures applied | Assessment of the creation of group of persons to share technical knowledge or to communicate on the project (environmental awareness, grievance, etc.) |
| Frequency of monitoring/recording | Every 5 years |

| Data Category | STATE |
|---|---|
| Data / Parameter | Number of complaints |
| Data unit | - |
| Description | Number of complaints received by the GNR and REDD project |
| Source of data | GNR registry |
| Description of measurement methods and procedures applied | Complaints will be separated by category and the answer to the query will also be registered |
| Frequency of monitoring/recording | Every year |

| Data Category | STATE |
|---|---|
| Data / Parameter | Efficiency of elephant-scaring techniques |
| Data unit | Number of grievance for crop destruction |
| Description | Presence of elephant that do destroy crop because the techniques proposed by the project could not be used or not efficiently |
| Source of data | Enquiries on concerned communities |
| Description of measurement methods and procedures applied | Declaration of households |

| Frequency of monitoring/recording | Every year |
|---|---|

**Human Capital**

| Data Category | STATE |
|---|---|
| Data / Parameter | Number of households supported by the project |
| Data unit | Number |
| Description | Number of household in each community directly and indirectly supported for:<br>- Agroecological techniques<br>- Goat breeding<br>- Cashew production and value chain<br>- Elephant scaring techniques<br>- Charcoal improved productions techniques |
| Source of data | Project registry |
| Description of measurement methods and procedures applied | Collection of households' names, contact information and community |
| Frequency of monitoring/recording | Every year |

**Physical Capital**

| Data Category | STATE |
|---|---|
| Data / Parameter | Number of machines and infrastructures built thanks to the project |
| Data unit | Number |
| Description | Machines or infrastructures built by the project or thanks to benefits for communities due to the project |
| Source of data | Project annual reports for international donnors |
| Description of measurement methods and procedures applied | Collection of data in each community concerned by the project |
| Frequency of monitoring/recording | Every year |

**Natural Capital**

| Data Category | STATE |
|---|---|
| Data / Parameter | Time necessary to reach NFTP or wood fuel collection sites |
| Data unit | Hours |
| Description | With decrease of deforestation, availability of forest resource should stay stable and this time of walk to collect essential product should not increase and could decrease |
| Source of data | Inquiry to a selection of households in concerned communities |
| Description of measurement methods and procedures applied | Inquiry identifying the dependence on forest resource, the location of collection sites, and time necessary to reach them (regular enquiry about beneficiaries and no-beneficiaries every 5 years in the communities of the project zone). Questions in the enquiry will be asked on the type of used NTFP and on the location where they are collected (location in the GNR and walking time to reach the collection point). The frequency of the collection of NTFP will indicate how much communities are dependant on these resources. |
| Frequency of monitoring/recording | Every 5 years |

| Data Category | STATE |
|---|---|
| Data / Parameter | Duration of agricultural cycles |
| Data unit | Years |
| Description | An agricultural cycle comprises years of cultivation and years of fallow. If the time of fallow increase and the time of cultivation thanks to new agroecological techniques, the necessity of new field opening will decrease and so, deforestation. |
| Source of data | Inquiry to supported households |
| Description of measurement methods and procedures applied | Data of each inquiry will be compared to assess the evolution of this variable in time during the project. |
| Frequency of monitoring/recording | Every 5 years |

| Data Category | STATE |
|---|---|
| Data / Parameter | Location of fields |

| | |
|---|---|
| Data unit | Km |
| Description | Location of field in comparison to households housing. If deforestation and the necessity of new field opening decrease, distance of fields from villages should not increase. |
| Source of data | Inquiry to supported households |
| Description of measurement methods and procedures applied | Data of each inquiry will be compared to assess the evolution of this variable in time during the project. |
| Frequency of monitoring/recording | Every 5 years |

**Monitoring plan for HCVs related to community well being**

The stabilization and strengthening of two HCV identified in part G1.7 and described in part CM1.1 are directly linked to the efficiency of the project in terms of deforestation and forest degradation reduction and climate change mitigation. The following indicators will help to estimate their enhancement during project lifetime. As no critical essential area for cultural identity, religious significance, historic or economic purposes has been identified in project zone, access to these sites is guaranteed and no future negative impact has been identified on resources contained in HCV 6 category, no monitoring is needed.

**Table 38: Monitoring plan for HCVs considered for community impact**

| HCV | Variable | Source | Time frame |
|---|---|---|---|
| **HCV4**<br><br>**Clear water supply** | Evolution of forest cover | Monitored for VCS (see GNR project PDD and verification) | Every 5 years |
| | Measure of perceived availability of main water resources of (usually rivers) during the dry season | Inquiry | Every 5 years |
| | Number of functioning water wells in each community | Inquiry | Every year |
| **HCV 5**<br><br>**Availability of forest resources** | Measure of perceived scarcity of main forest resources | Inquiry | Every 5 years |
| | Evolution of daily time spent in gathering a defined quantity of main forest resources | Inquiry | Every 5 years |
| | Sites for the gathering of forest resources | Participative cartography | Every 5 years |

| | Number of infractions related to illegal resources extraction (illegal logging, mining, poaching, use of wolf-traps or hemming-fires) | GNR's documentation | Every 5 years |
| --- | --- | --- | --- |

### 4.4.2.    Monitoring Plan Dissemination (CM4.3)

The full detailed monitoring plan, presented in parts CM4.1 and CM4.2, has been designed on the basis of previous inquiries and researches, as well as participative agro-environmental action plans. It was proposed to each community during the second consultation phase and ought to be integrated to the future local forest resources management plans. Those plans, which will provide community members the opportunity to manage and monitor their own resources, will be specific to each community.

Accordingly, complementary periodic measurements, conducted by each CGRN, will be added to this monitoring plan in order to complement the current baseline. Finally, the monitoring plan and its results will be available on demand at the Musseia main camp as well as Gilé and Pebane SDAE (Serviços Distritais das Actividades Económicas – Districts services).

### 4.5.    Optional Criterion: Exceptional Community Benefits

The project is not claiming exceptional community benefits and does not seek Gold level for community section.

# 5. BIODIVERSITY

### 5.1.    Without-Project Biodiversity Scenario (B1)

### 5.1.1.    Existing Conditions (B1.1)

**5.1.1.1. Major eco-regions in which the project zone is located**

Mozambique is one the few sub-Saharan countries to possess a significant portion of natural forest: 51% of its territory is composed of natural forest - that is 40.6 million ha (Marzoli, 2007). Miombo forest is the most extensive forest type, covering approximately two third of the country. Miombo forests especially cover vast areas of the central and northern regions of Mozambique, and are characterized by a dense vegetation, with deciduous and semi-deciduous trees, often reaching between 10 and 20 meters (FUNAB, 2015). As shown in the next figure, the GNR and its buffer zone are located in a zone o « Miombo dense forest ».  As defined by White (1983) (cited in Mesochina et al. 2010), it falls within the Zambezian Regional Centre of Endemism phytogeographic unit and within the Vegetation Type 26: "Dry Zambezian Miombo Woodland".
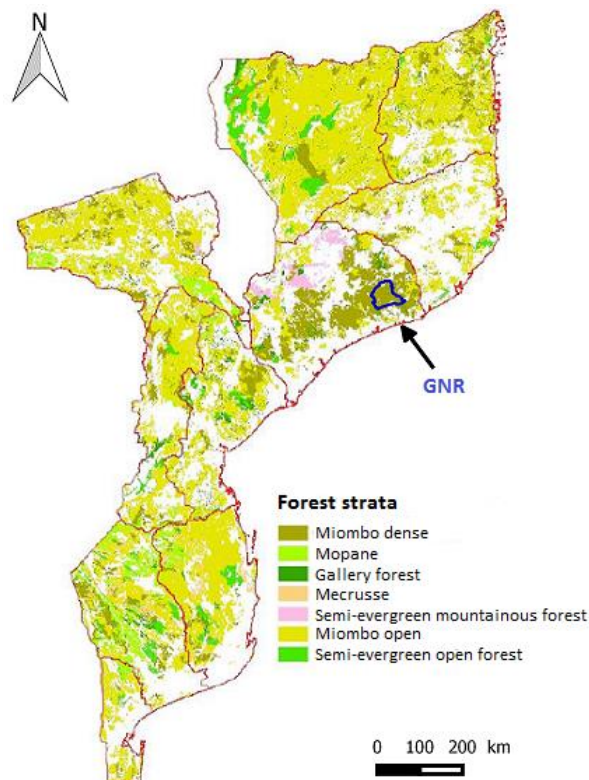


**Figure 16: Map of different forest strata of Mozambique -Source: Government of Mozambique - Unidade MRV**

### 5.1.1.2. Description of biodiversity in project zone

**Main vegetation in project zone**

The GNR and its buffer zone (composing the project zone) belong to a semi-arid savannah woodland formation, widely found across Southern and East Africa. This formation is made of Miombo forest, dominated by trees belonging to the Caesalpinoidae legume sub-family, of the genera *Brachystegia*, *Julbernardia* and *Isoberlinia* (Campbell, 1996).



**Figure 17: Picture of Miombo forest in the central Zone of the GNR**

In a study by Prin (2008), based on 39 circular field plots of 804 m$^2$, 70 tree species and 10 gramineae species were identified in the project zone. A forestry survey conducted by a team from the Mozambican Ministry in charge of environment also identified four (4) different vegetation types in the project zone, based on the degree of canopy cover and tree height (MICOA, 1999 – cited in Mésochina et al., 2010). Their characteristics are reported below and summarized in table 1:

i. **Open forest,** also called open woodland. Although no obvious dominant species emerges in this vegetation type, several trees are common: the wild custard apple (*Annona senegalensis*), the monkey pod (*Senna petersiana*), the snake bean, also called *Pau-Ferro* in Mozambique (*Swartzia madagascariensis*) and a species of bride's bush (*Pavetta* sp.). Open forest represents 47.36% of the project zone. The canopy cover ranges from 40% to 70% and tree density is about 1,159/ha (Fusari et al., 2010). The main species are: *Setaria* sp., *Themeda triandra*, *Eragostris rigidor* and *Digitaria* sp., while the endemic species *Ozoroa reticulate* is also present.

ii. **Woodland.** The dominant tree species are the munondo (*Julbernardia globiflora*), the mobola plum (*Parinari curatellifolia*), the parsley tree (*Heteromorpha trifoliata*) and the heart tree (*Hymenocardia acida*). Main herbaceous species are: *Themeda triandra*, *Schizachyrium jefferysii*, *Digitaria sp.* and

*Setaria sp* (Fusari, et al., 2010). This is the second most important type of vegetation in the project zone (43.66% of the area). The canopy cover usually is below 40% and tree density is about 1,241/ha. Forest biomass is 2,862 kg/ha (i.e. 1,286 metric tons/km$^2$) and herbaceous biomass is about 3,224 kg/ha.

iii. **Closed forest**: although there is no clear-defined tree species dominance within the closed forest vegetation type, species like the Pride of De Kaap tree (*Bauhinia galpinii*), the panga-panga (*Millettia stuhlmannii*), the mobola plum (*Parinari curatellifolia*), the munondo (*Julbernardia globiflora*), the glossy flat-bean (*Dalbergia nitidula*), the wild seringa (*Burkea africana*) and the variable bushwillow (*Combretum apiculatum*) are common. This type of vegetation represents 8.05% of project zoneFusari et al., 2010. The canopy cover usually is higher than 70% and tree density is about 1,305/ha. Forest biomass is 22,902 kg / ha (i.e. 2,290 metric tons/km2) and herbaceous biomass is about 1,192 kg/ha (i.e. 119 metric tons/km$^2$), with species such as *Setaria* sp., *Digitaria* sp., *Schizachyrium jefferysii* and *Cyperus sp.* (Fusari et al., 2010).

iv. **Riverine vegetation**: In this vegetation, canopy cover varies from 40% to 70% (Mésochina et al. 2010). While the screw pine (*Pandanus livingstonianus*) dominates this vegetation type in the southern sectors of the GNR and its buffer zone. No clear species dominance is noticeable elsewhere. Common tree species include the red-heart tree (*Hymenocardia ulmoides*), the munondo (*Julbernardia globiflora*) and the mobola plum (*Parinari curatellifolia*).

To a much lesser extent, the ecosystem also includes **dambo grassland**, which represent 0.07% of the GRN and its buffer zone (Fusari et al., 2010). The dambos are small to medium size edaphic grasslands that are often flooded during the rainy season. The main species are: acacia trees (*Acacia sp*.) and cluster leaf trees (*Terminalia sericea*) (Fusari et al., 2010). The canopy cover usually is less than 10% with a very low tree density, while the grass biomass is very high (i.e. around 5,550 kg/ha) (Mesochina et al., 2010).

**Figure 18 : Dambo in the GRN (Delbergues, 2015)**

According to Mesochina (2010), due to the very poor quality of the grass species (coarse and unpalatable for grazers), the grass layer of Dambo vegetation has a low forage score, indicating its low capacity to support grazers. Conversely, the herbaceous stratum of open forests, woodlands and closed forests has a potential for grazing and hosting herbivorous species: not only is their soil less acid than in Dambo areas but they also host *Themeda triandra*, which is a ubiquitous grass plant that can grow in very diverse edaphic and climatic conditions and that is characterised by a good forage value (Prin, 2008). Both forest and herbaceous strata of the woodland vegetation in the project zone are therefore considered to be valuable for many herbivorous species (Fusari et al., 2010).

In conclusion, the floristic composition of the GNR core area and its buffer zone is rich and diversified. The structure and composition of the vegetation present in the project zone are very typical of the clear dry Zambezian Miombo forest type (White, 19831983 – cited in Fusari et al., 2010), defined by trees height reaching in average 12m to 18m, with a canopy cover that is superior to 40% and lower layers composed of bushes and grass. As the second table below shows, *Diplorhynchus condylocarpon, Brachystegia boehmii, Julbernardia globiflora, Dalbergia nitidula, Brachystegia spiciformis, Parinari curatellifolia* and *Pterocarpus angolensis* account for more than 54% of the trees. *Annona senegalensis, Burkea africana, Erythrophleum africanum, Hymenocardia acida, Combretum adenogonium, Pterocarpus rotundifolius, Uapaca nitida, Millettia stuhlmannii* also have a significant frequency in the project zone (more than 1%) (Etc Terra, 2014a). As stated earlier, the herbaceous cover is mainly composed of *Themeda triandra* (63% of transcripts), which is, most of the time (85%), dominant (Prin, 2008).

**Table 39: Characteristics of the main types of vegetation identified in the project zone**

| Type of vegetation | Characteristics | | | |
|---|---|---|---|---|
| | Canopy cover | Tree height | Main tree species | Main plant species |
| **Closed forest**<br><br>(Wooded grassland and woodland) | > 70% | > 7 m | *Bauhinia galpinii*<br>*Millettia stuhlmannii*<br>*Parinari curatellifolia*<br>*Julbernardia globiflora*<br>*Dalbergia nitidula*<br>*Burkea africana*<br>*Combretum apiculatum* | *Setaria* sp.<br>*Digitaria* sp.<br>*Schizachyrium jefferysii*<br>*Cyperus* sp. |
| **Riverine vegetation** | 40% - 70% | > 7 m | *Pandanus livingstonianus*<br>*Hymenocardia ulmoides*<br>*Julbernardia globiflora*<br>*Parinari curatellifolia* | *na* |
| **Open forest**<br><br>(Open woodland) | 40% - 70% | < 7 m | *Annona senegalensis*<br>*Senna petersiana*<br>***Swartzia madagascariensis*** | *Setaria sp*<br>***Themeda triandra***<br>*Eragostris rigidor*<br>*Digitaria sp*<br>*Pavetta sp.*<br>*Ozoroa reticulate* |
| **Woodland** | 40% - 70% | < 7 m | *Julbernardia globiflora*<br>*Parinari curatellifolia*<br>*Heteromorpha trifoliata*<br>*Hymenocardia acida* | ***Themeda triandra***<br>*Schizachyrium jefferysii*<br>*Digitaria sp*<br>*Setaria sp* |
| **Dambo** | < 10% | < 7 m | *Acacia sp.*<br>*Terminalia sericea* | *na* |

**Table 40: Most common trees species identified in the Gilé National Reserve and its buffer zone (Etc Terra, 2014a)**

| Family | Species | Frequency in the GNR in % | Cumulated frequency in % |
|---|---|---|---|
| Apocynaceae | *Diplorhynchus condylocarpon* | 10.97 | 10.97 |
| Fabaceae | *Brachystegia boehmii* | 10.30 | 21.28 |
| Fabaceae | *Julbernardia globiflora* | 9.19 | 30.47 |
| Fabaceae | *Dalbergia nitidula** | 8.52 | 38.99 |
| Fabaceae | *Brachystegia spiciformis* | 6.15 | 45.14 |
| Chrysobalanaceae | *Parinari curatellifolia* | 5.41 | 50.56 |
| Fabaceae | *Pterocarpus angolensis* | 4.08 | 54.63 |
| Annonaceae | *Annona senegalensis* | 4.00 | 58.64 |
| Fabaceae | *Burkea africana* | 3.78 | 62.42 |
| Fabaceae | *Erythrophleum africanum* | 2.74 | 65.16 |
| Phyllanthaceae | *Hymenocardia acida* | 2.67 | 67.83 |
| Combretaceae | *Combretum adenogonium** | 2.37 | 70.20 |
| Fabaceae | *Pterocarpus rotundifolius** | 2.22 | 72.42 |
| Phyllanthaceae | *Uapaca nitida* | 2.22 | 74.65 |
| Fabaceae | *Millettia stuhlmannii* | 1.70 | 76.35 |

**Description of main wildlife in project zone -**

<u>Mammals</u>

The first detailed data on wildlife in the GNR were provided by Dutton et al. (1973) who conducted a preliminary ecological survey that mainly focused on large mammals. It has been updated after through various field surveys and/or ethnozoological surveys of local communities (Chande et al., 1997; Carpaneto, 2001; Chardonnet & Dobremez, 2005; Boulet & Lamarque, 2007). In 2010, the IGF Foundation also conducted a preliminary survey of large mammals in the GNR and its buffer zone (Mésochina et al., 2010). In 2012, another study on biodiversity in the project zone completed it (Deffontaines, 2012). **At project start, between 59 and 69 species of mammals were estimated to be present in the project zone**[25]**, including a large number of herbivorous species** with bushbucks, common duikers and greater kudus representing up to 85% of recorded mammals (Mésochina et al., 2010). Those figures have been updated in 2012 by Deffontaines (2012), accounting for **75 different species of mammals in the project zone** (including African buffaloes). They are listed in the next table (for IUCN status of each species, see part 5.2.4).

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[25] According to Mésochina et al. (2010, p. 34): "Following the surveys carried out by Dutton et al. (1973), Chande et al. (1997) and Carpaneto (2001), Gallego-Lizon (2002) considered that **69 species of mammals had been identified** in the GNR. However, **only 59 species** were reported as occurring in the management plan of the GNR (Fusari & Cumbane, 2002) ». In 2010, Fusari, Lamarque, Chardonnet and Boulet (2010) registered **67 different species** of mammals in the project zone.

**Figure 19: Photos of greater kudus, sable antelopes and warthogs in the GNR -** *Deffontaines, 2012*

In the GNR, the most common species belong mostly to the Artiodactyla order and are (ranked by order of occurrence): bushbucks (*Tragelaphus scriptus)*, bush pigs (*Potamochoerus porcus)*, common duikers (*Sylvicapra grimmia)*, greater kudus (*Tragelaphus strepsiceros)*, sable antelopes (*Hippotragus niger)*, southern reedbucks (*Redunca arundinum*) and waterbucks (*Kobus ellipsiprymnus)* – see their respective Abundance Kilometre Index in the table below. For the Carnivores family, striped polecats (*Ictonyx striatus)* are the most commonly found specie; even though signs of large carnivores were rarely observed, the occurrence of the leopard (*Panthera pardus*), the side-striped jackal (*Canis adustus*), the lion (*Panthera leo)* and the serval (*Felis serval*) was also confirmed (Mésochina et al., 2010). Rodents are especially characterised by the occurrence of the spiny mice (*Acomys spinosissimus)*. Three main primate species are also significant in the project zone: the yellow baboon (*Papio cynocephalus)*, the samango monkey (*Cercopithecus mitis*) and the vervet monkey (*Cercopithecus aethiops*) (Deffontaines, 2012).

The existence of a few remarkable species is worth noticing, especially for the Proboscidea (African elepehants) and Cetartiodactyla families (Africa buffaloes and Lichtenstein hartebeests). The African elephant is of particular importance in the project zone: its protection is a core objective of the project (*see section 7.5 for more details*). Furthermore, even though it has been declared to be extinct from the project zone thirty years ago, a couple of hippopotamus have regularly been spotted in the GNR since the 2000s (Fusari et al., 2010). The presence of African buffalo was also confirmed in the 2000s, even though their number may be limited (Mésochina and al., 2010) - re-introduction operations of African buffaloes are part of project scenario (*see section 7.2 for more details*). Lichtenstein Hartebeests have been identified in the project zone. They are estimated to be between 5 and 10 individuals (Brugière, 2013).

**Table 41: Consolidation of main mammals identified in the project zone and relative abundance, classified by Order - *(Deffontaines, 2012; Mésochina et al., 2010; Fusari et al., 2010)***

| English name | Scientific name | AKIe in the GNR / buffer zone |
|---|---|---|
| **Artiodactyla** | | |
| Natal red duiker | *Cephalophus natalensis* | |
| Hippopotamus * | *Hippopotamus amphibius* | |
| **Sable antelope** | ***Hippotragus niger*** | **0.148** |
| **Waterbuck** | ***Kobus ellipsiprymnus*** | **0.276** |
| Suni | *Nesotragus moschatus* | |
| Klipspringer | *Oreotragus oreotragus* | |
| Warthog | *Phacochoerus aethiopicus* | |
| **Bush pig** | ***Potamochoerus porcus*** | **0.195** |
| **Southern reedbuck** | ***Redunca arundinum*** | **0.275** |
| **Common duiker** | ***Sylvicapra grimmia*** | **4.39 / 0.320** |
| **Bushbuck** | ***Tragelaphus scriptus*** | **0.831 / 0.416** |
| **Greater kudu** | ***Tragelaphus strepsiceros*** | **0.294 / 0.656** |
| **Carnivores** | | |
| African clawless otter | *Aonyx capensis* | |
| Marsh mongoose | *Atilax paludinosus* | |
| Bushy-tailed Mongoose | *Bdeogale crassicauda* | |
| Side-striped jackal * | *Canis adustus* | |
| African civet | *Civettictis civetta* | |
| Spotted Hyaena * | *Crocuta crocuta* | |
| Wild cat | *Felis silvestris* | |
| Miombo genet | *Genetta angolensis* | |
| Common genet | *Genetta genetta* | |
| Blotched genet | *Genetta tigrina* | |
| Dwarf mongoose | *Helogale parvula* | |
| Ichneumon mongoose | *Herpestes ichneumon* | |
| White-tailed mongoose | *Ichneumia albicauda* | |
| **Striped polecat** | ***Ictonyx striatus*** | **0.341** |
| Serval* | *Leptailurus serval* | |
| Spotted-necked otter | *Lutra maculicollis* | |
| African wild dog * | *Lycaon pictus* | |
| Ratel | *Mellivora capensis* | |
| Banded mongoose | *Mungos mungo* | |
| African palm civet | *Nandinia binotata* | |
| Lion * | *Panthera leo* | |

| Leopard * | *Panthera pardus* | |
|---|---|---|
| **Cetartiodactyla** | | |
| Lichtenstein Hartebeest | *Alcelaphus lichtensteinii* | |
| African buffalo | *Syncerus caffer* | |
| **Eulipotyphla** | | |
| Shrews | *Crocidura sp.* | |
| **Hyracoidea** | | |
| Southern tree hyrax | *Dendrohyrax arboreus* | |
| Bush hyrax | *Heterohyrax brucei* | |
| Rock hyrax | *Procavia capensis* | |
| **Lagomorpha** | | |
| Scrub hare | *Lepus saxatilis* | |
| European rabbit | *Oryctolagus cuniculus* | |
| Natal red rock hare | *Pronolagus crassicaudatus* | |
| Smith's Red Rock hare | *Pronolagus rupestris* | |
| Four-toed sengi | *Petrodromus tetradactylus* | |
| Chequered sengi | *Rhynchocyon cirnei* | |
| **Pholidota** | | |
| Temminck's ground pangolin | *Smutsia temminckii* | |
| **Primates** | | |
| Grivet monkey | *Cercopithecus aethiops* | |
| Samango monkey | *Cercopithecus mitis* | |
| South African galago | *Galago moholi* | |
| Brown greater galago | *Otolemur crassicaudatus* | |
| Yellow baboon | *Papio cynocephalus* | |
| **Proboscidea** | | |
| African elephant | *Loxodonta africana* | |
| **Rodentia** | | |
| **Spiny mouse** | ***Acomys spinosissimus*** | **0.36** |
| Rats | *Aethomys sp.* | |
| Lord Derby's anomalure | *Anomalurus derbianus* | |
| Long tailed pouched rat | *Beamys hindei* | |
| Forest giant pouched rat | *Cricetomys emini* | |
| African dormouse | *Graphiurus* sp. | |
| Silvery mole rat | *Heliophobius argenteocinereus* | |
| Mutable sun squirrel | *Heliosciurus mutabilis* | |
| African porcupine | *Hystrix africaeaustralis* | |
| Single-striped mouse | *Lemniscomys rosalia* | |
| Natal multimammate mouse | *Mastomys natalensis* | |

| Mices | *Mastomys sp.* | |
|---|---|---|
| Ethiopian striped mouse | *Muriculus imberbis* | |
| Typical Vlei Rat | *Otomys typus* | |
| Smith's bush squirrel | *Paraxerus cepapi* | |
| Striped bush squirrel | *Paraxerus flavovittis* | |
| Red squirrel | *Paraxerus palliatus* | |
| Black rat | *Rattus rattus* | |
| Gerbils | *Tatera sp.* | |
| Lesser cane rat | *Thryonomys gregorianus* | |
| Greater cane rat | *Thryonomys swinderianus* | |
| **Tubulidentata** | | |
| Aardvark | *Orycteropus afer* | |
| **AKIe: Abundance Kilometre Index of species** | | |
| *\* Those species have not been directly spotted for a long time so they are rare or are not considered to be permanent in the GRN despite records on their crossing in the area.* | | |

Birds

At project start (2012), Fusari et al., 2010210 species of birds were identified in the GNR and its buffer zone (Fondation IGF, 2011). In January 2011, the French consultancy firm Biotope was responsible for conducting the first ornithological study. The main bird species that have been identified in the project zone are: the African fish eagle (*Haliaeetus vocifer*), martial eagle (*Polemaetus bellicosus*), the osprey (*Pandion haliaetus*), the reed cormorant (*Phalacrocorax africanus*), the grey heron (*Ardea cinerea*), the great egret (*Egretta alba*), the little egret (*Egretta garzetta*), the striated heron (*Butorides striatus*), the African jacana (*Actophilornis africanus*) and the hamerkop (*Scopus umbretta*). The most connected to terrestrial habitat birds of prey that have been identified in the project zone are: the African black kite (*Milvus migrans*), the palm-nut vulture (*Gypohierax angolensis*), the Southern banded snake eagle (*Circaetus fasciolatus*), the Bateleur (*Terathopius ecaudatus*) and the African harrier-hawk (*Polyboroides typus*). Other species of terrestrial habitats have also been identified, such as: the hadada ibis (*Bostrychia hagedash*), the crested guinea fowl (*Guttera pucherani*), the helmeted guinea fowl (*Numida meleagris*), the purple crested turaco (*Tauraco porphyreolophus*), the crowned hornbill (*Tockus alboterminatus*), the paled billed hornbill (*Tockus pallidirostris*), the trumpeter hornbill (*Ceratogymna bucinator*) and the Southern ground hornbill (*Bucorvus cafer*), among others (Fusari et al., 2010). Main vulture species are absent in the area probably because they have always been rare in this landscape with close canopy and they have been suffering from poaching.

**Figure 20: Photos of helmeted guinea fowl, Reed cormorant and Bateleur in the GNR –** *Deffontaines (2012)*

Reptiles

Although the observation of reptiles has not been systematic in the project zone, a non-exhaustive list can be proposed (Table 4). It is worth noticing that the African rock python (*Python sebae*) is increasingly rare in the reserve and its buffer zone (it is the only snake that is eaten in the area). Three main species of turtles and tortoises have also been identified in the project zone: the terrestrial Bell's hinge-back tortoise (*Kinixys belliana*), the Zambezi flapshell turtle (*Cycloderma frenatum*) and the serrated hinged terrapin (*Pelusios sinuatus*) (Fusari et al., 2010).

**Table 42: Main reptiles identified in the project zone (*Fusari et al., 2010; Mésochina et al., 2010; Fondation IGF, 2013b*)**

| Scientific name | Common name |
|---|---|
| **Snakes** ||
| *Bitis arietans* | African puff adder |
| *Crotaphopeltis hotamboeia* | White-lipped herald snake/Red-lipped snake |
| *Dasypeltis scabra* | Common egg eater |
| *Dendroaspis polylepis* | Black mamba |
| *Dendroaspis angusticeps* | Eastern green mamba |
| *Dispholidus typus* | Boomslang |
| *Naja annulifera* | Snouted cobra |
| *Naja melanoleuca* | Forest cobra |
| *Naja mossambica* | Spitting cobra |
| *Philothamnus hoplogaster* | South Eastern green snake/Green water snake |
| *Philothamnus natalensis* | Natal Green Snake/Eastern green snake |
| *Philothamnus semivariegatus* | Spotted bush snake |
| *Psammophis phillipsi mossambicus* | Olive whip snake |
| *Psammophis subtaeniatus orientalis* | Eastern stripe-bellied sand snake |

| | |
|---|---|
| *Python natalensis* | South African python |
| *Python sebae* | African rock python |
| *Telescopus semiannulatus* | Tiger snake |
| *Thelotornis capensis* | Twig snake |
| *Thelotornis mossambicanus* | Eastern twig snake |
| **Lizards and monitors** | |
| *Gerrhosauros validus* | Giant plated lizard |
| *Platysaurus sp.* | Flat lizard |
| *Varanus albigularis microsticus* | Rock monitor |
| *Varanus niloticus* | Nile monitor |
| *Hemidactylus sp.* | The house gecko |
| **Crocodiles** | |
| *Nilo Crocodylus niloticus* | *Nilo Crocodylus niloticus* |

### 5.1.1.3. Threats to biodiversity in project zone

Biodiversity in the original baseline scenario of the project zone is significant, but endangered by many threats. Those threats are linked to anthropic activities and related mainly to deforestation and degradation of the Miombo forest as well as to animal poaching especially for bushmeat.

Threats to biodiversity in the project zone are mainly analysed through the observation of forest cover loss over time, that is, historical deforestation. This was analysed for three dates of historical analysis (2000, 2005 and 2010) that are included in the reference period (2000 – 2010) of this project (see section 3.1). In addition, the risk of future deforestation was assessed in the ZILMP background study (Mercier et al., 2016). Methodological details are provided in section 7.1.3. Other data, especially on animal poaching and logging, are generated through the actual figures of poachers that have been arrested or traps that have been found in the project zone.

***Threats to biodiversity linked to forest cover loss:***

Deforestation and forest degradation are the most important threats to biodiversity in the project zone. It is caused by:

- **Slash and burn agriculture**, which is the main conversion cause of forests into agricultural lands. This trend is linked to low-tech farms and poor soils, resulting in low operating performance. Clearing new fields is a key element of smallholders' strategy to overcome fertility problems and labour constraints due to ecological conditions. Small-scale itinerant agriculture is the main, and almost exclusive, driver of deforestation in the project zone.
- **Commercial overexploitation and non-renewal of forest resources** (illegal logging).
- **Spread of uncontrolled wildfires** both (i) from outside the GNR, for the opening of new agricultural fields and (ii) inside the GNR for poaching purposes. Wildfires are almost provoked

solely by human activities. However, only late fires can cause small scale deforestation/degradation as Miombo is adapted to these events (Ryan and William 2011) and they are one of the most significant ecological factors that control the structure of Miombo forests (Chidumayo 1997).



**Figure 21: Log stocking site in the GNR buffer zone – From *Chardonnet et al. 2014***

The impact of those factors on forest cover and biodiversity in the project zone is significant:

i. **Deforestation and degradation may lead to a direct loss of floristic diversity**. For instance, mainly, but not exclusively, in the buffer zone, illegal logging is especially focused on *Swartzia madagascariensis* trees (called *Pau Ferro* in Mozambique), of which the prices on the international market have drastically increased very recently. Accordingly, in 2012, all the reported cases of illegal logging in the GNR and its buffer zone involved, exclusively, *Swartzia madagascariensis* trees (Deffontaines, 2012), posing a direct threat to floristic diversity. In the short term, there is a significant uncertainty on the future of this species in the project area, in particular considering that it is a species with a slow growth rate and does not entail any stump sprouts (Fondation IGF, 2012).

ii. **The reduction of forest cover leads to the reduction of habitat available for wildlife species and a modification of their potential distribution area.** This is especially true for mammals, which are more demanding with regards to their habitat than other terrestrial animals. The loss of forest cover in the project zone is a direct threat to their presence and abundance.

iii. **Wildfires and inappropriate practices may cause changes in chemical composition, compaction and soil erosion** (MINAG/SPFFB, 2002). More specifically, wildfires occurring at the end of the dry season can pose a major threat to forest biodiversity, because a large amount of natural combustible (dry biomass) favors high temperatures that can destroy or modify the structure of the vegetation (Ryan and William, 2011). Frequent fires may raise soil and atmospheric temperatures, reduce organic matter, release gaseous elements and, indirectly, modify both the post-fire microclimate and the activity of the soil biota (Zolho, 2005). Yet, this is especially true in Mozambique where 39.6% of the vegetation is burnt annually. This figure increases to 73.6% for the Northwest and the Central regions of the country, where the project area is located (Taquidir, 1996, cited in Zolho, 2005). This may have direct consequences on vegetation composition and carbon cycles in project area, both influenced by fires frequency

and fires intensity. Admittedly, although not all the woody species are equally sensitive to fire, overall Miombo woodland species and most species present in project area (especially *Brachystegia* and *Julbernardia*) are tolerant to fire (Cauldwell and Zieger, 2000)). Late season fires and high frequency burning may inhibit flora regeneration. According to Ryan and Williams (2011), « managing the fire regime of these flammable systems is difficult, but crucial for sustaining biodiversity, ecosystem services, and carbon stocks » especially to manage regeneration.



**Figure 22: Deforestation in the GNR buffer zone - (From Chardonnet et al. 2014)**

### Threats to biodiversity linked to poaching

**Poaching is a direct threat to wildlife diversity and abundance in the project zone**, especially to medium and large-sized mammals, which represent local hunters' main preys. During colonial era, indiscriminate hunting (food and sport hunting) already led to the reduction and/or extinction of zebra and black rhinoceros in project area (Fusari et al., 2010). After decolonization and during the civil war, poaching in the area was eased by the lack of proper management of the GNR and of its surroundings (Fusari and Cumbane, 2004). Today, poaching, is practiced mainly for bushmeat and for traditional reasons. In 2002, a study showed that 81.6% of smallholders living in project area regularly are engaged in hunting activities (Fusari and Cumbane, 2004). Their hunting strategies vary according to spatial locations, time of the year, water cover, early wildfires and visibility. Firearms can be used, as well as nets (especially in the Southern area of the project zone), gin traps (close to water points and on burnt areas) and fires (Deffontaines 2012; Fusari and Carpaneto 2006).

**Figure 23: Poachers from local communities in the GNR and traditional traps for catching medium and small rodents - (From Fondation IGF, 2012)**

### 5.1.2.  High Conservation Values (B1.2)

The project zone includes several High Conservation Values (HCVs) related to biodiversity. Their protection is the core objective of the project. For all of the identified HCVs below, the relevant management area is the GNR core area and its buffer zone.

**Table 43: Identification of HCV for biodiversity**

| High Conservation Value | *HCV1 -Concentration of biological diversity, including endemic species and rare, threatened or endangered species that are significant at global, regional or national levels.*<br><br>**The GNR core and buffer zones contain regionally and nationally significant concentrations of biodiversity values. It hosts the last viable population of *Swartzia madagascariensis in Mozambique* and supports 10 mammal species and 2 bird species that are considered to be globally threatened or nearly.** |
|---|---|
| Qualifying Attribute | Biodiversity conservation is the main objective of the definition of National Parks and Natural Reserves in the world and in Mozambique. This is also true for the GNR, which currently holds the status of a National Reserve and can be classified in IUCN "Management Category II" (Fusari et al., 2010).<br><br>As previously stated, the GNR and its buffer zone mainly harbour a semi-arid savannah woodland formation, commonly known as Miombo, which is widely found across Southern and Central Africa. Although this is not a rare woodland formation, the size and density of forest habitat make the GNR and its buffer zone be of particular value for biodiversity conservation. |

With regards to vegetation, the project zone is a diverse botanical resource with 70 identified tree species and 10 identified *Gramineae* species (see section 5.1). It is mainly composed of *Fabaceae* but, also, of some other species that are noteworthy because their occurrence in the GNR and its buffer zone is part of a limited range in Mozambique and in the world. Miombo forests contain some of the world's most precious hardwood timbers, including *Pterocarpus angolensis* (umbila), *Millettia stuhlmannii* (jambirre), *Pericopsis* angolensis (muaga) and *Swartzia madagascariensis* (Pau-ferro in Mozambique). Those species only comprise, in average, from 5% to 20% of the total volume of trees in Miombo forests (Mackenzie, 2006).

The fact that the project zone hosts *Swartzia madagascariensis* is significant in terms of biodiversity, as this is probably their last viable population in Mozambique[26]. In the same way, the project zone is the only formal place at global scale to host the *Habenaria villosa* orchid (Fondation IGF, 2011). As a terrestrial orchid located in dry dambo long grass, *Habenaria villosa* had been, so far, only been described in Tanzania (two times, in 1898 and 1968) and Malawi (in 1991). Its unique presence in the GNR is very significant in terms of biodiversity.

In addition, as stated before, wildlife in the project zone is significant with, possibly, 75 identified species of mammals (Deffontaines, 2012) and up to 210 identified species of birds: the biological specificity rate of the GNR is high and the project zone is nationally ranked with the highest conservation priority index (FFEM, 2011). More importantly, the project zone supports 10 mammal species and 2 bird species that are considered to be globally threatened or nearly (see following table). Among them, the elephant population has been drastically reduced in Mozambique since the 1960s. In project scenario, they are subject to special protection measures *(see section 7.5 for more details)*.

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[26] https://www.theguardian.com/sustainable-business/2016/aug/31/mozambique-illegal-logging-china-timber-deforestation

| English name | Scientific name | IUCN Red list Status |
|---|---|---|
| African wild dog | *Lycaon pictus* | **Endangered** |
| African elephant | *Loxodonta africana* | **Vulnerable** |
| Hippopotamus | *Hippopotamus amphibius* | **Vulnerable** |
| Lion | *Panthera leo* | **Vulnerable** |
| Southern ground hornbill | *Bucorvus cafer* | **Vulnerable** |
| Temminck's ground pangolin | *Smutsia temminckii* | **Vulnerable** |
| African clawless otter | *Aonyx capensis* | **Near Threatened** |
| Bateleur eagle | *Terathopius ecaudatus* | **Near threatened** |
| Chequered sengi | *Rhynchocyon cirnei* | **Near Threatened** |
| Leopard | *Panthera pardus* | **Near Threatened** |
| Spotted-necked otter | *Lutra maculicollis* | **Near Threatened** |

Among those species, the project zone also hosts African buffalo. Although they are considered to be "lower risk" species according to the IUCN ranking, buffaloes are declining in Mozambique (East, 1999). In the same way, Lichtenstein Hartebeest, which have been identified in the project zone, are in danger of extinction in the GNR (Fusari et al., 2010). Finally, among the three species of turtles and tortoises that have been identified in the GNR, it is worth noticing that the serrated hinged terrapin (*Pelusios sinuatus*) is endemic in Eastern African countries and can only be found from the South of Tanzania to the Rio Save in Mozambique. The presence of those species in the GNR is therefore an additional sign of significant biodiversity value.

**Focal Area**

Gile National Reserve

Buffer zone of the Gile National Reserve

**High Conservation Value**

*HCV 2 - Intact forest landscapes and large landscape-level ecosystems and ecosystems mosaics that are significant at global, regional or national levels and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.*

**The GNR is the only protected area of the province and one of the three that exist in the North of the country. It shelters one of the most beautiful and pristine forests of Miombo in Africa and contains a remarkable variety of ecosystems.**

**Qualifying Attribute**

The GNR and its buffer zone are located in the Zambezia province, which is one of the most wooded provinces of the country. Even though the GNR is not identified as an "Intact Forest Landscape"[27], it is still sheltering one of the most pristine forests of Miombo in Africa and it contains a remarkable variety of

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[27] See Global Forest Watch

ecosystems ranging from high-altitude inselbergs to low and medium altitude Miombo forest, savannahs and river systems. As it does not entail any human settlement, the forest of the GNR is largely intact and represents one of the largest uninterrupted forest massif of Northern Mozambique (FFEM, 2011). The list of tree and herbaceous species of the project zone currently includes 285 species (Fusari et al., 2010).

As previously stated, the GNR and its buffer zone are mainly made of a mosaic of Miombo woodland and dambo grassland. Miombo is the most important type of vegetation of the Zambezian regional centre of endemism. It is characterized by a large number of different structures and compositions (White, 1983). Although this type of vegetation is not rare, it is especially rich in terms of biodiversity and entails a very specific ecosystem: unlike other tropical formations, its ground components can store large amounts of carbon because of the role played by ectomycorrhiza (FFEM, 2011).

**Inselberg -** *Delbergue, 2015*

The GNR and its buffer zone are characterized by a fairly complex drainage system, consisting of three major rivers that include several smaller streams, some of which permanent and others only seasonal. The three main rivers are the Mulela river (western boundary of the GNR), the Molocue river (eastern limit of the GNR) and the Malema river (central watercourse within the GNR). Other permanent rivers of relative importance are the Naivocone river in the north, the Nakololo river, the Malemacuculo river and the Mucussa river.

| Focal Area | Gilé National Reserve |
| --- | --- |

| High Conservation Value | *HCV 3 - Rare, threatened or endangered ecosystems, habitats or refugee.*<br>***The GNR core area and the buffer zone, which host significant biodiversity value and wildlife, are facing increasing rate of deforestation and forest degradation.*** |
| --- | --- |
| Qualifying Attribute | Forest in the project zone constitutes a threatened and endangered ecosystem. 51% of the territory of Mozambique is composed of natural forest. However, between 1990 and 2004, the average deforestation rate in the country reached |

| | |
|---|---|
| | 0,58%/yr (Marzoli, 2007). Forest cover decreased from 52 million hectares in 1990 to 49 million hectares in 2004 and to only 40 million hectares in 2008. The annual loss of forest cover in Mozambique is estimated to be 200,000 ha, with important differences between the various provinces of the country (FFEM, 2011). |
| | More precisely, deforestation rate in the Zambézia province is 0.71%/yr, which is higher than the national rate (0.58%/yr) and almost twice as important as the global mean deforestation rate for tropical forests (0.36%/yr). The project zone is therefore characterized by a threatened ecosystem and habitat: although the GNR is an officially gazetted Protected Area, anthropic pressure in the buffer zone (project area) has already reduced the availability of natural habitat for large wildlife (section 3.1) and, especially, for elephants. Increasingly fewer, their presence has progressively been concentrated in the Southern and Eastern parts of the area, where vegetation is denser (Martins and Ntumi, 2002). In the same way, black rhinoceros has become extinct in the GNR whereas they were estimated to be 3 in the 1970s (Dutton et al., 1973). No evidence of occurrence of the common zebra (*Equus quagga*) - of which 81 individuals were confirmed forty years ago (Dutton et al., 1973) - and of the blue wildebeest (*Connochaetes taurinus*) was found: they were both considered as extinct from the project zone (Mésochina et al., 2010) until their reintroduction by the project (*see section 7.2*). |
| | The project zone is, therefore, an important concentration of natural forest and threatened habitat to be preserved. In 2013, the districts of Gilé and Pebane (reference zones), over which the GNR and its buffer zone extend, had a forest area of, respectively, 543,366 hectares (61% of district area) and 1,005,479 (58% of district area) (Mercier et al., 2016). |
| **Focal Area** | Gile National Reserve<br>Buffer zone of the Gile National Reserve |

### 5.1.3.  Without-project Scenario: Biodiversity (B1.3)

As stated earlier, the without-project scenario for biodiversity follows the evolution of local activities in the Reserve and its surroundings before project implementation:

- Continual expansion of agriculture which gains the boundaries of the central zone of the GNR, leading to increasing loss of forests cover;
- Increasing forest exploitation (especially for *pau ferro*) and artisanal mining;
- Continuation of poaching of fauna in the reserve on the remaining populations of large animals leading to increasing loss of biodiversity.

In this scenario, the GNR lacks funds and capacities to limit deforestation and poaching in the future.

With regard to animal poaching, the without-project scenario implies a continuation over time of former practices, as social status for hunters within the local communities is high. Bush meat is the main source of animal protein in the project zone and its sales provide immediate personal enrichment. Poaching is therefore part of the everyday life of the communities living in and around the project zone, and this

situation is expected to continue in the without project scenario. Antelopes are the main target of hunting in the project zone. Eleven species of antelopes have been identified. Five of these species are small, generally less than 35kg carcass weight, and are the main prey of local hunters: the bushbuck (*Tragelaphus scriptus)*, the common duiker (*Sylvicapra grimmia)*, the red forest duiker or natal duiker (*Cephalophus natalensis)*, the suni (*Neotragus moschatus)* and the klipspringer (*Oreotragus oreotragus*). The other species – the greater kudu (*Tragelaphus strepsiceros*), the southern reedbuck (*Redunca arundinum)*, the waterbuck (*Kobus ellipsiprymnus)*, the Lichtenstein's hartebeest (*Alcelaphus b. lichtensteinii)* and the sable antelope (*Hippotragus niger*) are larger animals, but all those species were severely reduced in the past through the use of firearms and are now heavily hunted with gin traps. They are all in decline in Mozambique (Fusari et al., 2010). Although it is difficult to precisely quantify animal poaching, this activity is estimated to be very intense in the surroundings of the GNR, where control is weaker than in the GNR itself. It is expected to grow in the without-project scenario. By way of illustration, the number of arrested poachers in the project zone went from 57 in 2009 to 104 in 2011 (IGF, 2013) – *those numbers include animal and wood poachers.*

With regard to deforestation and forest degradation, their main drivers in the project zone are itinerant agriculture (deforestation) along with illegal logging and uncontrolled wildfire (forest degradation). Although the GNR core area is still preserved from deforestation with an annual rate of deforestation of 0.02%/yr between 2000 and 2005 and 0.01%/yr between 2005 and 2010, deforestation in project area (buffer zone) is increasing significantly during the reference period, from 0.18%/yr between 2000 and 2005 to 0.28%/yr between 2005 and 2010 (Mercier et al., 2016). Annual average deforestation in the RRD during the reference period is **2,877 ha/y**, with annual deforestation rates of 0.62%/yr between 2000 and 2005 and 0.68%/yr between 2005 and 2010 (see section 3.1) – see the next table.

Admittedly, deforestation rates in project area are increasing years after years, especially in the northern and north-western part of the Reserve (Figure 14). Even the forest that is located within GNR may soon be affected by land clearing activities, which are increasing on its periphery, despite a recent stabilization that may be due to management improvement since 2009. **At project start, the annual deforestation rate in project area (GNR buffer zone) was estimated to be 0.28%/yr**. **In the without project scenario, this figure is expected to be maintained or to increase.**

**Table 44: Deforestation rates in its buffer zone 2000 – 2010 (Mercier et al., 2016)**

|  | Annual deforestation (%) | |
|---|---|---|
|  | *2000 – 2005* | *2005 – 2010* |
| Gilé National Reserve | 0.023 | 0.006 |
| **Buffer zone** | **0.18** | **0.28** |
| GNR + Buffer Zone | 0.073 | 0.094 |

Increased deforestation and poaching in the baseline scenario means that the biodiversity status in terms of habitats and species in project area will highly be affected in the without project scenario. Loss of forest cover, would lead to a net loss of habitat and to habitat degradation for wildlife, but also to soil disturbance resulting from clear-cuts and uncontrolled wildfires, as well as the progressive disappearance of some tree species, namely *Swartzia madagascariensis* – itself reinforced by the continuation of illegal logging. In terms of national and international biodiversity conservation goals, the overall impact of no project is likely to be unbeneficial and even harmful, given the presence in the

project zone of a significant number of endemic species and globally vulnerable, near threatened and endangered species.

## 5.2. Net Positive Biodiversity Impacts (B2)

### 5.2.1. Expected Biodiversity Changes (B2.1)

#### 5.2.1.1. Biodiversity conservation objectives

The project being a REDD project, biodiversity benefits of the project are expected to come from the long-term preservation of forest plant and animal species that would otherwise be removed from the project area by deforestation, illegal hunting, and other similar threats (Pitman, 2011). Whereas, in the without project scenario, biodiversity is affected by the loss of forest cover and the maintenance or increase of animal poaching, project scenario results into the protection of forest landscape that supports and increases HCVs and associated biota. In order to do so, project activities aim to (Fusari et al. 2010):

- Extend the protected area and strengthen conservation in the core area, through the creation of the Buffer Zone;
- Ensure the conservation of threatened animal and plant species;
- Promote the reintroduction of species that have become locally extinct from the project zone;
- Promote the reinforcement of species that are still present but have become on the verge of extinction;
- Reduce human activities that do not comply with the conservation of biodiversity;
- Rehabilitate locally degraded habitats;
- Facilitate the sustainable use of natural resources by local communities;
- Raise awareness of environmental-related issues in local communities;
- Promote scientific research and monitoring of natural resources.

#### 5.2.1.2. Expected positive impacts of project on biodiversity

Net impacts resulting from project activities are assessed as the difference, with respect to defined biodiversity indicators, between the without-project scenario and direct-monitored project outcomes. Predicted positive changes in biodiversity can be summarized as follows:

| Biodiversity Element | *Timber biodiversity* |
|---|---|
| Estimated Change | Slowdown of the loss of timber biodiversity through the reduction of deforestation and forest degradation in project area |
| Justification of Change | In project scenario, deforestation and degradation of the Miombo forest are mitigated through the reduction of anthropic pressure that is exerted on the ecosystem and soil management is improved through the reduction of uncontrolled wildfire and "slash and burn" agriculture. Specific measures (guards patrols and monitoring of loggers' trucks – see section 1.1.2) in the GNR management plan (Fusari et al., 2010) aim at reducing illegal logging, especially for *Swartzia madagascariensis* which is, as previously stated, greatly |

affected in the without project scenario. All in all, forest protection in the project zone has proven to be effective from 2012 to 2016 (see monitoring of GHG emissions in the VCS PD) and it is expected that forest cover in the GNR (core area and buffer zone) will be maintained beyond, as the project also seeks to perpetuate the management mechanism, through generating environmental externalities that are economically recoverable (carbon credits), in order to initiate the transition to sustainable financial autonomy in the project zone. Moreover, as a management measure, early fires (beginning of the dry season) are voluntarily initiated to burn the herbaceous vegetation when the dry material is still limited in order to prevent intense fires at the end of the dry season, late fires being potentially prejudicial to forest cover (see section 2.1.10).

| Biodiversity Element | *Habitat* |
| --- | --- |
| **Estimated Change** | Improvement of habitat for wildlife |
| **Justification of Change** | In project scenario, the measures aiming at reducing deforestation and forest degradation (see section 1.1.2, the project has been designed to reduce deforestation) are expected to have significant positive impact on forest biota with stability or expansion in their populations. This is partly linked to the fact that habitat connectivity between the GNR and the buffer zone is improved, contributing to increasing habitat area for vulnerable and threatened species and to easing movement of forest specialist animals.<br><br>Positive impact of the project can be assessed through the evolution of the deforestation rate in the project zone and the observation of wildlife that has been formerly identified. |

| Biodiversity Element | *Protected area& HCVs* |
| --- | --- |
| **Estimated Change** | Expansion of total area benefiting from a conservation status and subsequent enhancement of identified HCVs in the project zone |
| **Justification of Change** | Thanks to the creation of the buffer zone at the beginning of the present REDD project, the total area benefiting from conservation status has much increased. From an initial area of 2 861 km$^2$ in 1960 (GNR), the total area benefiting from conservation status (GNR core area + buffer zone) reached 4,396 km$^2$ in 2011 with the creation of the buffer zone – that is, an increase of 1,535 km$^2$ (+54% in comparison to the initial area). In 2013, 964 km$^2$ of this area was allocated to the *Coutada* (sport hunting area) – the total surface |

under protection status did not change. This increase in the conservation area is associated with a management plan (control of some hunting and NTFP harvesting activities in agreement with communities) for the GNR and especially for its buffer zone (Fusari et al., 2010).

This should be considered as the core measure aiming at biodiversity protection in the project zone: this transition zone defines a larger area which enables to control and reduce the impacts of human action in the protection zone – see section 1.1.2. This is expected to contribute to the protection of native forest that supports HCVs through the conservation of an effective natural habitat for wildlife and the protection of diversified vegetation.

| Biodiversity Element | *Wildlife* |
|---|---|
| **Estimated Change** | Increase of the number of animal species and of wildlife in project area |
| **Justification of Change** | The range of animal species is expected to widen and the abundance of animal is expected to increase in project area, through the reduction of animal poaching, the reintroduction of extinct mammal species and the reinforcement of depleted mammal species (see section 1.1.2). Animal poaching is expected to reduce with various project activities, including the development of tourism-hunting in a community-based managed dedicated area in the GNR buffer zone. During the course of the project, the community-based tourism hunting area within the GNR buffer zone (Coutada of Mulela) has been officially gazetted by the Mozambican Government in 2013. However, mainly due to the political and economic difficulties that the country is experiencing in the last few years, it was not yet possible by the date to identify an appropriate private operator to collaborate with the local communities for the management and development of this area. |
| | During the project's implementation two wildlife re-introductions have been conducted. During the first one in 2012, 20 buffaloes from the Marromeu National Reserve and the Gorongosa National Park have been re-introduced in the GNR. During the second one in 2014, 47 buffaloes have been restocked and 20 wildebeests and 15 zebras have been re-introduced. All these species originally occurred in the GNR. It should be noticed that the two reintroduction operations have been preceded by a feasibility study conducted in 2010 (Chardonnet et. al., 2010). Details of the operations are presented in Appendix 5. |

**5.2.1.3. Possible negative impacts of project on biodiversity and mitigation measures**

In the project scenario, changes in biodiversity could also include negative impacts due to activities launched in the project zone and resulting in:

**(i)**     The possible increase of animal poaching linked to a too narrow focus on deforestation measures;

**(ii)**    The displacement of deforestation from the project zone to other areas.

| Biodiversity Element | *Wildlife* |
|---|---|
| **Estimated Change** | Possible increase of animal poaching linked to a too narrow focus on deforestation measures |
| **Justification of Change** | One could argue that a too-narrow focus on avoiding deforestation may overlook damages to other important aspects of the project zone and negative biodiversity impacts, including those on animal communities, such as hunting or poaching (Pitman, 2011). **However, as the project scenario includes an "anti-poaching" component along with anti-deforestation measures, this impact is expected to be limited.** |
| **Mitigation measures** | – Creation and adoption of a long-term management plan for the GNR and its buffer zone, based on a comprehensive approach of their dynamics;<br>– Creation of a legal and well-monitored community hunting area;<br>– Reintroduction of mammal species.<br>*Those measures are detailed in 5.2.2.* |
| **Conclusion** | This change is not expected to take place in project scenario. |

| Biodiversity Element | *Forest cover* |
|---|---|
| **Estimated Change** | Displacement of deforestation from the project zone to other areas |
| **Justification of Change** | It should be noted that the displacement of deforestation from project site to other areas is a risk for all REDD projects, along with the risk of displacement of the economic activity that would have caused deforestation to a site with fewer trees, such as grasslands or wetland areas with high biodiversity value (Pitman, 2011).<br>The project scenario therefore includes the **involvement of local communities in order to reduce human activities that do not** |

| | |
|---|---|
| | **comply with the conservation of biodiversity**, including "slash and burn" agriculture, in and around the project zone.<br><br>Leakage may also be limited by the proximity, next to the project zone, of the GNR, which itself holds the status of "protected area", which implies subsequent means of deforestation control. The existence of the buffer zone itself is a mean to avoid sharp leakage of deforestation. |
| **Mitigation measures** | – Activities developed with communities to reduce expansion of slash and burn agriculture (fertility management with agroecology techniques and development of the cashew market) should limit potential displacement of communities' activities.<br>– The improvement of communities' revenues should limit communities' research of incomes by illegal activities such as poaching of precious wood.<br><br>*Those measures are detailed in section 5.2.2.* |
| **Conclusion** | This risk is very limited in project scenario. |

### 5.2.2. Mitigation Measures (B2.3)

The two potential negative impacts on biodiversity in the project zone are subject to specific mitigating measures in order to ensure the overall net positive impact of the project on biodiversity in the project zone. The main potential negative impacts are twofold: risks of displacement of deforestation and the risk of a too narrow focus on deforestation rather than wildlife management.

The probability of this risk is considered as low for various reasons:

- The existence of long term and comprehensive management plan;
- The support on sustainable agricultural practices;
- The creation of a community-based hunting area (Coutada);
- The insertion of the project into a bigger program at jurisdictional scale.

### *1. Risk of displacement of deforestation from the project zone to other areas*

In project scenario, various activities are implemented in the project zone in order to reduce anthropic pressure on the Miombo forest and to reduce deforestation and forest degradation within the project zone. Hence, without any appropriate measures, a potential negative offsite biodiversity impact in project scenario could be a displacement of deforestation from the project site to other areas, caused by a displacement of the agents of deforestation's activities.

The creation of the buffer zone in 2011 was the first step of the project implementation. It was created as a way to manage the socio-economic development process in the periphery of the GNR (including pilot activities), to implement the 2012 – 2022 management plan of the GNR and its surroundings and to establish the official community-based hunting area (Fondation IGF, 2013a; Fondation IGF, 2012). The buffer zone was officially gazetted by Mozambican decree n°70/2011, published in the Republic

Bulletin (*Boletim da República*) n°52 of December 30th, 2011, with a total area of 1,671 km². The aim of the buffer zone is to define a precise territorial area in which local communities are directly associated with the natural resources' management process, in order for them to benefit from direct revenues generated by this process. Especially, the Coutada (community based hunting area), was created for community to benefit from revenues of international tourism for trophy hunting. This measure is a compensation of the limitation of hunting for communities and provide them economic interests in the wildlife conservation. Moreover, this would limit displacement of community activities outside the project zone if they have diversify source of revenue in the Project Area.

One of the most important measures related to natural resources' management is the implementation of sustainable agricultural techniques in the project zone, which is expected to favour agricultural activities' settlement through land intensification, contributing to the reduction of deforestation and minimizing the risk of deforestation displacement. In the project zone and offsite, the main responsible party for deforestation are smallholders. The project entails a significant training component for smallholders to adopt and benefit from sustainable and settled agriculture. One of the priority objectives is, precisely, to reduce deforestation trough agro-ecological intensification and progressive disappearance of "slash and burn", itinerant, agriculture. The revenues gained from these new agro-ecological techniques are expected to contribute to the long-term settlement of sustainable agricultural practices; thus reducing the risk of displacement of deforestation

Finally, this risk is even more lessened by the insertion of the project into a broader program: the Zambézia Integrated Landscapes Management Program (ZILMP). The ZILMP is a jurisdictional program that has been created under the REDD+ initiative in Mozambique, building up on this project. It will also be implemented in the province of Zambezia and will cover the project zone as well as a broader area. Nine districts, surrounding the GNR and its buffer zone, are involved: Alto-Molocué, Gilé, Ilé, Maganja da Costa, Mocubela, Mulelava, Pebane, Gurué and Mocuba. The objective of the ZILMP is to reduce deforestation by 30% during the first 4 years of its implementation and by an additional 10% during the next 4 years through significant changes in agricultural and bio-energy production patterns (Mercier et al., 2016). So measures to limit deforestation will also be implemented outside of the project zone, limiting options for displacement of agricultural activities. If the program is accepted by the FCPF-CF, it will start in 2018. The very existence of this broader program is a significant means to control the offsite impact of the project: it especially enables satellite imagery monitoring of the activities around and outside the project zone, at larger scale.

### 2. Too-narrow focus on deforestation overlooking damages to other important aspects of the project zone

As previously stated, negative impacts on biodiversity resulting from the project could be caused by a too-narrow focus on avoiding deforestation. This may lead to overlooking damages to other important aspects of the project zone and negative biodiversity impacts, including those on animal communities, such as poaching (Pitman, 2011). Along with the creation of the buffer zone at project start, which itself enables the implementation of various pilot projects that contribute to fuel a comprehensive approach of anthropic dynamics in the project zone and its surroundings, this risk is mitigated in project scenario though the creation of a legal community-based hunting area that is expected to help fighting against animal poaching in and outside the project zone.

In project scenario, this community-based hunting area is an innovative measure based on a co-management framework between a private investor (selected through a call for tenders) and a Mozambican representative community association (*Nokalano*) that was created in order to represent four communities living in the project zone – that is 9,000 people to whom the right of exploitation of the hunting area are conceded (Fusari, 2012). This initiative is seen as a way to fully integrate local communities to natural resources management and to involve them into the overall objective of reducing animal poaching in the project zone (Fondation IGF, 2012). The creation of the community-based hunting area (*comuniataria coutada*) relies on the realization of various feasibility studies (including analysis aiming at delimitating its exact boundaries), biodiversity inventories (especially on large mammals that are present in the area), public consultations in order to associate local communities to the project and to the management of the hunting area and accreditation by local, provincial and central administrations. The community-based hunting area (Coutada of Mulela), with a surface of 965 km$^2$, was declared by the Council of Minister in Mai 2013 and legally gazetted by Mozambican decree published in the Republic Bulletin (*Boletim da República*) on August 23rd, 2013. However, up to date, an appropriate private investor, which should contract with the *Nokalano* community association, for the management and development of the Coutada de Mulela, has not been identified yet. The two main reasons for this situation are: 1) the degradation of the economic condition of Mozambique, which have led to economic and currency instability, and 2) more recently the resurgence of low-level conflicts between political parties has created security concerns in several regions of the country, including the Zambézia Province. These two problems have discouraged, at present, some private investors that have been already identified and with which negotiations have been started.

Along with the creation of the community-based hunting area, the project provides for the reintroduction of native mammal species in project zone. From a general point of view, the reintroduction and reinforcement of animal populations contribute to the protection of ecosystem in the project zone. It is also necessary to: ensure proper balance between the primary consumers (herbivores) and plant species, in order to avoid any "bush encroachment" effect; enable the dynamic equilibrium between the various strata of the ecological pyramid, taking into account the essential functional role of primary consumers, especially in forest habitats; maintain viable populations of prey for large carnivores, especially lions, leopards and wild dogs; guaranty sufficient numbers of game species for the community-based hunting area (Fusari et al., 2010).

Since project start, two significant wildlife reintroduction operations were organized in the project zone: in June 2012, 20 buffaloes were transferred from the Marromeu National Reserve and the Gorongoza National Park to the project zone; in September – October 2013, 47 buffaloes, 15 zebras and 20 wildebeests were transferred from Niassa National Reserve to the project zone (Fondation IGF, 2013a). It is worth noticing that those reintroduction operations followed the exact rules that are prescribed by the IUCN (online guidelines). They were preceded by feasibility studies (Fondation IGF, 2010) and sanitary evaluation (Pereira and Ntumi 2014). Those operations were followed by surveillance and monitoring measures. Three buffaloes, two wildebeests and two zebras have been equipped with GIS/VHF collars in order to provide monitoring (Fondation IGF, 2012 – see Appendix 5). Patrols and surveillance were also increased in the areas where the animals were reintroduced in order to prevent poaching, especially during the dry season. It is only the second time in Mozambique that wildlife reintroduction operations were organized between two national reserves – the first one took place between the Limpopo National Park toward Gorongosa Park (Brugière 2013).

**Figure 24: Buffaloes in the GNR two months after re-introduction - *Deffontaines, 2012***

More broadly speaking, the risk to neglect other negative biodiversity impacts outside of deforestation dynamics in the project zone is mitigated by the creation and adoption of a long-term management plan for the GNR and its buffer zone. This management plan is based on a comprehensive approach of the dynamics, history and challenges of the project zone and of the communities living in and around the project zone. The Management Plan of the National Reserve of Gilé and its Buffer Zone (2012-2021) (Fusari et al., 2010) – which is an actualization of a previous management plan that had not been fully implemented, due to a lack of financial and technical resources – actually defines a new vision and new goals for management and conservation of the GNR and its buffer zone, to ensure that biological resources are preserved, while at the same time, a certain level of access to some resources by local populations be maintained (Fusari et al., 2010). The creation and adoption of the management plan is therefore a mean to ensure that a truly comprehensive approach, based on various socio-economic analysis of the evolution of the project zone, is respected in order to take into account a plurality of biodiversity challenges for the project zone. The management plan entails a list of various activities that should be implemented in the project zone so as to enable a sustainable and multi-disciplinary management of the GNR and its buffer zone.

Reducing deforestation, although being part of the objective of the management plan, is not the only component of its program that, for instance, recalls the need and willingness to engage in hunting tourism in the buffer zone (Fusari et al., 2010). It also defines specific objectives and measures on: the overall surveillance and management of the GNR and its buffer zone and on its management structure; the delimitation of various areas within the project zone and the GNR according to their degree of protection status; the involvement of local communities into the project in the project zone; the management of natural resources; hunting and fishing practices etc.

An important part of the management plan is dedicated to, specifically, the protection of biodiversity in the project zone – it goes beyond the protection of forest and deforestation reduction objectives, with a special focus on communities' needs in terms of wood resources but also non-woody products, the management on wildfires, the commercial component of logging, mining activities in project area, agricultural practices and their potential impact and the protection of mammals.

### 5.2.3. Net Positive Biodiversity Impacts (B2.2, GL1.4)

**Net impact on biodiversity in the project zone resulting from the project is expected to be positive**.

Broadly speaking, net biodiversity positive impact of the project is enhanced by the official gazetting of the buffer zone at the end of year 2011 (project start). The buffer zone's objective is, precisely, to mitigate the effects of human activities on natural resources in project area (Fusari, 2010): it should be considered as the core measure aiming at biodiversity protection in the project zone. As stated in the general dispositions of the Mozambican Law on Forest and Wildlife (*Lei de Florestas e Fauna Bravia*) n°10/99 of July 7, 1999, which settles the principles and norms on the protection, conservation and utilization of forest natural resources and wildlife, the buffer zones of conservation areas are "portions of land surrounding a protected zone, which forms a transition zone between the protected area and multiple use areas, in order to control and reduce the impacts of human action in the protection zone" (Fusari, 2009).

**In project scenario, the buffer zone helps to implement specific measures that address all the negative impacts anticipated in the baseline scenario**. They are summarized below:

**Table 45: Net impact of project on biodiversity**

| Negative impact in the without project scenario | Measure entailed in the project scenario | Net positive impact |
| --- | --- | --- |
| Continuation over time of former practices regarding animal poaching leads to the reduction of wildlife in the project zone. | - Implementation of an effective surveillance and protection system in the project zone, based on anti-poaching units and ground patrols with increased team of rangers;<br><br>- Development of community-based tourism hunting in a well-managed and watched dedicated area in the buffer zone, within the project zone;<br><br>- Creation and maintenance of a database on wildlife and biodiversity monitoring in the project zone;<br><br>- Adoption of a long-term management plan for the GNR. | Strengthening of HCV 1 in the project zone through the protection of threatened animal and plant species. |
| The expansion of itinerant ("slash and burn") agriculture leads to increased deforestation in the project zone (decrease of vegetal | - Development of conservation agriculture and promotion of agro-ecological techniques in the project zone (support to 300 smallholders on about 450 ha). | - Strengthening of HCV 2 and HCV 3 in the project zone through the protection of forest landscape and ecosystem;<br><br>- Reduction of deforestation; |

| | | |
|---|---|---|
| biodiversity and destruction of habitats). | | - Improvement of wildlife habitat and strengthening of HCV 3 through the protection of threatened habitats. |
| Illegal logging is not reduced and leads to increased forest degradation and to the disappearance of rare species of trees in the project zone ("pau ferro"). | - Implementation of an effective control and surveillance system in the project zone, based on anti-poaching units and ground patrol with and increased and better trained team of rangers; <br><br> - Implementation of a punitive system (fees and confiscation of equipment) for arrested wood poachers; <br><br> - Adoption of a long-term management plan for the GNR. | - Strengthening of HCV 1 in the project zone through the protection of rare tree species; <br><br> - Reduction of forest degradation; <br><br> - Improvement of wildlife habitat and strengthening of HCV 3 through the protection of threatened habitats. |
| Uncontrolled wildfires lead to increased degradation, soil disturbance and habitat degradation in the project zone. | - Fire management through outbreaks of early fires (less intense); <br><br> -Communities' awareness raising; <br><br> - Organization of managed early fires. | - Reduction of forest degradation and soil perturbation; <br><br> - Strengthening of HCV 2 and HCV 3 in the project zone through the protection of forest landscape and ecosystem; <br><br> - Improvement of wildlife habitat and strengthening of HCV 3 through the protection of threatened habitats. |

The results of those measures are expected to be positive in terms of net biodiversity impact, with **all the negative impacts identified in the without project scenario being prevented or lessened in the project scenario**. Net positive impacts on biodiversity will be demonstrated over time through periodic monitoring and reporting of biodiversity indicators but some effects are already visible. As previously stated, net biodiversity impact in the project scenario can be assessed through three indicators, which are interlinked. They are listed below.

*1 - Net reduction of deforestation and forest degradation*

*- Reduce deforestation through the promotion of conservation agriculture -*

In the baseline scenario, deforestation is primarily caused by "slash and burn" agriculture, especially related to the culture of maize and cassava. It has resulted, over the years, in a significant extension of cultivated lands and fields, at the expense of forest cover: in the province of Zambezia, the total area dedicated to agricultural activities has grown by 32% between 1972 and 1990, mainly in the districts of Pebane and Gilé (Sacket, 1994). Today, "slash and burn" agriculture accounts for 83.1% of total carbon emissions in the project zone (Mercier et al., 2016). Project scenario entails the implementation of reduced impact agriculture and the promotion of agro-ecological techniques (part of the project managed so far by Agrisud International). During the 2015-2016 agricultural campaign, 380 smallholders were trained to agro-ecological practices by Agrisud International on 440 parcels around the GNR – representing 70 ha. Most of the support focused on the implementation of improved irrigation systems with row planting and relevant leguminous plants. By supporting land-intensification, the project is expected to contribute to reduce deforestation. Plant and animal communities in the project zone will also benefit from longer-term crop rotations with seasonal cycles and higher crop diversity (Pitman, 2011). Project scenario also include the diversification of cultures with the strengthening of cash crops that are not responsible for deforestation - such as sesame and cashew (Mercier et al. 2016) - and the development of agro-forestry systems based on cashew trees. **The agricultural component of the project is therefore expected to have net positive impact on soil fauna, forest cover and plant and animal species present in the project zone.**

*- Reduce forest degradation through diminishing illegal logging and wildfires -*

In the baseline scenario, forest degradation mainly results from illegal logging and uncontrolled wildfires. In project scenario, forest degradation can be reduced through better management of wildfires and reduction of illegal logging. The reduction of illegal logging is addressed by measures also aiming at reducing animal poaching (*see "improvement of wildlife habitat" below for more details*). Uncontrolled wildfires, are initiated by local communities between August and November for agricultural and hunting purposes. They happen without any control and can have negative impacts on vegetation and small animal communities, representing a threat to the conservation of biodiversity in the project zone (Fusari et al., 2010). In project scenario, wildfires are reduced through educational campaign with local communities, effective supervision and better management. More precisely, since the project start, an early fires strategy has been implemented in the project zone even though it has to be strengthened (Fondation IGF, 2013b).

In the project scenario, early fires are used to prevent or minimise late and hot fires used by poachers as techniques for catching animals or initiated by slash and burn activities in order to reduce the impact on tree layer: usually, wildfires are fuelled by natural humid combustible (herbs and small growing bushes) that ultimately give them significant proportion, turning them into uncontrolled and devastative fires. To reduce the scope of the fires, early fires can be organized between July and August in forested area that have lost humidity during with the onset of the dry season. As a consequence, those early fires do not reach very high temperature and remain relatively limited to the first forest layer (Fondation IGF, 2013b).

## 2 - Strengthening of HCVs

In the baseline scenario, HCVs are affected by increased deforestation and poaching, with potential negative impact on vulnerable and endangered animal species, endemic and rare tree species and vegetation, rare ecosystems. **In project scenario, all the identified HCVs that are of importance in conserving biodiversity are enhanced** (*see section 5.2.4).*

## 3 - Improvement of wildlife habitat

In project scenario, wildlife habitat is improved through the overall reduction of deforestation and forest degradation as a mean to maintain a forest landscape that is compatible with biodiversity and wildlife protection. The implemented measures have already been detailed above. Their impact on the improvement of wildlife habitat can be assessed through the evolution of the frequency of animals' direct and indirect signs- which gives an estimation of the evolution of species' presence and abundance - and through the trends of the various species, including bird species, over the years.

Regular monitoring of wildlife in the project zone, conducted by the Fondation IGF, have already shown positive evolution that are expected to be maintained in the future (Fondation IGF, 2011; 2012; 2013b).

*- The reduction of deforestation and forest degradation increases birds and mammals' populations -*

The table below describes the indexes of relative abundance of the main herbivore species in the project zone since the beginning of the project. Since 2011, all indexes rose, except for bush pig and elephant. The number of animals encountered over 10 kilometres has increased for the three most common species: +57% for duiker, +38% for greater kudu and +24% for baboon. The number of encountered sable antelope increased by 40%. These numbers indicate an increase in population growth for those species (Fondation IFG, 2013b).

**Table 46: Evolution of the relative abundance of the most common species in the project zone - (From Fondation IFG, 2013b)**

| | Common Duiker | Baboon | Greater Kudu | Waterbuck | Bushbuck | Sable Antelope | Reedbuck | Bush Pig | Elephant |
|---|---|---|---|---|---|---|---|---|---|
| **2011** | 1.03 | 0.29 | 0.16 | 0.08 | 0.08 | 0.04 | 0.08 | 0.08 | 0.02 |
| **2012** | 0.98 | 0.25 | 0.26 | 0.13 | 0.10 | 0.05 | 0.04 | 0.02 | 0.00 |
| **2013** | 1.54 | 0.31 | 0.36 | 0.15 | 0.11 | 0.07 | 0.05 | 0.01 | 0.00 |

**Table 47: Comparison of the populations of common duikers and greater kudus in the project zone** *(From Fondation IFG, 2011; 2012; 2013b)*

| Species | 2011 | | | | 2012 | | | |
|---|---|---|---|---|---|---|---|---|
| | Jan. – Aug. | | Sep.-Dec. | | Jan. – Aug. | | Sep.-Oct. | |
| | Number of encounters | Ratio | Number of encounters | Ratio | Number of encounters | Ratio | Number of encounters | Ratio |
| **Common duiker** | 578 | 82% | 420 | **72.7%** | 338 | **64.9%** | 664 | **67,5%** |
| **Greater kudu** | 127 | 18% | 158 | **27.3%** | 183 | **35,1%** | 330 | **32,5%** |
| **2013** | | | | | | | | |
| Species | Jan. – Aug. | | | | Sep. – Dec. | | | |
| | Number of encounters | | Ratio | | Number of encounters | | Ratio | |
| **Common duiker** | 635 | | **65.6%** | | 224 | | **75.4%** | |
| **Greater kudu** | 333 | | **34.4%** | | 73 | | **24.6%** | |

Actually, the two populations of common duiker and greater kudu can be easily compared. The trend in the ratio of the number of individuals between those two species can serve as a wildlife indicator in the project zone along the years: they are both present in all areas of the project zone – they are not restricted to or specialized in particular environments – and their evolution should follow the same path. Analysis have shown that, for 100 observations (greater kudu and common duiker combined), a ratio of 73 (common duiker) to 27 (greater kudu) encounters should be considered as maximal – that is, 1 greater kudu for every 3 common duikers (Fondation IGF, 2011). Since project start, the number of encounters of those two species has increased, with the ratio remaining stable (Fondation IGF, 2013b).
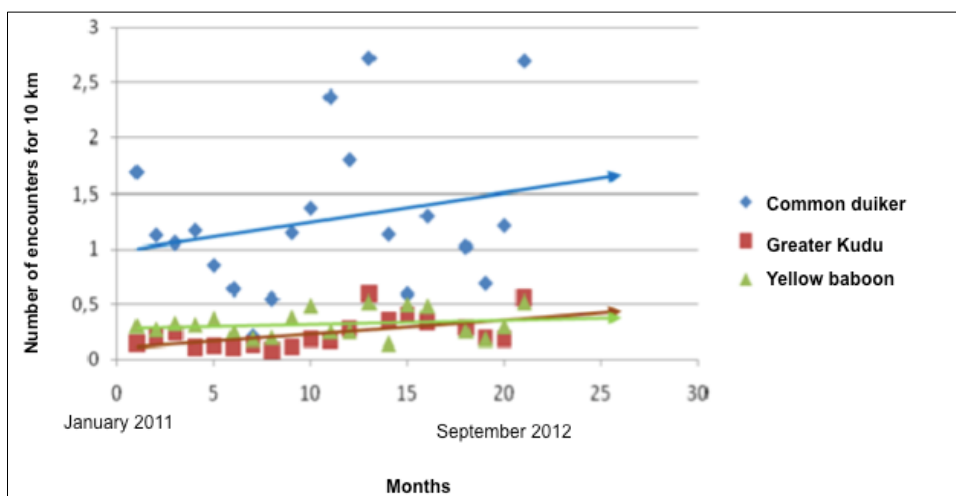
**Figure 25: Evolution of the number of encounters between 2011 and 2012 (From Fondation IGF, 2012)**

In addition, it is also worth noticing that several new species of birds have been discovered since project start, witnessing the non-negative impact of the project on birds' population.

*- Better management and surveillance contribute to reduce illegal logging and poaching -*

Finally, **in project scenario, an important management component based on effective control and watching system, anti-poaching units and ground patrols is implemented** in order to reduce anthropic pressure in the project zone, often related to illegal activities. **This measure contributes to reducing animal poaching and improving wildlife habitat through the reduction of illegal logging.** It relies on: an increase of surveillance staff; the definition of efficient administrative arrangements aiming at sharing costs between implementing partners in order for this system to be sustainable at long term; the establishment of specific and differentiated types of patrols.

In order to ensure the maintenance of the staff at long term, the project entails the adoption of a partnership agreement between various implementing parties of the project so as to share salary cost. Performance bonuses are also part of the management component in order to ensure efficiency of the control system. It is based on financial rewards for the handover and confiscation of traps, weapons and firearms. As an example, in 2012, this system enabled the disabling of 97 traps, against 31 in 2011, therefore contributing to the protection of wildlife in the project zone (Fondation IGF, 2012).

Patrols are regularly organized in the GNR, may they be daily patrols (one day patrol on up to 20 km) or mobile patrols (several daily patrols operated in further areas, on 50km to 80 km). They have two different objectives: demonstrating regular presence of surveillance teams in the project zone and enabling in-depth surveillance of more isolated areas (Fondation IGF, 2011b).

**Figure 26: Destruction of a bush meat smoking site -** *Chardonnet et al. 2014*

Between project start (2011) and 2013, the permanent surveillance staff of the GNR (all type of rangers combined) has already been increased by 27%, reaching a total of 33 rangers (Fondation IGF, 2013b) – to whom should be added some 10 seasonal rangers. Early results have already proved the net biodiversity impact of such measures. The number of registered infringements in the project zone has diminished: between 2011 and 2013, although the number of patrols has increased by 6% (from 411 patrols in 2011 to 436 in 2013), the number of met poachers has decreased by 65% (from 237 individuals in 2011 to 82 individuals in 2013) and the number of arrested poachers has decreased by 74% (from 104 individuals in 2011 to 27 individuals in 2013) (Fondation IGF, 2013a).



**Figure 27: Examples of surveillance in the GNR, against illegal logging -** *Fondation IGF, 2015*

### 5.2.4. High Conservation Values Protected (B2.4)

As previously stated, the project zone is characterized by the presence of various HCVs. The core objective of the project is to protect native forest: the project zone contains one of the most beautiful and

pristine forests of Miombo in Africa. The project is therefore expected to value and further increase the associated HCVs. More precisely, the protection of precious hardwood timbers - including *Pterocarpus angolensis* (umbila) and *Swartzia madagascariensis* (snake bean or *Pau-ferro*), of endemic species – such as the *Habenaria villosa* orchid, of which the unique presence in the GNR is very significant in terms of biodiversity – and of threatened animal species is a priority objective of the project.

With regards to the protection of threatened species, an important component of the project is dedicated to the protection of the African elephant, estimated to be more than 50 individuals in the project zone at project start (see section 5.5 – optional criterion, for more details).

**Considering the overall project goals and the observed and expected positive impacts on the ecosystem and biodiversity of plants and wildlife in the project area, it is not anticipated that the HCVs will be negatively affected by the project activity.**

The absence of negative impacts on HCVs will be demonstrated over time through periodic monitoring and reporting of HCVs indicators *(see Biodiversity Monitoring Plan)*.


### 5.2.5.  Introduction and invasive Species (B2.5 & B2.6)

The project does not involve the introduction of any invasive species in the project zone.

It only uses non-invasive species for agricultural purposes: Cashew tree. Cashew trees have historically been growing in Mozambique, including in the project area, and Mozambique is considered to be a historical producer of raw cashew nuts: exports of raw cashew nut from Mozambique to India can be traced back, at least, to the beginning of the 20th century (Rabany, 2014). In the 1960-70s, Mozambique used to produce 50% of world production of raw cashew nuts (Rabany, 2014; Rabany, 2015). Today, in Mozambique, cashew trees are estimated to cover 200 000 ha. Their actual covering shows that they are not invasive species, since it is limited to areas where trees have been planted, without any natural regeneration elsewhere. The national production (90,000 t / year) represents 2% to 3% of global production, with a significant concentration in the Zambézia province (15,000 t / year) (Rabany, 2014). More specifically, the project reference areas, the districts of Pebane and Gilé, already produce between 4,000 and 7,000 t per year of raw cashew nuts (Rabany, 2014). In project scenario, cashew production in the project zone is enhanced and supported through the introduction of new cashew plants in order to rehabilitate the aging orchard. Meanwhile, intercropping techniques are promoted. The objective of such measure is to increase the revenues derived from the sustainable use of cashew trees, while reducing the drivers of deforestation that are the cultivation of maize and cassava through "slash and burn" agriculture.


With regards to wildlife, the project only entails the reintroduction of native species that have become extinct from the project zone. At project start, five large herbivores species have been recognized as extinct in the project zone:

-The black rhinoceros *(Diceros bicornis);*

-The African buffalo (*Syncerus caffer*);

-The eland (*Taurotragus oryx*);

-The wildebeest (*Connochaetes taurinus);*

-The zebra (*Equus quagga*).

In the project scenario, the two re-introduction operations imply the reintroduction of African buffaloes,

zebras and wildebeests**.** Those species used to occur in large numbers some decades ago (Fondation IGF, 2010). It is worth noticing that the practicability of the reintroduction of major large mammal species to the project zone has been assessed prior to any reintroduction, in order to describe ways and means to ensure the success of the operation, to assess eventual risks and identify risk alleviation methods (risk analysis) and to match the operation with the IUCN principles (compliance with IUCN guidelines) (Fondation IGF, 2010). They concluded to the suitability of those three species for reintroduction.

**Because no known invasive species are introduced into any area affected by the project, no population of invasive species is expected to increase as a result of the project.**

### 5.2.6. GMO Exclusion (B2.7)

The project does not make any use of GMOs. The project only plants non-invasive species that are raised in nurseries from seeds collected from natural trees and that are not genetically modified (cashew trees).

### 5.2.7. Inputs Justification (B2.8)

Initially, in project scenario, no fertilizers, chemicals, pesticides or biological control agents are used. The promotion of agro ecological practices in the project zone is exclusively based on biological techniques.

However, the support to cashew production in the project zone could imply at medium-term pulverization operations in order to temporarily increase the yields of aging orchard. Nevertheless, at longer term, the new cashew plants that will be implemented by the project are expected to be productive enough to avoid any use of external agents, which is only a temporary measure. Specific trainings will be organized to ensure that the prescribed doses are respected. Furthermore, those pulverizations are expected to be too few and sufficiently well managed to have any negative impact on biodiversity in the project zone: future assessment on their effect should nevertheless be conducted, when more data becomes available. If any, negative impact of pulverization will be limited and the net impact of the measure will be positive.

### 5.2.8. Waste Products (B2.9)

Waste resulting from project activities is limited. No particular waste products are expected to result or increase from project activities especially. Implementing partners are responsible for sensitizing their teams to the need to collect possible domestic waste in their area of intervention. Regular site inspections are expected to be conducted by implementing partner on their intervention zone to ensure that no domestic waste or waste resulting from their activities is left unattended.

### 5.3. Offsite Biodiversity Impacts (B3)

### 5.3.1. Negative Offsite Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

Potential negative impacts on biodiversity outside the project zone resulting from project activities are:

- Risk 1: Displacement of deforestation from the project site to other forested areas (leakage);
- Risk 2: Increased fuel wood collection pressure by local residents displaced from project areas;

- Risk 3: Air, soil, or water pollution from chemical inputs (fertilizers, pesticides) used in reforestation, afforestation, or sustainable agriculture projects.

All those potential negative offsite impacts are addressed by mitigating measures that are described in the following tables. **They are not expected to outweigh the biodiversity benefits within the project zone.**

| Negative Offsite Impact | Mitigation Measure(s) |
|---|---|
| Risk 1: Displacement of deforestation from the project site to other areas (leakage); | – Measures aiming at "settling" agricultural practices and reducing the risk of displacement of agriculture induced by "slash & burn" agriculture (land intensification);<br>– Diversification of communities' revenues through cash crop market development (cashew) and the creation of the Coutada;<br>– Insertion of the project into a bigger program at jurisdictional scale.<br><br>*Those measures are described in details in section 5.2.2.* |
| Risk 2: Increased fuel wood collection pressure by local residents displaced from project areas; | This risk is considered to be very low. First, no local resident will be displaced from project area. The GNR is currently the only natural reserve in Mozambique free of any human settlement and, in its buffer zone, residents are sedentary smallholders who are expected to benefit from the project in the project zone: they are not expected to move from the project zone.<br><br>In addition, fuel wood collection is subject to specific measures within project scenario that should mitigate any un-planned displacement of fuel wood collection activities from the project zone to further areas. |

| | |
|---|---|
| Risk 3: Air, soil, or water pollution from chemical inputs (fertilizers, pesticides) used in reforestation, afforestation, or sustainable agriculture projects | This risk is associated with the use of fertilizer for cashew trees. *The mitigating measures linked to this activity are* detailed in section 5.2.9. They encompass: <br><br> − A limited use of inputs in time (temporary measure only); <br> − The organization of specific trainings to ensure that the prescribed doses are respected; <br> − Future assessment on the effect of fertilizers. |

### 5.3.2. Net Offsite Biodiversity Benefits (B3.3)

Risks 1, 2 and 3 are entirely reduced to almost zero through mitigating measures that are expected to be efficient. For those three risks, no unmitigated negative offsite biodiversity impacts as a result of the project are expected to remain.

It can be expected that some un-mitigated pollution from chemical input used in the agricultural component of the project be observed outside of the project zone (risk 4). However, if any, this pollution is expected to be very limited and not exceed the project's biodiversity benefits within the project zone. Thus, net impacts of the project are unlikely to be negative.

### 5.4. Biodiversity Impact Monitoring (B4)

### 5.4.1. Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

Biodiversity monitoring is a key element to ensure the viability and success of the project. In project scenario, biodiversity monitoring is based on previous works that have been conducted in the project zone since 2008, including:

- Mésochina P., Langa, F., Chardonnet, Ph., 2008. *Preliminary survey of large herbivores in Gilé National Reserve, Zambézia province, Mozambique*. IGF Foundation.
- Prin T., 2008. *Typologie et cartographie de la végétation de la Réserve Nationale de Gilé (Mozambique): Étude préalable à la réintroduction de grands mammifères*. Fondation IGF.
- IGF Foundation, 2010. *Reintroduction of extinct species of large herbivores to the Gilé National Reserve, Zambézia province, Mozambique*. FFEM, IGF Foundation.

Those preliminary works have drawn efficient strategies that are part of the monitoring process for biodiversity in project scenario, such as regular on field data collection conducted throughout the year during surveillance patrols and car journeys and specific missions of expertise on precise subjects and topics, including on key species (Deffontaines, 2012). Those guidelines have been completed at project start (2011) by the implementation of a participatory monitoring process on wildlife that has, since then, been regularly assessed and revised in order to make sure it is coherent with the evolution of the project. Relevant literature on project biodiversity monitoring in project scenario includes:

- Fusari, A., 2011. *Coutada Comunitária de Mulela, Plano de Maneio 2012-2016*. Província da Zambézia, Moçambique. Fundação IGF.
- Julliand S., Meunier C., 2011. *Mise en place d'une méthode de suivi de la grande faune dans la réserve nationale de Gilé (Zambézie, Mozambique)* - Rapport de fin de mission (juillet 2010 - juin 2011). FFEM, Fondation IGF, DNAC.

- Magane, S., Boulet, H., Chardonnet, Ph., Lamarque, F., 2011. *Proposta de estabelecimento de um método de monitoria ecológica «orientado gestão» para as Coutadas.*IGF Fondation.
- Deffontaines, J.-B., 2012. *Biodiversité et Suivi Écologique - Réserve Nationale de Gilé, Province du Zambèze, Mozambique - janvier 2011 à novembre 2012.* Fondation IGF.
- Delbergue, A., 2015. *Evaluation de la méthode du système de suivi de la grande faune de la Réserve Nationale de Gilé: Bilan et Perspectives d'avenir, Province du Zambèze, Mozambique.* Fondation IGF.

### 5.4.1.1. Monitoring method

In 2015, the monitoring process was entirely re-assessed and updated (Delbergue, 2015). It mainly focuses on wildlife monitoring. In project scenario, monitoring is based on a list of species to be monitored in a precise area of monitoring and on a list of specific indicators to monitor, to which frequencies of monitoring have been associated – even if most indicators are monitored during all journeys and displacement in the Reserve, direct and indirect observations and systematic use of fauna reporting. Those elements are described hereafter. Tools and techniques of monitoring and are also detailed.

Various monitoring methods, that can be classified into 5 categories (Danielsen et al., 2008) according to their data collection methods and degree of implication of local population, have been analyzed in order to choose the adequate monitoring system for the project - see below:

**Table 48: Monitoring category systems according to Danielsen et al. (2009)**

| Monitoring category system | Data collection | Data management |
|---|---|---|
| Category 1 | Scientific researchers and professionals | Scientific researchers and professionals |
| Category 2 | Scientific researchers and voluntary local population | Scientific researchers with feedbacks to local population |
| Category 3 | Local population with the support of professional researchers | Local population with the support of professional researchers |
| **Category 4** | **Local population** | **Local population with the support of professional researchers** |
| Category 5 | Local population | Local population |

The system that was selected aims to avoid any strong participation of scientists and to involve as much as possible local rangers with autonomous data collection process, relying on the patrolling system already in place. A monitoring system that would be classified in the "category 4" according to (Danielsen et al., 2008) was therefore preferred.

More specifically, in project scenario, monitoring of wildlife is based on a Management Oriented Monitoring System (MOMS) (Stuart-Hill et al. 2005). This method was chosen so that it is sustainable over time. From a general point of view, MOMS are primarily based on community participation, with the support of scientists and technicians (Stuart-Hill et al., 2005). In project scenario, the overarching goal

is to involve local rangers and guards in the monitoring process and enable long-term independent survey data (Delbergue, 2015). The monitoring plan is therefore implemented gradually and ought to involve more and more rangers over time (Delbergue, 2015). This system is completed by the presence of a technical adviser within the project area and/or by assistance of the IGF Fondation. Specialists and professionals, who are part of the implementing parties, regularly control the collected data to make sure the monitoring system produces viable information.

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**Main objectives of the monitoring process in project scenario:**

(i)   Assessing regular changes in wildlife populations in the project zone;

(ii)  Valorising rangers' and patrols' work for them to be involved in the management of wildlife in the project zone;

(iii) Facilitating the establishment of reasonable quotas for the community hunting area (Delbergue, 2015).

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This method enables to collect information on the trend of wildlife in the project zone, including the distribution of animal populations per geographic units, their relative abundance, the trend of their population over time as well as poaching data (Delbergue, 2015). In addition, MOMS does not imply the use of informatics tools for data collection – this could have been an obstacle for monitoring process implementation in remote areas of the project zone.

### 5.4.1.2. Areas to be monitored

In project scenario, biodiversity is monitored in the GNR core area and buffer zone. The GNR core area is divided into 16 monitoring zones in order to ease data collection. The 16 monitoring zones are between 10 000 and 20 000 ha (Magane et al., 2011). The number of the monitoring zones should be large enough to enable the comparison of data and indicators between geographical units as well as between seasons and years (Julliand and Meunier, 2011).
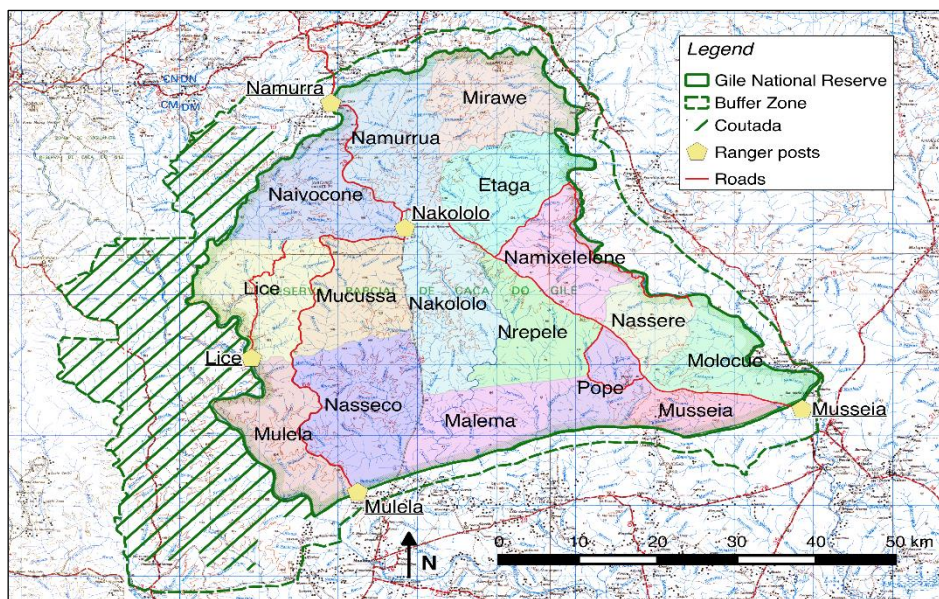
**Figure 28: Geographical units in the GNR and in the buffer zone (From Magane et al., 2011)**

### 5.4.1.3. Types of measurements and frequency of monitoring

Monitoring tools are defined in close cooperation with the rangers, so that they are adapted to field conditions and data's collectors' requirements. For example, the division of the monitored area into 16 sub areas is organized with the rangers: the geographical units are delimited with trails, roads or waterways which are all well known by them, and named accordingly (Magane et al., 2011). During the patrols, the rangers are equipped with GPS trackers and tracking/monitoring sheets (see below), a plasticized map of the project zone, another map in the back of the monitoring sheets for them to re-trace their distribution and a panel of animal drawing to help recognition (Julliand and Meunier, 2011). The main important monitoring tools are:

- **Follow-up sheets**: those are regularly filled in by surveillance patrols during surveillance patrols and car journeys. In 2015, 1,600 sheets had already been completed (Delbergue, 2015). Created at project start in 2011, the monitoring sheets have been updated in 2015 (Delbergue, 2015):

  (i)    *Regular monitoring sheet* are filled in as often as possible, after journeys and displacements in the Reserve. It provides general information about fauna monitoring, including direct observations data (number of animal encounters and individual animals for each sightings) and indirect observations (with regard to various clues, evidence and signs). It also summarizes the information on poaching combining direct observations (number of poachers met / arrested, number and types of defused traps) and indirect observations (evidence of poaching).

  (ii)   *The rare species monitoring sheet* is dedicated to animals that are considered to be of particular value in the project zone: lion, leopard, serval, spotted hyena, wild dog,

Lichtenstein's hartebeest, African elephant and hippopotamus – this monitoring, except for elephant, was abandoned in 2012 because of the low frequency of encounters (Deffontaines, 2012).

(iii)    *The monthly monitoring sheet* is filled every month according to a pre-formatted model. It provides information on all the patrols that have been conducted during the month, with both general and synthesized data for the whole project zone and more specific ones on each geographic unit.

-    **Multiple trainings**: in project scenario, local rangers benefit from various trainings that enable to stimulate long term monitoring dynamics. Those trainings include: GPS utilization training, map-reading training, Mozambican ecological law training, storage and data analysis training (Delbergue, 2015; Magane et al., 2011).

-    **Camera traps**: at project start, 4 camera traps were also installed in the project zone. Equipped with temperature variation detectors, they are expected to capture day and night movement of animals. With significant autonomy and a large memory card, traps can stay in place up to several months. They are settled in various sites with different characteristics (rivers, *dambos*, etc.) enabling the detection of many species according to their environment (Deffontaines, 2012).

**Figure 29: Animal movement captures by photo-traps: warthog and bushbucks in project area - *Deffontaines, 2012***

-    **Tracking collars**: elephants and reintroduced species (buffaloes, zebras, and wildebeests) are also monitored, in project scenario, with GPS tracking collars. Their GPS position is regularly monitored via Internet and their field monitoring can be organized accordingly. In the field, animals fitted with radio collars can also be identified through conventional radio signal HF and localized via triangulation (Deffontaines, 2012).

-    **GPS:** GPS are used for geo-referencing animal observations or specific sites. They are also used to trace back with precision the itineraries of patrols and the number of kilometres that were patrolled. Since 2015, the rangers are equipped with GPS trackers that automatically read the coordinates of the location at regular frequency (1 point every 15 seconds) (Delbergue, 2015);

- **Biodiversity monitoring database**: in order to consolidate the data available on biodiversity in the projects zone at long-term, an Excel biodiversity database, in which the information collected and detailed in the monitoring sheets were compiled, was created. Each monitoring sheet was transferred in one line of the spreadsheet and all the spreadsheets of the same month were compiled in the same tabbed section (twelve per year, from January to December). Each project year has a specific Excel database file (Delbergue, 2015). In 2015, all the databases were checked and updated to guaranty the efficiency of the monitoring plan and to assess its degree of appropriation by the rangers. Furthermore, in order to simplify data handling, the yearly monitoring databases (from 2011 to 2015, that is 5 files) was compiled into one single general database (Delbergue, 2015).

The frequency of monitoring depends on the indicators (see tables below). Indicators related to wildlife are monitored as often as possible through ranger patrols and observation, both direct and indirect. More precisely, the biodiversity databases are updated regularly. Every semester, the implementing parties are in charge of writing in-depth reports on their activities, with an update on new data collected, including on biodiversity. Every year, the IGF annual report on project evolution provides specific information on biodiversity in the project zone. In addition to those regular monitoring, *ad-hoc* specific studies and reports are conducted to obtain more information on various topics related to biodiversity and to the indicators that were identified.

### 5.4.1.4. Sampling methods and variables to be monitored

As previously showed, the project is expected to have net positive impact on biodiversity in the project zone. By monitoring outputs, outcomes, and impacts of project activities, the project will demonstrate long-term impacts on biodiversity, may it be in terms of wildlife abundance and diversity, in terms of natural vegetation or in terms of ecosystem, assessed through forest biomass monitoring. The results are expected to show the success of the implemented activities with regards to deforestation and forest degradation reduction and overall biodiversity, including for wildlife.

The main species that are monitored are listed in the table below. They encompass especially sought-after herbivores (which enables to assess in the meantime the evolution of poaching in project zone), species considered as threatened and reintroduced mammals.

**Table 49: Monitored species in the wildlife biodiversity monitoring plan, from 2015 – (***Delbergue, 2015; Deffontaines, 2012***)**

| English name | Scientific name |
|---|---|
| Buffalo (from 2012) | *Syncerus caffer* |
| Bush pig | *Potamochoerus porcus* |
| Bushbuck | *Tragelaphus scriptus* |
| Common duiker | *Sylvicapra grimmia* |
| Elephant | *Loxodonta africana* |
| Greater kudu | *Tragelaphus strepsiceros* |
| Hippopotamus | *Hippopotamus amphibius** |

| | |
|---|---|
| Leopard | *Panthera pardus** |
| Lichtenstein's hartebeest | *Alcelaphus lichtensteini** |
| Lion | *Panthera leo** |
| Natal red duiker | *Cephalophus natalensis* |
| Sable antelope | *Hippotragus niger* |
| Serval | *Leptailurus serval** |
| Southern reedbuck | *Redunca arundinum* |
| Spotted hyena | *Crocuta crocuta** |
| Waterbuck | *Kobus ellipsiprymnus* |
| Wild dog | *Lycaon pictus** |
| Wildebeest | *Connochaetes taurinus johnstoni* |
| Yellow baboon | *Papio cynocephalus* |
| Zebra (from 2012) | *Equus quagga* |
| *\* Species of which the monitoring was abandoned in 2012 because of a too low encountering rate* | |

As stated by Pitman (2011), monitoring programs should never monitor conservation targets in isolation, but rather together with the positive and negative influences on those targets. The indicators that are globally used in project scenario can be classified in three categories: pressure, state and response (PSR indicators). They are detailed in the next tables.

| Data Category | STATE |
|---|---|
| Data / Parameter | Area of forest cover |
| Data unit | Ha |
| Description | The quantity and quality of forest cover, including HCV2 (large, landscape-level forest) and HCV3 (rare, threatened or endangered ecosystems) is associated to forest conservation, assessed through the evolution of forest cover area for the different project zones: RRD, PA and LB. |
| Source of data | Remote sensing images: Landsat scene of 30-m resolution. |
| Description of measurement methods and procedures applied | Use of Landsat images 5, 7 et 8 with priority use of GLS (Global Land Survey) products dedicated to the analysis of land use changes. In case of unavailability or presence of clouds on these products, archival images L1T (geo-referenced only) are downloaded. The description of the method is available in section 3.4. |
| Frequency of monitoring/recording | Every 5 years |

| Data Category | STATE |
|---|---|
| Data / Parameter | Abundance of wildlife for key species |

| Data unit | Probability of encounter of animals per targeted species |
|---|---|
| Description | Number of patrols during which the species was encountered/total number of patrols |
| Source of data | Rangers' patrols, displacement and journeys in project area; reports of patrols; camera traps. |
| Description of measurement methods and procedures applied | Direct counting; fauna monitoring reports; biodiversity monitoring database; animal sightings and records of camera traps. |
| Frequency of monitoring/recording | Continuously |

| Data Category | STATE |
|---|---|
| Data / Parameter | Quantity of wildlife diversity |
| Data unit | Number of species per groups |
| Description | Wildlife species diversity, assessed trough the share of different species in the project zone and their evolution over time. This implies to assess the percentage of each species encountered and determine their relative abundance (number of individual of each specie encountered on every 10km). |
| Source of data | Rangers' patrols, displacement and journeys in project area; reports of patrols; camera traps. |
| Description of measurement methods and procedures applied | Direct counting; fauna monitoring reports; biodiversity monitoring database; animal sightings and records of camera traps. |
| Frequency of monitoring/recording | Continuously |

| Data Category | STATE |
|---|---|
| Data / Parameter | Status of HCV 1 |
| Data unit | Number of individuals per targeted species |
| Description | - Monitoring of species identified HCV1: vulnerable, near threatened and endangered mammals and birds.<br>- Abundance of especially hunted herbivores and evolution of the ratio of the numbers of individuals of greater kudus and common duikers.<br>- Monitoring of reintroduced species that were extinct. |
| Source of data | Rangers' patrols, displacement and journeys in project area; reports of patrols; camera traps. |

| | |
|---|---|
| Description of measurement methods and procedures applied | Direct counting; fauna monitoring reports; biodiversity monitoring database; animal sightings and records of camera traps; specific surveys. |
| Frequency of monitoring/recording | Continuously |

| Data Category | STATE |
|---|---|
| Data / Parameter | Abundance of species of trees not threatened but significant in terms of biodiversity |
| Data unit | Number of tree species |
| Description | Species especially representative of the region or notable for other reasons (especially logged): *Swartzia madagascariensis, Pterocarpus angolensis, Millettia stuhlmannii, Pericopsis angolensis.* |
| Source of data | Forest inventory in the GNR |
| Description of measurement methods and procedures applied | Direct counting |
| Frequency of monitoring/recording | Every 5 years |

| Data Category | PRESSURE |
|---|---|
| Data / Parameter | Anthropogenic impact on biodiversity: wildfires |
| Data unit | Number |
| Description | Monitoring of the number of wildfires occurring |
| Source of data | Remote sensing images: Landsat scene of 30-m resolution. |
| Description of measurement methods and procedures applied | Use of Landsat images 5, 7 et 8 with priority use of GLS (Global Land Survey) products dedicated to the analysis of land use changes. In case of unavailability or presence of clouds on these products, archival images L1T (geo-referenced only) are downloaded. Description of the method is available in Mercier et al. (2016). |
| Frequency of monitoring/recording | Every 5 years |

| Data Category | PRESSURE |
|---|---|
| Data / Parameter | Anthropogenic impact on biodiversity: illegal logging |
| Data unit | Number of targeted trees cut in the GNR |

| | |
|---|---|
| Description | Monitoring of illegal logging (number of trees cut) in the GNR for Pau-Ferro trees (*Swartzia madagascariensis)* during forest inventory (counting of stumps) and monitoring of number of trunks with illegals logged arrested. |
| Source of data | Forest inventory and monitoring of trunks arrests |
| Description of measurement methods and procedures applied | Direct counting |
| Frequency of monitoring/recording | Every 5 years for forest inventory and continuously for trunks arrests |

| Data Category | RESPONSE |
|---|---|
| Data / Parameter | Frequency and intensity of project interventions: anti-poaching activities |
| Data unit | Number of interventions |
| Description | Intensity of surveillance monitoring assessed though the number of kilometres covered by rangers and patrols; monitoring of the evolution of the number of poacher traps collected and of poachers arrested (ratio). |
| Source of data | Rangers' patrols reports; GNR management team. |
| Description of measurement methods and procedures applied | Systematic records of the number of patrols and area covered by the patrols and of the number of traps and poachers arrested. A ratio between the intensity of patrolling and the results in terms of poachers arrested and traps collected could be defined. |
| Frequency of monitoring/recording | Annually |

### 5.4.1.5. Maintaining and enhancing HCVs

As previously stated, the protection and enhancement of HCVs in the project zone is a core objective of the project. Whereas, in the without project scenario, biodiversity is affected by the loss of forest cover and the maintenance or increase of animal poaching in the project zone, project scenario should result into the protection of forest landscape that supports and increases HCVs and associated biota. In project scenario, the impact of the project on HCVs is monitored through the general monitoring process: HCVs are part of the "state" indicators that were previously listed. As detailed in the previous tables, the main indicators that were selected with regards to HCVs monitoring can be summarized as follows:

-   The number of the rarest species of trees in Miombo forests, including *Swartzia madagascariensis*, to evaluate the impact of the project on endemic and rare species present in the project zone (HCV1);
-   The number of the various IUCN categories of threatened mammals and birds – identified as such by the IUCN (HCV 1). *It is worth noticing that, although the "rare species monitoring sheet" was abandoned in 2012, due to low frequency of encounters, those animals are still monitored through regular monitoring patrols which details the encountered species.*

- The extent of forest cover in project zone, to measure the impact of the project on the Miombo forest landscape (HCV 2);
- The area of forest cover as an indicator of natural habitat extent.

The general monitoring plan encompasses specific monitoring activities with regards to HCVs. They include:

- Carry out animal species monitoring-census, with specific focus on endangered and vulnerable species;
- Carry out forest inventories;
- Carry out forest cover mapping;
- Monitor the evolution of the species that are reintroduced in the area;
- Create a map of risk of future deforestation;
- Use LANDSAT images to assess forest cover;
- Monitor the evolution of carbon stocks and biomass;
- Make systematic use of fauna monitoring reports;
- Create and maintain an efficient biodiversity-monitoring database.

It is worth noticing that the African elephants, which are identified as a trigger species in project scenario, benefits from a specific monitoring component. It is notably based on in depth analysis and surveys that were conducted by specialists as well as on the use of satellite beacons that enable to map their repartition and evolution in the project zone (*see section 5.5 for more details*). The overall efficiency of the project in the protection of HCVs will eventually be assessed through the overall reduction of deforestation and forest degradation and the maintenance or increase of animal species over time.

### 5.4.2. Biodiversity Monitoring Plan Dissemination (B4.3)

The monitoring design of the project as it had been applied since project start in 2011 has been regularly assessed and updated. After a first readjustment in 2012 (see Deffontaines, 2012), it was entirely assessed and revised later to make sure it is both consistent and efficient with regards to project's objectives (Delbergue, 2015). This process concluded that the data that have been collected throughout the year are successful in tracking the evolution of animal populations and poaching activities in the project zone. They are also useful as a management tool for the project zone (*ibid.*). In addition, the implementing parties are expected to produce regular reports throughout the project, including annual reports that summarize project activities and components, with a significant focus on the biodiversity-monitoring element.

Monitoring and implementation reports will be posted in the public domain on the CCBA and VCS websites in accordance with each program's procedures. Once approved, the Project Description Document will be uploaded on the implementing parties' webpages and available to the public. Its content will be shared with communities and stakeholders and summaries of the monitoring results will be disseminated within the project zone to every interested party.

## 5.5. Optional Criterion: Exceptional Biodiversity Benefits (GL3)

### 5.5.1. High Biodiversity Conservation Priority Status (GL3.1)

The GNR and its buffer zone are part of an area that holds exceptional biodiversity values that have already been identified and described in section 5.1. The project zone hosts various species that holds the "vulnerable" and "endangered" status as defined by IUCN. They are presented in the following table.

**Table 50: List of vulnerable and endangered species in project zone**

| Species | Scientific name | UICN Status |
|---|---|---|
| African elephant | *Loxodonta africana* | Vulnerable |
| Temminck's ground pangolin | *Smutsia temminckii* | Vulnerable |
| Hippopotamus | *Hippopotamus amphibius* | Vulnerable |
| Lion | *Panthera leo* | Vulnerable |
| Southern ground hornbill | *Bucorvus leadbeateri* | Vulnerable |
| Martial eagle | *Polemaetus bellicosus* | Vulnerable |
| African wild dog | *Lycaon pictus* | Endangered |

More precisely, the project zone includes a site of high biodiversity conservation priority on the basis of Key Biodiversity Area (KBA) framework of vulnerability and irreplaceability. The project zone meets the vulnerability criteria through hosting at least one specific trigger species in suitable proportion:

- African wild dogs (endangered): at least a single individual identified in the project zone (;
- African elephants (vulnerable): at least 30 individuals identified in the project zone (confirmed).

Although their population density may be limited, African wild dogs could be present in project area, where their most probable location would be southwest of the Reserve (Deffontaines, 2012). Indeed, significant packs of wild dogs, from 14 to 16 individuals, have been identified in project area in the past. Although one individual may have been spotted by local residents at the beginning of the project, in 2011, the last direct and credible observation of African wild dogs goes back to 2008, when a pack of 16 individuals was spotted (Fondation IGF, 2013b). In 2009, the carcasses of 4 African wild dogs were discovered, poisoned, in Malema (Deffontaines, 2012).

Conversely, African elephants are regularly observed in the project zone and subject to specific survey and studies, giving precise information on their evolution. At project start, African elephants are estimated to be close to 80 individuals (Mesochina *et al.*, 2008) in the project zone. In 2012, they are estimated to be 58 individuals (Ntumi et al. 2012). Their geographic repartition in the project zone is shown in the next figure.
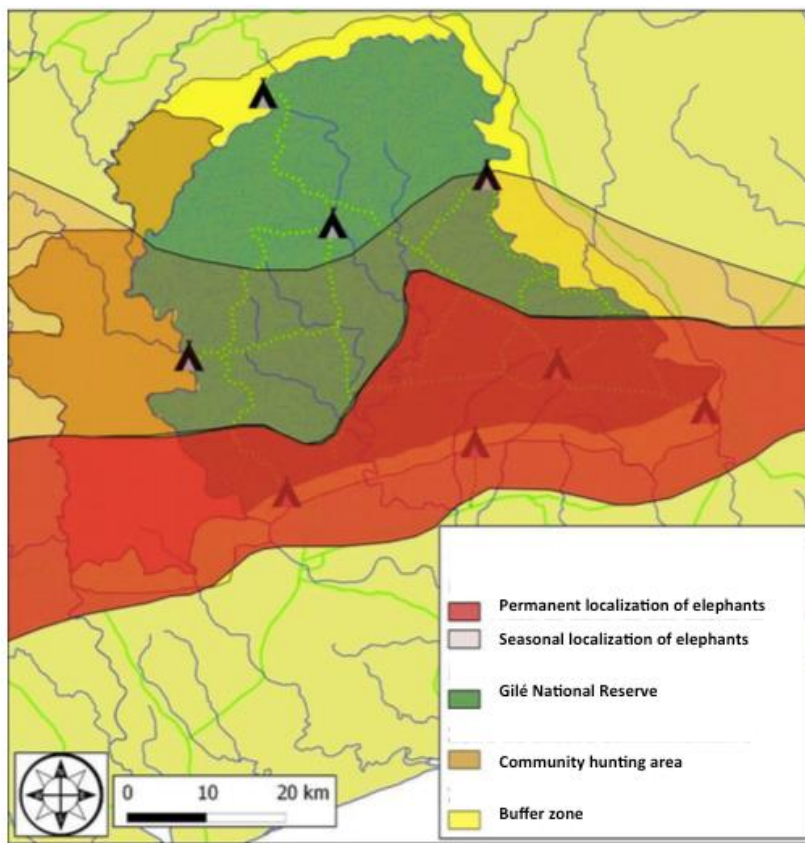
**Figure 30: Repartition of the elephant population in the project zone - Deffontaines, 2012.**

It is worth noticing that the area of distribution of elephants changed in the last few years. In 2011, a study by the University Eduardo Mondlane showed that the main area of distribution of pachyderms was the Southwest area of the GNR. The current analysis of collared elephants' displacement (see next section) shows a progressive shift to the South East of GNR (around the administration of GNR camp) (Bonde and Deffontaines, 2016).

The other threatened species that have been identified in the project zone have not been subject to any formal survey, precluding any precise knowledge of their exact number. They should not be considered as key species in this project.

### 5.5.2. Trigger Species Population Trends (GL3.2, GL3.3)

Population trends of the two trigger species identified in 5.5.1 display different levels of understanding and knowledge. Although it has been very difficult to assess the evolution of the population of African wild dogs in the project zone due to a lack of direct observations, the evolution of the elephants' population has been monitored since a long time. The data available enable to identify what could be the evolution of their population in the without project scenario and to define the needed measures to ensure their protection. Those elements are first summarised in the next table and then described in details below.

**Table 51: African elephant population trends and need measures in project scenario**

| Trigger Species | African elephants (*Loxodonta africana*) |
|---|---|
| **Population Trend at Start of Project** | The population of elephants in the project area has drastically been reduced during the 20th century, due to the civil war and the consequent lack of management and control of the reserve. From 200 to 300 individuals in the 1960s, elephants were reduced to approximately 50 in the 1980s. From the early 2000, the population of elephants in the project zone has started to rise again, in coherence with the effective management of areas under conservation status. At the start of the project, African elephants are estimated to be between 59 and 78 individuals (Mésochina et al., 2008; Ntumi *et al.*, 2012) – conservative hypothesis. |
| **Without-project Scenario** | Under the without-project land use scenario, the main factors threatening the population of elephants and their evolution in the project zone (destruction of their natural habitat and conflicts with local people for land use) are expected to continue over time. The evolution of the population of elephants is expected to be limited and to remain below mean annual population growth rate in ideal conditions – estimated to be 5.5%. At longer term, their existence in the project area could be endangered and even more threatened with a forthcoming ivory poaching – recently observed in project area. It is therefore clearly anticipated that, in the without project scenario, without any mitigating measure, those threats are expected to be maintained or to increase, accelerating the reduction of the elephant population in project zone. |
| **With-project Scenario** | In project scenario, all HCVs, including vulnerable, rare and endangered species, are protected through the conservation of their natural habitat - reduction of deforestation and forest degradation.<br><br>With regards to elephants, more specifically, a priority is given to the mitigation of conflicts between elephants and local population. This is pursued through several measures, including: (i) awareness raising with local population, trough consultation and meetings, to discourage new human habitations within the conflict areas and to disseminate good behaviour practices when facing elephants' invasion on the fields; (ii) the intensification of rangers' mobility in order for them to be able to quickly intervene on conflicts areas if necessary ; (iii) the implementation of an integrated and participatory approaches to conflicts mitigation including the use of artificial fires and the use of chili (*piri-piri*) to delimit the fields; (iv) a series of training of local population on methods meant to scare elephants away.<br><br>In addition, the project implies an intensification of elephants' population monitoring with the use of electronic collars (GPS position), in order to follow their movement, enhance field efforts to mitigate humans/ elephants conflicts and prevent a possible forthcoming ivory poaching inside and outside the project zone. |

### *Population trends and without project evolution*

The African elephant has always been and is still present in Zambézia Province, Mozambique, particularly in the GNR (Ntumi et al., 2009). However, the elephant population greatly diminished during

and after the war times in the whole country and the population in the GNR didn't make exception (Ntumi *et al.*, 2002; and 2009).

In 2012, using the dung-count method (Jachmann, 1980; Oliver *et al.*, 2009), Ntumi (Ntumi et al., 2012) estimated the elephant population in the GNR to 59 individuals (16-129 with 95% CI).

By expert opinion, after a decrease during the '70, the population size of the GNR elephant population has remained relatively stable during the last decades. This information is confirmed by Ntumi et al. (2012) who reported the following population trend along the last 60 years (Table 52)

**Table 52: Estimated number of elephants in the GNR between 1960 and 2012 - *(Adapted from Ntumi et al., 2012 and cited in Chardonnet et al. 2014)***

| Year | Estimated N° of elephants | Survey method | Reference |
|------|---------------------------|---------------|-----------|
| 1960 | Abundant | Other guess | Ntumi *et al.*, 2002 |
| 1970 | 200/300 | Other guess | Ntumi *et al.*, 2002 |
| 1973 | 39 | Informed Guess | Dutton *et al.*, 1973 |
| 1982 | 50 | Other guess | Ntumi *et al.*, 2002 |
| 1982 | 60 | Other guess | Ntumi *et al.*, 2002 |
| 1987 | 15 | Informed Guess | MICOA, 1997 |
| 2002 | 20/30 | Indirect sample | Ntumi *et al.*, 2002 |
| 2008 | 78 | Indirect sample | Mésochina *et al.*, 2008 |
| 2012 | 59 | Indirect sample | Ntumi *et al.*, 2012 |

During the first elephant collaring operation conducted in the GNR in September 2014, another estimation set to 50 individuals (Definite: 50; Speculative: 100) the elephant population of the GNR (Chardonnet et al. 2014). Whit this new estimation, the trend of the elephant population in the GNR between 1970 and 2014 is reported in the Figure 31 below. A further collaring operation took place in July 2015. Since these two operations, a total of 3 elephants (1 male and 2 females) have been equipped with GPS and radio transmitting collars that allow the GNR to constantly monitoring the movement of the major elephants heard.
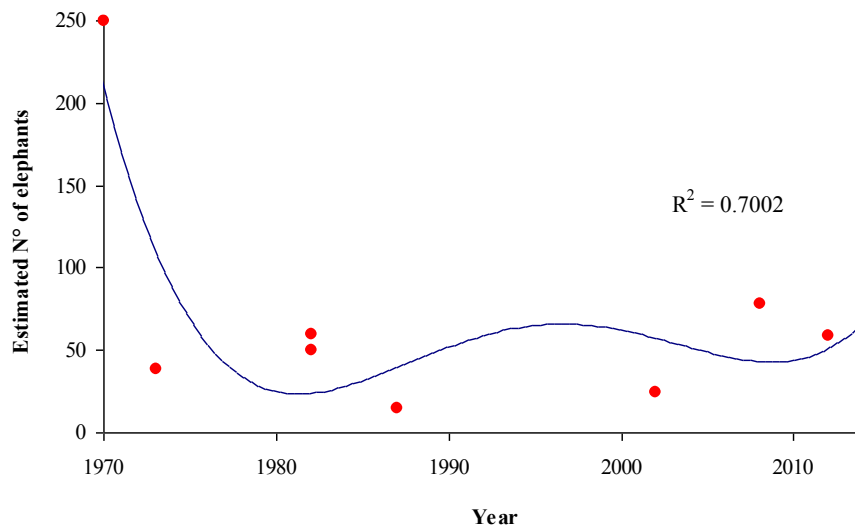
$R^2 = 0.7002$

**Figure 31: Trend of elephant population in the GNR between 1970 and 2012 - *(Chardonnet et al. 2014)***

Elephant distribution in the GNR was estimated using data obtained from the GPS satellite collars (2014-2016) and from direct observations or spoors reported by GNR rangers during their patrols (2012-2015). Elephant spatial occupancy was determined by calculating the relative frequency at which they used different areas of their range, also known as utilisation distributions (Benhamou, 2011). Total home ranges were defined by their 95% Utilisation Distribution (UD), core areas as the area within which elephants spent half of their time (50% UD) and hotspots were defined as the area with the highest density (10% UD) (Figure 32).

Since 2011, GNR rangers report wildlife sightings and illegal activities observed during patrols following the Event Book System (Stuart-Hill *et al.*, 2005). After each patrol, rangers indicate which species they encountered or for which they observed fresh spoor. These indications were used to calculate the probability of encountering elephants or their spoor within each one of the Monitoring zones between 2012 and 2015 (Figure 32).

Both indices of elephant occupancy are consistent. Elephants occupy the Southern half of Gilé National Reserve as well as the adjacent buffer zone and communal area. Key habitats include the riparian vegetation along the Lice and Molocue rivers that define the Reserve East and West boundaries as well as forested areas in the South of the reserve both inside and outside the buffer zone. Individual yearly home ranges cover about 1000 km2 corresponding to about a third of the core area of GNR.
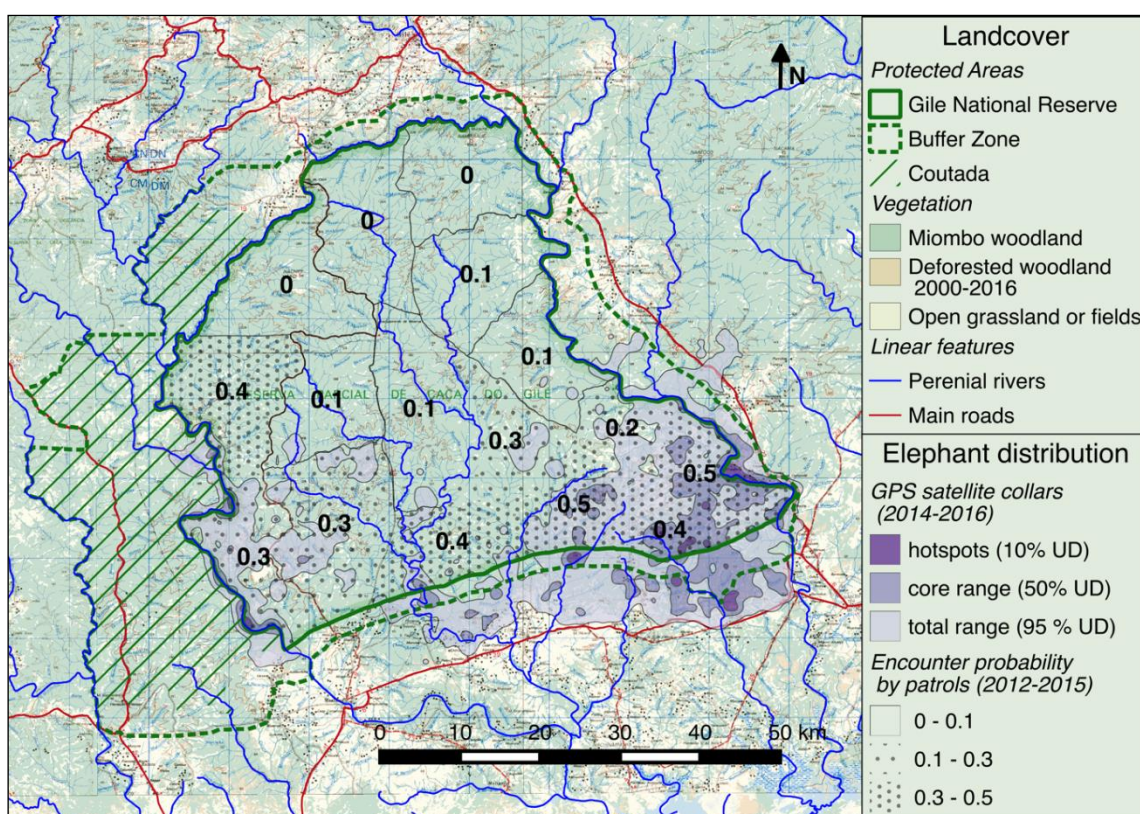
**Figure 32: Spatial distribution of elephants in Gilé National Reserve.**

Although the elephant population has increased in the project zone since the early 2000s, it did not evolve at the rhythm it should have reached in optimal conditions. As stated by Chardonnet et al. (2014): "considering that (i) the intrinsic annual population growth rate of the species varies between 4% (Hanks and McIntosh, 1973) and 7% (Calef, 1988) and that (ii) no elephant carcass has been detected within the GNR for many years, the elephant population in the GNR and its surroundings should be much higher than estimated, in ideal conditions (i.e. without off-take) and considering an average annual intrinsic growth rate of 5.5%", the elephant population in project zone should have evolved as below:
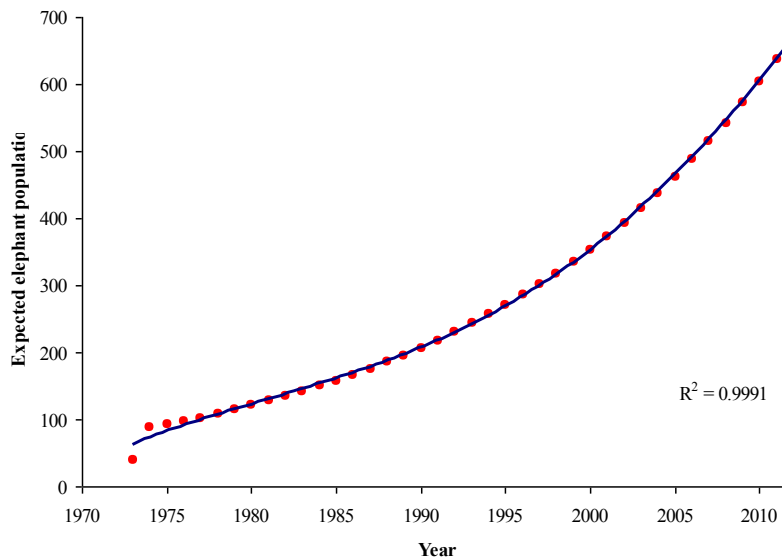
Where $P_{t1973}$ = 73; intrinsic annual population growth = 5.5%; $P_{t2012}$ = 673

**Figure 33: Expected growth of elephant population in the GNR between 1973 and 2012 - (Chardonnet et al., 2014)**

Currently, the main factors threatening the population of elephants and their evolution in the project zone are (Fusari *et al.*, 2010):

1. ***Destruction and disturbance of natural habitat through deforestation and forest degradation***
   On this matter, it is significant to see that the preliminary results of elephants monitoring through satellite collars in project zone show that the dominant geographic position of elephants in the project zone is in forested areas: 82,24% of the points of location that have been registered through satellite monitoring are in forest zone (Fondation IGF, 2015). In the without project scenario, destruction and disturbance of natural habitat is therefore expected to have significant negative impact on the population of elephants in the project zone and important effects on their geographic distribution.

2. ***Conflicts with local people for land use.***
   Hoare and du Toit (1999) provided interesting data to predict conflicts that appear between humans and elephants in rural areas: they consider that a population density of 15.6 inhabitants / $km^2$ can threaten the occurrence of the elephants. Precisely, in Pebane and Gilé districts, densities are above 15 inhabitants/$km^2$ (Fusari *et al.,* 2010). In the Southwest of the project zone (localities of Nacuruco, Calane, Mutagane, Macujuco, Sacane and Necuco) local people regularly report invasions of elephants on their fields. Even though the humans/elephants conflict is limited in time and space, local people report that elephant invasions have serious implications especially for food security. The increased of such tensions in the without project scenario is a direct threat

to the evolution of the elephant population in the project zone that could increasingly be attacked and slaughtered by local population. However, it is important to underline that despite the common idea that elephants are intruders, the dynamics is actually opposite, with a historical displacement of human population towards areas where elephants were concentrated. This is an important point to be considered for the conservation and management of elephants in project zone (Fusari *et al.,* 2010). Yet, today, most of the time, local communities have a negative perception of elephants that they only see as responsible for the reduction of farm incomes. Depending on the areas, conflicts with elephants may result in the reduction of significant parts of the productions (Bonde and Deffontaines, 2016). It is important to understand this perception to take into consideration local communities' needs while protecting trigger species.

In the without project scenario, without any mitigating measure, those two threats are expected to be maintained or to increase, accelerating the reduction of the elephant population in project zone. In addition, it should be noted that those threats are related and interlinked: conflicts with local people for land use are intensified with increasing anthropic pressure on elephants' natural habitat. Since deforestation and forest degradation have anthropic origins (as previously stated), the availability of habitat for large animals in general (and elephant in particular) is reduced by the increased density of local population in the project zone (Martins and Ntumi, 2002). This can have possible negative impact on the amount of food available for elephants in the project zone through limiting the occurrence number of tree species that are used as primary sources of food by elephants; the pattern of distribution and the availability of food play a crucial role in the geographic repartition of the population of elephants. Hence the scarcity of the relevant tree species for elephants' regime may contribute to rise conflicts with local populations, the elephants being attracted in smallholders' fields where food is available. It is therefore clearly anticipated that the population of elephants, associated with native forest, would suffer declines in the without-project scenario.

In addition, the current surge of wildlife crime and ivory poaching is a matter of great concern all over the continent and particularly in northern Mozambique (Couto, 2014; Pereira *et al.*, 2014). Moreover, during the past year the project zone has, for the first time, experienced ivory poaching that worries the GNR management team.

### *Protection of trigger species in project scenario*

First, it is necessary to remind that the overarching conservation strategy of the project for all HCVs, including for trigger species such as elephants, is the protection of Miombo forest in the project zone, trough measures and activities that have already been detailed. With regards to the protection of trigger species, this strategy is even more relevant as their natural habitat degradation and reduction has been identified as a primary threat to their evolution.

More precisely, the conservation of wild dogs in the project zone also depends on the increase of prey populations, especially species of medium and large herbivores. This strategy is followed, in project scenario, through large mammals' reintroduction and restocking operations. Two have already been organized, with good results (*see section 7.2 for more details*), while a further one is planned for 2017.

Regarding elephants, the GNR management plan (2012 – 2021) gives a special priority to the protection of their population in the project zone (Fusari *et al.,* 2010). In addition to measures aiming at protecting

their natural habitat, the reduction of conflicts between elephants and local population is a priority. On that matter, in project scenario, several measures have been defined:

- Discourage new human habitations within the conflict area;
- Create a mobile team of rangers, based in Mulela camp, who could quickly reach the area of conflict and chase away the elephants;
- Prevent the slaughter of elephants as a means to protect the fields through close cooperation with local population.


Actions specifically oriented towards the reduction of Humans / elephants conflicts have been organized from 2014 onwards. In 2014, M. La Grand, expert of the humans / elephants conflicts, realised a field mission in project area. This mission aimed to assess the situation on the ground, including the perception of existing communities, to study animal behaviour and to propose new methodologies. A strategic plan to mitigate conflicts between elephants and local communities was therefore designed, with progressive implementation. Measures include (Bonde and Deffontaines, 2016):

- Awareness raising with local communities and dissemination of basic information on animal behavior and displacement: this measure implies the organization of regular meeting with local authorities and communities to strengthen local knowledge and continuously improve the approach of the strategic plan to mitigate the conflict;

- Implementation of an integrated and participatory approaches to conflicts mitigation: this measure partly relies on the harmonization of the use of preventive and curative tools to enable communities to defend their crops and educate elephants to what are the limits of their fields. The dissuasive tools include traditional and improved fences with oil, bottles and cans, as well as vegetable fences with thorns. In addition to those traditional methods, other means are used in project scenario, such as artificial fires and the use of chili (*piri-piri*) to delimit the fields (Fondation IGF, 2015), through chili guns (Figure 34), cinderblocks and firecrackers (Bonde and Deffontaines, 2016).

- Concentration of the fields into blocks to facilitate their protection

**Figure 34: Chilli gun to scare elephants away - (Bonde and Deffontaines, 2016)**

In 2016, a second field mission was organized with Mr. La Grange to conduct a comprehensive training session on the above detailed strategy (Bonde and Deffontaines, 2016):

- In order to favor local communities' mobilization, a series of meetings and consultations were organized between May 12th and May 19th in the communities where the conflicts with elephants are more frequent: Etaga, Metacasse, Namahipe, Invana, Musseia, Nipamo, Mucucune, Pipine, Malema, Mujaiane, Chijipe, Sacane, Mulela and Naguruko. Participants were trained on the use of preventive and curative methods for reducing elephant invasion of their fields.
- Pipine was confirmed as a pilot zone for the training on humans/elephants conflict mitigation, after public consultation with local communities (May 20th). Community training was therefore organized from June 11th to June 19th with 19 volunteers.
- Before, training for trainers was organized in the Musseia camp from June 7th to June 10th with 20 people from implementing partner organizations (COSV, AGRISUD International) and staff of the Reserve. The aim of the training was to actively contribute to the implementation of methods meant to scare elephants away and of the strategic mitigation plan approved in 2014.

In addition to those training, kits containing various products meant to ease the implementation of the strategy were distributed, including chili and chili pump. In future, such training should regularly be launched. Feedbacks from the training also underlined the necessity to:

- Creating mechanisms to maintain direct contact with communities;
- Design a handbook to be distributed to participants;
- Increase the number of chili pumps provided to the communities;
- Develop a follow-up and monitoring plan;
- Implement a management and inventory strategy of the distributed kits.

**Figure 35: The administrator of the GNR and local community of Chijipe during meetings and consultations on Humans / elephants conflicts in June 2016 -** *(Bonde and Deffontaines, 2016)*

### *Monitoring of trigger species*

The monitoring of elephants in the project zone starts with regular surveys and inventories to be conducted in the project zone in order to follow the evolution of their population, in terms of number and geographic repartition. This had already been organized before project start in the context of other projects. The current project started in 2011 with a first recon mission led by Dr. Cornélio Ntumi and two of his colleagues from the University Eduardo Mondlane of Maputo (Fondation IGF, 2012). It was then followed by other surveys and studies, including:

- Ntumi, C., Monjane, N., Tafula, I., and Massinga, J., 2012. *Determinação preliminar do tamanho da população de elefantes da Reserva Nacional do Gilé, Moçambique* ;
- Chardonnet, P., Lopes Pereira, C., Deffontaines, J.B., Fusari, A., Dias, J.M., Davane, J., and Valia, D., 2014. *Elephants collaring in Gilé National Reserve –Preliminary Report*.

In addition, elephants' monitoring is regularly ensured by the daily patrols organized by the rangers. In order to enable continuous monitoring of large fauna in the project zone, project scenario implies the implementation of a participatory methodology of monitoring. During their patrols, rangers gather the information collected in the field - number of animals and encounters, poaching signs, etc. - and synthetize them (Fondation IGF, 2015) – *see section 7.4*. A special file is dedicated to the humans vs. elephants conflicts.

Finally, in project scenario, elephants are monitored through satellite beacons that enable to map their repartition. The tracking collars allows to follow in real time the existence of alarming elephant positions in situations of potential conflict with communities, through the Skyqlite application (see example below) (Fondation IGF, 2015). In 2014, the GNR organized its first operation of satellite necklaces placement: three elephants were collared with AWT collars equipped with satellite beacons. In this type of collaring operation, helicopter surveillance is used to locate the elephants that will be collared (see example below).

Later on, the monitoring process in project scenario encompasses (Chardonnet et al., 2014):

- Regular downloading of the positions of the collars;
- Regular monitoring of the collared elephants and of the other elephants associated to the collared individuals (the rest of the herd);
- Monitoring of humans vs. elephants conflicts.

**Figure 36: Manoeuvring a herd before darting - *(Chardonnet et al., 2014)***

Although the collars were placed in three different animal profiles (female leader, female middle age and male), the observation of the early maps show similar trends of spatial displacement (IGF Foundation, unpublished report).
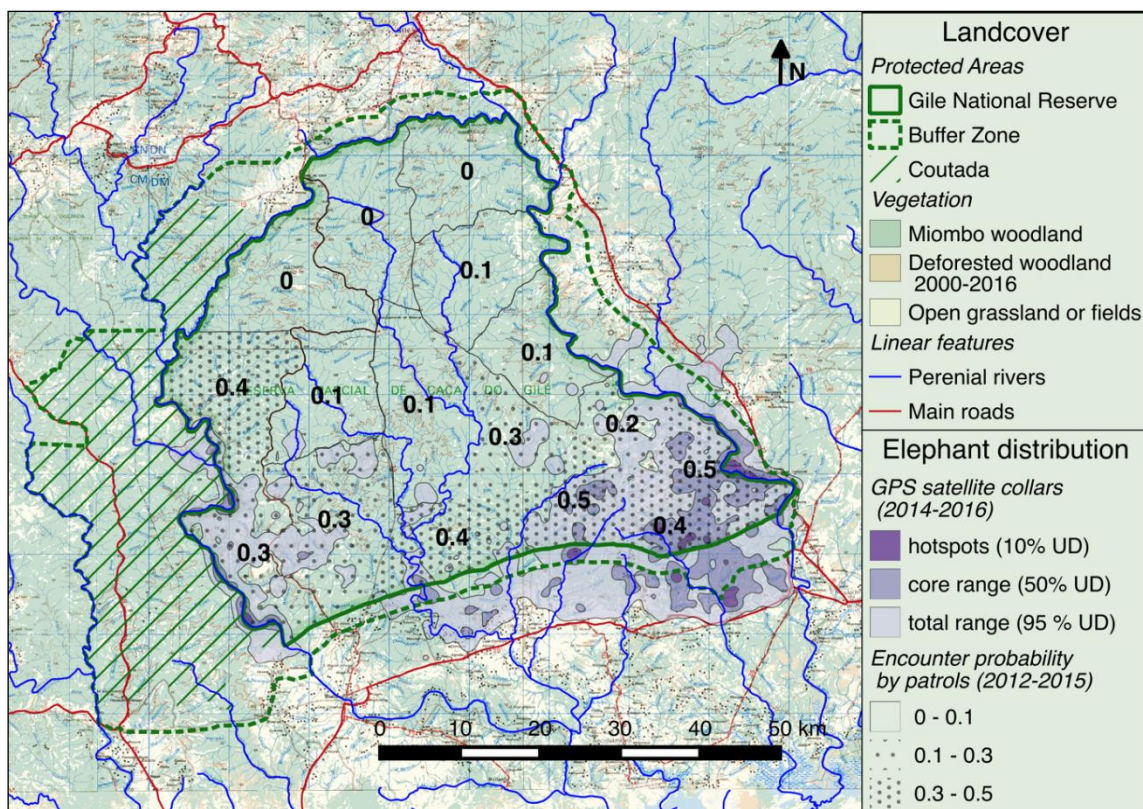


**Figure 37: Spatial distribution of elephants in Gilé National Reserve.**

Such measure enables the assessment of annual movements and trends of elephants in the GNR and its periphery (Bonde and Deffontaines, 2016). Their objective is to better monitor the elephant population in project zone in order to enhance field efforts to mitigate humans/elephants conflicts and to prevent a possible forthcoming ivory poaching inside and outside the project zone (Chardonnet *et al*., 2014).

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## Appendices

### Appendix 1: Dialogue process between communities and the Gilé National Reserve

**REPÚBLICA DE MOCAMBIQUE**
MINISTÉRIO DA TERRA AMBIENTE E DESENVOLVIMENTO RURAL
Administração Nacional das Áreas de Conservação
**Reserva Nacional de Gilé**

*Mecanismo de Diálogo Comunitário*

### 1.OBJECTIFOS GERAIS DO PROCESSO

O mecanismo de diálogo Comunitário é uma ferramenta que tem como objectivo garantir uma convivência harmoniosa e contribuir para o desenvolvimento das populações dentro da Zona Tampão da Reserva. O mecanismo consiste num processo de recepção, análise, resposta ou resolução das questões e solicitações apresentadas pelas comunidades. É uma forma para discutir com as comunidades de forma amigável sobre a as atividades das Reserva, recebendo assim recomendações, sugestões, pedidos de informação, reclamações e histórias de sucesso resultantes da sua actuação.

### 2. DESCRIÇÃO DE FUNCIONAMENTO DO PROCESSO

Em cada comunidade terá um líder comunitário e seu auxiliar (pode se chamar de núcleos de apoio ao dialogo ou grupos de apoio a informação), o qual terá a responsabilidade de receber, registar e encaminhar as reclamações, preocupações, percepções e sugestões da comunidade, e contactar a Administração da Reserva para recolher as fichas.

No prazo máximo de 15 dias após a recepção da ficha, a equipa da GNR identificará as possíveis soluções sempre que possível e irá contactar o reclamante a fim de marcar um encontro. Este encontro deve incluir uma equipa da GNR, um representante dos líderes locais e a pessoa que submeteu a ficha de diálogo juntamente com 2 testemunhas se for necessário. Se ambas partes encontrarem um acordo, cada um receberá uma cópia da acta, incluindo os termos de resolução.

Se a [queixa] forrejeitada ounão sealcançar nenhum acordo, o reclamante tem o direito de solicitar um novo encontro, marcado num prazo de 15 dias, qual incluirá a presença de uma Terceira estrutura neutra, proveniente do governo local (Localidade ou Posto administrativo).

Se a preocupação não estiver ao alcance da Reserva ou quando forem esgotadas as opções locais, se encorajará às comunidades a fazer uso das alternativas distritais, nomeadamente os conselhos consultivos comunitários, entidades distritais do governo como SDPI ; SDAE PRM e Administração do Distrito.

Todas as reclamações, os procedimentos e resoluções, podem ser consultados, sob requesta, no campo administrativo de Musseia.

Fernando Bonde

Oficial de ligação Comunitária

**Appendix 2: didactic posters for sensitization on deforestation and climate change**

Os impactos das actividades humanas nas florestas e nas comunidades

Desenhador: Silva Afonso Mamudo

Uma agricultura melhorada para conservar as florestas e seus benefícios

Desenhador: Silva Afonso Mamudo

**Sensibilização sobre às consequências do desmatamento e apresentação de atividades futuras a serem desenvolvidas no âmbito da implementação do projecto REDD+**

**Lado A, visão sem projecto – Porque as atividades humanas afastam as florestas, e quais são as consequências nas comunidades?**

Com o crescimento populacional nas zonas urbanas como rurais, aumenta apressão nas florestas e seus recursos, através de 3 atividades humanas:a *agricultura decorte-queima, as queimadas descontroladas* (**1a**) e, marginalmente,o corte *de madeira* (**1b**) e a *produção de carvão* (**1c**). Em certas comunidades, a criação de cabritos participa indirectamente ao afastamento das florestas, pois os animais *andamsem contrôle* (**2b**), causandodanosnas hortascaseiras (**2b**), facto este que*impõem a construção de machambas*nas áreasvizinhas as comunidades. As zonas com capim ao redor das casas e debaixo das árvores não estando mais limpas, esta práctica aumenta os *prejuízos ligados as queimadas* durante o tempo seco (**2c**). A fertilidade dos solos, geralmente muita baixa, obriga os camponeses a deslocarem-se sempre mais longe, neste caso para a floresta, como forma de manter a produção e os rendimentos (**4**), aumentando o desmatamento. Embora a venda de castanha de caju seja uma fonte de rendimento, a produção baixa por causa da idade das árvores,(árvores velhas), a falta de limpeza e de tratamentos quimícos (**4a**), limitam a produção, os rendimentos (**4b**), e aumentam a dependência dos agregados familiares na agricultura e nos produtos tirados das florestas. Porém, a desflorestação tem consequências nas comunidades (i) ao nível da *disponibilidade de produtos florestais*, que ficam sempre mais distante à medida que a floresta afasta-se, com impactos graves nas famílias que dependem da sua colheita e consumo durante o tempo chuvoso, (ii) em termos de *acesso à água potável*, captada e filtrada nas áreas de florestas, fica mais rara (**5**). Além de ter impactos ao nível das comunidades, a desflorestação tem impactos globais, com consequências locais, através da *emissão de gases de efeito estufa* (**6**), que participam no aumento global das temperaturas e a ocorrência mais frequente de eventos relacionados com condições climáticas extremas, tais chuvas e secas prolongadas e fortes.

**Lado B, visão com projecto – Uma agricultura melhorada para conservar as florestas e seus benefícios**

Através de várias atividades, o projecto tem como alvo conservar as florestas de Miombo, manter a disponibilidade dos recursos florestais essenciais às comunidades, melhorar a gestão da fertilidade dos solos assim como os rendimentos, através de técnicas agricolas melhoradas, emfim de limitar o desmatamento e afastamento das florestas (**1**). Currais melhorados com plantas forragens (**2a**) permitirão diminuir o andamento de animais e recuperar o estrume que é útil aos sistemas hortícolas e frutufeiras (**2b**). Apoios técnicos frequentes em termos de agricultura de conservação (gestão melhorada da fertilidade dos solos), permitirá acrescentar o pousio de machambas antigas, aumentar o prazo de permanência nos campos agricolas e aumentar a produção (**3**). Graça à associação de culturas com cajueiros novos (**4a**) e apoios técnicos na área da produção e de comercialização de caju (**4b**), os agregadores familiares aumentarão as suas fontes de rendimento. Uma melhor gestão dos solos e das atividades ligadas às florestas permitirá diminuir o desflorestamento assim como o afastamento dos produtos essenciais às comunidades, que sejam não lenhosos (**5a**) como caracois, cogumelos, remédios, capim, ou lenhosos, como paus usados para construção das casas (**5b**). Permitirá manter a captação e filtração das águas, serviços fornecidos pelos ecosistemas florestais. Enfim, a diminuição do desmatamento limitará as consequências das mudanças climáticas, ao nível das comunidades e globalmente (**6**), assim como a ocorrência de eventos climáticos extremos.
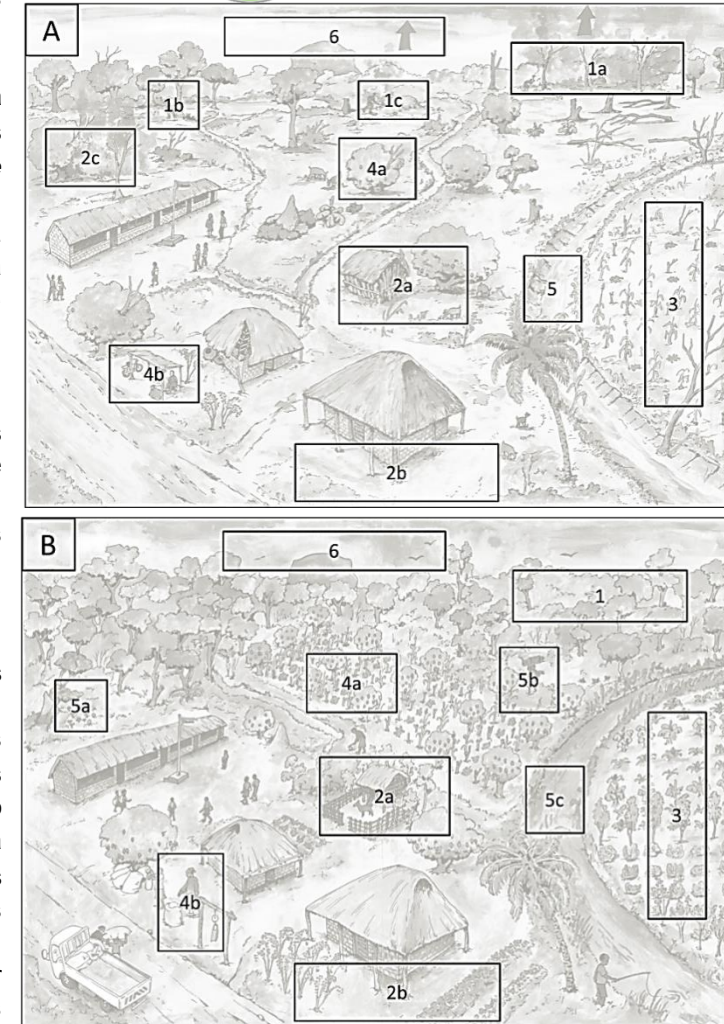
**Appendix 3: content of the consultations for the GNR REDD project**

## Primeiro dia

*Consulta pública com acomunidade inteira, líderes locais e administrativos do districto e da GNR*

| ASSUNTO | MATERIAL | PALAVRA |
|---|---|---|
| **Procedimento de apresentação** | **/** | **GNR, Radeza, autoridades** |

- Abertura da consulta pela GNR. Agradecer pela presência de administrativos, líderes locais e membros das comunidades

| **Apresentação das razões do encontro** | **/** | **GNR** |
|---|---|---|

- Apresentar os objectivos gerais do projecto: diminuir o desflorestamento e a degradação florestal na Zona Tampão da GNR, em fim de conservar as florestas, manter seus benefícios pelas comunidades e propôr formas sustentáveis de melhorar as condições de vida na vizinhança da ZT = « conviver com as florestas »
- Apresentar as recomendações do CLIP (Consentimento Livre, Informado e Prévio)
- Apresentar os 2 dias de encontro: consulta pública e capacitação com representantes
- Apresentar os membros da equipa

| **Mudanças climáticas percebidas dia-após-dia** | **Poster 1 Mapas de desmatamento** | **Radeza** |
|---|---|---|

- Criar condições para gerações diferentes conversarem sobre sazonalidade, alterações percebidas, consequências ao nível da comunidade, da disponibilidade de recursos e causas prováveis das alterações
- Depois da comunidade ter analisado os elementos figurados no primeiro poster, apresentá-lo como síntesis das preocupações mencionadas
- Concluir na necessidade de diminuir o desflorestamento para manter os serviços floretais fornecidos às comunidades
- Dar a perceber o nível de desflorestamento hoje, apresentando os mapas de desflorestamento (mapa GNR e mapa local)

| **Apresentar rapidamente os benefícios do projecto** | **Poster 1 e 2** | **GNR** |
|---|---|---|

- Resumo dos objectivos do projecto: apoiar as comunidades nas preocupações mencionadas, aumentar os rendimentos da agricultura graça a técnicas melhorando a fertilidade dos solos, propôr atividades fontes de rendimentos, diminuir as alterações do meio ambiente, manter os

serviços florestais, através da conservação das florestas e da diminuição do desmatamento

| Zoneamento e legislação da área de projecto | Mapa GNR de desmatamento | GNR |
|---|---|---|
| - A zona de projecto é a Zona Tampão: histórico de sua criação<br>- O projecto não traz mais impedimentos: relembrar as atividades permitidas e prohibidas | | |

| Resumo do dia a seguir | / | GNR/Etc Terra |
|---|---|---|
| - Tem como alvo capacitar os representantes escolhidos em alguns assuntos técnicos do projecto, que eles deverão compartilhar | | |

| Escolha de representantes | / | Radeza |
|---|---|---|
| - Prestar atenção à presência ao número de mulheres e jóvens | | |

| Assinatura do acta de encontro (1) | Acta de consulta pública | GNR |
|---|---|---|

# Segundo dia
*Capacitação REDD+ com representantes
escolhidos pela comunidade*

| ASSUNTO | MATERIAL | PALAVRA |
|---|---|---|

**Palavra de introdução** — / — **GNR**

- Apresentar o programa do dia e os objectivos: entender os o funcionamento do projecto, suas perspectivas e implicações

**Detalhar o desflorestamento como problema global** — **Poster 1 e 2 Mapas de desflorestamento** — **Radeza/EtcTerra**

- Introduzir as noções de efeito estufa, emissões/sequestro de carbono, impactos do desflorestamento nas mudanças climáticas, usando as cetas dos dois posters
- Contextualisar com o desflorestamento ao nível da GNR (e nível local se tal mapa for disponível). Explicar que « diminuir o ritmo de desflorestamento » quer dizer cortar menos árvores cada ano (não significa para de criar machambas no mato).

**Apresentar o mecanismo REDD+** — **ZPoster 2 Mapa GNR de desflorestamento** — **GNR/EtcTerra**

- REDD+ como forma de:
  - Reduzir as emissões de carbono
  - Através da conservação das florestas, da redução do desflorestamento e degradação florestal
  - Do sequestro de carbono(manter árvores nas machambas, promover a agricultura de conservação e sistemas agro-florestais, sensibilizar na gestão dos fogos, aumentar o prazo entre a abertura de novas machambas, melhorar a volta de fertilidade nas machambas em pousio, …)

Financiamento do REDD+: introduzir a noção de « crédito de carbono », o funcionamento da compra/venda de créditos, tratar da repartição dos benefícios financeiros (permite à Reserva apoiar as comunidades graça a actividades favorecendo uma redução do desmatamento), se as comunidades alcançarem diminuir o desflorestamento.

Metodologia usada: as mapas de desmatamento, feitas cada 5 anos para seguir o ritmo de desmatamento.

**Actividades propostas e benefícios do projecto** — **Poster 1 et 2** — **Radeza**

- Baseando-se nos posters 1 e 2, detalhar as soluções propostas às preocupações mencionadas durante o primeiro dia e outros benefícios ligados às actividades:
  - Reduzirão o afastamento dos serviços florestais ou conservarão-nos,
  - Aumentarão as rendas, através de apoios em várias actividades,

- o Conseguirão benefícios indirectos ligados às actividades (melhor fertilidade do solo dos campos e das machambas em pousio graça à agricultura de conservação e sistemas agroflorestais, menor dependência nos rendimentos da agricultura, etc)
  - o Poderiam conseguir benefícios financeiros a ser investidos em projectos comunitários
- Insistir no facto que não haverá actividade nem benefício se aumentar o ritmo de desflorestamento

| Funcionamento da certificação e próximas etapas | Mapas de desmatamento | EtcTerra |
|---|---|---|

- Certificação: um organismo independante da GNR verifica
  - o Que houve realmente uma diminuição de desmatamento
  - o Que as actividades do projecto trazem realmente benefícios às comunidades (se o desmatamento ter reduzido)
- Será presente nesses próximos meses, depois da entrega do PDD (documento apresentando o projecto) para validar o projecto e de 5 em 5 anos para verificar seus resultados em termos de apoio às comunidades, de conservação da biodiversidade e de diminuição das emissões de carbono (mostrar de novo as mapas)

| Apresentar o mecanismo de ligação comunidades/GNR | Processo | GNR |
|---|---|---|

- Processo a ser entregado aos representantes de cada consulta

| Assinatura do acta de encontro (2) | Acta de consulta REDD+ | GNR |
|---|---|---|

**Appendix 4: Questionnaire used to assess the socio-économic condition of communities at the beginning of the project**

| | |
|---|---|
| **Questionário número:** | |
| **Nome do investigador:** | **Data:** |
| **Hora começar:** | **Hora acabar:** |

Contexto:  dentro da casa ☐   ao redor da casa ☐   ao longo da estrada ☐

Situação geográfica: (*distrito / localidade / comunidade*)

Ponto GPS:

## 1   Informações gerais sobre agregado familiar e o inquerido

* Nome e apelido do inquérito:

* Solteiro ☐  Casado ☐

* Idade:                              * Idade da esposa ou do esposo:

* Profissão:

### - Agregado familiar

 * Quantas pessoas tem o agregado familiar?

1 ☐     2 ☐     3 ☐     4 ☐     5 ☐     6 ☐     7 ☐     8 ou mais ☐

 * Quantos menores de idade?      Rapazes      [____]      Meninas      [____]

 * Quantos maiores de idade?      Homens      [____]            Mulheres  [____]

### - Inquérito

* A que tribo você pertence?  _____

* Qual é a sua religião? _____

* Quais são as idiomas que você fala? _____

* Você é natural de onde? (*nome do lugar + distrito + distancia em km*) _____
        [_____] km

 * Se não for natural daqui, há quanto tempo que você mora aqui mesmo? (*meses ou anos*) [_____]
        * E porque mudou por aqui? _____

* Se for natural daqui, já morou em algum outro lugar?          Não          Sim
        * Onde? _____
        * Quanto tempo? (*meses ou anos*) [_____]

* Você tem família,      - Na comunidade?          Não          Sim
                         - Nas comunidades vizinhas?      Não          Sim

### - Educação

* Pode:        ler?          Não          Sim
       escrever?                Não          Sim

contar?                              Não                     Sim

* Qual é o seu nível de estudo?         Sem ☐         Primária ☐              Secundária ☐

    Mais ☐ : _____

* Quantos menores do agregado familiar vão para a escola ?    ainda não entraram?    [_____]
                                                primária?         [_____]
                                                secundária?       [_____]

* Quantos menores do agregado familiar sabem contar, ler e escrever ?          [_____]

* Quantos maiores do agregado familiar sabem bem contar, ler e escrever?       [_____]

## - Saúde

* Qual foi a ultima doença que apanhou um membro da sua família?

Dor de barriga ☐              Febre ☐                Gripe ☐              Malária ☐       Hérnia ☐

    Epilepsia ☐       Outra ☐ : ____

    * Quem apanhou a ultima doença?

Criança (*menos de 5 anos*) ☐   Menino (*5-18*) ☐           Adultos (*>18*) ☐               Mulher

grávida ☐              Idoso ☐

    * O que fizeram?

Nada ☐                      Perguntaram avisos a outras pessoas ☐              Visitaram a um

medico tradicional ☐

Compraram remédios ☐              Foram ao posto de saúde ou ao hospital ☐      Outro ☐ :
_____

    * Se não fossem pelo posto de saúde, porquê?

O preço da consulta ☐              O preço dos remédios ☐              O tempo para chegar ☐

Falta de confiança ☐         Outro ☐ : _____
    * Se falta de confiança, porquê ? : _____

## - Bens do agregado familiar

* O pavimento da casa é de (sem contar com a cozinha e casa de banho):

Sem nada o outro        ☐              Adobe (matope) ☐                  Almotaçada, madeira ;

granito ; cimento ; mosaico/tijoleira ☐

* A casa é construída com paredes de:

       Caniço/paus/bambu/palmeira ☐        Madeira/zinco ☐

       Lata/cartão/papel/saco/casca ☐

       Blocos de adobe ☐        Paus maticados (pau a pique) ☐        Bloco de cimento

ou tijolo ☐

       Outro ☐: _____

* Casa do banho:  Nenhuma ou outro ☐        Latrina (de qualquer tipo) ☐

       Retrete ligada com fossa séptica ☐

* Tem o agregado familiar um ferro de engomar (eléctrico ou a carvão)?        Não        Sim

* Tem o agregado familiar um relógio (parede, pulso ou bolso)?        Não        Sim

* Tem o agregado familiar um rádio ou aparelhagem?

       Não ☐        Só rádio       ☐        Aparelhagem (independente de

rádio) ☐

* Quantas camas o agregado familiar tem (de casal, de solteiro, de crianças e beliches)?

       Não ☐        Um ☐        Dois ou mais ☐

* Tem o agregado familiar uma bicicleta, motorizada ou carro?

       Não ☐        Só bicicleta ☐        Motorizada ou carro (independente de

bicicleta)       ☐

* Como o agregado familiar acessa à agua de beber?

Agua canalizada / torneira ☐    Agua das chuvas ou do rio ☐        Do seu próprio poço   ☐

       Garrafas ☐

Tirar agua do poço de um vizinho/da família ☐        Dispositivo de filtração ☐        Um poço

comunitário  ☐

* Como o agregado familiar acessa à agua de cozinhar  / tomar banho /  lavar roupa?

Agua canalizada / torneira ☐    Agua das chuvas ou do rio ☐        Do seu próprio poço   ☐

       Garrafas ☐

Tirar agua do poço de um vizinho/da família ☐        Dispositivo de filtração ☐        Um poço

comunitário  ☐

* Quanto tempo precisa para chegar até o ponto de agua?

Menos de 5 minutos ☐      5-15 minutos ☐      15-30 minutos ☐

     Mais de 30 minutos ☐

* Tem bastante água tudo o ano?      Não      Sim
     Se não, durante quantos meses não tem bastante ?      _____

* Precisa pagar para ter água potável ?      Não      Sim
     * Se sim, quanto custou em média por mês? _____

* Qual é a principal fonte de energia que usa para iluminação desta casa?

Lenha ☐      Bateria ☐      Gás ; petróleo/parafina/querosene ; vela ☐      Eletricidade ;

gerador/painel solar☐

     Outra ☐ : _____

* Qual é a principal fonte de energia que usam para cozinhar?

Lenha ☐      Carvão ☐      Gás ☐      Eletricidade ☐      Outra ☐ :
_____

     * Se tiver, quanto custa eletricidade cada mês em média? (*meticais*) _____

* Se usar lenha, a sua família      ☐ apanha      ☐ compra      ☐ os dois

* Se apanhar lenha como energia, quantos quilos você apanha cada semana?      [_____]
     - Qual são as três espécies que você apanha o mais?
_____

     - Onde você apanha lenha?      Perto da casa ☐      No mato ☐ *distancia*:
_____

     * Quem no agregado familiar apanha lenha?
_____

* Se comprar lenha,
     - Qual quantidade você compra em média cada mês? (*são sacos / kg / molhinhos* ) [_____]
     - Quanto você paga em média cada mês (*meticais*)?      [_____]
     * Onde compra a lenha? (*distância*)      [_____]

Mercado ☐      Ao longo da estrada ☐      Numa feira ☐      Na casa do explorador ☐

     Outro ☐: _____

     * Sabe onde foi explorada a lenha ? (*nome do lugar + distancia*): _____
     [_____]

* Em relação ao carvão, a sua família      ☐ produz      ☐ compra      ☐ os dois

* Produzir carvão :      - Você produz carvão para o seu próprio consumo ?      Não      Sim

     - Se for sim, quantos sacos você produz em média cada mês para o seu próprio

consumo?        [_____]

 * Se comprar carvão,
                    - Qual quantidade você compra cada mês em média? (*sacos ou kg)*        [_____]
                    - Quanto custa cada mês em média? (*meticais)*        [_____]
            * Onde compra o carvão ? (*distância)* _____ [_____]

        Mercado ☐        Ao longo da estrada ☐        Numa feira ☐    Na casa do explorador ☐

        Outro ☐: _____


                    * Sabe onde foi produzido o carvão? (*nome do lugar + distancia*) _____
        [_____]


* Que tipo de lareira o agregado familiar usa?    Tradicional com pedras ☐            Tradicional com

lenha grande ☐                        Fogão ☐        Outro ☐: _____


| 2 | Atividades de produção |
|---|---|

### - Agricultura

*Fazem produção agrícola no seu agregado familiar:        Não            Sim

Se produzir, é:   só para autoconsumo ☐            só para vender ☐                os dois ☐


| As suas 3 produções agrícolas principais para autoconsumo? | | |
|---|---|---|
| Consumo de | Consumo de | Consumo de |
| [_____] sacos | [_____] sacos | [_____] sacos |


| As suas 3 produções agrícolas principais para vender? | | |
|---|---|---|
| Venda de | Venda de | Venda de |
| [_____] sacos | [_____] sacos | [_____] sacos |

* Em que ano derrubou a floresta pela primeira vez para abrir a sua machamba? [_____]

* Desde, quantas vezes já derrubou a floresta para abrir as suas machamba?        [_____]

* Qual é a superfície média que derruba cada vez?        [_____] hectares        ou        [_____] metros
vezes [_____] metros

sd

* Hoje, quantas machambas você tem?          no mato [_____]          a volta da casa [_____]

* Qual é a superfície das machambas que usam hoje no mato?   [_____] hectares      ou      [_____] metros  vezes  [_____] metros

* Qual é a superfície da machamba à volta da casa ?) :   [_____] hectares      ou      [_____]  metros vezes  [_____] metros

* Qual é a distancia entre a sua habitação e  as suas machambas: (*km*) [_____]

* Em média, quanto tempo pode ficar os seus campos a produzir? (*anos*)          [_____]

* Em média, quando deixar repousar uma machamba, quanto tempo leva para voltar a cultivar novamente? (anos)                    [_____]

* Já abandonou para sempre uma machamba?          Não                    Sim

       Porque? _____

* Quando abrir uma machamba, o que faz da madeira? _____

* Quais instrumentos agrícolas você possui ?          Pá ☐          Machado ☐          Ancinho ☐

Encheada ☐

 Arado ☐                    Xarua ☐          Alfaia ☐          Katana ☐          Outro ☐ :

_____

* Algumas pessoas ajudaram para derrubar?          Não                    Sim

* Algumas pessoas ajudaram para os outros trabalhos das machambas?                    Não
       Sim

* Você tem um DUAT o algum documento?                    Não                    Sim

- **Pecuária**

*Alguém cria animais no seu agregado familiar?          Não          Sim

       Se criar animais, é:          só para autoconsumo ☐          só para vender ☐

       os dois ☐

* Se for sim, quais e quantos animais o agregado familiar tem?

 Galinhas, ☐ :[_____] Patos ☐ :[_____]          Cabras ☐ :[_____] Porcos ☐ :[_____] Carneiros ☐:

[_____]          Vacas ☐ : [_____]

* Onde tem alimentado ou pastando os seus animais? _____

- **Pesca e criação de peixes**

*Alguém pesca no seu agregado familiar?          Não          Sim

       Se pescar, é:          só para autoconsumo ☐          só para vender ☐                    os

dois ☐

* Se alguém pescar no seu agregado familiar, onde pratica?

Nas praias ☐                         No mar ☐        No rio ☐                Nos mangais ☐

        Outro ☐: _____
* Como você pesca ?

        Andando a pé, sem material ☐                        Andando a pé, com uma xinda e um anzol ☐

        Com veneno ☐        Andando a pé com uma malhadeira ☐        Com um barco e uma rede

☐                Outro ☐ : _____
* Quantos kilos pesca em média cada mês?

* Você cria peixes?        Não                Sim
        * Se sim, quantos tanques você tem? [_____]
        * Quantos peixes você esta a criar agora ? (*kg de peixes OU números de peixes*) : [_____]
kg/números

**- Produção de carvão para vender**
* O seu agregado familiar produz carvão para vender?    Não                Sim

        * Se for sim, em média, quantos sacos você produz por mês?    [_____]

        * A que preço você vende?        [_____]

        * Que tipo de arvores você usa para produzir carvão? _____

        * Que quantidade de lenha/madeira você usa para produzir um saco de carvão?  [_____]

        * Que técnica você usa para produzir carvão? _____

        * Onde você explora madeira para produzir carvão? _____


 **- Produtos madeireiros**

* Usou madeira para,    - A construção da sua habitação?        Não                Sim                Que tipo:
_____
                - Para fazer as camas?  Não        Sim                        Que
tipo:_____

        * Se for sim, você comprou ou explorou a madeira?        Comprei ☐        Explorei ☐
* Também explora madeira para vender?                Não                Sim
        * Se for sim, quais são as 4 espécies que você derruba o mais ? :
1 : _____                2 : _____        3 : _____        4 : _____

        * Qual quantidade você derruba cada mês?        [_____] árvores

        * A que preço você vende?        [_____]

        * Quem compra? _____

\* Qual material você usa para explorar?   Catana ☐        Machado        ☐

Motosserra ☐

\* Onde você tira a madeira?

Com licença florestal ☐        Com concessão florestal ☐        Qualquer floresta

☐

\* Você trabalha :        Por iniciativa própria ☐        ou        Alguém mandou a explorar ☐

\* Você paga alguém ?   Não        Sim

### - Produtos florestais não madeireiros

\* Você apanha outros produtos que vêm da floresta que não são lenha ou madeira para:

- Comer?    Não        Sim        O que: _____
- Curar-se ?  Não        Sim        O que: _____
- Habitação?        Não        Sim        O que: _____

### - Caça

\* Alguém caça no seu agregado familiar?        Não        Sim

Se caçar, é:        só para autoconsumo ☐        só para vender ☐        os

dois ☐

\* Que animais você caça? (*nomes*) _____

\* Quantos animais caça por ano? [_____]

\* Quais materiais você usa para caçar ? _____

## 3    Finanças

### - Aceso ao empréstimo
\* Você tem alguma  conta bancária?        Não        Sim

\* Já pediu um empréstimo?        Não        Sim

\* Se sim, para que fim ?  Agricultura ☐        Vendas ☐        Criação de peixe ou gado

☐

Habitação ☐        Outro ☐ : _____

\* Quanto? (*meticais*)  [_____]

\* Pediu o empréstimo a   um banco ☐   um instituto de micro-finança ☐          Outro ☐ :
_____

**- Outras fontes dos rendimentos**

\*  Alguém no seu agregado familiar tem um emprego:          Não          Sim

        Se for sim, onde trabalha:      Mina    ☐          Comércio  ☐                    Empregado

domestico ☐    Artesanato ☐                    Funcionário do estado ☐          Outro ☐ :

_____

\* Alguém no seu agregado familiar foi sezonal no ultimo ano?    Não          Sim

\* Tem um período no ano em que o agregado familiar há fome?          Não          Sim

\* Quanto tempo demora a situação? (*meses*) _____

**4        Situação social**

**- Coesão**

\* Tem roubo aqui?      Não          Sim

\* Já pediu emprestado de instrumentos agrícolas a alguém ?     Não          Sim

\* Já emprestou instrumentos a alguém?                    Não          Sim

**- Pertencer a uma associação**

\* Existem associações de produtores ou comité de gestão nessa comunidade: (*quantas*)
_____
        Quais objetivos? _____

\* Você pertence a uma associação de produtores ou comité de gestão?  Não          Sim
        Se sim, você participa às tomadas decisões ?          Não          Sim
        Você é satisfeito pelo modo de gestão?          Não          Sim

\* Os resultados da associação correspondem as suas expectativas?          Não          Sim

### Appendix 5: Summary and monitoring of reintroduction operations conduted in the GNR

Details of the two operations of reintroduction (2012 and 2013) conduted in the GNR are reported in the table below (Table 53) and in Figure 00.

**Table 53: Summary of the two re-introduction operations conducted in the GNR**

| 2012 Operation |
|---|
| **Source area:** Gorongosa National Park (GNP), Sofala Province, central Mozambique; |
| Buffaloes in the GNP are of the same subspecies, the Cape buffalo (*Syncerus caffer caffer*), than the one formerly occurring in the GNR; |
| **Founders:** 20 buffaloes (16 females, 4 males); |
| June 2012. Without mentioning the long period of preparation, six days were needed for conducting the operation between the day of capture in the GNP and the day of release in the GNR. The distance travelled between the capture and release site was of 886 km. One single trip was enough; |
| **Monitoring:** Ear tags were put on both ears of all the animals. Out of the twenty individuals released, three adult cows were equipped with GPS collars to monitor their movements in order to (i) analyse movement patterns and distribution in the new environment & (ii) provide precise positions for facilitating surveillance and protection; |

| 2013 Operation |
|---|
| **Source area:** Niassa National Reserve (NNR), Niassa Province, north of Mozambique; |
| The three mammals from the NNR are of the same subspecies than the ones formerly occurring in the GNR: the Cape buffalo, the Nyassa wildebeest (*Connochaetes taurinus johnstoni*) (Picture 1) and the Crawshay zebra (*Equus quagga crawshayi*); |
| 47 buffaloes (31 females, 16 males); 20 wildebeests (15 females, 5 males); 19 zebras captured in NNR (12 females; 7 males), but only 15 individuals released (13 females, 5 males); |
| September - October 2013. Without mentioning the long period of preparation, ten days were needed for conducting the operation, between the first day of capture in the NNR (25th of September) and the last day of release in the GNR (5th of October). The distance between the capture and release site was of 840 km. Four return trips were needed to transport all the captured animals between the NNR and the GNR; |
| Ear tags were put on both ears of all buffaloes and wildebeests, not zebras. Out of the eighty-two individuals released, three adult buffalo cows, two adult wildebeest cows and one male zebra were equipped with GPS collars (Picture 2) for the same purpose as in 2012. |

## 2012 reintroduced buffalo initial age distribution : 20 individuals
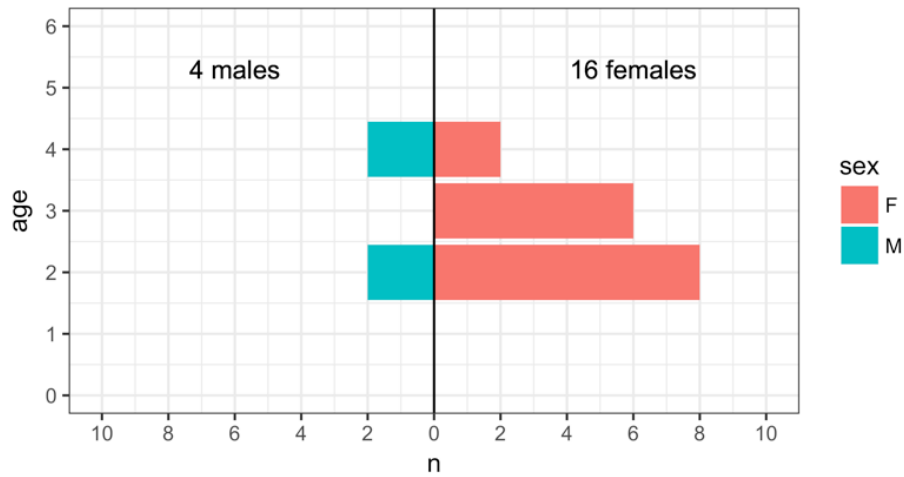


## 2013 reintroduced buffalo initial age distribution : 47 individuals
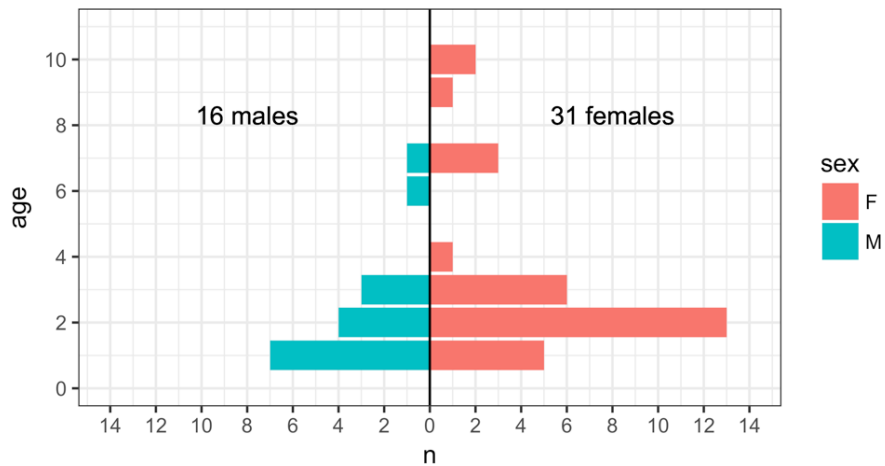


## reintroduced wildebeest initial age distribution : 20 individuals
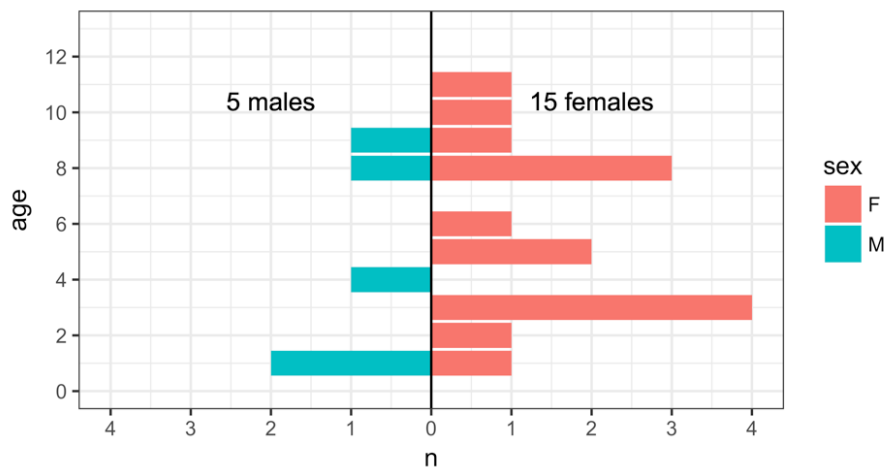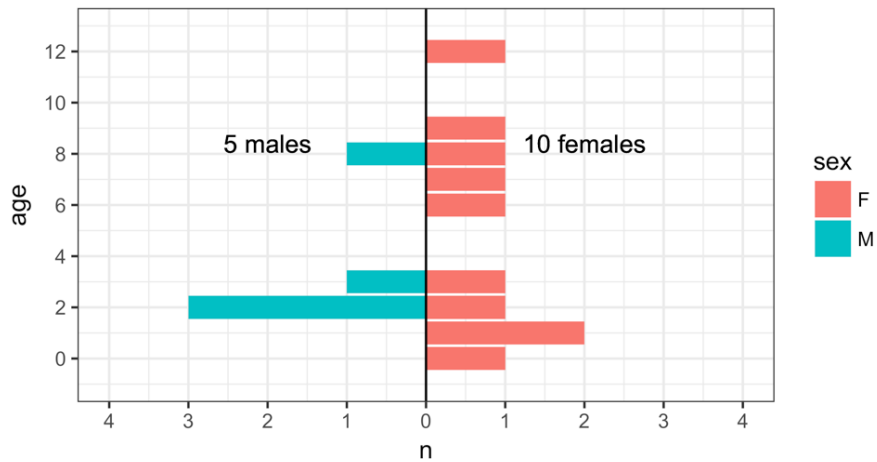
**Figure 38: Age class of the animals reintroduced in the GNR in 2012 and in 2013.**

The following three figures show the movement of individuals of the three species re-introduced, equipped with GPS collars.
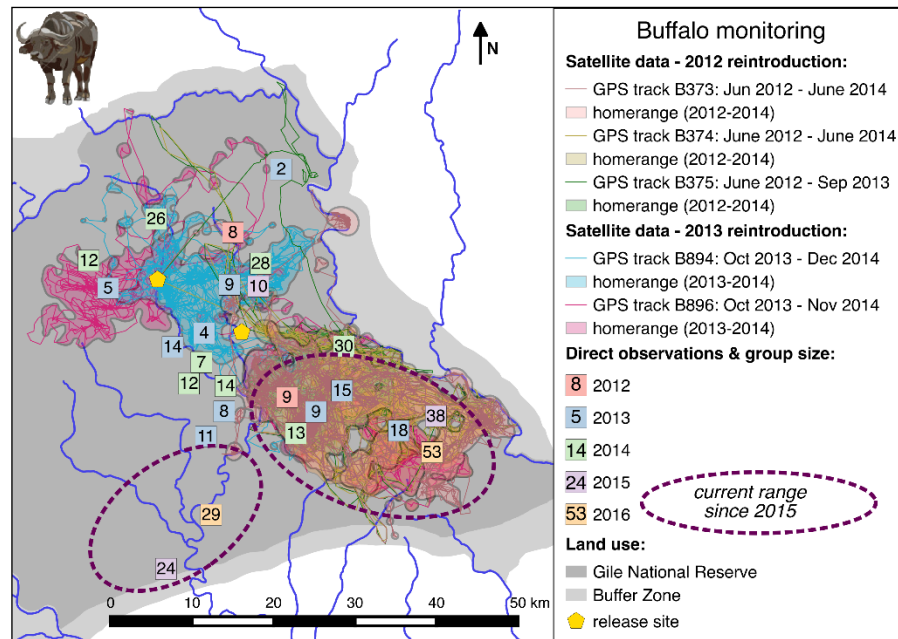


**Figure 39: Distribution of reintroduced African Buffaloes in the GNR between 2012 and 2016.**

(The overall home range was estimated by calculating the 95% utilisation distribution)

In September 2013, a single herd of 18 individuals including three calves and all three collared individuals was observed. However only one of the 20 reintroduced was presumed dead following sightings outside of the

reserve. Thus, an estimated 18-23 buffalo were residing in GNR at the time of the second reintroduction.

The larger number of buffalo herds made monitoring more complex in 2014, however 6 individuals were known to have left the reserve two of which had died bringing the total population to about 59-67 individuals (including 3 expected births of reintroduced pregnant females. Buffalo numbers appear to be on the increase with a total population estimate of 72 (including 6 Juvenile) in 2015 (Morio 2015) and 82 (including 10 juvenile) in 2016 (Laboureur 2016).
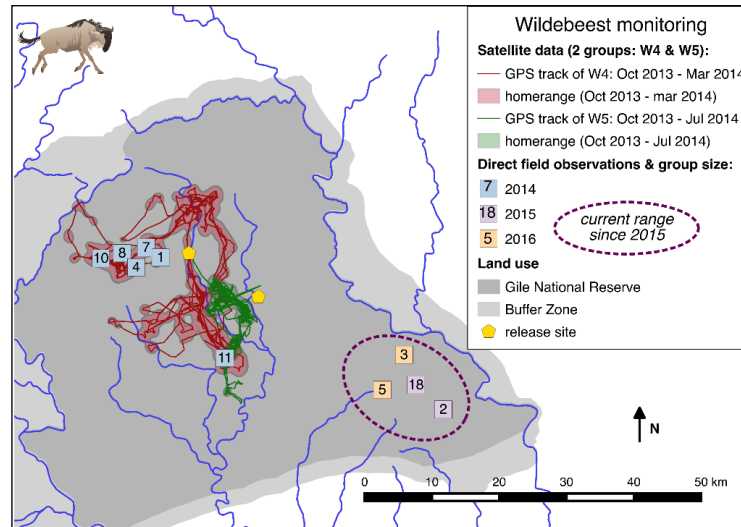


**Figure 40: Distribution of reintroduced Wildebeests in the GNR between 2012 and 2016.**
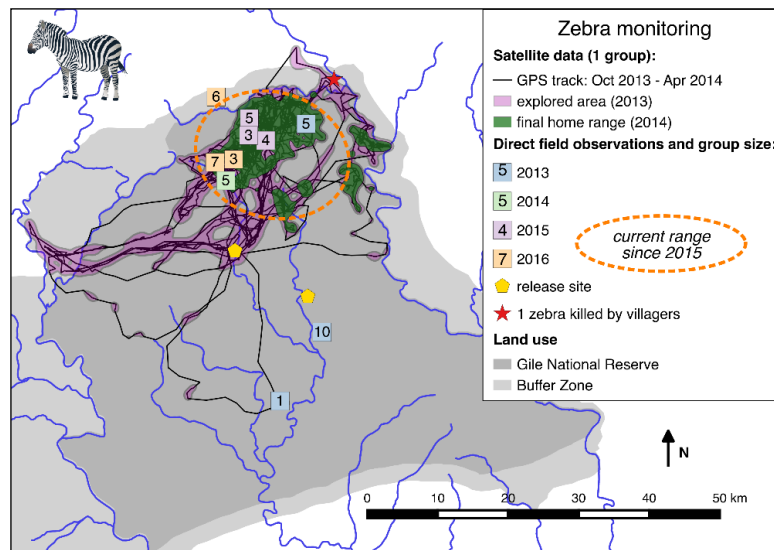


**Figure 41: Distribution of reintroduced Zebras in the GNR between 2012 and 2016**
(The overall home range was estimated by calculating the 95% utilisation distribution)

### Appendix 6: Results of wildlife monitoring

Main results of the monitoring of wildlife (main species monitored), conducted between 2011 and 2015, are reported in the series of figures below. Each map reports, per each monitoring zone, the probability of encounter of the monitored species (i.e. n° of patrols during which the spp. was encountered/total number of patrols).
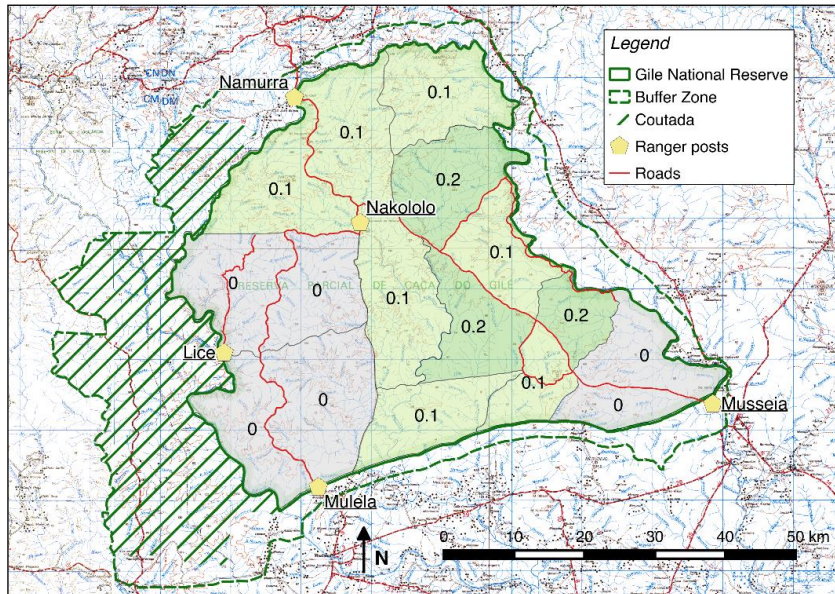


**Figure 42: Results of the monitoring for the African buffalo.**
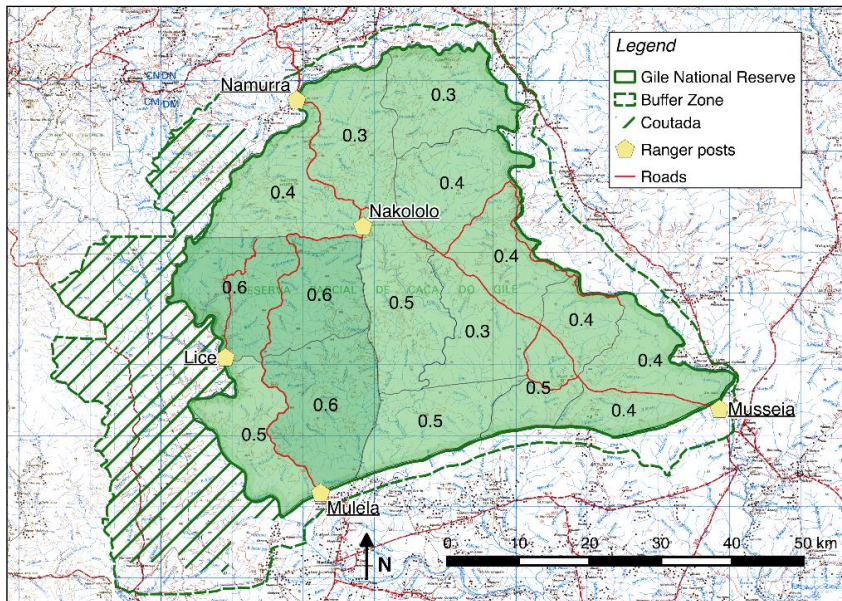


**Figure 43: Results of the monitoring for the bushbuck.**
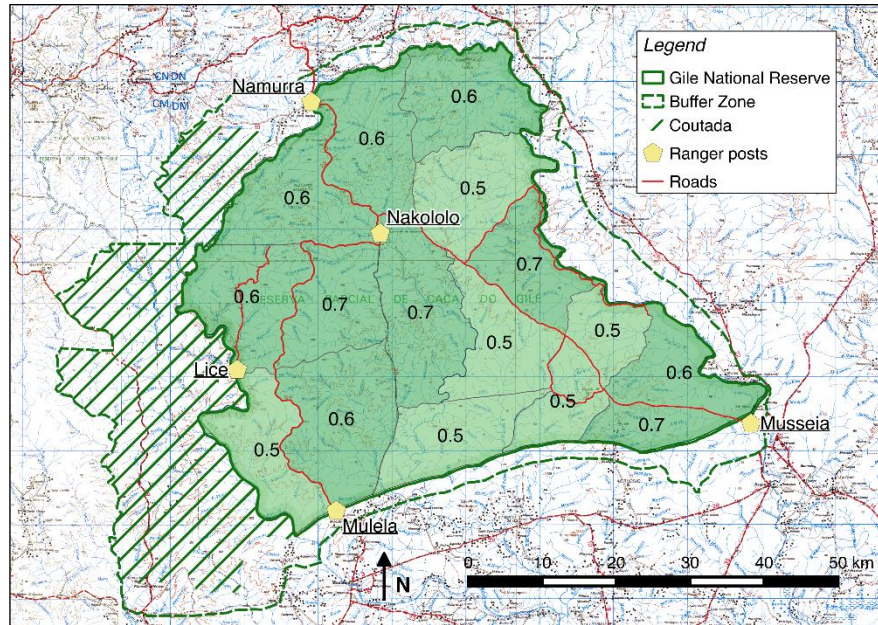
**Figure 44: Results of the monitoring for the bushpig.**
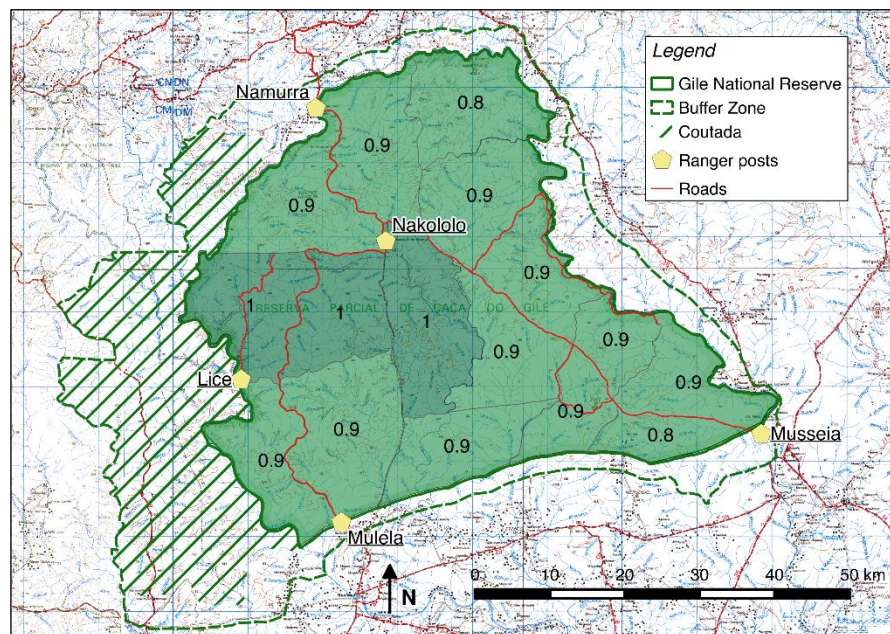


**Figure 45: Results of the monitoring for the common duiker.**
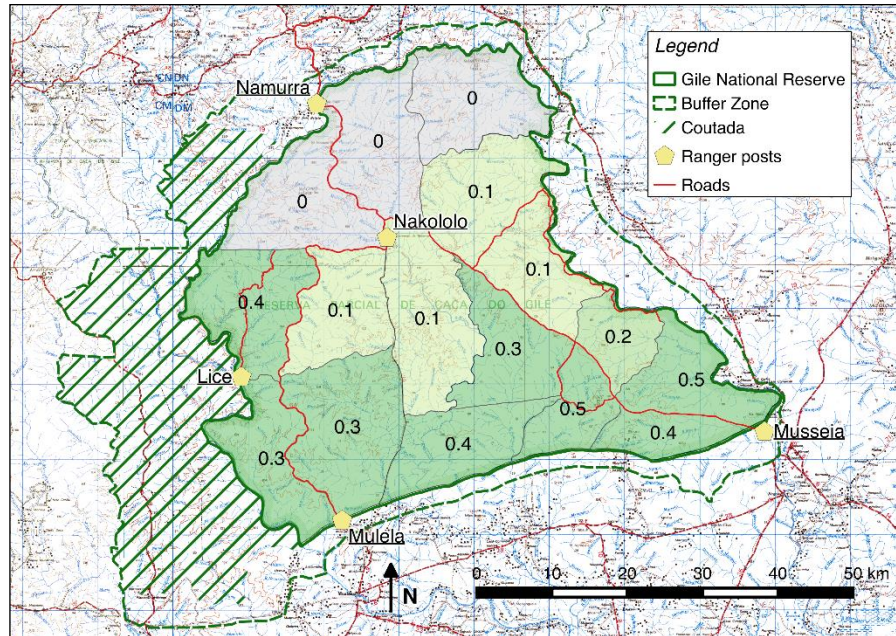
**Figure 46: Results of the monitoring for the African elephant.**
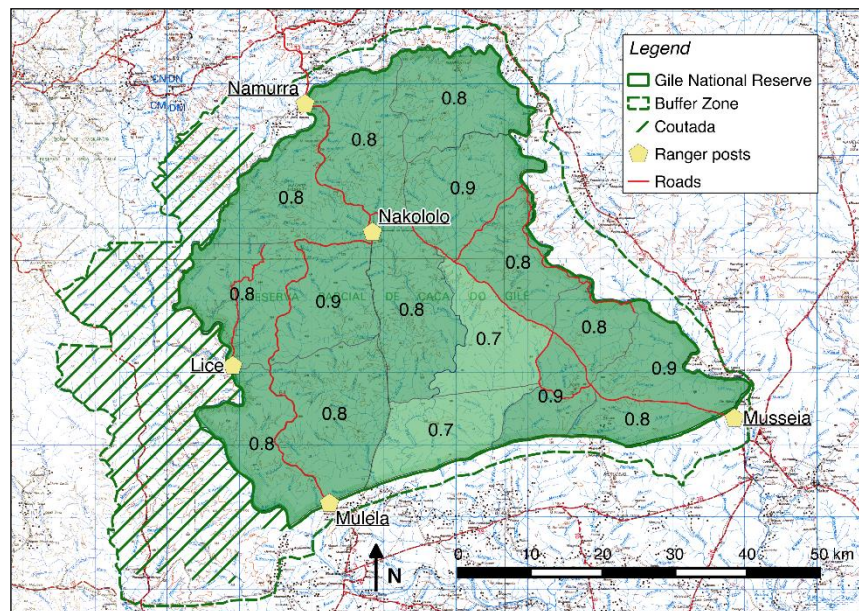


**Figure 47: Results of the monitoring for the greater kudu.**
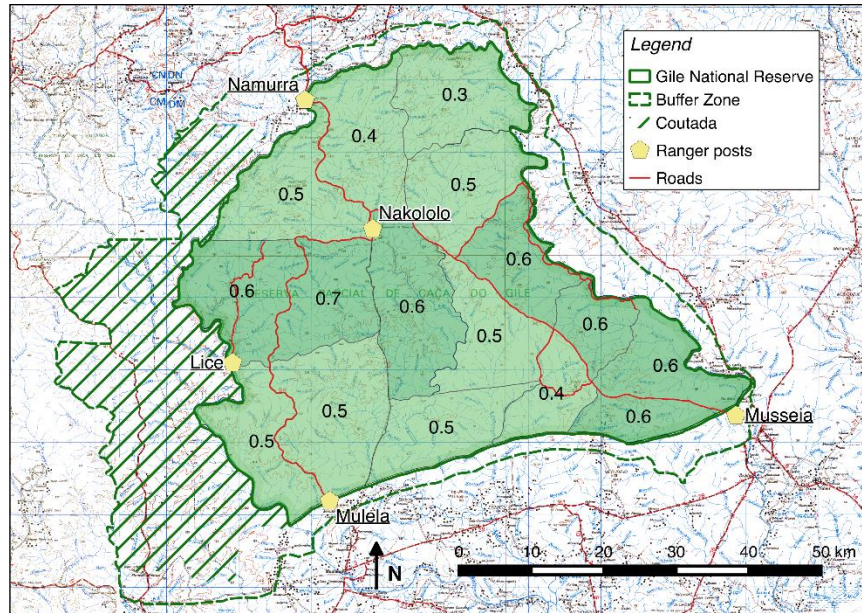
**Figure 48: Results of the monitoring for the reedbuck.**
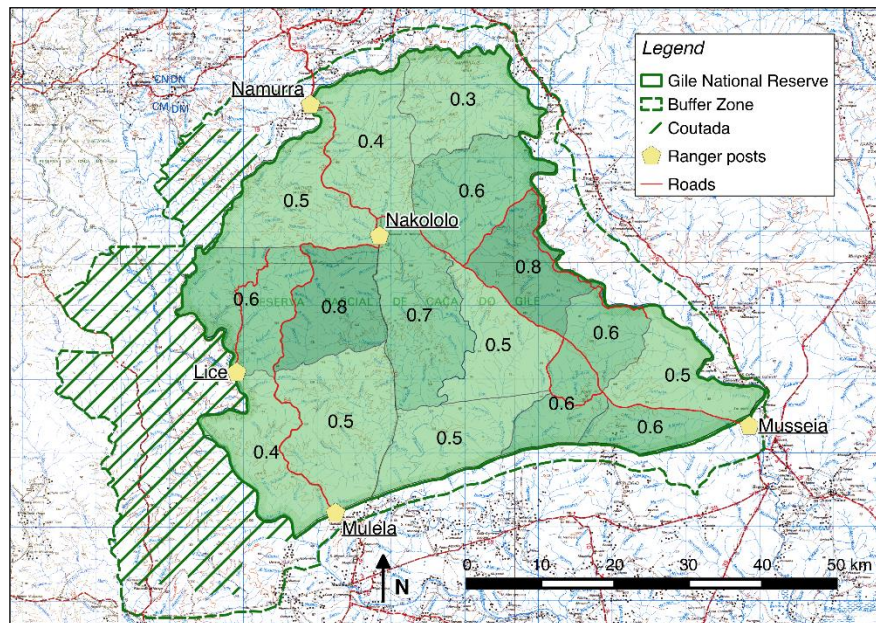


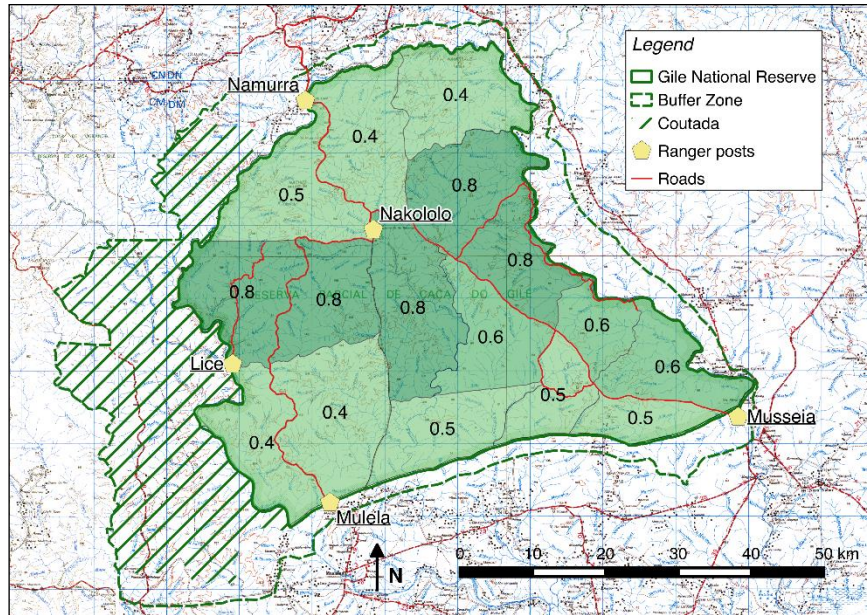**Figure 49: Results of the monitoring for the sable antelope.**

**Figure 50: Results of the monitoring for the waterbuck.**

The results of the wildlife monitoring during the period 2011-2015 show that the species with the higher probability of encounter (or encounter rate) is the common duiker, followed by the grater kudu. Hence, these 2 species are the most abundant in the GNR. On the contrary, the 3 species with lesser probability of encounter are the zebra, the wildebeest and the African buffalo. The latest is not surprising since these are the species reintroduced between 2012 and 2014 (Table 54).

**Table 54: Probability of encounter per species during the period 2011-2015**

| Species | Probability of encounter | Total number of patrols (2011-2015) |
|---|---|---|
| Common duiker | 0.89 | 1,632 |
| Greater kudu | 0.81 | 1,632 |
| Monkey spp. | 0.7 | 1,632 |
| Bushpig | 0.59 | 1,632 |
| Waterbuck | 0.57 | 1,632 |
| Sable antelope | 0.52 | 1,632 |
| Reedbuck | 0.50 | 1,632 |
| Bushbuck | 0.44 | 1,632 |
| African elephant | 0.18 | 1,632 |
| African buffalo | 0.08 | 1,632 |
| Wildebeest | 0.01 | 1,632 |
| Zebra | 0.01 | 1,632 |

As reported above, the monitoring system in place in the GNR is also used to monitor the effectiveness of the patrolling and so the occurrence of poaching in the considered period (2001-2015). The results are reported below.
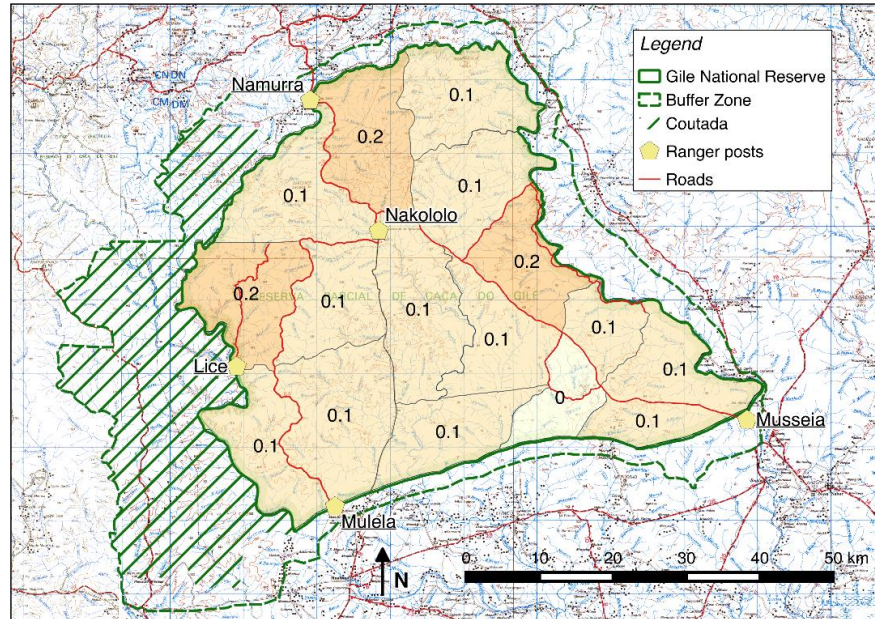


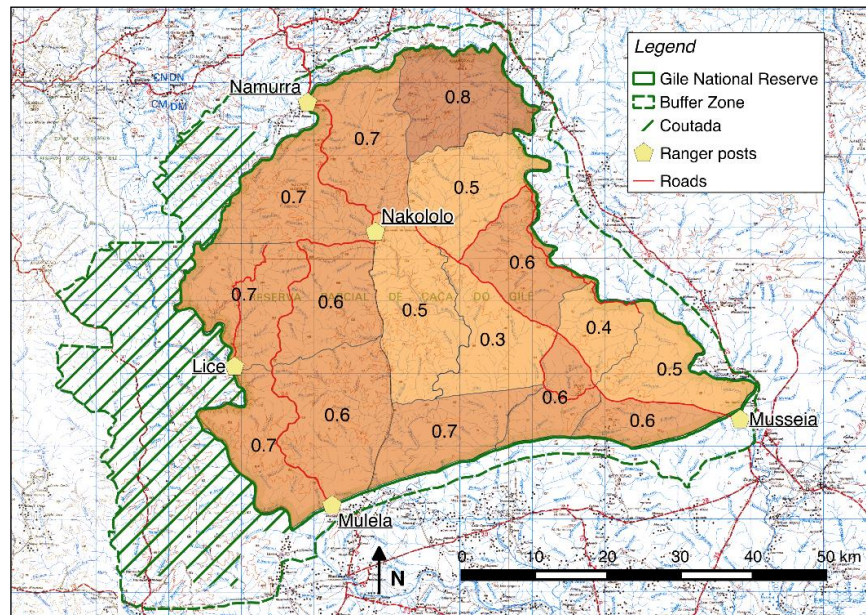**Figure 51: Probability of encounter of poachers in the GNR**



**Figure 52: Probability of encounter of poachers' spoors in the GNR**

The 2 figures above show the monitoring zone with the higher probability to encounter poachers and so the zone with higher poaching activities. This info is very useful to concentrate the patrolling efforts, especially considering the low number of effective rangers of the GNR.

The following figure shows the effectiveness of the patrolling in the GNR between 2001 and 2015, considering the encounter rate with poachers, the n° of poachers arrested and the fire arms sized.
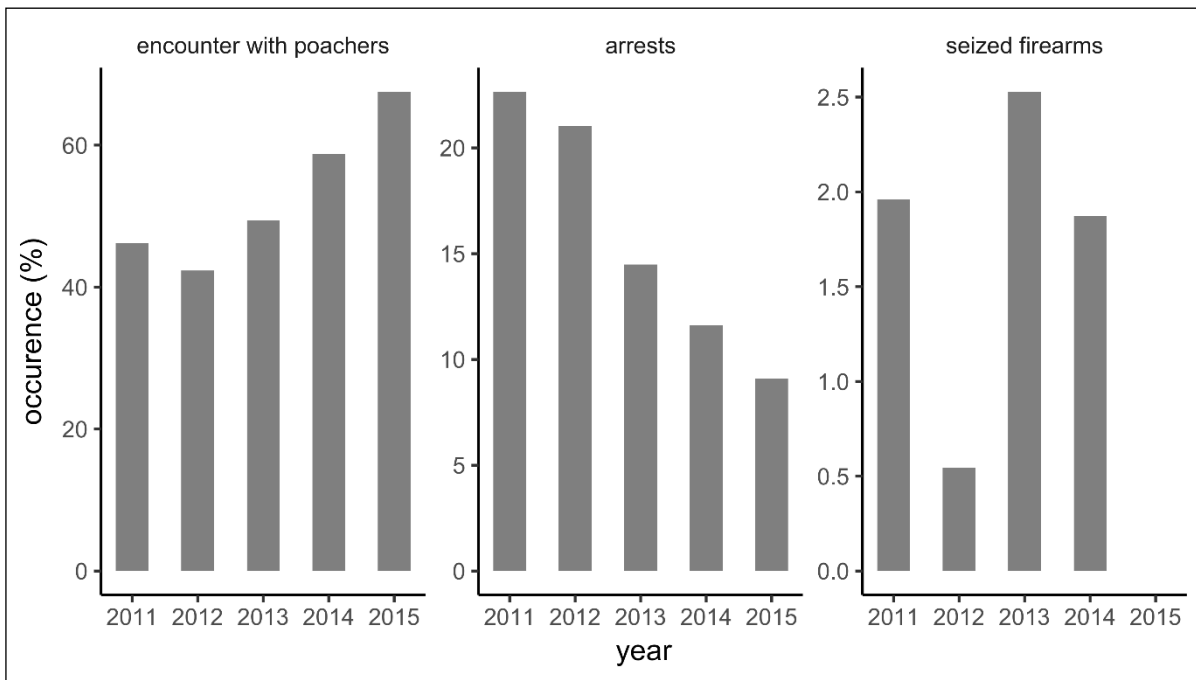


**Figure 53: Effectiveness of the patrolling in the GNR between 2001 and 2015**

Finally, the following figure reports the patrolling effort of the rangers of the GNR between 2011 and 2015 and compare it with the encounters with poachers. It is important to note that the drop in the patrolling effort inside the GNR in 2015 was caused by the insurgence of illegal logging activities mainly outside the GNR and in its buffer zone. This issue was reported largely in many reports produced by the GNR and its partner, showing that the rangers of the GNR were mainly involved outside the GNR in the tentative of stopping the illegal logging problem. Since that, the patrolling effort inside the GNR drastically diminished in 2015.
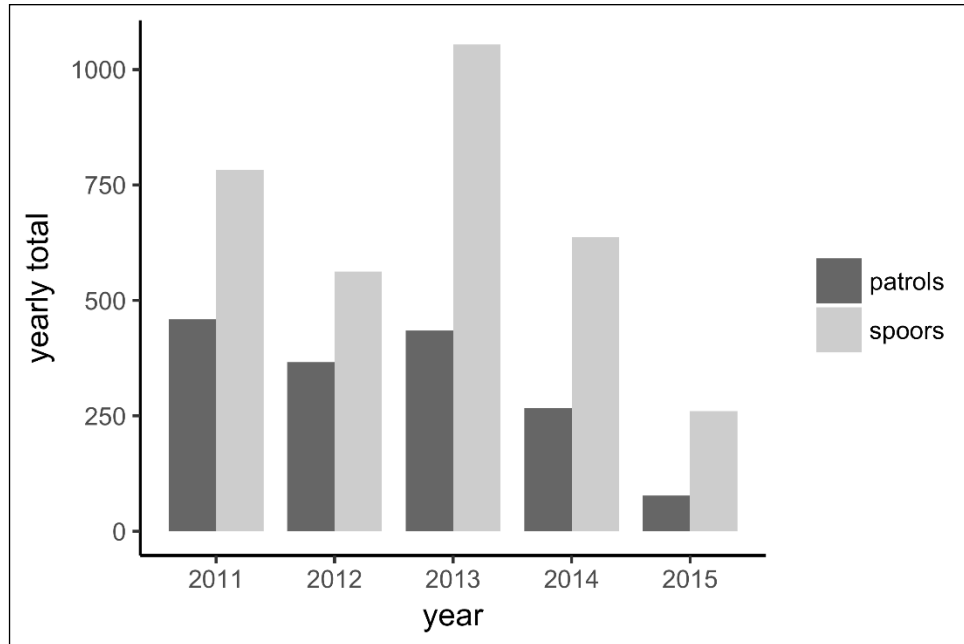
**Figure 54: Patrolling effort vs. poacher's spoors (inside the GNR) in the period 2011-2015.**