Environmental Impact and Socio-economic Incentives of Contrasting Land Management Systems in Southern Namibia

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Abstract

Marked fence-line contrasts are visible outcomes of the effects of different natural resource managements in the dryland rangeland of southern Namibia. Within the framework of the interdisciplinary BIOTA Southern Africa project, comparative investigations were carried out on a pair of permanently marked Biodiversity Observatories (i.e. standardised research sites) at the Gellap Ost Research Station and the neighbouring Nuwefontein and Nabaos Communal Land. Results show that on the historically more intensively used communal farms, there is an overall decline in perennial vegetation, especially within low-growing life-forms. Short-term annual growth in the rainy season is followed by extensively barren surfaces during the dry season. In direct vicinity, the site on the governmental research station looks intact. The access of livestock to the camp is timely restricted and indicator plants are regularly monitored in order to prevent overgrazing. Overall stocking rates are low also because of missing economic incentives for profit maximisation, due to fixed budgeting. These circumstances ensure a dense grass-cover throughout the year. The state of the natural resources on both sites is strongly influenced by present and past motives, actions and constrains of land users, population pressure and the change in incentives set by institutions, such as the (re-)distribution of property rights, especially use rights. In particular, the shift of rights and governance away from local users to government authorities as an outcome of apartheid-related policies and incomplete reforms after Independence, has led to a situation where practised communal resource management is unable to rehabilitate degraded rangeland and to maintain biodiversity. Apart from the human impact on changing biodiversity, the effects of degradation on the area's rural households' livelihoods have been investigated. The general decline in self-generating natural capital and the increase in the seasonal fluctuation in available biomass increases the risk for farming, thereby making additional sources of income indispensable. Based on a participatory approach, and firmly embedded in local realities, interdisciplinary investigations into the processes of socio-economic change and ecological effects of various land use systems, will form the basis for proposing biodiversity maintenance strategies.

Keywords: Biodiversity, biomass, fence-line contrast, governance, land use, Namibia, property rights

1. Introduction

The interdisciplinary research initiative BIOTA AFRICA is conducting long-term research towards the sustainable use of biodiversity in Africa. The goal is to gain knowledge for decision makers for the feasible and sustainable management of biodiversity (WWW.BIOTA-AFRICA.ORG).

Different tenure systems offer different opportunities and may affect the habitat condition differently. The two contrasting land management systems in southern Namibia on which the presented BIOTA research is being carried out, result from a combination of various historic and institutional influences stemming from administration under South African apartheid laws, such as discriminatory homeland systems, contract labour and influx control (Devereux, et al., 1995). Access, ownership and utilisation of pasture in the communal lands have not remained constant since pre-colonial times (Boonzaier et al., 2000), resulting in a highly skewed and unequal distribution of land which, in return is seen by many as the main cause of rural poverty in Namibia today (Giorgis, 1995).

The Karas Region is the most southern region of the country and has a total of 161 324 square kilometres in size. With a population of 69 677 (Census 2001), it is sparsely populated with more than half of the population living in the rural areas. The impacts of past events are, despite recent and on-going government efforts to improve the living conditions of the rural poor, still strongly portrayed by the current socio-economic conditions found in the studied area. And it is exactly these prevailing socio-economic conditions, which in turn have its bearing on the area's ecological development.

Fig. 1: Fence line contrast between Gellap Ost Research Station (left) and Nabaos/ Nuwefontein communal land (right) in the Karas Region.

The effects can be devastating even at a national level, as 41 % of Namibia's total land surface is covered by communal state owned land (BLACKIE & TARR, 1999). Thus, vaguely defined resources allocation regulations can effect a large area, often initiating or accelerating the pace of a downward spiral of poverty. Already today, the out-migration of family members to cities is regarded as one strategy of destabilised communal households to cope with land degradation.

Fig. 2. The BIOTA Southern Africa Biodiversity Monitoring Transect in Namibia and South Africa, and the location of the Biodiversity Observatories

2. Methodology

It is a major aim of the BIOTA AFRICA project to develop standardised tools for the long-term monitoring of biodiversity. *BIOTA Southern Africa* therefore uses standardised methodology and tools on 1km² large, permanently marked so called "Biodiversity Observatories". Over 28 of these Biodiversity Observatories were established along the transect in 2001 (Jürgens *et al.* 2001). This enables the large-scale comparability of the research results. In order to quantify the effects of different land uses on biodiversity and to contribute to the development of cost-effective and efficient management tools which are based on sound ecological data, the *BIOTA Southern Africa* initiative established two directly neighbouring Biodiversity Observatories in identical abiotic environments at the Gellap Ost Research Station and Nuwefontein/Nabaos Communal Land (Gellap/Nabaos research sites) in 2001. Both Observatories are located in the semi-arid Karas-Region. (Fig. 1 & 2).

These two research sites are embedded into *BIOTA Southern Africa*'s regional large scale ecological and socio-economic investigations along the

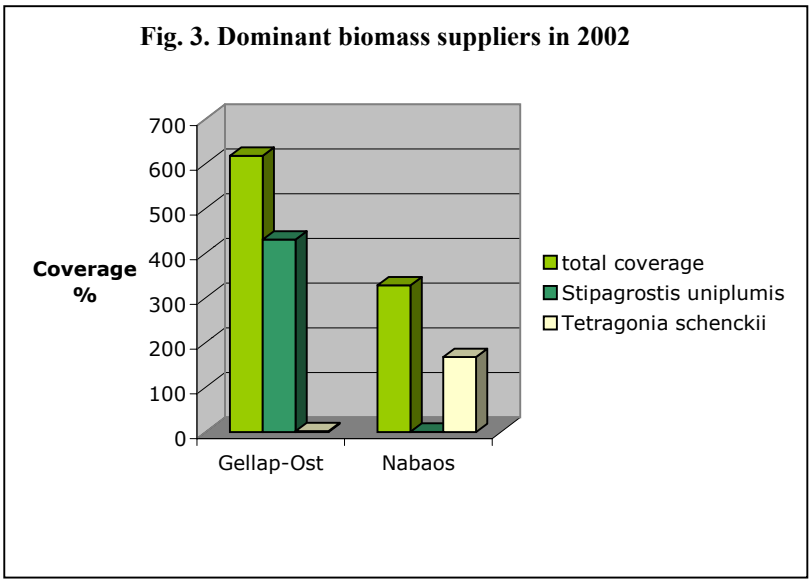
2 000 km long transect, which covers the major biomes along the main rainfall gradient, leading from the summer-rainfall area of northern Namibia to the winter-rainfall Cape region, South Africa (Fig. 1). During the first field campaign in 2001, the BIOTA Biodiversity Observatories were subdivided into 100 hectare plots and the major habitat type of each hectare plot was identified. In randomly selected plots, field observations were started during the same year. The investigated plots represent all habitat types occurring in the Biodiversity Observatory. Standardised sampling scales (100 m², 1 000 m², 10 000 m²) were defined for the floristic inventory (species identification, growth form composition, cover values). The abundance, life-form composition and cover values were documented in the 100 m² and 1 000 m² relevés during the rainy season. In order to estimate the soil seed reserves that are vital for the rejuvenation capacity of the plant cover, soil was sampled from the surface up to a depth of 5 cm in the relevant habitats.

Research methodologies used for the collection of socio-economic data, include structured and semi-structured questionnaires, interviews, observations as well as desk research. Annual rainfall figures were calculated per season (August to July), while stocking rates were only available per calendar year.

3. Documenting and processing phytodiversity information for user needs

Semi-arid summer rainfall areas have a pronounced rainfall variability. This leads to natural seasonal and inter-annual fluctuations of the phytodiversity as well as the biomass availability hence, substantially effecting farming strategies. In order to differentiate between rainfall and human-driven impacts, research on the development of proposals for sustainable management strategies of phytodiversity, first of all has to consider rainfall-induced changes to phytodiversity. Long-term field investigations in the Biodiversity Observatories (Gellap/Nabaos) commenced in the rainy season of 2001 and are subsequently being carried out every year during the time of ´possible rainfall events´. The area under investigation has a long-term annual average rainfall of 150 mm. Animal husbandry strategies prevalent in this semi-arid environment, are harshly affected by recurrently occurring dry years and are thus risk-prone.

Fig. 3. Dominant biomass suppliers in 2002



The Biodiversity Observatory on the government owned Gellap Ost Research Station has overall low stocking rates and a dense perennial grass-cover (predominantly *Stipagrostis uniplumis*) throughout the year (Fig. 3) as recorded in the rainy season of 2002.

In direct vicinity and separated by a mere fence, the more intensively grazed and browsed Nabaos and Nuwefontein communal lands are devoid of an extensive surface cover by perennial plants (Fig. 3). The vegetation recordings clearly reflect the rainfall induced inter-annual variations of phytodiversity in the area. During the humid vegetation period of 2001/2002, rainfall was above average (159 mm during the time slot prior to vegetation recordings, considered time slot: 18.08.01-21.04.02), while being considerably below average (63 mm during the time frame prior to vegetation recordings, considered time slot: 02.09.2002-19.03.2003) in the vegetation period of 2002/2003.

Comparative analyses clearly indicate higher phytodiversity values at both Biodiversity Observatories during the wet year, and lower phytodiversity ranges during the dry year (Fig. 4a/b). However, in both

years comparisons between the Observatories, show that in the wet year of 2002, phytodiversity was approx. ¼ lower in the communal land, and declined even up to 36 % during the lean year. This clearly indicates human-induced impacts on the phytodiversity in the region which overlap the rainfall-driven inter-annual variations of phytodiversity.

Fig. 4a. Species diversity at Gellap Ost

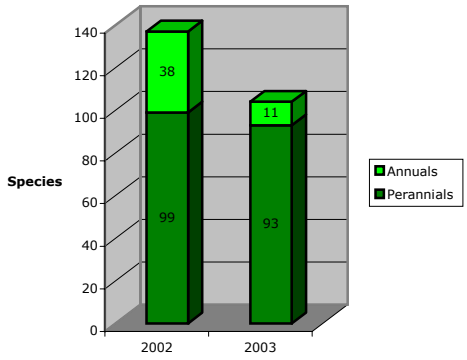
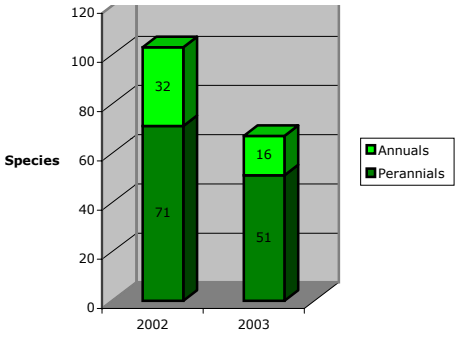


Fig. 4b. Species diversity in the Nuwefontein Communal Land



In order to analyse the extent of the impact that this vegetation degradation currently has or will have on communal livestock husbandry in the future, comparative investigations into the distribution pattern of major plant strategy types were undertaken (these investigations will continue at least over the next three years).

Whereas the inter-annual variation of the perennial species is negligible (approx. 6 %) on the "intact" Gellap site, almost 30 % less perennial species during the dry year was experienced on the degraded communal site. The communal site generally has less perennial species than the Gellap site. In addition, the proportion of annual species is higher on the degraded site. This is especially the case during the year with sub-optimal rainfall. The grazing system on the communal grazing site, consequently does not only have a lower phytodiversity, but it can also be assumed that seasonal as well as the inter-annual fluctuations have increased due to the decline in perennial- and the proportionate increase in annual species. The function of natural grazing lands as areas of feed supply for animal husbandry, is thereby destabilised.

4. Socio-economic Incentives of Contrasting Land Management Systems in Southern Namibia

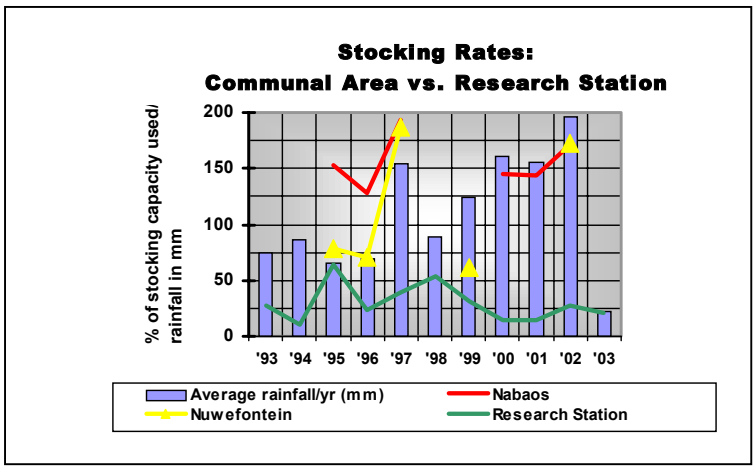


Fig. 5. Stocking Rates: Communal Areas versus Research Station

After characteristic changes to phytodiversity have been considered, it is necessary to inspect human-induced impacts on biodiversity changes, as well as the consequential effects these changes have on the socio-economic activities of the households in the area.

Figure 5 contrasts the land use intensity on the Gellap Research Station with that of the communal areas. The Research Station keeps strict record of stocking data and regular animal censuses are carried

out by the Veterinarian Office[1] in the communal areas. With an average of close to 140 % stocking capacity used, the communal areas are always overstocked. Stocking numbers are at all times above the recommended carrying capacity.[2] The Gellap Ost Research Station on the other hand, uses an average of only 30 % and is thereby clearly under-stocked.

The area has an average annual rainfall of 150 mm[3]. The rainy seasons 1996/1997, 1999/2000, 2000/2001 and 2001/2002 had the highest rainfall during the last five years, which were nevertheless only just above the long-term average. These were also the years when the stocking rates in the communal areas were extremely high. This could be human-induced or due to natural occurrences, such as less animals dying or more female animals reproducing. The annual census data is however not sufficient for natural resource development analysis and an insight into the socio-economic processes leading to ecological changes is required.

5. Factors contributing to the actual stocking rates in two research areas

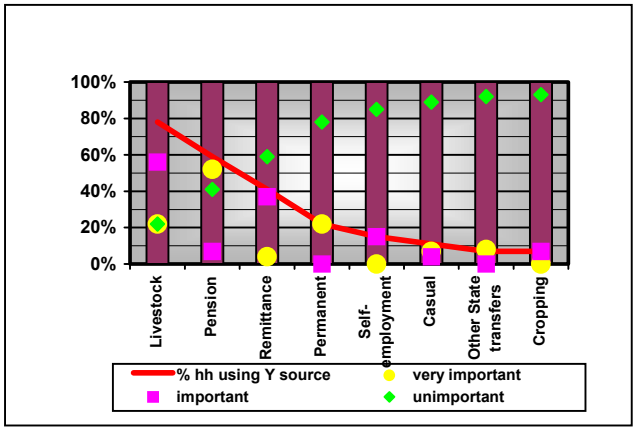


Fig. 6. Sources of income in the communal areas: Ranking of income options in terms of importance of contribution to household income

About half of the Namibian population depends on subsistence agriculture for its livelihood, with livestock keeping playing a vital role (CIA World Fact Book, 2003). Figure 6 shows that almost 80 % of all interviewed households own livestock. Functions of livestock keeping have been assessed in the Nuwefontein and Nabaos communities. Very low selling and slaughtering rates, as opposed to high keeping of livestock preference rates, have been identified, strengthening the assertion that rural communities prefer keeping animal numbers as high as possible. 78 % of all respondents regards the animals either as an important or a very important source of not only cash income, but also as a means to fulfil many other needs. This may be attributed not only to the fact that a lot of families own very few animals and would therefore prefer to keep them, but also that livestock is seen as an investment offering short- and long-term monetary returns and social support in times of financial emergencies (Directorate of Rural Development, 1992). Many see maximising the size of their herds as the only viable option to prepare themselves for dry years when losses of livestock are inevitable and alternative insurance mechanisms are rare. This is also based on the rationale that livestock farming poses a way of living out the traditional way of life in the southern communal areas of Namibia and that it generates social status.

78 % of all households have a regular monetary income either in the form of monthly salary or pension pay-outs. These available financial resources, although small, have a direct negative influence on the willingness of these farmers to sell livestock to cover monetary demands (own research, 2003). The selling of livestock as a means of coping with dry periods is not a popular option, since livestock prices obtained in the market are relatively low compared to the transaction costs involved in the selling of animals at auctions organised mostly in the town areas. Farmers, as a result, prefer to keep their livestock with the hope that it will survive even the extreme dry periods (own research, 2003). Donkey carts are the most important means of transport, leading to excessive numbers of free-roaming donkeys in the communal areas.

[1] Falls under the Ministry of Agriculture, Water and Rural Development
[2] Carrying capacity recommended by Extension Office, Ministry of Agriculture, Water and Rural Supply is one small stock unit per ten hectares in the communal areas and one small stock units per six hectares on commercial farms and government owned Research Stations in the region.
[3] Source: Gellap Ost Research Station with mean of 58 years annual values.

Looking at institutional dynamics, it was found that the Namibian government has, through the passing of the Traditional Authorities Act in 1995 (Republic of Namibia, 1995), provided formal recognition to the Traditional Authorities. It has also, as the owner of the communal land and related natural resources, delegated the administration of the resources to the traditional authorities in the different regions of the country. These institutions at the local level, therefore have strong influence over movement and grazing practices, with their authority often ranked by outsiders above that of the current users of a specific area.

The National Land Policy (Republic of Namibia, 1998) states that tenure rights to land include all renewable resources on the land and that they are conditional to sustainable use (National Land Policy 1998a). Property rights over resources are viewed as a bundle of rights, which include the right to use, the right to transfer, the right to exclude, the right to obtain benefits as well as the right to receive compensation for damages (Kirk, 1999). User rights, being connected to residential rights, are in general perceived by the interviewed communal households to be secure. The households are generally also very sure about their rights to decide on land use forms. Only a minority of users are however, very sure or even only relatively sure about their rights to exclude others staying on the same communal farm or coming from other communal areas, from using the natural resources in the area. The result is that the current users seldom confront others about their stocking rates, wood cutting, wood collection and herding habits. This reduces incentives for resource maintenance based on social pressure. Decisions taken by the traditional authorities with regard to the settlement of outsiders, are often without consultation of and resistance from the current users and without knowledge of current grazing conditions. Communal farmers consequently are often left to deal with the situation where numerous households, most owning animals, have to share small areas of land. In the case of the Nuwefontein and Nabaos settlements, 11 households have to share an area of 9813.7 hectares.

The government offers instruments for the control of stocking rates as well as for the protection of forest products. These include grazing fees calculated in relation to the number of animals per household, various permit systems for the handling of wood as well as inspection duties to be carried out before the issuing of the permits. These control mechanisms have however, either not been implemented in this specific area yet or lack enforcement due to human and technical capacity constraints (own research, 2003).

Local Water Point Associations have been established as a result of the government's newly adopted approach to natural resource management and rural development, where a lot of emphasis have been placed on participatory planning and development, in order to replace the highly centralised and patronising approach used prior to Independence (Werner, 2003).

These Water Point Associations, represented by elected committees, are to control water use, water structure maintenance and the still-to-be-implemented, grazing fees in the area.

Ostrom (1990) as well as Meinzen-Dick and Knox (2001) identified a number of factors influencing the level of collective action present in communities. These include a) the importance of the resource to the users, b) the time horizon of the users, c) the size of the management unit, d) the history of co-operation amongst users, e) the local social structures, f) the characteristics of the local leadership and a factor which can hardly be influenced by the communities namely, g) the surrounding institutional environment. Factors d) to g) hamper effective collective action in the case of the Nuwefontein and Nabaos communities, with confusion over roles and jurisdiction of the Local Water Point Committee - as only one example - intensifying the lack of cohesion present in the communities. Time horizon also plays an impeding role as many households have already given up on the regeneration of the natural capital base in the studied area and are always in search of better grazing areas to move their animals into (own research, 2003).

The south of Namibia is, because of various reasons, not well developed in terms of infrastructure and easy access to transport, social services and markets. Even the informal sector is practically non-existent mainly as a result of lack of access to markets, low population density and limited purchasing

power among people. Self-employment mainly encompasses mobile shops. Only limited opportunities for formal employment are available for rural communities (Department of Rural Development, 1992).

The opportunities that the natural resource base has to offer are limited due to lengthy periods of droughts and a generally low rainfall (Boonzaier et al., 2000). This is reflected in Figure 6, where livestock and cropping as options for income generation, are positioned on opposite sides of the graph. Levels of poverty are high and a striking feature is the almost exclusive reliance on pensions and remittances for cash income. The homogeneous use of natural resources in the form of livestock keeping is also evident.

A small number of farmers who have a higher cash income, are able to provide supplement feed to their animals during the drier periods. The animals of the majority of farmers are however, totally dependant on the rangeland. Firewood is the most common energy source for cooking and light, increasing the burden natural resources have to bear.

The fencing off of communal lands is not allowed by the government as stipulated in the Communal Land Reform Act of 2002 (Republic of Namibia, 2002). This not only limits options for alternative and resource-friendly grazing strategies, but also puts intensive co-operation in land management amongst farmers as a prerequisite.

Sending the animals in a specific direction in the morning for them to choose their own direction in the field, is the most common practise. Missing fences are on the other hand, partly compensated through specific herding techniques which depend on the presence of children during school holidays; the prevalence of animal illnesses; the guarding of the reproducing females and the protection of the young. Seasonal changes in the route to be taken are based on predators in the environment; the need to avoid other herds; and changes in the grazing conditions before and after the rains (Allsopp, 2003; own research, 2003).

Livestock keepers and members of the community do recognise the fact that livestock reduction leads to natural capital increment for the rest of the herd. They also recognise that rest from grazing can improve the condition of the rangeland. They do nevertheless, feel that putting it into practise is impossible due to lack of alternative grazing areas (own research, 2003).

The Gellap Ost Research Station with its 13 734 hectares falls under the Directorate for Research and Training of the Ministry of Agriculture, Water and Rural Development (MAWRD). Activities concentrate on research and focus is put on the breeding and selling of karakul and the cross-breeding of the Dorper and Damara sheep breeds. A small number of other animals such as cattle and goats are also kept, mainly for selling purposes as well as for the provision of milk and meat to Research Station staff members living on the Station premises. The Station organises auctions where sellers from as far as South Africa attend. Conducted training activities target commercial as well as communal farmers. Activities on the Station are the determinants of the number of animals kept on the farm.

The yearly budget which they receive from the Ministry of Agriculture, Water and Rural Development is fixed and is not influenced by revenue received through Station activities. Questions about economic incentives to fully use capacity and thereby maximising profits, therefore arise.

The Gellap Ost Research Station as opposed to the communal areas, has 160 purposefully under-stocked camps, allowing a strictly adhered to rotational grazing system which guarantees the timely restricted access of livestock to the study site. The grazing capacity used in each camp, is determined by the specified carrying capacity and regular indicator plant inspections are being carried out, hence preventing overgrazing.

6. Effects of natural resource degradation on communal livelihoods

Outcomes of past policies and practices left communal households in a marginalised position. Together with long- and short-term effects of continuous natural resource degradation, the vulnerability of these livestock depending communal households has increased.

Biodiversity changes alter the set of resources available to the households and impact on the household income is severe, given the central role of animals as savings. Alternative, more reliable income sources, substituting the loss of or decrease in animal husbandry, need to be found. Households compete for grazing and water facilities. With increased degradation, the competition level is due to increase, escalating conflict situations. The migration to urban areas does not only lead to an increase of weekend farmers, which in turn has negative consequences for the resource maintenance, but it also influences the household composition with mainly elderly people and young children staying on the farm and being affected.

A coping strategy may include the reduction of spending on non-essential items. Children from communal areas may be withdrawn from school in order to save on school fees and related expenses. The nutritional and health status of the community members may be further declined. Long-term poverty is thus entrenched.

7. Conclusion

It is generally the low-income rural population in Namibia whose basic needs are satisfied by and whose household economy is based on the local or regional natural resources. External elements such as drought contribute to natural fluctuations in phytodiversity. Serious legal and social vacuums in apartheid-related changes to land tenure have, however, led to the continuous decline in the ability of the natural resources in communal areas to sufficiently regenerate, thereby presumably generating partly irreversible changes or losses to biodiversity. The natural resource users do acknowledge the role their livelihood activities play in this process of land degradation. The weak local institutional framework and lacking regional infrastructures; the role animal husbandry has to play in the household livelihood maintenance; the resulting homogeneous use of natural resources due to the given natural and physical capital; and the existing communal land tenure system which allows free grazing and the accumulation of livestock, thereby undermining the concept of land carrying capacity, are all factors contributing to overstocking which consequently promote environmental degradation.

Communal households, in the face of ever increasing natural resource degradation, have to seek alternative means of income and can be forced to migrate. Migration, which is accompanied by a downward movement on the poverty scale, extreme vulnerability and negative consequences for access to education and health.

The need for biodiversity maintenance strategies developed and implemented to recognise the socio-economic dynamics at play, is consequently critical.

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