

# 5

# MANAGEMENT STRATEGIES AND ACTIONS

## 5.1 Management Structure and Responsibilities

Several management strategies and actions have been identified to respond to the previous discussed issues. Primary aims of the GRG managers are the preservation of the biodiversity and the development of the GRG. These scopes need to be achieved with the active participation of local communities, for both their development and to minimize conflicts between humans and wildlife, and in strict collaboration among the various management performers. The following performers are designated to control, patrol, develop and manage the GRG and its boundary areas:

### **Ministry of Tourism (MITUR)**

The Ministry of Tourism is the definitive responsible for the correct management and development of the GRG, as well as for the other conservation areas in Mozambique.

### **National Directorate of Conservation Areas (DNAC)**

The National Directorate of Protected Areas formulates policies on all protected areas in the country. This department of the Ministry of Tourism represents the effective responsible for the management of the GRG and it is the necessary linkage between the GRG on-day managers based in Zambézia Province and the Ministry of Tourism.

### **Governor Bureau of Zambézia Province (GBZP)**

The Governor Bureau of Zambézia Province is the direct responsible for the administration and management of the whole Province.

### **Provincial Bureau of Tourism (DPT)**

The Provincial Bureau of Tourism is the direct responsible of all the national policies on protected area within Zambézia Province and is responsible for all the relationships between the DNAP, the GBZP and the other governmental institution within the Province. The DPT is the main responsible for developing the tourism in the target area, linking the GRG with other tourism sites both inside and outside Mozambique, and proposing the GRG to private investors.

### **GRG Administrator (GRGA)**

The Administrator, nominated by the DPT, is the direct manager of the GRG and is the responsible for all matters concerning the GRG administration and is subject to the control of the DNAP. The GRGA is responsible to local communities, District authorities and other stakeholders, including notifying them of planning efforts, management progresses and arising issues and assuring that they have the correct participation. The GRGA strictly collaborates with the Provincial Bureau of Tourism and responds directly to the National Directorate of Protected Areas.

### **GRG Wardens (GRGWs)**

The GRG wardens are the direct responsible for the day-by-day patrolling and controlling of the GRG. A total of 12 wardens are required: 2 wardens with the secondary level of instruction for administrative purposes and 10 wardens with the primary level of instruction mainly for patrol purposes. They are the responsible for the correct maintenance of all means of transport and other equipments operating in the GRG. The GRGWs respond directly to the GRGA. The GRGA and the GRGWs constitute the GRG-staff, responsible for the day-by-day management and patrol of the GRG.

### **Provincial Bureau of Agriculture and Rural Development (DPADR)**

The Provincial Bureau of Agriculture and Rural Development has been the former manager of the GRG. The DPADR is still the direct responsible for the management and utilization of both forestry and wildlife resources outside the conservation areas at provincial level, including the release of logging concessions.

### **District Administrations of Gilé (ADG), Pebane (ADP) and Maganja da Costa (ADMC)**

The administrations of Gilé, Pebane and Maganja da Costa play an essential rule in the relationships between the GRG and local populations and are the direct responsible for the development of the respective districts. The Bureaus of Tourism and the Bureaus of Agriculture and Rural Development of Gilé District (**DDTG, DDADRG**), Pebane District (**DDTP, DDADRP**) and Maganja da Costa District (**DDTMC, DDADPMC**) are directly related with the respective district administration and with the GRGA for a series of management issues regarding: a) active collaboration in controlling illegal activities outside the GRG boundaries; b) releasing land-use concession at district level; c) manage issues related with agriculture and other land use outside the GRG boundaries; d) developing tourism at district level; e) involving local communities in the manage of the GRG. The district administrations respond directly to the Governor Bureau in Quelimane, while the district bureaus of agriculture and tourism respond to the respective provincial bureaus. However, for an improved management a direct link between the aforementioned governmental authorities and the GRGA is necessarily required.

### **Local Communities (LCs)**

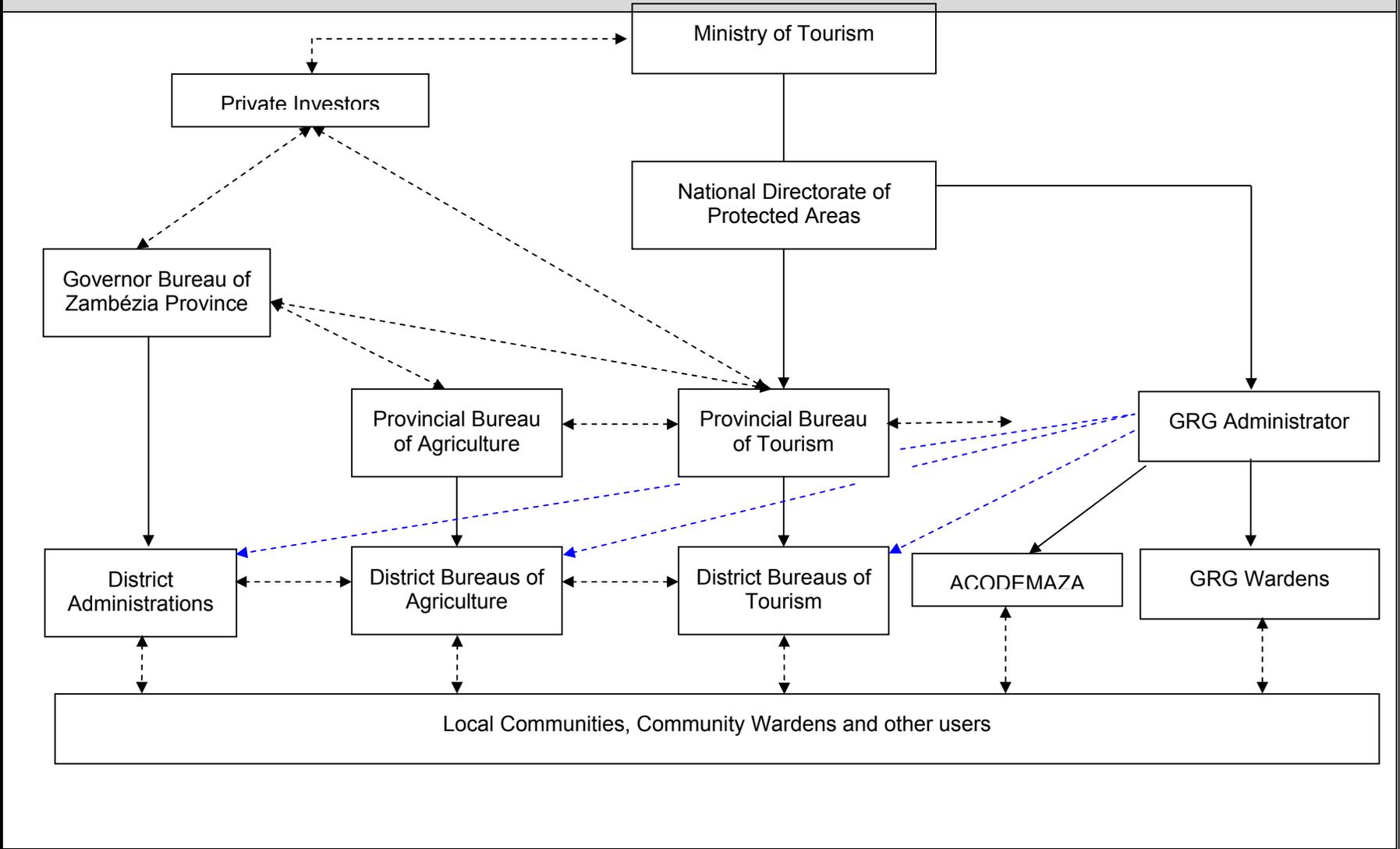
Local communities need to become the first beneficiaries of the GRG. They represent presently the main threat to the biodiversity conservation in the target area; such a situation needs to be rapidly modified. The governmental authorities designed for the GRG management should strictly collaborate with the local communities in order to educate them to a sustainable utilization of bioresources within the contest of the rules indicated in the present management plan. Therefore, local communities need to be involved in each management decision regarding the use of wild resources within the GRG, as well as in the allocation of exploitation concessions outside the GRG, which could be affect their access to livelihood sources (e.g. logging concessions). During the PRPGRG implementation, Movimondo, with the support of the Mozambican NGO ACODEMAZA (**ACOD**), trained some 60 community wardens (**CWs**). Their role consists mainly in conducting participatory meetings to educate and inform the local population concerning the appropriate techniques to extract wild resources and to report infractions to the GRGWs and to the governmental authorities. Such community structure needs to be maintained and even developed by the GRG managers, once again with the support of ACODEMAZA.

### **Private Investors (PIs)**

Developing a correct eco-tourism is an essential goal for conservation of the GRG and the development of local communities. Private investors could play an essential rule if receiving an

adequate collaboration by the institutional authorities and need to be encouraged to invest in the GRG management and conservation.

**FIGURE 5.1** The Management Structure of the Game Reserve of Gilé



## 5.2 Management of Bioresource Use

At present, several bioresources still represent an important livelihood strategy for most of local people in the target area (see Section 3.1). Such a situation needs to be carefully evaluated and kept in consideration in each management decision regarding both the use and conservation of natural resources. The present Management Plan considers the opportunity to maintain the actual extraction of several bioresources, even within the GRG. Nevertheless, such a possibility needs to be regulated and confined within some defined areas (Zoning plan). Furthermore, subsistence hunting needs to be regulated and controlled both spatially and temporally. Instead, the exploitation of other resources needs to be totally forbidden because of the serious threat for the bioconservation.

### 5.2.1 Management of Community Exploitation of Timber

Timber products are essential goods for all the local communities living in the neighbouring of the GRG. Most of them are available both inside and outside the protected area, while others are extracted mostly or uniquely within the GRG. Presently, the local exploitation of timber products doesn't appear unsustainable, given both the lack of human settlements in the GRG and the by hands extraction methods. Given that, such activities could be allowed within all sectors of the GRG and during all the year.

<b>Management strategies</b>
1. Allow the present exploitation of timber products by local residents within all the sectors of the GRG.
2. Inform clearly the local communities concerning the possibility to continue the extraction of timber products within the GRG.

<b>Management actions</b>	<b>Management performers</b>
1. Allow the local utilization of timber products avoiding any kind of punishment for these activities.	GRGA, GRGWs, ADG, ADP, ADMC, LCs
2. Organize and conduct several participatory meetings to inform local residents concerning the possibility to extract timber products within all the sectors of the GRG.	GRGA, GRGWs, ACOD, LCs

### 5.2.2 Management of the Exploitation of Non-Timber Forest Products (NTFPs)

As timber products, non-timber forest products (NTFPs) are essential goods for dwelling people. Most of them represent an irreplaceable food source during the shortage periods (see Section 3.2). All of them, despite their relevance, are still extracted traditionally (without any modern technique or instrument). The man-induced pressure on most of NTFPs in the target area appears sustainable given their abundance, confirmed by the large availability reported by locals, and their reduced seasonal exploitation (see Fig. 3.1 in Section 3.2). Hence, the extraction of the following NTFPs could be allowed within the GRG during the whole year: a) mushrooms, b) wild fruits, plants and grasses, c) roots and tubers.

The exploitation of invertebrates (i.e. caterpillars, crickets, termites, giant snails) is likely to be considered as sustainable. The extraction of such resources could be presently allowed. However, adequate and comprehensive scientific studies are required for a good understood of invertebrate fauna of the GRG as well as to evaluate the real impact of man-induced pressure.

For the other NTFPs mentioned in the Section 3.1.2, both conservation purposes and extraction techniques utilized avoid them from a free exploitation by local populations. Honey gathering is conducted mainly by residents that enter in the GRG for hunting or fishing purposes. The extraction technique, which results in felling trees and destroying natural hives, is improper, even considering the very small quantity of product obtained (see Fusari, 2002). Reptiles and amphibians are still poorly studied in the GRG and it is difficult to assess the real human impact on their populations. However, as conservation goal, even considering the occurrence of the Zambezi soft-shelled terrapin (*Cycloderma frenatum*), which is a rare East African endemic, the capture of reptiles and amphibians needs to be avoided.

<b>Management strategies</b>
1. Allow the present exploitation of certain NTFPs by local residents within all the sectors of the GRG.
2. Inform clearly the local communities concerning the possibility to continue the extraction of certain NTFPs within the GRG.
3. Inform clearly the local communities concerning the impossibility to extract certain NTFPs within the GRG: honey, reptiles and amphibians.
4. Avoid the extraction of certain NTFPs: honey, reptiles and amphibians.

<b>Management actions</b>	<b>Management performers</b>
1. Allow the local utilization of certain NTFPs avoiding any kind of punishment for these activities.	GRGA, GRGWs, ADG, ADP, ADMC, LCs.
2. Organize and conduct several participatory meetings to inform local residents concerning the possibility to extract certain NTFPs within all the sectors of the GRG and during all the year.	GRGA, GRGWs, ACOD, LCs.
3. Organize and conduct several participatory meetings to inform local residents concerning the impossibility to extract certain NTFPs: honey, reptiles and amphibians.	GRGA, GRGWs, ACOD, LCs.
4. Avoid the extraction of honey, reptiles and amphibians within the GRG through an efficient patrol and the severe application of punishments.	GRGA, GRGWs.

### 5.2.3 Management of Subsistence Hunting

Hunting activities both within the GRG and its boundary areas need to be strictly regulated and controlled, avoiding poaching. The GRGA and GRGWs have to inform the local communities, through several participatory meetings, concerning the rules to be applied for hunting activities and involve them in the active control of any infractions.

Local people utilize several hunting techniques and weapons. Some traditional hunting techniques could be maintain because not representing a serious risk for local fauna, while others need to be completely avoided.

Traps are wide spread in the area. Hunting with traditional traps as *mranko* and *nicolope* doesn't appear unsustainable. In spite of these traps are not selective, the amount of preys catch and their size are limited.

Nets are deeply rooted traditional hunting weapons. Netting is the only hunting technique that involves the entire household. Given the possibility to make this technique selective (educating the local hunters) and because of the booty is usually composed by small animals, netting could be considered as sustainable extraction method under some regulation.

Subsistence hunting through the aforementioned techniques could be permitted exclusively within the *Buffer Zone*, the *Regulated-use Zones* and during a limited period of the year. Such period is comprised between December and June, taking into consideration two reasons: 1) the food shortage period in the target area is limited to the early period of each year; 2) avoiding hunting during mammal breeding and matting periods is essential. Regarding antelopes capture, the GRG managers require conducting participatory meetings to educate local hunters to select their preys, avoiding the slaughter of female specimens.

Gin traps (*rapito* or *langa*) and fall traps (*inthcepe*) result in a severe impact on the local fauna. These traps are totally unselective and allow capturing from small to very large animals. Moreover, they represent a serious hazard for dwelling people; is not rare that local residents, mainly women whose go into the GRG for fishing or gathering, are cruelly injured by these traps.

Hound hunting is not sustainable and needs to be avoided because of two main reasons: 1) this method is not selective and is depleting the primate population that is already in poor conservation status; 2) the frequent presence of domestic dogs in the GRG could have serious consequences because of the introduction of diseases, such as rabies and ehrlichiosis, potentially dangerous for wild carnivores, mainly considering the remain population of African wild dogs.

<b>Management strategies</b>
1. Inform the local communities concerning the new role for hunting activities.
2. Avoid any kind of poaching within the GRG and its boundary areas.
3. Avoid the utilization of certain unsustainable hunting weapons and techniques.
4. Permit subsistence hunting activities under certain rules.
5. Permit the utilization of certain non-disruptive hunting weapons and techniques.
6. Educate local hunters to select their preys.
7. Establish an active collaboration between the GRGA and GRGWs and local communities.
8. Establish an active collaboration amongst all the GRG institutional managers.

<b>Management actions</b>	<b>Management performers</b>
1. Organize and conduct several participatory meetings to inform local residents concerning the hunting techniques allowed and the hunting period.	GRGA, GRGWs, ADG, ADP, ADMC, ACOD, LCs.
1. Active patrol of the GRG and its boundary areas against poaching and effective applications of punishments.	GRGA, GRGWs, DDADRG, DDADRP, DDADPMC, LCs.
2. Avoid the utilization of certain unsustainable hunting weapons and techniques: gin traps, fall traps and hound hunting.	GRGA, GRGWs, DDADRG, DDADRP, DDADPMC, LCs.
3. Permit subsistence hunting within the buffer zone and use-zones during the period January/July.	GRGA, GRGWs, DDADRG, DDADRP, DDADPMC, LCs.
4. Permit the utilization of certain non-disruptive hunting weapons and techniques: traditional traps, <i>mranko</i> and <i>nicolope</i> , and nets.	GRGA, GRGWs, DDADRG, DDADRP, DDADPMC, LCs.
5. Educate local hunters to become prey selective through the use of permitted techniques avoiding the capture and slaughter of females and juvenile individuals.	GRGA, GRGWs, LCs.
6. Establish active collaborations between the GRGA, GRGWs and local communities through monthly meetings to discuss arising issues and to inform them concerning.	GRGA, GRGWs, LCs.
7. Establish active collaborations amongst the GRGA and governmental authorities at district level through monthly meetings to discuss arising issues.	GRGA, ADG, ADP, ADMC, DDADRG, DDADRP, DDADPMC, DDTG, DDTP, DDTMC.

### 5.2.4 Management of Subsistence Fishing

Subsistence fishing is a further livelihood strategy in the target area. Presently, is extremely difficult to assess the man-induced impact because of the very few information available concerning the local fisheries. However, fishermen still use traditional fishing techniques, which don't appear unsustainable. Some doubts exist on the use of the basket fishing; such method is very unselective and could menace juveniles and fries. The utilization of poisonous natural substances is probably a non-disruptive technique because used since hundreds of years; however, such an attitude represents a trend to introduce dangerous chemical substances from outside; an education campaign could be conducted to inform local residents about the threat of introducing such substances.

Local fishermen could be educated to select their preys, releasing fishes under 10 cm size. Nevertheless, subsistence fishing could be considered sustainable within the GRG, but should be better studied and monitored in the next future.

<b>Management strategies</b>
1. Inform the local communities concerning the possibility to fish within the GRG.
2. Inform the local communities concerning the threat to introduce chemical substances for poisoning water for fishing purposes.
3. Avoid the introduction of such chemical substance.
4. Educate local fishermen to become prey-selective.
5. Facilitate more comprehensive studies on the local fresh water fisheries.

<b>Management actions</b>	<b>Management performers</b>
1. Organize and conduct several participatory meetings to inform local residents concerning the possibility to fish within the GRG.	GRGA, GRGWs, ADG, ADP, ADMC, ACOD, LCs.
2. Organize and conduct several participatory meetings to inform local residents on the threat to use chemical substances for poisoning water for fishing purposes.	GRGA, GRGWs, DDADRG, DDADRP, DDADRMCMC, ACOD, LCs.
3. Avoid the introduction of chemical substances for fishing purposes through an effective patrol and application of punishments for the infractions.	GRGA, GRGWs, DDADRG, DDADRP, DDADRMCMC, LCs.
4. Organize and conduct participatory meetings to educate local fishermen to become prey-selective, releasing fishes smaller than 10 cm.	GRGA, GRGWs, DDADRG, DDADRP, DDADRMCMC, ACOD, LCs.
5. Facilitate scientific studies concerning the fresh water fisheries contacting and involving national and foreign research institutes and University. Research facilities could include logistic support through the GRG infrastructures and avoiding the request of research fees.	GRGA, DPT, DNAP.

### 5.3 Management of the Socio-economic Situation

The socio-economic situation described in the Section 3.2.1 presents a major challenge to the prospect of sustainable resource-use and consequently to the conservation of the biodiversity. Despite the reported decline in the wild resources availability, rather than switching out of hunting or other extraction activities to other forms of livelihood, the narrow income generating base forces local communities to carrying on to extract natural resources regardless. If sustainable forest resource-use is to become a reality, local communities urgently need technical support to broaden the income base and develop alternative livelihood strategies.

During the last three years, the PRPGRG and the FSPIGD (both financed by the EU and implemented by Movimondo) developed an array of activities to increase the income base of the communities living around the GRG. Between these activities there are: a) the improvement of the local farmers capacity to produce agricultural products, 2) introduction of cash crops such as

sunflower and sesame, 3) improvement and increase of local production of cashew nuts, 4) introduction of small domestic animals (goats), 5) provide access to markets for local sellers. Is essential to continue, increase and improve such activities, in order to provide even alternative source for local populations. Furthermore, a series of direct and indirect incentives could be provided to local residents encouraging them to gradually abandon improper extraction techniques. Such incentives could be provided by both governmental authorities and private investors and include the ecotourism development in the area. The possibility to provide such incentives is considered as a part of the Community-based Management and is discussed in Section 6.1.1.

<b>Management strategies</b>
1. Increase the narrow income base of the local populations through the adoption of sustainable livelihood strategies.

<b>Management actions</b>	<b>Management performers</b>
1. Continue, improve and increase the activities started by the PRPGRG and the FSPIGD.	DDADRG, DDADRP, DDADRMC, DPADR.
2. Assure market access to local producers and sellers.	ADG, ADP, ADMC.
3. Provide a series of direct incentives to local users encouraging them to abandon improper extraction techniques.	DDADRG, DDADRP, DDADRMC, DPADR, PIs
4. Provide a series of indirect incentives to local users encouraging them to abandon improper extraction techniques.	DDADRG, DDADRP, DDADRMC, DPADR, PIs

## 5.4 Management of Biodiversity Conservation

Unsustainable use of bioresources and inappropriate extraction techniques represent the main threat to bioconservation in the GRG; managing them is the essential prerequisite to preserve the GRG biodiversity (see Section 5.2). Further risks are represented by the following anthropogenic activities or induced disturbances: 1) wildfires, 2) commercial exploitation of timber, 3) mining, 4) agriculture activities.

### 5.4.1 Management of Wildfires

Wildfires occur annually within the GRG during the late dry season (August/November); their impact is the principal and more severe threat to the vegetation cover of the GRG. Ignition is largely man-induced, while natural ignition (i.e. lightning) is assumed very rare (Trollope & Trollope, 2002). Local resident essentially induce wildfires for hunting purposes or just for paths cleaning. Occurring fires without any control produce severe impacts on both vegetation and small animal communities, representing a serious risk for bioconservation in the immediate. Such a practice needs to be immediately avoided through the application of a correct fire-management (see Section 6.3) and through vast campaigns to educate the local populations to abandon the use of fires within the GRG. Information provided should distinguish the inopportunity of wildfires within the GRG from the important practice of fields cleaning, during which fire needs to be control and restricted, using fire breaks and burning only during the late evening or early morning. During

the PRPGRG implementation, Movimondo, in collaboration with the PMSRN, financed by the Finnish Government, conducted information campaigns using several methods as: a) participatory meetings with local populations; b) disseminating a number of posters; c) using radio spots both in Portuguese and Lomwé languages. The GRG managers should protract such effort at least during the next five years; the presence of the PMSRN in Zambézia Province could represent an important support for this activity during the whole 2003.

<b>Management strategies</b>
1. Inform the local communities concerning the threat represented by wildfires.
2. Prevent the large accumulation of fuel biomass (i.e. standing grasses, wood-litter and leaf-litter).
3. Avoid the ignition of wildfires within the GRG.
4. Inform the local communities concerning the possibility of use appropriate and restricted fires to clean fields.

<b>Management actions</b>	<b>Management performers</b>
1. Organize and conduct participatory meetings to inform local residents concerning the threat represented by wildfires.	GRGA, GRGWs, ADG, ADP, ADMC, LCs, CWs.
2. Adopt a correct fire-management for the GRG.	GRGA, GRGWs.
3. Create a firebreak system around the whole GRG <i>Core Zone</i> .	GRGA
4. Active controlling and patrolling of the GRG and affective application of punishments for the infractions.	GRGA, GRGWs.
5. Organize and conduct participatory meetings to educate local residents to use correctly the fire for cleaning fields and how to control them (i.e. using firebreaks and burning during the late evening or in the early morning).	GRGA, GRGWs, DDADRG, DDADRP, DDADPMC, LCs, CWs.

## 5.4.2 Management of Commercial Exploitation of Timber

Logging concessions around the GRG represent a hazard for bioconservation because they can correspond to 1) a severe reduction of vegetation cover; 2) a progressive lost of habitats for animals; 3) a likely increment of bioresources extraction by local populations within the GRG because their decreasing within the logged areas. Moreover, deforestation, as emphasized in Section 3.3.1, could represent the lost of indirect value, such as the economic value represented by 2,100 km<sup>2</sup> as carbon sink, and the lost of several related ecosystem functions as watersheds protection and erosion control. The commercial exploitation of timber represents the main risk to the vegetation conservation outside the GRG, even considering that several environments have already experienced sever man-induced disturbances through the land cleaning for agriculture purposes.

For these reasons, logging concessions need to be avoided in the future within all the buffer zone around the GRG. Furthermore, the licences previously granted within the proposed Buffer Zone call for an immediate retire. The legislation in force foresees that logging companies should provide benefits to local communities, usually intended as grain millers or rehabilitation of

infrastructures. Even so, these benefits are seldom allocated. Such a situation requires particular attentions from the GRG managers that would be able to guarantee profits to the communities from any type of land use or concession in the target area.

While the GRGA and DPT are the direct managers of the GRG, the DPADR is responsible for releasing logging licences. Given that, a more strict collaboration between these governmental authorities is required to manage and control such concern.

<b>Management strategies</b>
1. Avoid severe deforestation in the neighbouring of the GRG.
2. Benefit local residents from existing and future logging concessions outside the GRG Buffer Zone.

<b>Management actions</b>	<b>Management performers</b>
1. Avoid the concession of new logging licences within the GRG Buffer Zone.	GRGA, DPADR, DPT.
2. Retire immediately the logging licences existing within the GRG Buffer Zone.	DPADR.
3. Active control of illegal timber logging within the GRG Buffer Zone.	GRGA, GRGWs, DDADRG, DDADRP, DDADPMC, LCs, CWs.
4. Assure that the local populations benefit, in the terms foresee by the actual legislation, from the existing logging concessions outside the GRG Buffer Zone.	GRGA, DDADRG, DDADRP, DDADPMC, ADG, ADP, ADMC, LCs.
5. Create a strict synergy amongst the GRGA, DPT and DPADR for manage and control any logging concession outside the GRG Buffer Zone.	GRGA, DPT, DPADR.

### 5.4.3 Management of Mining Activities

Mining activities are concentrated north of the GRG, along the Molocué and Mulela Rivers, and concern mainly the extraction of tantalite. Unfortunately, no data are available concerning the possible impact of such activities on the water table. The GRG managers should involve the qualified authorities from Quelimane to evaluate and monitoring the matter.

<b>Management strategies</b>
1. Prevent water pollution deriving from mining activities through monitoring of water condition of the Molocué and Mulela Rivers.

<b>Management actions</b>	<b>Management performers</b>
1. Involve the qualified authorities to monitor the water quality both in the Molocué and Mulela Rivers.	GRGA, DPT.
2. Establish an active collaboration with the mines managers to monitor and possibly minimize any water pollution.	GRGA, DPT

#### 5.4.4 Management of Agriculture Activities

Presently, there is no evidence that land is currently being cleared within the GRG for agricultural purposes. Given that, agriculture activities appear a remote threat for bioconservation within the GRG. Although, the remarkable situation of no human settlements within the protected area, some sectors nearby the GRG borders experience significant population densities (i.e. Namurrua, Gilé, Naeche, Etaga and Mulela). This situation is likely destined to worsen in the short and middle time, given the positive trend of population increasing in the region. An important task of the GRG managers is to avoid that land would be cleared within the GRG for agriculture purposes, or settled by local residents.

<b>Management strategies</b>
1. Avoid any clearing of land human settlements within the GRG in the future.

<b>Management actions</b>	<b>Management performers</b>
1. Active control that forested land within the GRG will not be cleared for agriculture purposes and settled by local populations.	GRGA, ADG, ADP, DDADRG, DDADRP.

#### 5.5 Management of Mammals Conservation

Conservation and/or preservation of mammals within the GRG consist inevitably of the control of the man-induced disturbances, which mainly originated from the extraction of wild resources by local people, as already underlined in the previous sections.

Conservation management intensity is often dictated by spatial variables with relatively small areas requiring more intense conservation measures than relatively large areas. Modern conservation paradigms also tend to focus on meta-dynamics rather than equilibrium concepts. Within this context conservation management fosters source-sink interactions through which populations are maintained within populations. As a consequence attention focuses on spatial and temporal dynamics and allows for populations within different parts of a region both to increase and decrease over time (van Aarde, 2002).

In the case of the GRG, wildlife numbers are probably to low for populations to operate within the framework of metapopulation theory, in spite of the relatively large spatial scale over which such dynamics could conceivably operate in the region. As a first and urgent action of conservation management, the apparent downward trends in population numbers need to be halted and replaced, either with stabilisation or the increase in their numbers. This may be achieved through overt protection of all populations and the habitats within a delineated core area through the

reduction and minimization of man-induced mortalities. Actions to reduce and minimize the man-induced mortalities of wildlife in the GRG include a) the continuation of the efforts to reduce the numbers of operational inhumane animal traps (gin traps) in operation in the area and b) the reduction in the wild fires occurring in the region by the development of a fire management programme and control of excess to the protected area.

The development of a fire management programme need to take cognisance of the positive role fires may play in maintaining forest heterogeneity when applied at an ecologically accepted scale, intensity and frequency. The scale of wild fires may be controlled through the development of a network of roads that can serve as fire brakes and/or through the early burning of selected patches that could serve as fire brakes (Trollope & Trollope, 2002; van Aarde, 2002).

The manipulation of resources such as food and water is not considered needed to improve stocking numbers as present numbers are well below those that may be supported by the area.

Special efforts need to be placed for the protection of elephants and wild dogs. Both species represent taxon of conservation concern and they could represent flag species for the GRG.

Considering trends in elephant populations afforded total protection elsewhere in Africa is reason to think that appropriate conservation measures will give rise to elephant numbers increasing in the area. Like elsewhere, such an increase is deemed to have negative consequences for the local habitats of other species and for communities living in the proximity of the GRG. At such a time the use of elephants as a resource through trophy hunting, safari hunting or traditional hunting may well be appropriate as long as the number of elephants removed never exceed 5 - 7% of those present within the population. Elephant harvesting and hunting is complicated by the intricacies of their social system and hunting and harvesting strategies need to be developed in close consultation with expert opinion (van Aarde, 2002).

Elephant conservation concerns mainly habitat preservation and minimization of conflicts with local populations. Elephant use range extends both inside and outside the GRG (see Section 3.3.3), where conflict derives from field cropping by elephants in the south-western sector. Removing local people from the area appears totally unjustified and not cost efficient. Three measures could be applied: 1) discourage further human settlement within the conflict area; 2) provide a warden team, based in Mulela camp, that could rapidly reach the conflict area and drive away the elephant; 3) avoid the slaughter of elephant as practice to protect crops.

The viability of mega- and meso- herbivore populations within the GRG is clearly challenged, as numbers in general appears to be low and to be kept low. The local extinction of at least two of some 20 mammal grazers typical of the region and the low abundances of others is a matter of grave concerns and points to extinctions being induced by deterministic events such as poaching and hunting rather than habitat destruction (man-induced habitat destruction is often the primary cause of local extinction). Total protection afforded to local populations of game and carnivore species for a period of ten to 12 years may provide most of these to build up in numbers to a level where sustainable consumption may even be considered.

The option of re-introducing meso- and mega- herbivores are one that is expensive and may only be viable once the man-induced disturbances reflected on earlier have been brought under control. At that stage the introduction of Liechtenstein's hartebeest, blue wildebeest and eland may be considered and must preferably be sourced from reserves within the region without putting unduly stress on such source populations. In the case of all three of these species mass introductions involving no less than 10 -15 individuals should be considered. Such introductions should only be considered after conservation measures within the GRG have reached appropriate levels to ensure total protection to all mammals within the Reserve. The supplementation of other

species populations (i.e. buffalo, sable, waterbuck, kudu) should only be considered should total protection not give rise to a recovery of their numbers.

<b>Management strategies</b>
1. Preserve the mammalian fauna of the GRG.
2. Avoid any severe man-induced disturbances on mammal populations.
3. Preserve the elephant population within the GRG.
4. Minimize the conflict between elephants and local communities.
5. Preserve the wild dog populations within the GRG.

<b>Management actions</b>	<b>Management performers</b>
1. Active patrol and control of the GRG to avoid unsustainable extraction practices by local populations and effective punishments for the infractions.	GRGA, GRGWs.
2. Avoid any kind of anthropogenic disturbances within the GRG <i>Core Zone</i> through an effective and effective control.	GRGA, GRGWs.
3. Monitoring the respect of use-rules within the <i>Regulated-use Zones</i> through an active and effective control.	GRGA, GRGWs.
4. Apply a correct fire-management within the GRG.	GRGA, GRGWs.
5. Avoid any increase of anthropogenic disturbances within the elephant use-range (i.e. avoid the increasing human incidence, avoid the release of logging licenses).	GRGA, ADP, ADMC, DPADR.
6. Organize a team of three wardens, based in the Mulela camp, to respond, through rapid interventions, to the conflict between elephants and local communities.	GRGA, GRGWS.
7. Apply special effort to avoid any slaughter of wild dogs through an effective patrol of the GRG against illegal hunting activities.	GRGA, GRGWs, CWs.

## 5.6 Management of Research and Monitoring

Several research and monitoring issues have been identified, as underlined in the Section 3.4, to provide an adequate database for the management of the GRG. Required scientific studies and monitoring activities are:

1. A research to provide detailed information on the human demography and local livelihood strategies in the target area;

This research is justified by the importance that a likely constant increment of population density in the area, and the related livelihood strategies adopted, represent for the increase of man-induced pressure on the bioresources

2. Constant monitoring of the exploitation level of the bioresources, including the commercial exploitation of timber

This monitoring activity is justified by the essential aim of prevent that improper extraction of resources, as well as logging of timber, continue at unsustainable levels

3. A research to provide detailed information on the GRG invertebrate micro-fauna;

This research is justified by the importance that several invertebrate species (mainly insects) represent as food-source for local users

4. An exhaustive research on the elephant population dynamic in the GRG and a constant monitoring of their conservation status;

This research is justified because the present knowledge of elephants within the GRG is still limited. This species represent a taxon of conservation concern and could represent a flag species for the conservation of the GRG. Furthermore, a better knowledge of their movement and use-range could improve the effort devoted to minimize the conflict with local population

5. Exhaustive researches and constant monitoring of the populations of meso- and mega-herbivores;

These researches are justified by the importance that herbivores have for both conservation aims and as resource for local people. Meso- and mega- herbivores are mainly threatened by the utilization of incorrect hunting techniques that require to be avoided. Such researches are essential even considering the future possibility to re-stocking several herbivores species within the GRG

6. Exhaustive research on the conservation status of large carnivores, mainly considering the African wild dogs

This point has been already underlined in the Section 5.5

7. Constant monitoring of the occurrence of wildfires and their impact on the vegetation communities

This monitoring activity is justified by the role that fire plays in miombo woodland and in particular the impact that man-induced wildfires have on the vegetation of the GRG. As one of the prior menace for biodiversity conservation in the GRG, wildfires occurrence is radically to be avoid and well-monitored in the future

Such a scientific activity is, and will always be, beyond the capacity of the GRG staff. It is essential that the governmental authorities appointed for the management of the conservation areas in Mozambique institute a strict collaboration and synergy with both national and foreign research institutes to assure an adequate research development in the GRG.

It is essential that all facilities should be given to scientific specialists that visit the GRG for research purposes, as first research facility the is important to avoid the payment of research fees during the next five years.

<b>Management strategies</b>
1. Provide a complete information set on several management and scientific issues.
2. Establish an internal monitoring system, integrated into the routine GRG operations, to allow periodic evaluations of management performance and resource sustainability.
3. Collaborate with national and foreign research institutes to fill the complex data requirement not covered by the internal monitoring capacity.
4. Provide research facilities for external specialist.
5. Establish a database of all relevant research data collected in the GRG.

<b>Management actions</b>	<b>Management performers</b>
1. Define and organize a series of scientific researches on the identified issues.	GRGA, DNAC.
2. Organize and train an internal team, composed mainly by the GRG administrator and the GRG wardens, for constant monitoring of important management issues and management performance.	GRGA, DPT, GRGWs.
3. Involve national and foreign research institutes in researching activities in the GRG, elaborate and propose scientific programmes to be developed by professional scientists and students.	GRGA, DNAC.
4. Permit the utilization of the GRG infrastructures by external researches, provide logistic support during research activities, avoid the requirement of research fees during the next five years.	GRGA, DPT, DNAC.
5. A complete database of the scientific data concerning the GRG should be provided and update. This database should be available in the offices of the GRG and duplicated in the offices of the DPT and DNAC.	GRGA, DPT, DNAC.

## 5.7 Management of Existing and Developing Infrastructures

Given the rehabilitation undertaken during the implementation of the PRPGRG, the GRG presently disposes of 6 warden posts and a road network of around 180 km (see Section 3.5). These structures represent the essential basis for the management and patrol of the GRG, allowing the logistic support for several activities such as patrolling, office activities, scientific research and in general all the day-by-day management activities. However, routine maintenance needs to be given to the edifices as well as regular cleaning and light rehabilitations to the roads. Routine maintenance of edifices, such as a complete painting and other routine activities, should be provided directly by the GRG wardens. Instead, for cleaning and repairing roads a team of approximately 40 auxiliary workers for 4-5 months period should be appositely contracted. Such cleaning and repairing activities should be conducted once a year during the dry season.

Given the surface of the GRG, a larger road cover is desirable, mainly considering a future tourism development and a better management of the area. Nevertheless, such option could be considered only after a complete control of the area is provided, as underlined in the Section 3.5.

Hence, the opening of the following paths, even if only accessible during the dry season, is suggested:

1. a path of some 15km from the Lice crossroad to the Muipige River;

The opening of this road is justified by the increase patrolling capacity and to delimited one of the proposed *Regulated-use Zone* (see the Zoning Plan)

2. a path of some 30 km from the main road to the Muipige River;

The opening of this road is justified by the increase patrolling capacity and to reach an area of conservation concern. Most of large mammals, as well as elephants, occur within this area

3. two road bordering the proposed GRG *Core Zone*, the first one along the border between Gilé and Pebane districts and the second one along the southern limit of the GRG between the Malema River and the Musseia camp.

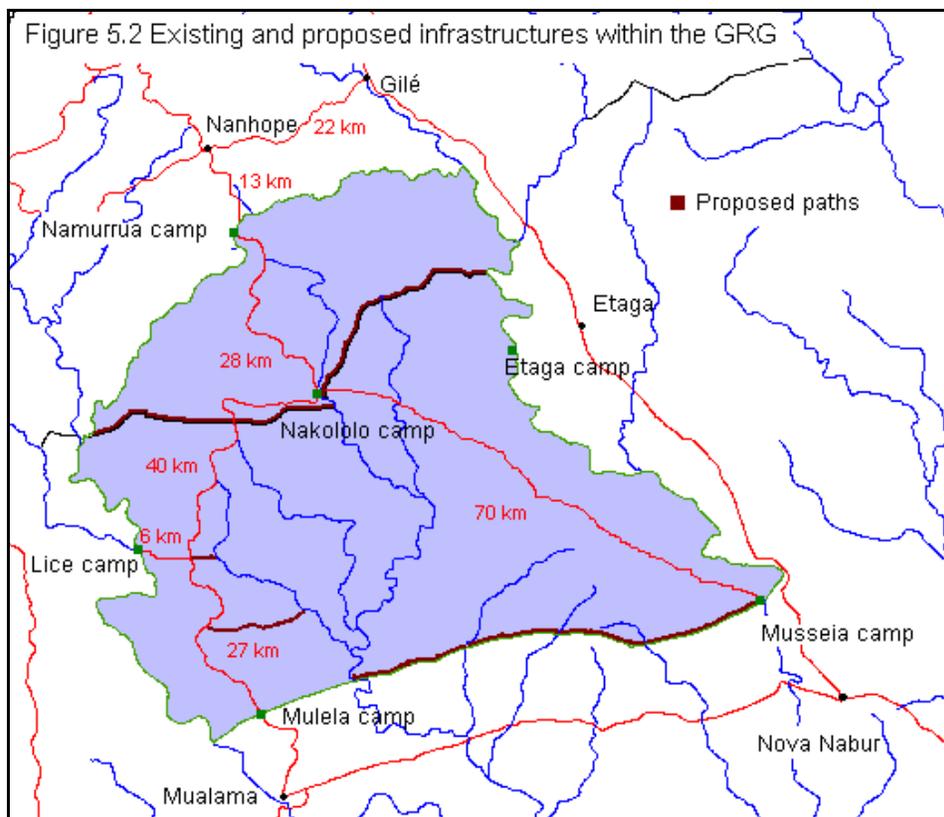
The opening of these two roads is justified by their importance for management, patrol and as firebreaks

See Figure 5.2 for camps location and for the proposed paths to be opened.

The traffic along the main road between the Namurrua and Mulela needs to be regulated. Given the impossibility to patrol continually the main road, and despite it connects the districts of Gilé and Pebane, the private transit needs to be closed. However, such decision should be discussed with the administration of Gilé and Pebane districts and with the Provincial Bureau of Public Works (DPOH). Otherwise, a system of permits should be provided to regulate the private transit.

The existing camps should assure the appropriate logistic support for the GRG-staff day-by-day activities. We suggest that the GRG-staff should be based in the camps as follow:

- 2 wardens based in the Namurrua camp to control the northern gate and the northern sector of the GRG
- 2 wardens based in the Lice camp to avoid the illegal entrance of local hunters through the western limit of the GRG (Mulela River) and to patrol the central sector the GRG
- 3 wardens based in the Mulela camp to control the southern gate and the south-western sector of the GRG. Furthermore, this team should be equipped with a motorbike to assure rapid interventions in the area of conflict between elephant and local populations
- 2 wardens based in the Etaga camp to patrol the eastern limit (Molocué River) and the eastern sector of the GRG
- 3 wardens (two with the II level of instruction for administrative purposes) based in the main camp of Musseia to patrol the south-eastern sector of the GRG and to assure the running of the main camp and equipments. The GRG administrator should be based as well in the Musseia main camp



**Management strategies**

1. Maintenance of the five rehabilitated warden camps.
2. Maintenance of the Musseia main camp.
3. Maintenance of the GRG main road.
4. Private traffic regulation along the GRG main road.
5. Maintenance of the 6 km patch to the Lince camp.
6. Maintenance of the road between the Musseia and Nakololo camps.
7. Opening and maintenance of two roads along the *Core Zone* limits with firebreak function.
8. Assure a correct dislocation of the wardens between the rehabilitated camp to permit a correct management and patrol of the GRG.

<b>Management actions</b>	<b>Management performers</b>
1. Assure the routine maintenance of all the warden camps.	GRGA, GRGWs.
2. Assure the routine maintenance of the Musseia camp by the GRGWs, contracting a team of occasional workers for one complete repainting of all the warden camps and for special maintenance.	GRGA, DPT, GRGWs.
3. Assure the repairing and cleaning of the GRG main road at the end of each rainy season, contracting a team of around 30-40 occasional workers to conduct the operation.	GRGA, DPT.
4. Coordinate with the DPOH and the administrations of Gilé and Pebane districts the regulation of the traffic through the GRG main road and the related entry permissions instruments, assure the effective traffic control.	GRGA, DPT, ADG, ADP.
5. Assure the repairing and cleaning of the road between the Musseia and Malema camps at the end of each rainy season, contracting a team of around 30-40 occasional workers to conduct the operation.	GRGA, DPT.
6. Contracting a team of 20 occasional workers to open a patch of ~ 15 km from the Lice crossroad to the Muipige River.	GRGA, DPT.
7. Contracting a team of 20 occasional workers to open a patch of ~ 30 km from the main road to the Muipige River.	GRGA, DPT.
8. Contracting a team of 40-50 auxiliary workers to open two roads, with firebreak functions, along the <i>Core Zone</i> limits.	GRGA, DPT.
9. Assure the permanence of, at least, two wardens in the Namurrua, Lice and Etaga camps, and three wardens in the Mulela camp and in the main camp of Musseia.	GRGA.

## 5.8 Management of Tourism Development

The tourism potential of the GRG and the possible links with other valuable tourism sites have been discussed in the Section 3.6. Developing ecotourism in the GRG is an essential goal to provide a sustainable development in the area and assure the conservation of biodiversity.

The ecological features of the GRG, its remote location and the lack of facilities, prevent the area from the development of a copious, tour operator-organised, reach tourism, at least in the next future. Such opportunity could be viable only in the medium time (10-15 years) if serious conservation measures will be taken allowing the recovery of large mammal populations.

Presently, a more feasible option is represented by the development of appropriate and green-conscious ecotourism and cultural tourism.

The GRG represents such a great scenario for hiking within an intact tropical forest ecosystem allowing naturalistic observations of the extreme interest flora, bird watching and sighting of mammals typical of this environment, such as duikers, kudu and sable. A series of tracking could be provided for ecotourists, including routes around the Mussirima and Popé hills and along the

Mulela and Lice Rivers. Hikers could be accompanied by armoured wardens, to avoid any risk of attack by leopards or lions, and by local guides that could illustrate the features of the environment and their traditional knowledge of plants and animals. Furthermore, the possibility of sport such as canoeing in the Mulela River, both along the western sector of the GRG and outside the southern limit should be evaluate. This activity could include excellent bird watching and hippos sight.

Cultural tourism is another feasible opportunity in the area. During the last decades even greater interest has been taken for traditional cultures worldwide and exist a well-aimed tourism at visiting also remote areas to discover traditional cultures and populations. The traditional culture of the Lomwé people living in the area is fascinating and could represent an important resource. Visits to the villages neighbouring the GRG should be organised to illustrate to the visitors the traditional style of live and the traditional knowledge of this ethnic group, including demonstrations of traditional rituals and hunting and fishing techniques. For instance, a tracking to the slopes of Gilé Mountain could represent an opportunity. The Gilé Mountain represents a sacred place for local communities and the tracking is preceded by a series of small ceremonies and traditional offerings of food. The local populations could learn how to provide basic commodities to external visitors, such as basic accommodation in improved traditional huts and food.

It is important to underline that such type of tourism (ecotourism and traditional tourism) represent a primary incentive for local population to change their present style of live and could have a higher local multiplier and backward linkage effect than up-market version (Wunder, 2000). The arising of this type of tourism could determine two important conservation impacts: 1) unsustainable local management practices (e.g. over-hunting, burning) may be reformed or reduced; 2) tourism income motivates and strengthens local populations in struggling against environmental threats from external agents (e.g. loggers, squatter, miners).

Both the DPT and the DNAC could contact specialized tours operator in South Africa, Europe and USA to promote the image of the GRG as ecotourism and cultural tourism site and evaluate the possibility to include the GRG within their packages holiday.

Essential task of the institutional managers of the GRG will be assure that an adequate percentage of revenues from tourism fall on the local communities. This late concern is essential: to many times the expectation of rural people of benefits from conservation has been failed, mainly in Africa. A further task for the managers of the GRG is linking the GRG with other tourism sites (see Section 3.6). Such linkages could represent important tourism options providing unique combination of nature/history/culture very attractive for foreign visitors. The Provincial Bureau of Tourism needs to make a special effort collaborating with the Provincial Bureau of Nampula Province to link the GRG with Ilha de Moçambique. In a similar way it needs to link the GRG to other sites within the Province, such as Pebane and Gurue. As immediate and not expensive action, the DPT should be prepare and print a quantity of booklets that inform about the existence of the GRG and other tourism place within the Province and distributed them in the Quelimane and Nampula airports and in the hotels and restaurants. Such simple activity could represent a first step to let know the GRG to the visitors or foreign workers in Zambézia.

The possibility to develop cynegetic tourism in the GRG seems to be very limited: the present number of large mammals is to low and their conservation status not well know to permit such activity in the immediate (see Section 3.6). Hunting tourism would be possible uniquely after a serious re-stocking programme of species as wildebeest, sable and buffalo, but not without an appropriate feasibility study. An area that pursuits the ecological potentialities and the required low population density (*Developing-use Zone*) has been identified within the *Buffer Zone* in the western sector of the GRG. Cynegetic tourism within such area could be evaluated in the future.

Nevertheless, any hypothesis of tourism development in the area is seriously restricted by the lack of infrastructures. Only few basic accommodation are available in Pebane, while practically no one

is available in Gilé. Even considering the possibility for local populations to provide simple accommodations in improved huts for ecotourists or using part of the existing infrastructures within the GRG to accommodate a few numbers of tourists, the desirable future growth of tourism is demanding new developments. Both the DPT and the DNAC should encourage private investors to visit the area illustrating the potentialities and giving them any facility to invest in constructing tourism infrastructures in the area. If the option of the construction of new infrastructures should arise in the future, we suggest that will be limited to two restricted sites: the Lice camp and the Musseia main camp, avoiding the utilization of other areas. Such a suggestion derives from the necessity to keep free of disturbance the *Core Zone* of the GRG as important conservation measure.

<b>Management strategies</b>
1. Develop an appropriate tourism in the area.
2. Encourage ecotourism and cultural tourism in the area.
3. Assure that revenues and benefits from tourism fall on the local communities.
4. Link the GRG with other tourism sites both inside and outside Zambézia Province.
5. Stimulate private investments in the area.
6. Evaluate the option of develop cynegetic tourism within the <i>Developing-use Zone</i> .

<b>Management actions</b>	<b>Management performers</b>
1. Educate the local communities to provide basic services for tourists.	GRGA, DPT.
2. Contact tour operators specialised in ecotourism and cultural tourism, both at national and international level, to promote the image of the GRG.	DPT, GRGWs.
3. Involve local populations as active actors during the tourism activities.	GRGA, DPT.
4. Identify the most attractive cultural traditions and traditional activities of the Lomwé people as resource for cultural tourism.	GRGA, DPT, DNAC.
5. Identify sites of interest for cultural tourism (sacred sites, sites used for traditional rituals).	GRGA, DPT.
6. Verify the existence of traditional craftsmanship with potentialities for tourism.	GRGA, DPT.
7. Promote the image and potentialities of the GRG through the preparation of booklets to be distributed in the airports, hotels and restaurants, both in Zambézia Province and other provinces.	GRGA, DPT.
8. Coordinate with the Provincial Bureau of Nampula Province the linkage between the GRG and Ilha de Moçambique, promoting the image of a unique tourism combination of nature/history/culture.	DPT, DNAC.
9. Provide advertising material to promote the linkage of the GRG with Ilha de Moçambique and other tourism sites in Zambézia Province (Pebane, Moebase, Gurue).	DPT.
10. Encourage private investors to visit the GRG illustrating the potentialities and opportunities, facilitating investments.	DPT, DNAC, Pls.
11. Allow and stimulate the construction of appropriate tourism infrastructures in the Lice and Musseia sites.	DNAC, DPT.
12. Stimulate the existing investors to improve the level of service provided.	DPT, Pls
13. Provide a feasibility study to evaluate the option to utilize the <i>Developing-use Zone</i> for cynegetic tourism.	GRGA, DPT, DNAC.