



SWAZILAND

GOVERNMENT

A FIELD ASSESSMENT OF PRIORITY PROTECTION WORTHY AREAS OF SWAZILAND

MAKHONJWA, MANZIMNYAME, SIBEBE AND NYONYANE



Swaziland Biodiversity Program Implementation Committee
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FINAL REPORT

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Background

Following Swaziland's ratification of the Convention on Biological Diversity in 1994, a national Biodiversity Strategy and Action Plan (BSAP) was developed. One of the core objectives of the BSAP is to conserve a representative proportion of the Kingdom's biodiversity. The present system of protected areas is not adequately achieving this objective and only covers 4% of Swaziland.

As part of the biodiversity support program a pilot Rapid Assessment of Protection Worthy Areas (PWA) of Swaziland was conducted (Roques 2001). This rapid assessment involved brief visits to 44 areas and later, an additional 12 areas, to prioritize them for further more detailed evaluation. The assessment highlighted 16 areas of high priority to be surveyed. This included nine areas of high overall priority (Mdzimba, Ntungulu, Nyonyane, Ndlotane, Mahuku, Jilobi, Shewula, Manzimnyame and Makhonjwa), with an additional two areas of biological priority (Mahamba and Muti Muti) and an additional five areas of socio-economic priority (Sinceni, Maguga, Sibebe, Gebeni and Panata).

The overall objectives of this protection worthy study are to: 1) survey 16 areas to gather relevant information on their biodiversity, social and tourism value; 2) compare this information in order to prioritize the areas as a basis for recommending their legal proclamation; 3) develop realistic preliminary plans for the conservation management and sustainable development of these areas; and 4) to pilot such a detailed integrated survey to develop best practices.

Of the 16 areas above, four were selected for the detailed field survey, based on the urgency of threats to their conservation and opportunities for their conservation. This report presents the results of the detailed survey of these four PWAs. The remaining 12 areas should be surveyed in similar detail in subsequent studies.

This report presents the findings of the four areas as selected above. Only baseline information pertaining to each area is presented. Comparisons between areas and preliminary conservation management plans will be done once all 16 areas have been surveyed.

Study area

The study area includes the Protection Worthy Areas, Makhonjwa, Manzimnyame, Sibebe and Nyonyane as identified in the Rapid Field Assessment of Protection Worthy Areas of Swaziland (Roques 2001).

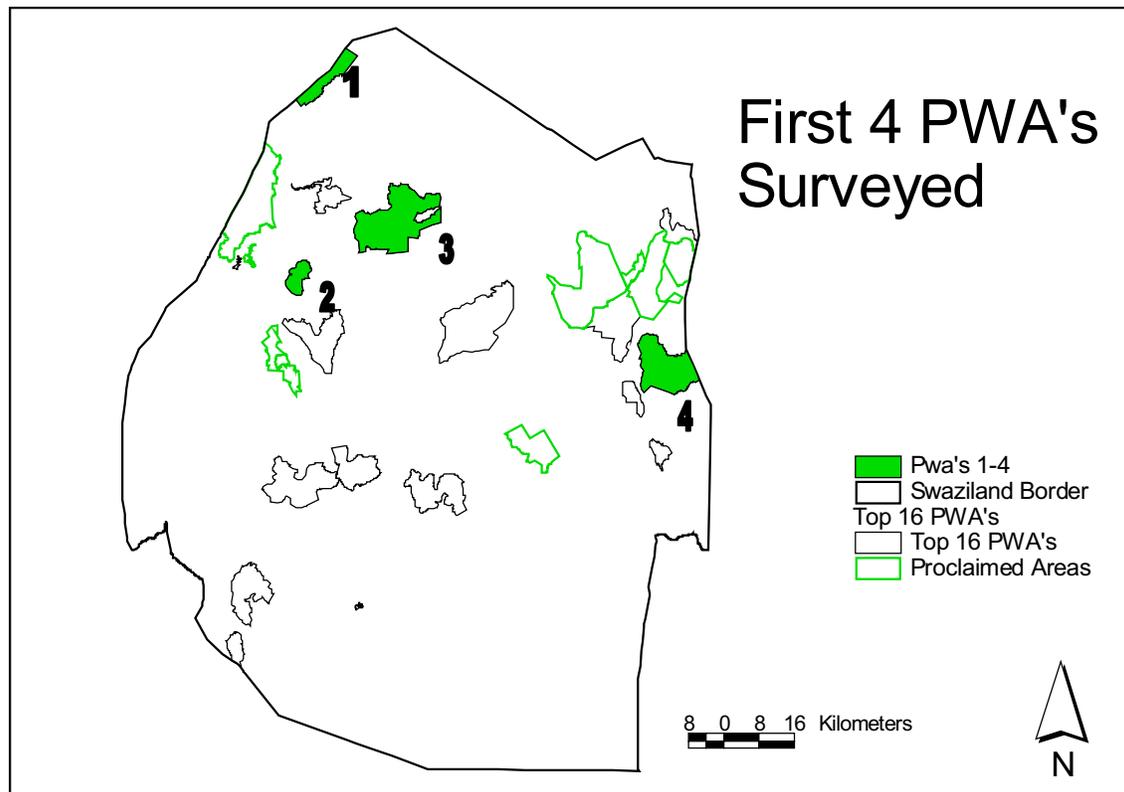


Figure 1: Study Area. 1 = Makhonjwa, 2 = Sibebe, 3 = Nyonyane, and 4 = Manzimnyame.



Figure 2: Kim Roques at work

Methods

Field surveys

The surveys involved combined field visits by an ecosystem management specialist, botanist, herpetologist, ornithologist, mammalogist, social environmentalist and tourism specialist. With the exception of Sibebe, three days were spent by each of these specialists in each area between October 2002 and February 2003. Sibebe was visited on a single day in January 2003. On visiting an area, the surveyors covered as much of the area as possible by vehicle, bicycle and/or foot to gather their respective data.



Figure 3: Linda Dobson and Ara Monadjem at work with a field assistant at Makhonjwa

Data Collection

Ecosystems

Records were made of the types and distributions of ecosystems at global (WWF & IUCN), national (Sweet & Khumalo 1994, Roques & Dobson in prep., expert knowledge) and local (field- & orthophoto-based mapping & assessment) scales. Condition of the ecosystems was noted by searching for physical signs of degradation and based on evidence from the floral and faunal surveys. The goods and services supplied by the ecosystems were identified from the floral, faunal, and social surveys, and from field observations. The types and extent of pressure and threat to the ecosystems were recorded based on information from the floral, faunal, and social surveys, and from field observations. Areas of high alien weed densities were noted for each PWA.

Flora

A wandering survey was carried out in the areas combined with setting up plots and transects to determine the current status of vegetation in each area.

On an ecosystem level, broad vegetation units using Sweet and Khumalo (1994) and Roques & Dobson (in prep.) were identified which were then split up into finer scale vegetation units. Critical eco-regions were highlighted based on phytochoria or Centres of Plant Endemism, described by Van Wyk & Smith (2001) as areas with high concentrations of endemic taxa.

On a species level, species richness was determined using the data collected within sample plots and transects. The plots and transects were identified based on as broad a representation of the different vegetation types per PWA as possible, following Braun-Blanquet methodology (Kent & Coker 1992). Plots sizes differed per habitat. 20x20m plots or 200x2m transects were used in forest and bushveld (depending on accessibility, transects were used when the terrain was difficult) and 10x10m plots were used in grassland. Characteristic species were noted for each plot as well as any disturbance factors such as alien weeds, grazing and/or cultivation.

A search for threatened taxa (Red Data) and species endemism (including endemics with over 90% of their population confined to Swaziland, and species with restricted distributions) was conducted in each PWA. Proportions of the national total were based on an estimate of 3244 plant species for Swaziland (Braun & Dlamini, 1994). New records for Swaziland were noted and if considered threatened were flagged as candidate Red Data species. A plant checklist of each area was compiled highlighting the threatened and endemic plants and species with restricted distributions i.e. those with global distributions restricted to Swaziland and one or two other countries (South Africa and/or Mozambique) only.

Fish, Reptiles and Amphibians

Prior to each visit a summary of knowledge of the Ichthyofauna (fish) and Herpetofauna (amphibians and reptiles) of the area was compiled. Distribution records for the fish, amphibians and reptiles were obtained from the literature (Boycott 1992a, 1992b, 2001; Hyslop 1991, 1994), from museum printouts, from recent national surveys and from field visits to each area. Fish, amphibian and reptile collections were made during the field visits. Amphibians were searched for during the night at rivers and pans, and tape recordings of frog calls were made. Reptiles were searched for during the day under rocks, in rock crevices and out in the open and at night in and around the campsite. Road kills of amphibians and reptiles within or adjacent to the PWAs were collected. Fish, amphibian and reptile habitats were assessed.



Figure 4: *Richard Boycott at work.*

Species inventories for each PWA were compiled from the sources mentioned above. The checklists are based on species that were confirmed from the area and, from on site habitat assessment, species that are presumed to occur in the area. Once the list had been compiled reference to regional and national red data lists was made (Branch 1988; Skelton 1987, 2001; Monadjem et al. in prep) in order to identify regionally important species. Proportions of the national total were based on 50 species of freshwater fishes, 44 species of amphibians and 111 species of reptiles for Swaziland (Boycott 1992b, 1996; Hyslop 1994).

Birds

Habitats of relevance to birds were noted while driving and walking through each PWA. Birds were recorded by sight and call and a checklist of all species recorded was compiled for each of the four areas. In addition, bird counts were conducted in each of the main habitats, allowing an assessment of the relative richness and density of birds between the four areas. The timed-count transect method was used for this purpose, which involved recording all species within a 20 minute time interval. Due to the short visit to Sibebe, such a timed count could not be conducted there.

Special emphasis was placed on searching for threatened bird species (derived from Monadjem *et al.*, in prep.). This included intensive searches for the presence and nesting sites of all threatened species thought to occur in the area. No birds are endemic to Swaziland. However, birds with global distributions less than 50 000 km² were considered to be range-restricted (Barnes, 1998). Regional threatened birds were obtained from Barnes (2000). Proportions of the national total were based on 500 bird species for Swaziland (Parker 1994).

Mammals

The mammals sampled fall within three categories: small mammals (excluding bats), bats and larger mammals. Appropriate methodology was employed for each of these, as outlined below. For all the mammals covered in this report local knowledge and data from previous surveys were taken into account. Proportions of the national total were based on 127 mammal species for Swaziland (Monadjem 1998).

Small mammals: 100 Sherman live-traps baited with oats were set in a line transect with 10m between trap points for two nights in each area (200 trap nights). These were left open in the evening then checked for catches and closed during the day. 48 break-back traps were also set in another line transect. These were kept primed and baited all the time but checked both morning and afternoon. Animals caught were identified then released or taken as voucher specimens.

Bats were sampled using a bat detector system (ANABAT). This was set up in the early evening and bats passing by were recorded by their echolocation calls. The sonograms produced are characteristic of each species of bat as calls are unique to the species.

The larger mammals though they are difficult to detect include a large number of species listed in the country's Red Data Book. These were detected using signs (faeces, spoor, etc). Habitat suitability and previous records from the greater area were also taken into account. Those that would need to be re-introduced following local extinctions were also noted.

Social

A literature review of social information on each of the priority areas was undertaken to establish details of land ownership, traditional authority, and local government.

A questionnaire was used as a guide for interviews and discussions which were held with community members, their leaders and other relevant persons. The questionnaire included questions covering the following: level of subsistence or traditional use of PWA by the local community; presence of religious, spiritual, historical significance; presence of species of high social or economic value (e.g. medicinal, food etc.); recognition by community of any ecosystem functions of the PWA that contribute significantly socially or economically to the well-being of the community; utilization of PWA resources for economic (economical) purposes by the community; position of landowner with regards to being managed for conservation; communities' support (or lack) for management of the area for conservation.

Field visits focusing both inside and outside the PWA were conducted. The approach of the survey was participatory and happened in three different ways:

- Homesteads interviews.
- Key informant interview (Community traditional leaders such as Indvuna ye Nkhundla, Chief etc; Other leaders, MPs, RAs, development officers etc; Leaders of civic groups, associations etc).
- Focus group discussions where a homogeneous group of people got together to discuss the issue.

Tourism

Preliminary desk research was undertaken for each area, with a review of available literature and telephonic interviews with pre-identified stakeholders, where possible. Due to the absence of suitable scientific models for the analysis of tourism potential, a rating scale was developed based on contributions from a panel of local and regional tourism operators and developers. This panel was consulted for their knowledge of local and regional tourism development criteria.

The purpose of this rating scale was to allow comparison of the PWA's and their respective potentials in a quantifiable manner. This rating scale formed the framework for analysis during field visits.

Fieldwork at each study area included a listing of development opportunities, through reference to a fairly exhaustive list of potential development activities. See Appendix 9. Landscape, presence of natural features suitable for commercialization, accessibility, access to infrastructure (electricity, water, telecommunications), proximity to tourist routes, linkages to existing or potential tourism infrastructure and identification of development risk factors were analysed. A collection of useful GPS waypoints was made and analysed with the aid of digitized 1: 50 000 maps.

Notes from field visits were combined with an analysis of results listed by fellow team members to ensure a synthesis of tourism development opportunities with the corresponding biodiversity values listed. In approaching the individual scores, the researcher also weighed up the likely priorities of consumers (tourists), tourism developers and operators, together with the overall goals of national tourism facilitators such as the Swaziland Tourism Authority and the Ministry of Tourism, Environment and Communication.

Ratings of potential were given against a background of the current status of the areas visited and the current status of the local and regional tourism markets, without speculation as to the future direction of tourism development.

Area attributes such as location and setting, ease and variety of access, marketability, likely nature and variety of potential products, potential for revenue-earning infrastructure and overall economic potential were rated on a scale of 1 to 10 as follows:

0	no value
1-4	very low to low value
5-7	medium value
8-10	high to very high value

A weighting was applied by reducing this scale to a score out of 5 or increasing it to scores out of 20 and 30 in instances when certain factors were deemed either of lesser or greater importance.

A ranking of A to H was used for the estimation of revenue earning potential, with the following scale of annual turnover:

A	E 9 500 000 +
B	E 8 000 000 – E 9 500 000 per annum
C	E 6 500 000 – E 8 000 000 per annum
D	E 5 000 000 – E 6 500 000 per annum
E	E 3 500 000 – E 5 000 000 per annum
F	E 2 000 000 – E 3 500 000 per annum
G	E 500 000 – E 2 000 000 per annum
H	E 0 – E 500 000 per annum

This estimation of revenue relates to activities to be undertaken within the boundaries of the PWA areas. It does not include peripheral activity and operations, which could arise out of development of the PWA's. The wider economic impact is therefore understated in this survey.

A similar scale of job creation potential was created, as follows:

A	260 + jobs created
B	220 - 260
C	180 - 220
D	140 - 180
E	100 - 140
F	60 - 100
G	20 - 60
H	0 - 20

Jobs were weighted to reflect their impact. The number of positions of an ongoing part-time nature were divided by two. The number of project related positions, such as those created during construction and development programmes was divided by four.

Analysis and Comparison

A scoring system was developed based on a more detailed modification of a WWF methodology (Ervin 2000) for rapidly assessing protected areas and their management effectiveness. This was a participatory exercise done combining the expertise of the various specialists involved in the survey. The system developed enables PWAs to be scored according to their biological and socio-economic value based on a set of objective criteria. The criteria used are presented in Table 1. These criteria required information which was not available prior to conducting the detailed field surveys.

Table 1: Criteria for assessing priority PWAs. Each criterion is weighted equally. Where applicable, different taxonomic groups are given equal weighting.

BIOLOGICAL IMPORTANCE	<ol style="list-style-type: none"> 1. Proportion of a globally threatened ecosystem present. 2. Proportion of a nationally threatened ecosystem present. 3. Number of ecosystems present. 4. Number and proportion of ecosystems not occurring in PAs.
	<ol style="list-style-type: none"> 5. Number of regional red data species present. 6. Number of national red data species present. 7. Number of red data species present not occurring in PAs. 8. Number of species present as proportion of national total. 9. Number of endemic species present. 10. Number of range restricted species present¹.
	<ol style="list-style-type: none"> 11. Number of first order perennial streams present. 12. Size of area. 13. Distance to nearest PA (not only in Swaziland) & presence of migration corridors. 14. Inverse of area disturbed and level of disturbance.
SOCIO-ECONOMIC IMPORTANCE	<ol style="list-style-type: none"> 1. Tourism product potential². 2. Overall economic potential³. 3. Estimate of revenue-earning potential 4. Estimate of potential job creation.
	<ol style="list-style-type: none"> 5. Proportion of people willing to manage for conservation 6. Level of usage of PWA by locals 7. Presence of areas of religious, spiritual or historical significance 8. Occurrence of species of high social or economic value 9. Locals' access to centers of education and health 10. The importance of ecosystem services provided by the PWA to the community 11. People's dependence, either economically or otherwise, upon PWA resources

¹ For Plants this refers to species occurring in Swaziland & one or two other countries (South Africa and/or Mozambique). For fish this refers to species occurring within three river systems or less. For amphibians, reptiles, mammals and birds this refers to species with a range of less than 50,000 km².

² This incorporates the following factors: Location and setting, Ease & variety of access, Marketability, Nature & variety of product, Potential for revenue-earning infrastructure.

³ This incorporates the following factors: Factors enhancing economic potential, Development risk factors.

Results

Makhonjwa



Figure 5: Makhonjwa PWA.

Biological

Ecosystems

Makhonjwa (see map in Appendix 1) has high ecosystem value. From a global perspective, it is situated in the transition between the important (priority index 3) Drakensberg Afro-montane Grassland and Woodland Ecoregion and the lower priority (priority index 2) Zambezi and Mopane Woodland (WWF 2002). From a regional perspective, it represents a significant proportion of the Barberton Mountainland Centre of Endemism (Van Wyk & Smith 2001) and contains two broad vegetation types. From a national perspective, it contains almost 10% of the Barberton Sourveld Grassland and almost 1% of the Swaziland Sour Bushveld within the country, both of which are already represented within Malolotja Nature Reserve and the latter of which is also represented within Mlilwane Wildlife Sanctuary. However, at present only 1.4% and 0.8% of these vegetation types respectively occur within proclaimed reserves. From a local perspective contains a high diversity of ecosystems. It contains ecosystems of all four biomes

including three forest types, three grassland types, one savanna type and four aquatic types. It is an important catchment area containing eight headwater streams.

The majority of the ecosystems are in good condition. However, the grasslands in general (particularly highveld grassland) are heavily overgrazed by cattle and the scarp forests are subject to small scale clearing for *Cannabis* cultivation. There is also significant encroachment of *Chromolaena odorata* into the lower lying forest and savanna types and small scale *Eucalyptus spp.* plantations within the highveld grassland. Construction of a road was underway to access these plantations from the north west and this will have a significant impact on the landscape. A variety of goods and services are currently provided by the ecosystems to the people of the area including, fresh water, livestock grazing, medicinal products, food, construction materials, recreational enjoyment.

Makhonjwa PWA is of medium to small size (45 km²) relative to other PWAs and has a relatively low area to perimeter ratio (1.0); i.e. the area (in km²) is equal to the perimeter (in km). This means that edge effects (which are largely negative for biodiversity) would be limited and that the boundary to be patrolled/secured (e.g. through fencing) is relatively small. Conservation management should focus on addressing the problems of overgrazing, small scale but increasing clearing for *Cannabis* cultivation and alien plant invasion (Appendix 2). At the same time the area should be secured against the threats of mining, forestry plantations and expanding human settlement, which might erode the goods and services currently provided and destroy the potential of the area for economic benefit through tourism and biodiversity conservation.

Flora

The Makhonjwa hills are extremely interesting botanically. They form a subcentre of the Barberton Centre of Plant Endemism and host a wealth of indigenous plants many of which have restricted distributions (see Appendix 3) and/or are threatened.

Results of the survey show that Makhonjwa supports a relatively high number of plant species with 299 of them being indigenous, representing 9% of Swaziland's indigenous flora (see Table 2, Appendix 4). A low number of endemics were noted possibly because they are generally confined to the grasslands (Van Wyk & Smith, 2001) which did not benefit from previous surveys as did the forests. Sixteen red data species were recorded in Makhonjwa, three of which are regionally threatened (in South Africa) and seven of which do not occur in a protected area in Swaziland. A relatively high number of threatened species were found in the forests. It should be noted that the checklist provided for the Makhonjwa area was a result of a number of visits to the area with different plant experts and not just from the three days provided for the survey.

Interesting finds at Makhonjwa include the 'critically endangered' *Encephalartos heenanii*, the 'vulnerable' *E. paucidentatus*, (although neither were recorded in the wild) and the 'endangered' *Prunus africana* all of which are not found in protected areas. In addition the threatened *Clivia caulescens* and *C. miniata* var. *miniata*, *Homalium dentatum*, and *Pentas micrantha* subsp. *wyliei*, were also discovered during the survey all of which are not found within protected areas.

Twenty species which have restricted distributions were found, 15 of them are only found in Swaziland and one other country and five in Swaziland and two other countries.

Six not previously recorded in the country were discovered at Makhonjwa. These include the fern *Arthropteris monocarpa*, the orchid *Corymborchis corymbis*, also threatened regionally (in South Africa), *Memecylon natalense*, *Suregada procera*, *Trilepisium madagascariense*, and *Indigofera micrantha*.

This recent finding of the tree *Trilepisium madagascariense* extends its southern distribution by 340 km and presumably represents a relict population left over from a time when its favoured habitat occurred over a much wider or contiguous area. This is an interesting find and should be enough in itself to call for the protection of the Ugutugulo valley which is found within the Makhonjwa PWA.

The grassland areas were in most places heavily grazed and the presence of increaser species, those associated with high grazing pressure, were noted. The results of the plots and transects indicate that the grasslands host the highest species richness (19.0 species/100m²), followed by forest (9.8 species/100m²) and savanna (6.8 species/100m²).

The Ugutugulo and neighbouring valleys are threatened by, and infested with, the aggressive invader plant *Chromolaena odorata* which has already choked many of the forest clearings. Bugweed (*Solanum mauritianum*) is also invading the forests and the future of these areas looks questionable without some form of effective alien weed control programme. The spread of these alien plants is encouraged by forest patch clearing for *Cannabis* (dagga) plantations. These clearings were more noticeable in the lower lying forests and the higher altitude forests were generally less disturbed by these activities. However, commercial plantations border several of the higher forests and continually pose a threat to them and the surrounding grasslands.

Fish, Amphibians and Reptiles

Although no endemic or near-endemic species of fish, amphibians or reptiles occur in the Makhonjwa PWA, the area is important for the variety of habitats it provides for all these groups. Three globally threatened fish species occur in the PWA (Appendix 5). These are the Critically Endangered Mkhomati rock catlid (*Chiloglanis bifurcus*), and the Shortfin barb (*Barbus brevipinnis*) and Southern barred minnow (*Opsaridium peringueyi*) both listed as Vulnerable (Skelton 2001). Five regionally threatened species (three fish and two reptiles) occur in the area which include the three globally threatened species as well as the Southern African python (*Python natalensis*) listed as Vulnerable (in South Africa) and the Swazi rock snake (*Lamprophis swazicus*) listed as rare (Appendix 7). There are 11 range-restricted species that occur in the area, composed of five species of fish and six species of reptiles (Appendices 5 and 7). The Afromontane grassland and Afromontane forest patches therefore are important habitats that need to be protected.

Twenty-one fish species, representing 42% of Swaziland's recorded species, 20 amphibian species, representing 46% of Swaziland's recorded species, and 58 reptile species, representing 52% of Swaziland's recorded species are expected to occur in the Makhonjwa PWA (see Appendices 5 & 6).

Birds

The Makhonjwa PWA supports a rich bird life including numerous rare and threatened species (see Table 2, Appendix 7). The bird diversity at Makhonjwa is a result of the diverse vegetation types present in the area (see vegetation section), allowing birds of different habitats to occur in close proximity to one another. A total of 169 species of birds are predicted to occur in the PWA, of which 94 species were recorded in this study.

Interesting birds occurring in the area include a host of raptor (birds of prey) species. Potential nesting sites exist for the Lanner Falcon on some of the more remote cliffs, and this species was observed on several occasions. A juvenile Crowned Eagle was also observed, suggesting that this species also breeds in the PWA or adjacent area.

High-altitude grassland in southern Africa is of special conservation value due to the numerous endemics restricted to this habitat. Such grassland does occur at Makhonjwa and supports the Buffstreaked Chat and Malachite Sunbird.

Barberton scarp forest fragments support several threatened or localized species such as the Brown Robin, Bush Blackcap, Knysna Lourie, Grey Cuckooshrike and Yellowstreaked Bulbul. Such high altitude forests are not very extensive in Swaziland and are in need of protection.

Unfortunately, the forest habitats at Makhonjwa are highly disturbed both by alien weed invasion and by clearing for the planting of dagga. Such disturbances tend to favour forest-edge species (such as bulbuls, flycatchers and sunbirds) at the expense of forest-specialists (such as those mentioned above). This is not desirable from a conservation perspective, as forest-edge species tend to be adaptable and widespread, while forest specialists are usually unable to adapt and, therefore, tend to be localized and threatened.

Mammals

This area supports 28 mammal species (22% of Swaziland's total), four of which are nationally threatened and three regionally threatened ones (see Table 2, Appendix 8). In spite of serious poaching a number of mammal species still survive in the area. With conservation this area could become very important especially with its linkage to Malolotja Nature Reserve through Songimvelo Conservation Area. Re-introductions of locally extinct species would not be necessary with this linkage, as animals would naturally move into the area from Songimvelo. However, mammals such as bushbuck, eland, common reedbuck, mountain reedbuck, klipspringer, oribi and grey rhebuck could be introduced to either boost local populations or re-start extinct species. Predators like leopards could also be re-introduced though human-animal conflict would probably work against the introduction of this species.

Table 2: Summary species information for Makhonjwa PWA.

	Flora	Fish	Amphibians	Reptiles	Birds	Mammals
Number of indigenous species	299	21	20	58	94	28
Number of exotic species	15	0	0	0	0	0
Total number of species in project area	314	21	20	58	94	28
Percentage of Swaziland's indigenous species for this taxon (%)	9	42	46	52	19	22
Not previously recorded in the country	6	0	0	2	0	0
Number of endemic species	0			0		
Number of species with restricted distributions	20	5	4	8	4	0
Number of species found only in Swaziland and one other country	15					
Number of species found only in Swaziland and two other countries	5					
Number of Swaziland Red Data species	16	6	0	2	5	4
Number of Regional Red Data species (South Africa)	3	3	0	2	3	3
Number of Swaziland Red Data species present not occurring in PAs	7	3	0	0	1	0

Socio-economic

Social

According to the locals, the Makhonjwa hills are in South Africa. Rather, the hills are known locally known as Lufafa hills. Makhonjwa hills are under the Ntfontjeni inkhundla. The Ntfontjeni inkhundla includes four chiefdoms (adjacent to the Makhonjwa PWA), which are Hhelehhele under Chief Mnikwa, Lomshiyo under Chief Tikhontele, Hhohho waseZibonele under Chief Mvelase and Hhohho waseMvembili under Chief Solani.

Employment in the area is very low. This is offered locally by Mondi timbers/ forest, Ngonini Estates, Phophonyane Nature Reserve, Protea hotel, Pigg's Peak town and the Chinese Agricultural Mission at eMvembili. The population census of 1997 estimated the population of the area to be about 13600, with about a third (4533) of the population of employable age. The survey estimated that only about a third of employable population was permanently employed. This indicates that 2/3 of the population are natural dependants (children and old people) and yet the employable cohorts only a third are employed.

There are only two high schools in the area, namely Ntfontjeni in kaLomshiyo and Mswati at eMvembili. Seven primary schools are in the area and these are distributed throughout the inkhundla, with Hhohho wase Zibonele having only one whilst two primary schools are found in each of the other chiefdoms.

Health facilities in the area are inadequate as there are only two clinics for the whole area. These are Ntfontjeni Clinic at Lomshiyo and Horo Clinic at Hhohho waseZibonele. The people have access to both Horo and Ntfontjeni clinics.

Local uses of Lufafa Hills include (also see Table 3):

1. *Cattle grazing* - A resettlement program was carried out in the area in the past, in which residential and grazing areas were demarcated. The latter are presently overgrazed and now fall far short of requirements of the numbers of cattle in the area. The Lufafa hills which are farmlands, now present the major source of grazing for the cattle in the area.
2. *Medicinal plants* - According to local folklore, the Lufafa hills provide medicinal plants which are unique. A few of these used specifically for Royal functions, while a lot of other plants were quoted for a myriad of ailments. The impression created survey of the area would shed light on this aspect.
3. *Dagga cultivation* - The valleys of Lufafa hills are extensively utilised for cultivation of dagga. The area is known nationally to be one of the major dagga growing areas in the country. The survey confirmed this as most people felt that this was one of the major economic activities in the area and one that provided a livelihood for many people.
4. *Forest and grassland products* - A number of forest and grassland products such as lukhasi, lutindzi, lukhwane and sifunti are cut by women for the making of mats and baskets. These are a source of livelihood for some women in the area and were a concern when an alternative use of the area was mentioned. Other forest products such as indigenous fruits did not appear to be of much significance.
5. *Poles* - The area is used as a source of building poles although this does not appear to be major. Few species are put to specific uses such as building of cattle kraals, building of royal residences and other traditional rituals.
6. *Hunting* - Hunting of the few remaining mammal species is carried out in the area. Some of the mammal species that were mentioned as occurring in the area were impunzi (grey duiker), ligoga (klipspringer), umsumphe (red duiker), livondvo (cane rat), imfene (baboon), ingobiyane (vervet monkey), logwaja (scrub hare), imbolwane (slender mongoose), ingulube yesiganga (bush pig), imbabala (bushbuck), lincala (mountain reedbuck) and ingwe (leopard).

The survey was able to include only two of the four chiefs in the area. Chief Tikhontele is also the chief of an area in South Africa where he permanently resides and Chief Mvelase was at Buhleni at the time of the survey. Chief Mnikwa welcomed the idea of a protected area along the Lufafa hills and mentioned that a Northern Hhohho association that sought to develop community tourism in the area had recently touted the idea that the initiative at Lufafa hills would be along these lines. Chief Solani echoed the same sentiments as chief Mnikwa and said that the Association has the same objectives.

Of the four land owners, the survey included only two. Mr. Paul Pritz owns 660 hectares. He was very welcome to the idea, and said that he had long espoused the idea, to the point of approaching SNTC to have his area proclaimed as a protected area, but had hit a brick wall at the time. Mr. Ralph Kummer whose farm includes Lufafa hill was very much for managing the area for conservation, area and feared that the people's activities in the area, such as the illegal cattle grazing and cultivation of weed, was a reason why prompt action was needed because the area was quickly getting degraded.

The Bothma farm owners and representatives of Mondi Timbers were not seen. However, in as far as Mondi Timbers is concerned, the understanding is that the company wishes for its area to

be offered a higher level of protection than at present, and would welcome the area's proclamation as a protected area. Mrs. Bothma, who is one of three wives of the eldest Bothma, said that the Bothma farm was no longer being used for anything, as it had previously grown gum trees used in the mining industry in South Africa and Swaziland. She felt that the family would welcome the idea because the farm is presently idle.

The people interviewed guardedly welcomed the idea of a protected area because it would offer employment, but felt that an activity such as mining would have gone further in that regard. Their reservations were centred around the fact that they would no longer be allowed entry into the area, which would add pressure on the allocated grazing areas, which they feel are already overgrazed. Lack of access to medicinal plants was another concern, but the major point of rebuttal was the thought of losing access to the forest in which they cultivate dagga. The feeling is that government has forgotten about them and does nothing to improve their livelihoods, neither in terms of education, health or employment. As such the only recourse left to them is the growing of dagga. If this is taken away from them as well, then they feel they will be left with nothing. For further details see Appendix 9.

Table 3: Scores of social importance of Makhonjwa PWA, based on qualitative assessment of results.

Criterion	Score	Remarks
1. Proportion of people willing to manage for conservation	8/10	Community members : 6/10 Landowners and traditional leaders: 10/10
2. Level of usage of PWA by locals	7/10	
3. Presence of areas of religious, spiritual or historical significance	4/10	
4. Occurrence of species of high social or economic value	9/10	
5. Locals' access to centers of education and health	4/10	
6. The importance of ecosystem services provided by the PWA to the community	9/10	Reliable water supply plus all the others mentioned in 3 and 4
7. People's dependence, either economically or otherwise upon PWA resources	8/10	

Tourism

In terms of location and setting, this PWA presents high aesthetic values (see Table 4). The area has striking mountain scenery rising steeply from the Lomati Valley. The slopes show natural vegetation and exposed cliff and rock outcrops. The Lomati River is a strong-flowing river fed by a number of streams descending from high mountain valleys. Attractive waterfalls exist in certain valleys. Natural forest vegetation along the Lomati and various stream valleys adds to the aesthetic appeal of this area, giving a high overall value. The view eastwards is predominately onto inhabited community areas, which are cut by numerous dirt roads and cattle tracks. This is less attractive and likely to deteriorate further with population growth and conversion from natural building style (thatch, mud and stone) to block and tin roof dwellings. Due to the fact that most slopes look back over inhabited areas to the east, there is limited true

wilderness. On the high ground leading into South Africa there is a much greater potential for a wilderness experience, within a trans-frontier park area.

Although the natural features are diverse and impressive there are no unique natural features in this area. To the south the Mondi Forests and Swaziland Plantations present an alien, yet “green” neighbouring area. The potential for the extension of routes and trails into this area is good and is not incompatible with the development of the PWA. This potential linkage could be extended as far south as Malolotja Nature Reserve. To the west, areas in South Africa present great potential for a trans-frontier park – with possible linkages right through to Songimvelo Nature Reserve. To the north the mountain range continues with a further potential PWA at Sondeza. To the east, the Makhonjwa PWA borders on fairly extensively inhabited SNL areas. Although detracting from the wilderness potential, these areas do present, both an access route to the PWA as well as a dimension for cultural product development and a justification for tourism related economic development.

This area would be a valuable component of any future development of a National Trail Network. Existing tracks occur and would be of relatively low cost to maintain. There is the potential for a network of trails, suitable for 3 to 4 days exploration within the PWA. Climate and trails are suitable for horses. The lower reaches of the PWA are ideal for MTB access with extended rides into community areas being possible. Access for 2-wheel drives is limited both by the quality of roads, as well as due to the river crossings that are required. It is a great 4x4 adventure to reach the Wyldesdale and upper Lomati areas. There is also potential to use routes up the mountain range via the Bothma property. The re-opening of the old 4x4 route up the Mganda valley would be a very attractive 4x4 product linking to the very scenic Bulembu border crossing. Access by coach is very unlikely – even in the distant future.

This PWA is close to the major arterial tourist route through Swaziland. No unique marketable features stand out – unless the Trans-frontier park approach is used. A strong community-based product and extensive multi-functional trails would be the core of likely marketing efforts. Target markets would be niche markets associated with the activities listed below. International self-drive business (4x4 rental) could be targeted for cultural activities in particular. Overland tour groups could be attracted with the culture/activity mix on offer. Volunteer tourism could be easily facilitated linked to environmental and social project work. Appeal for domestic tourists is fairly limited as activity tourism is in relatively low demand in Swaziland

This is not a malarial area and is far enough west not to be lumped together with risky areas. Bilharzia risk in the Lomati River is very high.

Due to the variety of natural features in this area, this PWA has good potential as an activity hub with the following possible attractions:

- Hiking and day walks to mountain, waterfall and forest features.
- Overnight trekking between camps and/or trekking cabins
- Mountain Biking (MTB) and horse-riding
- Paragliding, with possible access to mountain top via Bothma access roads

- Caving (old mine exploration, in this case, but also explore community mention of caves which were used for hiding in times gone by)
- Canoeing, tubing, kloofing and swimming – in the Lomati river and tributaries
- Climbing and abseiling sites exist
- Fishing in the river has yellowfish-on-fly potential
- Team-building style activities, including orienteering
- 4x4 routes, quad and off-road bikes – possibly linking to Mondi Forests
- Bird-watching on foot would be good particularly on forest trails

This is definite potential for product development along the lines of historical mining operations at Wyldesdale and Lomati Mines. The isolated small village and rural nature of the communities in the Lomati Valley would be appealing for community-operated lodges or home-stay style trekking bases. There is real potential for a youth leadership style of training center, focusing on outdoor activities, as well as environmental and social issues.

Revenue-earning infrastructure could include a manned control point near the Lomati Mine, with unmanned access points at the bottom of the Bothma property and top of Mganda Valley. There is potential for further campgrounds and trekking cabins, as well as a base camp for corporate and family adventure style products. Potential for community tourism lodging and/or a mountain top character lodge exists. A small conferencing facility could be based at central point. This facility could be shared by various camps and lodges, as well as by the community for meetings and workshops.

Most development sites have access to water. Electricity and telephone supply points are likely to be extended into nearby community areas from Ntfontjeni at some point in the future. In general the area could accommodate three to four days for resident visitors (due to variety of attractions) as well as offer opportunities to day visitors from the Piggs Peak hotel. There is a lot of local interest in development opportunities from the Wyldesdale partners and Paul Pritz. There is also strong interest within the community, although in both cases little development capital is available.

Again due to the wide variety of activities and facilities that could be feasibly developed in this area, there is a good possibility that the area management could be self-sustaining.

Between E 729 000 and E 2 394 000 per annum could be feasibly brought in by tourism based on various development scenarios. Over 100 jobs of a part-time and full-time nature would be created. See Appendices 10 and 11 for more detailed report.

Table 4: Tourism rating of Makhonjwa PWA

	Makhonjwa	Max Rating
1. Product Potential		
Location and setting	20	40
Aesthetic value	7	10
Extent and quality of wilderness	4	10
Unique natural features	0	10
Compatibility of neighbouring areas	9	10
Ease and variety of access	38	80
Access by foot	5	5
Access by horse	5	5
Access by bicycle	4	5
Access by 2-wheel drive	1	10
Access by 4-wheel drive	5	5
Access by coach	0	10
Access by train	0	5
Access by air	0	5
Distance from main tourist route	16	20
Alternate route potential	2	10
Marketability	33	60
Unique marketable features	2	10
Identifiable and accessible target markets	7	10
Linkages to tourism flows	8	10
Absence of safety risks	7	10
Absence of health risk factors	6	10
Attractiveness for domestic tourism	3	10
Nature and variety of product	47	80
Potential as activity hub (quality/variety of activities)	10	10
Potential for a scenery-based product	2	10
Potential for a biodiversity-based product	3	10
Potential for species specific tourism	0	10
Potential for historical or cultural product	8	10
Potential for community-based product	8	10
Potential for educational facilities	6	10
Potential for volunteer tourism	10	10
Potential for revenue-earning infrastructure	54	100
Potential for entry gate & fees	10	10
Potential for restaurant development	0	10
Potential for camp ground / trekking cabins	5	5
Potential for self-catering rest camp	2	10
Potential for tented camp	8	10
Potential for small character lodge	8	10
Potential for community tourism lodging	5	5
Potential for hotel / conference center	6	10
Accessibility of H ₂ O, electricity, telecom	10	30

2. Analysis of overall economic potential		
Factors enhancing economic potential	67	120
Length of potential stay in area	9	10
Variety of economic earning opportunities	7	10
Presence of local interest in development	8	10
Presence of local management/tourism skills	2	5
Investment capacity of local interests	1	5
Re-intro of species of economic value	3	10
Linkages to existing tourism infrastructure	14	20
Linkages to potential tourism initiative	7	10
Potential to stimulate local supply	6	10
Potential for self sustainability	5	10
Attractiveness for external investors	5	20
Development risk factors	(9)	(30)
Economic risks	(5)	(10)
Environmental risks	(2)	(10)
Health risks	(2)	(10)
Totals	250	480
3. Estimate of revenue earning potential		
Annual turnover category – high scenario	F	
Annual turnover category – med scenario	G	
Annual turnover category – low scenario	G	
4. Estimate of potential job creation	E	
	(114)	
Full-time skilled employment	36	
Full-time unskilled employment	20	
Part-time employment (number divided by 2)	15	
Indirect employment	18	
Employment during constr./development (number divided by 4)	25	

Manzimnyame



Figure 6: Manzimnyame PWA

Biological

Ecosystems

Manzimnyame (see map in Appendix 1) has very high ecosystem value. From a global perspective, it is situated within the highly important and threatened (priority index 4) Maputoland Coastal Forest Ecoregion (WWF 2002). From a regional perspective represents a significant proportion of the Maputoland Centre of Endemism (Van Wyk & Smith 2001), but only contains one broad vegetation type. From a national perspective, it represents over 9% of the Southern Lebombo Bushveld vegetation type of which 4.5% is already represented within Mlawula Nature Reserve. From a local perspective Manzimnyame contains a high diversity of ecosystems. It contains ecosystems of all four biomes including two forest types, one grassland type, three savanna types and two aquatic types.

The majority of the ecosystems are in good condition. However, the plateau areas in general are becoming cultivated for dryland maize production. There is also significant encroachment of *Chromolaena odorata* into the lower lying gorges and drainage lines. Selective harvesting of the Lubombo ironwood (*Androstachys johnsonii*) is evident. A variety of goods and services are

currently provided by the ecosystems to the people of the area including, livestock grazing, medicinal products, food, construction materials, recreational enjoyment.

Manzimnyame PWA is of medium to large size (124 km²) and has a relatively high area to perimeter ratio (2.8); i.e. the area (in km²) is 2.8 times the perimeter (in km). Conservation management should focus on addressing the problems of alien plant invasion, poaching and uncontrolled burning (see Appendix 2). At the same time the area should be secured against the threats of increasing cultivation and expanding human settlement, which might erode the goods and services currently provided and destroy the potential of the area for economic benefit through tourism.

Flora

The Manzimnyame PWA is fascinating botanically. It forms part of the Maputaland Centre of Plant Endemism and hosts a wealth of indigenous plants many of which have restricted distributions (see Appendix 3) and/or are threatened.

Results of the survey show that Manzimnyame supports a relatively high number of plant species with 251 of them being indigenous, representing 8% of Swaziland's indigenous flora (see Table 5, Appendix 4). A low number of endemics were noted possibly because they are generally confined to the grasslands (Van Wyk & Smith, 2001) which did not benefit from previous surveys as did the forests. Seventeen Red Data species were recorded at Manzimnyame, two of which are regionally threatened (in South Africa) and four of which do not occur in a protected area in Swaziland. A relatively high number of threatened species was found in the forests. It should also be noted that the checklist provided for the Manzimnyame area was a result of a number of visits to the area with different plant experts and not just from the three days provided for this survey.

Interesting finds at Manzimnyame include the endemic and Endangered cycad *Encephalartos aplanatus*. The Vulnerable (in Swaziland) *Encephalartos senticosus*, *Haemanthus pauculifolius*, *Homalium dentatum*, and *Teclea gerrardii* were also noted in the area all of which are not represented within any protected areas in Swaziland. Of these species, *Haemanthus pauculifolius* is also regionally threatened (in South Africa). Six species with restricted distributions were recorded, one of which is found in Swaziland and one other country and the remainder of which are found in Swaziland and two other countries.

New records for Swaziland found in Manzimnyame include the fern *Microsorium scolopendrium*, a new form of the creeper *Rhoicissus tridentata* (Form B), *Tarenna supra-axillaris* subsp. *supra-axillaris* (tree), and the orchid *Oeceoclades* cf. *quadrilobum*. These findings highlight the importance of managing the Manzimnyame area for conservation purposes.

The results of the plots and transects indicate that the grasslands host the highest species richness (28.0 species/100m²), followed by forest (13.3 species/100m²). It was found that the *Androstachys* forests support similar numbers of species to the other Lubombo forests.

Manzimnyame is largely in pristine condition. The main disturbed areas are the riverine zones which are in areas heavily infested with the weed *Lantana camara* and affected by other flood related impacts. The main contributors to its good environmental state have been largely due to its relative inaccessibility (mostly 4x4 tracks, steep gorges and rocky outcrops) as well as being heavily guarded by the Swaziland Defence Force. Farms on the periphery however are a concern to the PWA where arable land is becoming a highly sort after commodity in the Lubombo area and presents a huge risk to the natural habitat, especially that of the flatter, more accessible areas.

Fish, Amphibians and Reptiles

The area is important as it provides specific habitats for endemic and near-endemic species of reptiles and for several regionally important species of fish, amphibians and reptiles. Apart from the regionally important species the area supports a high level of diversity in all three groups. The Southern barred minnow (*Opsaridium peringueyi*) listed internationally as Vulnerable is presumed to occur in the area. The Golden leaf-folding frog (*Afrixalus aureus*), listed as rare in South Africa and as Least Concern in Swaziland, occurs in the area. Two threatened reptiles, the Nile crocodile (*Crocodylus niloticus*) and Southern African python (*Python natalensis*), and the rare Natal hinged tortoise (*Kinixys natalensis*), occur in the area. Three Lubombo endemic reptiles, two of which have been confirmed, occur in the Manzimnyama PWA. These are Warren's girdled lizard (*Cordylus warreni*); Lubombo flat lizard (*Platysaurus lebomboensis*) and Tello's thread snake (*Leptotyphlops telloi*).

Twenty fish species, representing 40% of Swaziland's recorded species, 30 amphibian species, representing 68% of Swaziland's recorded species, and 67 reptile species, representing 60% of Swaziland's recorded species are presumed to occur in the Manzimnyame PWA (see Table 5, Appendices 5 and 6).

Birds

As for the Makhonjwa area, the Manzimnyame PWA supports a rich bird life including numerous rare and threatened species. The bird diversity at Manzimnyame is a direct result of the presence of bushveld savanna and forest, both of which support high numbers of bird species.

A total of 154 species of birds are predicted to occur in the PWA, of which 88 species were recorded in this study (see Table 5, Appendix 7).

A significant number of threatened species occur in the area, reflecting the diversity of raptors present at Manzimnyame as well as the presence of species restricted to Lubombo forests such as the Barred Owl and African Broadbill. These birds occur in only a few small, fragmented forest patches in the Lubombos, and are hence of conservation concern. Raptors recorded in the area include Crowned Eagle, Wahlberg's Eagle, Bateleur, Cape Vulture and Blackbreasted Snake Eagle. Many of these species probably breed in the area, but no nests were located. However, the nest of another threatened species, the Black Stork was found on a cliff face.

The species recorded at Manzimnyame reflect the habitat available to birds with most species falling into one of three categories: savanna species, forest species or generalists. Typical savanna species include Kurrichane Thrush, Whitebrowed Robin, Orangebreasted Bush Shrike,

Plumcoloured Starling and Rattling Cisticola. Forest species include a variety of robins, Forest Weaver, Squaretailed Drongo, African Broadbill, Barred Owl, Wood Owl and Narina Trogon. Widespread and adaptable generalist species include the Blackeyed Bulbul, Cape White-eye and Fiscal Shrike.

The status of most bird species appeared to be relatively secure in this area. Although some habitat alteration was perceivable, this was probably insufficient to cause spiraling population declines of threatened bird species leading to their local extinction. There is some concern for the safety of raptor breeding sites. Even minimal disturbance at such nesting sites can cause breeding failure and eventually lead to desertion of the area.

Mammals

The area has been used for cattle grazing and has suffered from poor range management practices in the form of unregulated burning regimes. This has impacted on the mammal populations of the area, e.g., all the small mammals recorded were caught on unburnt patches of grass and shrubs. This area has also been subjected to heavy poaching pressure in spite of its remoteness. Here 20 species of mammals were recorded (16% of Swaziland's mammals) and of these three are of local and one of regional conservation concern (see Table 5, Appendix 8). The size of this area and its possible linkage with Mlawula Nature Reserve would increase the value of this area greatly. Furthermore, this would invalidate the need for re-introductions of species. However, mammals such as leopard, bushpig, bushbuck, kudu, blue wildebeest, Sharpe's grysbok, oribi and klipspringer could be introduced to either boost local populations or re-start extinct species.

Table 4: Summary species information for Manzimnyame PWA.

	Flora	Fish	Amphibians	Reptiles	Birds	Mammals
Number of indigenous species	251	20	30	67	88	20
Number of exotic species	6					
Total number of species in project area	257	20	30	67	88	20
Percentage of Swaziland's indigenous species for this taxon (%)	8	40	68	60	18	16
Number of new records for Swaziland	4	7	3			
Number of endemic species	1			0		
Number of species with restricted distributions	6	0	0	5	9	0
Number of species found only in Swaziland and one other country	1					
Number of species found only in Swaziland and two other countries	5					
Number of Swaziland Red Data species	17	1	1	4	9	3
Number of Regional Red Data species (South Africa)	2	1	1	4	2	1
Number of Swaziland Red Data species present not occurring in PAs	4	0	1	0	0	0

Socio-economic

Social

The farms at Manzimnyame used to be owned by European settlers before they changed hands to Swaziland Government ownership under the Ministry of Agriculture and Co-operatives (MOAC). Remaining graves bear testimony to this history. The PWA falls within the boundaries of the area of Chief Mlimi and Loyiwe Maziya. The population is estimated to be 18129 (1997 Swaziland Population & Housing Census).

Economic activity in this area is very low, which is why most people here are working in town (Siteki) both in the public and private sectors. Some are employed in the sugar cane fields in the lowveld and others work as far as the Matsapa industrial sites and even in mines in South Africa. With an unemployment rate of 80.1% for the Lubombo region, most of the people here are expected to be unemployed.

There are six primary schools that are accessible to children from this area and three high schools namely, Nazarene, Lubombo Central and Good Shepard. The high schools are all close to Steki town, which borders the area. There is one hospital (Good Shepard hospital) and clinics close to this area, one of them being the Nazarene Clinic.

Local uses of Manzimnyame PWA include (also see Table 6):

1. *Cattle grazing* – This area is used by locals to graze their cattle. There is also a plan to rear the cattle for commercial purposes.
2. *Medicinal Plants* –The locals use some plants for medicine, which they also sell. Some of these plants are used specifically for royal functions. These plants have to be identified so that they are protected from depletion.
3. *Firewood* -The locals use the dead trees for fuel. MOAC is doing a great job in controlling the harvest of firewood and they issue permits for people wanting to collect firewood.
4. *Poles* - The area is a source of building poles for fence, houses, and kraals. Royalty also uses it for its kraal construction in the nearby royal residences (Mpumalanga).
5. *Fruits and Grasses* - There are mango trees, which may have been left by the former landowners. There are also marula trees the fruits of which are used for a popular traditional brew. The local women use the grass for thatching and making handicrafts.

The survey was able to include a member of the Siteki Town Council Member, the Member of Parliament, and the Bucopho and Indvuna of the constituency. They all supported the idea of managing the area for conservation and ecotourism. They believe that in a way local people would benefit from it through employment and stimulation of the local economy. This group was quite enthusiastic about the envisaged economic growth for the area that would result.

The people interviewed had different views about the conservation of the area. Those who were for the idea thought it would improve their economic status, create jobs and contribute to positive development of the area. They also felt it would reduce the level of game hunting. Those who were not for the idea would like to see the area being used for farming and having unlimited access to medicinal plants found in the area. They felt that the locals must be the ones to decide what they want to do in the area. Some want the area for a project plan of rearing a special breed

of cattle for beef. This ranching project, they reason, would be more beneficial to them. For further details see Appendix 9.

Table 5: Scores of social importance of Manzimnyame PWA, based on qualitative assessment of results.

Criterion	Score	Remarks
1. Proportion of people willing to manage for conservation	6/10	Little resistance from Manzimnyame Farmers' association. Army concerned about army training rights.
2. Level of usage of PWA by locals	5/10	-
3. Presence of areas of religious, spiritual or historical significance	4/10	-
4. Occurrence of species of high social or economic value	9/10	Lubombo ironwood, cycads, medicinal plants, thatching grass.
5. Locals' access to centers of education and health	7/10	-
6. The importance of ecosystem services provided by the PWA to the community	5/10	-
7. People's dependence, either economically or otherwise, upon PWA resources	7/10	-

Tourism

This area has long held an almost legendary status with conservation and wilderness enthusiasts. From a relatively flat area on the Lubombo plateau the Mnyame River with its many tributaries drops away steeply to the east, where it exits Swaziland into Mozambique. The area ranges from 620m on the western extremities of the PWA to 150m above sea level. The gorge is characterized by exposed cliff faces and thick vegetation, with deep river pools at intervals in the riverbed. On the plateau, the valley of the Mkubusela has attractive open grassland and natural vegetation. The view eastwards is across the plains of Southern Mozambique. Views north and south do not show much alienation due to the flat nature of the landscape. Inside the main gorge as well as in the minor gorges of tributaries, there is a true sense of wilderness. Roads are not visible and lights at night can only be seen once back on the plateau. There is potential to extend a protected area into Mozambique linking up with Mlawula to the north and the Ndumo-Tembe parks to the south.

The gorge area is currently only accessible on foot. This area would certainly be an integral component of any future development of a National Trail Network. Climate and terrain does not lend itself to the use of horses to access the gorge, and mountain bikes have limited use. Two-wheel drives are limited to reaching the northern boundary of the PWA. With the potential re-opening of an old route crossing the gorge to the east, this PWA could become an incredible 4x4 attraction. The PWA is fairly distant from the traditional tourist routes through Swaziland, although the opening of Mhlumeni-Goba border may precipitate changes in tourist flows. Being situated between Durban/Johannesburg and Mozambique, which is already a strong 4x4 destination, a 4x4 based scenic and nature-based product would be easily marketed, with mention of the interesting bird-watching opportunities (Broadbill, Barred Owl, raptors) as well as

other specialist interests being hung off this framework. The concentrations and variety of cycads, in particular would be another feature to emphasize. The potential for domestic tourism is limited. Recreational 4x4 ownership is small in Swaziland and Siteki is a small center.

This is a malarial area and being close to a relatively significant urban population concentration at Siteki, this risk is likely to be real. Bilharzia risk in the Mnyame River is likely to be very high due to the presence of reed beds and stagnant water. Although the area as a variety of natural features, this PWA has limited appeal as an activity hub due to the predominantly hot climate of this area. Envisaged activities could include:

- Hiking and day walks to river, cliff face and forest/cycad features.
- Overnight trekking between camps and/or trekking cabins
- Limited canoeing / oar boats on some of the bigger pools in the area.
- Swimming – subject to further analysis of crocodile and Bilharzia risks.
- Climbing and abseiling sites exist, however use of these could disturb valuable nesting sites for a variety of species of bird.
- Fishing in the river has some potential, especially if illegal netting is stopped.
- 4x4 routes – slow highly technical ascents and descents over rocks with river crossings.
- Bird watching on foot would be good.

There is good potential for a biodiversity-based product slant, but limited historical and cultural potential (see Table 7). The potential for community-based product is there, but conceptually difficult to link to the gorge. Revenue-earning infrastructure could include a manned control point at the northern and southeastern entry points to the park. A possible picnic site for domestic tourism and day walks could be established on the outskirts of Siteki. A campground would be essential for 4x4 trails and as a kick-off point for hiking and overnight trekking trails as well. A rest camp could be considered at a scenic point on the plateau overlooking the gorge. A tented camp may be the best style of development given the rugged nature of the gorge bottom area where access for construction vehicles would be limited. Other small lodges and guesthouses could be considered on the extremities of Siteki, where a number of small parcels of private land occur, or at Muti-muti with a linkage to this PWA. Water on the Lubombo plateau is scarce. Most sites would need to access water from the Mnyame River itself, which would require purification. Electricity and telephone supply points are within a reasonable distance of the rim of the gorge although it would not be desirable to drop lines into the gorge itself, as this would impact on the wilderness values of the area. Supply of fruit and vegetable and various lodge and area management employment opportunities would open up for community members and local residents.

Being a government owned farm, there has been no private ownership to spark interest in this sphere, although nearby interests at Muti-muti nature reserve have both the interest and capacity to get further involved. Some bigger business interests in Siteki may be convinced to get involved with development. The development of the Biodiversity and Tourism Corridor and/or a trans-frontier park linking this PWA to Mozambique and South Africa would be the main potential offered by this area.

Estimates of revenue-earning potential range from a high projection of E 3 576 000 per annum to a low projection of E 750 000 per annum. Approximately 100 jobs could be created in tourism,

conservation management and also in part-time project work. For further details see Appendices 10 and 12.

Table 7: Tourism rating of Manzimnyame PWA

	Manzimnyame	Max Rating
1. Product Potential		
Location and setting	30	40
Aesthetic value	10	10
Extent and quality of wilderness	9	10
Unique natural features	4	10
Compatibility of neighbouring areas	7	10
Ease and variety of access	26	80
Access by foot	3	5
Access by horse	1	5
Access by bicycle	1	5
Access by 2-wheel drive	1	10
Access by 4-wheel drive	4	5
Access by coach	0	10
Access by train	0	5
Access by air	0	5
Distance from main tourist route	10	20
Alternate route potential	6	10
Marketability	25	60
Unique marketable features	6	10
Identifiable and accessible target markets	6	10
Linkages to tourism flows	5	10
Absence of safety risks	5	10
Absence of health risk factors	1	10
Attractiveness for domestic tourism	2	10
Nature and variety of product	25	80
Potential as activity hub (quality/variety of activities)	2	10
Potential for a scenery-based product	8	10
Potential for a biodiversity-based product	7	10
Potential for species specific tourism	4	10
Potential for historical or cultural product	1	10
Potential for community-based product	2	10
Potential for educational facilities	0	10
Potential for volunteer tourism	1	10
Potential for revenue-earning infrastructure	54	100
Potential for entry gate & fees	8	10
Potential for restaurant development	0	10
Potential for camp ground / trekking cabins	5	5
Potential for self-catering rest camp	6	10
Potential for tented camp	8	10
Potential for small character lodge	7	10
Potential for community tourism lodging	3	5
Potential for hotel / conference center	2	10
Accessibility of H ² O, electricity, telecom	15	30

2. Analysis of overall economic potential		
Factors enhancing economic potential	39	120
Length of potential stay in area	7	10
Variety of economic earning opportunities	3	10
Presence of local interest in development	2	10
Presence of local management/tourism skills	1	5
Investment capacity of local interests	1	5
Re-intro of species of economic value	1	10
Linkages to existing tourism infrastructure	2	20
Linkages to potential tourism initiative	9	10
Potential to stimulate local supply	3	10
Potential for self sustainability	5	10
Attractiveness for external investors	5	20
Development risk factors	(16)	(30)
Economic risks	(5)	(10)
Environmental risks	(2)	(10)
Health risks	(9)	(10)
Totals	183	480
3. Estimate of revenue earning potential		
Annual turnover category – high scenario	F	
Annual turnover category – med scenario	G	
Annual turnover category – low scenario	G	
4. Estimate of potential job creation	E	
	(106)	
Full-time skilled employment	37	
Full-time unskilled employment	20	
Part-time employment (number divided by 2)	6	
Indirect employment	24	
Employment during constr./development (number divided by 4)	19	

Sibebe



Figure 7: Sibebe PWA

Biological

Ecosystems

Sibebe (see map in Appendix 1) has moderate to high ecosystem value. From a global perspective, it is situated within the important (priority index 3) Drakensberg Afro-montane Grassland and Woodland Ecoregion (WWF 2002) and contains the worlds largest exposed granite dome. From a regional perspective, it contains the regions largest exposed rock dome and two broad vegetation types. From a national perspective, it contains less than 1% of the Kangwane Montain Grassland and Swaziland Sour Bushveld within the country, both of which are already represented within Malolotja Nature Reserve and Mlilwane Wildlife Sanctuary. However, at present only 1.3% and 0.8% of these vegetation types respectively occur within proclaimed reserves. From a local perspective Sibebe contains a moderate diversity of ecosystems. It contains ecosystems of three biomes including one forest type, two grassland types, and four aquatic types. It is an important catchment area containing 15 headwater streams.

The majority of the ecosystems are in good condition. However, the grasslands in general (particularly highveld grassland) are quite heavily overgrazed by cattle. There is also patchy encroachment of black wattle (*Acacia mearnsii*) into the highveld grassland. Limited erosion was evident on slopes along footpaths and a 4x4 access track. A variety of goods and services are

currently provided by the ecosystems to the people of the area including, fresh water, livestock grazing, medicinal products, food, construction materials, recreational enjoyment.

Sibebe PWA is of small size (29 km²) and has a relatively low area to perimeter ratio (1.1); i.e. the area (in km²) is equal to the perimeter (in km). This means that edge effects (which are largely negative for biodiversity) would be limited and that the boundary to be patrolled/secured (e.g. through fencing) is relatively small. Potential future threats to the area include expanding human settlement and tourism development (there has been some interest already in developing accommodation facilities in the area and vehicle access into the area is facilitated by the maintenance of a 4x4 road). While positive impacts may be expected from eco-tourism in the area, care should be taken to ensure that such developments are appropriate. Conservation management should focus on addressing the problems of alien plant invasion, overgrazing and poaching (see Appendix 2). At the same time the area should be secured against the threats of expanding human settlement and inappropriate tourism development, which might erode the goods and services currently provided and destroy the potential of the area for economic benefit through appropriate tourism.

Flora

Sibebe is interesting botanically, hosting a wealth of indigenous plants some of which have restricted distributions (see Appendix 3) and/or are threatened. The PWA consists of a variety of vegetation types including Highveld forest and grassland, upper middleveld hill grassland and vleis.

Results of the survey show that Sibebe supports a relatively moderate number of plant species with 161 of them being indigenous, representing 5% of Swaziland's indigenous flora (see Table 8, Appendix 4). A relatively high number of species with restricted distributions were recorded (11 in total) possibly due to the large proportion of grassland habitat which have a high species diversity and are known to host endemics ((Van Wyk, 2001). It should also be noted that the checklist provided for the Sibebe area was a result of a one day visit to the area, hence a low species total, and not several days as per the other areas in the survey.

An interesting find at Sibebe includes the 'vulnerable' and endemic *Streptocarpus davyi* which is not found within any protected area. Other threatened species include the host specific orchid *Polystachya zuluensis* which is restricted to Swaziland and one other country and is not found within a protected area. *Diospyros galpinii* and *Heteropyxis canescens* were recorded which are restricted to Swaziland and one other country but can also be found in protected areas as can the 'Low risk near-threatened' *Scilla natalensis*. One regionally threatened orchid, *Disa nervosa*, was also recorded in the area.

No new plant records for Swaziland were discovered at Sibebe.

Sibebe is for the large part in pristine condition. The main disturbed areas are around the scattered homesteads where patches of wattle forests have been established, and near the base of the mountain along the roads and footpaths. The threat of more homesteads being built up in the area is imminent with the improved access to the area.

The results of the plots indicate that the grasslands host the highest species richness (27 species/100m²), followed by forest (11.5 species/100m²).

Fish, Amphibians and Reptiles

No fish species were recorded from Sibebe during the initial survey and further sampling is required. Sibebe has a number of highveld restricted species of amphibians and reptiles, including one endemic reptile, the Swazi thick-tailed rock *gecko* (*Afroedura major*). Several amphibians confirmed or presumed to occur in the area are highveld restricted species. Most occur in montane grassland but some, such as the Clicking stream frog (*Strongylopus grayii*), occur primarily in indigenous forest and marginally in grassland. Another highveld restricted species, the Grassland ridged frog (*Ptychadena porosissima*), was recorded from a moist seepage area on the top of Sibebe. The endemic Swazi *gecko* (*Afroedura major*) was found in a jumble of boulders on one of the ridges overlooking a shallow valley where the large boulders had formed a semi-dark cave. An interesting record was that of the Cape grass lizard (*Chamaesaura anguina*) collected in a grassy seepage area. Recently the species was only known from the Malolotja and Hawana Nature Reserves and consequently the Sibebe record represents a range extension for the species.

Forty-four (44) species of amphibians and one-hundred-and-eleven (111) species of reptiles are recorded from Swaziland (Boycott 1992b, 1996). Fifteen (15) amphibian species, representing 34.1% of Swaziland's recorded species and forty-four (44) reptiles, representing 39.6% of Swaziland's recorded species, are presumed to occur in the Sibebe PWA (see Table 8, Appendices 5 and 6).

Birds

Relatively few species of birds were recorded from the Sibebe PWA, accounting for only 9% of the national total (see Table 8, Appendix 7). There are two reasons for this. Firstly, due to its small size, Sibebe was only surveyed on a single day, as opposed to 3-day surveys for the other areas. Secondly, the predominant habitat at Sibebe is highveld grasslands, which support relatively few species of birds compared to the richer low-altitude savannas. Low species richness, however, does not necessarily equate with low conservation value. In fact, Swaziland's most threatened vertebrate, the Blue Swallow, was recorded breeding at Sibebe. This is a significant find, and greatly increases the conservation value of the area.

High-altitude grasslands of southern Africa are also recognized for the high proportion of endemic and range-restricted species. Although not recorded in this study, the range-restricted Chorister Robin and Forest Canary almost certainly occur in the forest fragments present in the area.

From an avian perspective, the Sibebe grasslands are in relatively good condition, as indicated by the presence of the Orangethroated Longclaw, which is generally absent in severely over-grazed areas. However, the presence of numerous species associated with well-grazed grasslands such as Ayre's Cisticola and Plainbacked Pipit indicate that grazing pressure is by no means low.

Mammals

Though no trapping of small mammals was done here (only a day was spent in this area) it is believed that data from previous studies is applicable. Here 16 species of mammals were recorded (13% of Swaziland’s mammal species)(see Table 8, Appendix 8). None of these are of conservation concern either locally or regionally. This however, does not detract from the value of the area. Though it is small in size its possible linkage with Hawane Nature Reserve and Malolotja makes this area very valuable and highveld grassland antelope like oribi would benefit from this additional area. Mountain reedbuck,, grey rhebuck and eland are suitable candidate species for re-introduction.

Table 6: Summary species information for Sibebe PWA.

	Flora	Fish	Amphibians	Reptiles	Birds	Mammals
Number of indigenous species	165		15	44	45	16
Number of exotic species	2					
Total number of species in project area	167		15	44	45	16
Percentage of Swaziland’s indigenous species for this taxon (%)	5		34	40	9	13
Number of new records for Swaziland	0					
Number of endemic species	1			1		
Number of species with restricted distributions	11		0	5	2	0
Number of species found only in Swaziland and one other country	4					
Number of species found only in Swaziland and two other countries	7					
Number of Swaziland Red Data species	5		0	4	4	0
Number of Regional Plant Red Data species (South Africa)	1		0	1	2	0
Number of red data/threatened species present not occurring in Pas	2		0	0	0	0

Socio-Economic

Social

Sibebe PWA is in the Dlangeni area under the Hhukwini Inkhundla in the Hhohho district. The PWA is on Swazi Nation Land in Dlangeni under Chief Nsukumbili II. The Dlangeni area has an estimated total population of 5834 according to the 1997 Swaziland population and housing census.

Economic activity in this area is rather low. Most people work in Mbabane and others work as domestic workers at Pine Valley. Mr. Persson employs some while others are employed at Mbuluzi mission where there is a clinic and a school. This school is just outside the PWA and has a primary and high school. Other schools near the PWA are Entjubeni and Nsukumbili primary and high schools. The nearest health center to the PWA is the Mbuluzi Clinic. Because of efficient transport between Mbulzi and the Capital City of Mbabane, locals also use the Mbabane Government Hospital and the many other clinics in the city.

Local uses of Sibebe PWA include (also see Table 9):

1. *Cattle grazing* – locals graze their cattle in the area and loss of this access is a cause for concern.
2. *Medicinal plants* – There are medicinal plants, which the locals use to treat their different illnesses. It does not look like there are many of these plants though and it seems there is more reliance on chicks than traditional medicines.
3. *Forest and grassland products* – There is a planted wattle forest, which provides locals with poles and firewood. There is Lutindzi and inchozoza type of grass, which they use to make mat for personal and commercial uses.
4. *Bushman Painting and Sibebe Rock* – These are recognized by the community as tourist attractions. The locals get a chance of selling their wares to the tourists when they visit.
5. *Hunting* – Locals hunt Klipspringers and leopards (historically) for food and skins. They use their skins to make loin clothes (emajobo), which are then sold or used by the hunter.

There is currently an effort on the part of the leadership (Chief) to establish a community tourism project in the PWA. The chief is keen on conservation of the area and conservation development though he is allowing for a lot of democracy in the matter.

The interviewees liked the idea of conserving the area. Their concerns were that animals introduced should not be harmful to them. For example they did not wish lions to be reintroduced into the area. Some just like the idea of nature conservation. It would seem some of the locals have had some bad experiences with tourists in the past. For further details see Appendix 9.

Table 7: Scores of social importance of Sibebe PWA, based on qualitative assessment of results.

Criterion	Score	Remarks
1. Proportion of people willing to manage for conservation	8/10	
2. Level of usage of PWA by locals	6/10	
3. Presence of areas of religious, spiritual or historical significance	6/10	The Sibebe boulder, Sotho caves, Bushmen paintings
4. Occurrence of species of high social or economic value	6/10	
5. Locals' access to centers of education and health	6/10	
6. The importance of ecosystem services provided by the PWA to the community	6/10	
7. People's dependance, either economically or otherwise upon PWA resources	4/10	

Tourism

The Sibebe monolith is one of Swaziland's best-known natural features, believed to be the world's largest unbroken granite dome (pluton). The plateau area is dominated by scattered

boulders and indigenous vegetation, with open grassland expanses between. It borders on the urban boundaries of Mbabane and the highly developed Pine Valley residential area. The unique physical nature of this area however results in a high score for aesthetic value. True wilderness is non-existent in this relatively small area. Some areas on the plateau, which are inward looking, have views that are free of peripheral interference, but these are limited. From an environmental perspective, Sibebe is an island in a sea of development.

Sibebe has brilliant potential for being accessed on foot (see Table 10). This access could be from a number of different directions and could include difficult climbs and rock scrambles as well as easier gradients along the plateau. Climate and trails are suitable for horses. There is great potential for an hourly out-ride or half-day trails. Although it would be a near impossible task to cycle up onto the plateau from the access points below, once on the plateau the flat nature of the area lends itself to the use of bicycles.

Access to the periphery is excellent on well-paved tar roads, however steep gradients to the summit and plateau make 2-wheel drive access almost impossible without major road works. It is currently a great 4x4 adventure to reach the plateau – with a route having been opened up from the north. Coach access to the attraction is scored highly, solely for the much highly prized photographic opportunities presented by its impressive west-facing slopes. This PWA is close to the major arterial tourist route through Swaziland, which passes through Mbabane. More adventurous travelers could be encouraged to travel the back route from Mnyokane and Maguga Dam through to Mbabane. A day trip circuit from the main tourism corridor between Mbabane and Manzini could also be easily developed. Coach travelers could be drawn to Pine Valley for a suitable lunch stop.

Being touted as the largest granite outcrop in the world or the second biggest rock in the world (after Ayres Rock – Australia) is certainly highly marketable. Security risks always increase in areas close to extensive habitation, however the open nature of the area reduces this risk. If uncontrolled and unguided, the appeal of climbing the vertical faces of the western faces of Sibebe Rock could also lead to fatalities in the future.

The potential for domestic tourism is huge. The urban populations of Mbabane, Ezulwini and Manzini are crying out for new activity, leisure and recreational venues. A multi-purpose circular trail that was useable by day walkers, mountain-bikers and horse-riders, with access onto the loop at various points would be a key foundation for activity-based tourism. A full list of activity type pursuits includes:

- Hiking and day walks, as well as mountain biking (MTB) and horse-riding
- Paragliding is a possibility if road access to the top is secured.
- Caving (not true caving – just boulder jams)
- Climbing & abseiling (mostly limited to bouldering and scrambling)
- Clay pigeon shooting (could be done – but with huge noise impacts)
- Team-building style activities and orienteering courses
- Bird-watching on foot (limited – would be better if Blue Swallow nesting was established)

Sibebe's main attraction is its unique scenery – although the uniqueness of this is really only “useable” by potential developments which are outside the PWA. This does not however preclude a high score here for tourism development potential based on scenic foundations. Potential for a biodiversity-based product is relatively limited. The story of Sibebe involves a historical tale, however this is more useful in marketing than in physical product development. The presence of old San habitation and some limited paintings in the area presents greater potential especially if the sites were developed through adding interpretive material and recreating paintings from other less accessible sites. The area also lends itself to Swazi cultural product development, especially in areas, which are already settled or are close to rural settlement. Potential for community-based product is high with an existing project proposal in place. Educational tourism for school groups that visit the rock for adventure and geographical/historical education purposes is a possibility.

Revenue-earning infrastructure could include an access permit system. Facilitating multi-points of access, rather than having one gate, would increase the utilization of the area. A single trail hut, campground facility would be a possibility, which hikers could reach from a secure parking area in Pine Valley. This could be used as a base of a day trails around the plateau. Longer treks are unlikely unless linked to excursions into community areas. A small character lodge would be the best form of development – possibly with a 4x4 shuttle from a peripheral parking area.

There is also great potential for guesthouses, B&B's, backpacker lodges and other small lodges in the Pine Valley area adjoining Sibebe. Electricity and telecomm lines are nearby, however for a scenery-based product the extension of these lines into the PWA would require careful planning. Water is available from springs. A challenge for this national attraction is to ensure that accommodation facilities on the periphery, as well as tourists bussed in from Ezulwini Valley and further a field are tied into making a meaningful contribution to the PWA management itself. There do exist project proposals from a community body, and a number of interested property owners in Pine Valley. Location and marketability point towards a great potential for this area as a sustainable tourism product. Estimates of revenue-earning potential range up to E 2 016 000 per annum. Over 50 jobs could be expected to be created. For further details see Appendices 10 and 13.

Table 8: Tourism rating of Sibebe PWA

	Sibebe	Max
1. Product Potential		
Location and setting	23	40
Aesthetic value	10	10
Extent and quality of wilderness	1	10
Unique natural features	10	10
Compatibility of neighbouring areas	2	10
Ease and variety of access	57	80
Access by foot	5	5
Access by horse	5	5
Access by bicycle	5	5
Access by 2-wheel drive	5	10
Access by 4-wheel drive	5	5
Access by coach	8	10
Access by train	0	5
Access by air	0	5
Distance from main tourist route	18	20
Alternate route potential	6	10
Marketability	56	60
Unique marketable features	10	10
Identifiable and accessible target markets	10	10
Linkages to tourism flows	10	10
Absence of safety risks	6	10
Absence of health risk factors	10	10
Attractiveness for domestic tourism	10	10
Nature and variety of product	47	80
Potential as activity hub (quality/variety of activities)	8	10
Potential for a scenery-based product	9	10
Potential for a biodiversity-based product	1	10
Potential for species specific tourism	1	10
Potential for historical or cultural product	8	10
Potential for community-based product	8	10
Potential for educational facilities	8	10
Potential for volunteer tourism	4	10
Potential for revenue-earning infrastructure	67	100
Potential for entry gate & fees	10	10
Potential for restaurant development	9	10
Potential for camp ground / trekking cabins	3	5
Potential for self-catering rest camp	1	10
Potential for tented camp	2	10
Potential for small character lodge	10	10
Potential for community tourism lodging	5	5
Potential for hotel / conference center	2	10
Accessibility of H ² O, electricity, telecom	25	30
2. Analysis of overall economic potential		
Factors enhancing economic potential	77	120
Length of potential stay in area	5	10

Variety of economic earning opportunities	7	10
Presence of local interest in development	8	10
Presence of local management/tourism skills	4	5
Investment capacity of local interests	3	5
Re-intro of species of economic value	1	10
Linkages to existing tourism infrastructure	18	20
Linkages to potential tourism initiative	5	10
Potential to stimulate local supply	4	10
Potential for self sustainability	9	10
Attractiveness for external investors	13	20
Development risk factors	(8)	(30)
Economic risks	(2)	(10)
Environmental risks	(4)	(10)
Health risks	(2)	(10)
Totals	319	480
3. Estimate of revenue earning potential		
Annual turnover category – high scenario	F	
Annual turnover category – med scenario	G	
Annual turnover category – low scenario	G	
4. Estimate of potential job creation	G	
	(55)	
Full-time skilled employment	18	
Full-time unskilled employment	8	
Part-time employment (number divided by 2)	10	
Indirect employment	9	
Employment during constr./development (number divided by 4)	10	

Nyonyane



Figure 8: Nyonyane PWA.

Biological

Ecosystems

Nyonyane (see map in Appendix 1) has moderate to high ecosystem value. From a global perspective, it is situated within the Zambebian and Mopane Woodland Ecoregion (WWF 2002) which is not of exceptional global importance (priority index 2). From a regional perspective, it contains three broad vegetation types. From a national perspective, it contains over 2% of the Granitic Lowveld Bushveld, which is not currently protected within the country. Although this vegetation type does extend into Mkhaya Game Reserve, the area protected is negligible (0.03%). Nyonyane also contains 2% of the Swaziland Sour Bushveld and almost 1% of the Kangwane Mountain Grassland within the country, both of which are already represented within Malolotja Nature Reserve and Mlilwane Wildlife Sanctuary. However, at present only 0.8% and 1.3% of these vegetation types respectively occur within proclaimed reserves. From a local perspective Nyonyane contains a high diversity of ecosystems. It contains ecosystems of all 4 biomes including 2 forest types, 2 grassland types, 3 savanna types and 2 aquatic types. It is an important catchment area containing 16 headwater streams.

The majority of the ecosystems are in good condition. However, much of the lower lying acacia, mixed and broadleaved savanna have been recently cleared for sugar cultivation and resettlement of people following the Maguga dam construction. Some of the grassland slopes have been heavily grazed in the past and are subject to sheet erosion. There is also significant encroachment of *Chromolaena odorata* into the drainage lines and valley bottoms. A variety of goods and services are currently provided by the ecosystems to the people of the area including, fresh water, livestock grazing, medicinal products, food, construction materials, recreational enjoyment.

Nyonyane PWA is of large size (193 Km²) and has a relatively high area to perimeter ratio (2.1). Potential future threats to the area include expanding human settlement, cultivation and infrastructure development. Conservation management should focus on addressing the problems of alien plant invasion and poaching (see Appendix 2). At the same time the area should be secured against the threats of expanding human settlement and inappropriate cultivation and infrastructure development, which might erode the goods and services currently provided and destroy the potential of the area for economic benefit through tourism.

Flora

The Nyonyane PWA is interesting botanically and hosts a wealth of indigenous plants many of which have restricted distributions (see Appendix 3) and/or are threatened. The PWA consists of a range of habitats including Highveld Grassland and Forest, Middleveld grassland, *Terminalia-Combretum* Broadleaf savanna and Riverine forest.

Nyonyane hosts a large diversity of species mainly due to its variation in vegetation types. It ranges from lowland broadleaf savanna and riparian vegetation up through a middleveld habitat into highveld grassland and forests. The area harbours 508 indigenous species, almost 15% of the countries indigenous flora which makes it an important area for conservation (see Table 11, Appendix 4).

It should be noted that data for this area was also extracted from available literature where literature was not available for the previous two areas. An Environmental Impact Assessment was carried out in 2000 for the area with included a comprehensive vegetation survey for the resettlement area, which falls within the proposed Nyonyane PWA. This vegetation survey was carried out over several months hence the detail is vast and cannot be directly compared to that of the data gathered for the 3 day surveys for the other PWAs described above. Results from the plots and transects are more indicative of the species richness of each area as described below.

No new records were discovered during the survey for Nyonyane PWA. 15 species which have restricted distributions were found, 3 of them are only found in Swaziland and one other country and 12 in Swaziland and two other countries. 9 red data species were noted of which two of them *Hemizygia petiolata* and *Ornithogalum saundersiae* are not recorded in a protected area. In addition, the endangered, much sort after, medicinal plant *Siphonochilus aethiopicus* has been recorded in the area and is a good reason to protect and manage the area for conservation.

Portions of Nyonyane PWA are in pristine condition but a significant area in the lower broadleaf savanna habitat has been modified for resettlement and is being used to cultivate sugar-cane and

for livestock grazing. Unfortunately with the past and present disturbance in the area, alien weeds have proliferated in some parts especially along road verges and in drainage lines. However, several riverine areas are still largely intact and some areas along the Komati River exhibit very fine almost pristine riverine vegetation (T De Castro pers comm.).

The results of the plots and transects indicate that the grasslands host the highest species richness (36 species/100m²), followed by forest (10 species/100m²) and savanna (8 species/100km²).

Fish, amphibians and reptiles

Located in the subtropical lowveld Nyonyane has a high diversity of fish, amphibian and reptile species. Fifty percent of Swaziland's fish species, 68% of Swaziland's amphibian species and 45% of Swaziland's reptile species have been confirmed or are presumed to occur in the area. One near-endemic reptile, the Barberton girdled lizard (*Cordylus warreni barbertonensis*) is presumed to occur in the area and this species is restricted to the middleveld region of Swaziland. Four Swaziland Red Data fish species, three regionally threatened fish species and two globally threatened fish species have been recorded from the Nyonyane and Nkomati Rivers in the area. The globally listed species are the Southern barred minnow (*Opsaridium peringueyi*) and the Lowveld rock catlet (*Chiloglanis swierstrai*). The latter occurs in three southern African river systems, two of which drain parts of Swaziland, the Incomati and Phongolo systems, and consequently the species is classified as restricted. The Phongolo rock catlet (*Chiloglanis emarginatus*) occurs in just two river systems in Swaziland and South Africa, the Incomati and Phongolo systems. Consequently the Swaziland populations of this species are regionally important, including the populations in the Nyonyane and Nkomati rivers.

The Nyonyane area provides suitable habitat for a high diversity of frog species, with 30 species being recorded. One regionally important amphibian, the Golden leaf-folding frog (*Africalus aureus*) is presumed to occur in the area. The reptile fauna of the area is also diverse with 50 species being recorded. The westernmost populations in Swaziland of two tortoise species, the Leopard tortoise (*Geochelone pardalis*) and Speke's hinged tortoise (*Kinixys spekii*) are found in the Nyonyane area. The Nyonyane area provides important protected habitat for a wide variety of fish, amphibian and reptile species and is a prime conservation area for these vertebrates.

Fifty (50) species of fish, forty-four (44) species of amphibians and one-hundred-and-eleven (111) species of reptiles are recorded from Swaziland (Boycott 1992b, 1996; Hyslop 1994). Twenty-five (25) species of fish, representing 50% of Swaziland's recorded species, thirty (29) amphibian species, representing 65.9% of Swaziland's recorded species and fifty (50) reptiles, representing 45.1% of Swaziland's recorded species, are presumed to occur in the Nyonyane PWA (see Table 11, Appendices 5 and 6).

Birds

The high species diversity recorded within the Nyonyane PWA is due to bushveld savanna extending over a large part of the area, together with the presence of numerous rivers and their associated riparian vegetation. A total of 90 species was recorded in the area (see Table 11, Appendix 7). Most of the birds recorded at Nyonyane were generalists, being widespread throughout Swaziland and highly adaptable to environmental change. Such species include the

Blackeyed Bulbul, Blackcollared Barbet, Familiar Chat, Paradise Flycatcher, Puffback, Whitewinged Widow and Pintailed Whydah. A few species were aquatic or riparian specialists such as the African Black Duck, Terrestrial Bulbul, Giant Kingfisher and the threatened Halfcollared Kingfisher.

A few small and fragmented patches of scarp forest were scattered throughout the area. These forests did not support species typically associated with high-altitude forests. In fact, no true forest birds were recorded here, although forest-edge species such as Paradise Flycatcher, Southern Boubou and Sombre Bulbul were common.

At higher altitudes, the vegetation was open grassland with scattered protea bushes. This habitat supported only a few species of birds, with cisticolas, widows and swallows being the most abundant species. No species associated with high-altitude grasslands were recorded.

None of the species were range-restricted and only two were threatened. The dearth of raptors in the area was highly noticeable and suggests that they are under pressure from hunters or, more likely, that their nest sites have been disturbed e.g. through the collection of eggs and chicks.

Habitats available to birds were generally in relatively good condition, and most species are probably not under any significant threat of local extinction.

In summary, the diverse avian community currently occurring in the Nyonyane area consists predominantly of widespread and common species that are not threatened. The conservation importance of this area to birds, therefore, is rather limited. However, the area could potentially serve as an important sanctuary for raptors. A re-introduction programme is not necessary, as raptors are good dispersers and will readily repopulate an area once the limiting factor (e.g. nest site disturbance) has been removed.

Mammals

Nyonyane like the majority of government farms has suffered from grazing and poaching pressure. Consequently, very few of the medium- to large-sized mammals were recorded in this and previous studies of this area. 18 species of mammals (14% of Swaziland's mammals) were recorded and only one of these are of regional and local conservation concern (see Table 11, Appendix 8). This area, from a mammalian point of view, is only important in that it is large. It has no obvious links with any of the other protected and/or protection-worthy areas. It still does provide suitable habitat for highveld forest and grassland species. A re-introduction programme would need to be instituted here, as there are very low numbers of medium- to large- sized mammals. Animals that could be re-introduced here include bushbucks, common duikers, red duikers, Meller's mongooses and honey badgers.

Table 9: Summary species information for Nyonyane PWA..

	Flora	Fish	Amphibians	Reptiles	Birds	Mammals
Number of indigenous species	508	25	30	50	90	18
Number of exotic species	30					
Total number of species in project area	538	25	30	50	90	18
Percentage of Swaziland's indigenous species for this taxon (%)	15	50	68	45	18	14
Number of new records for Swaziland	0		0	0	0	0
Number of endemic species	0		0	0	0	0
Number of species with restricted distributions	15	4	0	2	0	0
Number of species found only in Swaziland and one other country	3					
Number of species found only in Swaziland and two other countries	12					
Number of Swaziland Red Data species	9	4	1	2	2	1
Number of Regional Plant Red Data species (South Africa)	2	3	1	2	2	1
Number of red data/threatened species present not occurring in Pas	2		0	0	0	0

Socio-economic

Social

Meleti, Mzaceni, Ntsanjeni and Maphalaleni chiefdoms surround the Nyonyane PWA. The area falls under two tinkhundla centres, that is Madlangemphisi and Maphalaleni. The Swaziland Government under the Ministry of Agriculture administers Nyonyane Sisa Ranch.

Employment in the area is very low. Institutions such as the Sisa Ranch, Cane fields, and different types of business in Tshaneni provide employment for the people living in this area and its surroundings. There is an estimated population of 2743 (1997-population census) living in the area and its immediate surroundings.

There is one school in the area, namely Nyonyane Royal farm primary school, and a number of schools near the area, namely Maguga Dam primary and high school, Mzaceni primary, Madlangemphisi primary and high school, and Meleti, Ngomane and Maphalaleni schools.

Health facilities in the area are sparsely distributed, and include Maguga Dam clinic, Bhalekane clinic, Malandzela clinic, and Nsingweni clinic.

Local Uses of Nyonyane PWA include (also see Table 12):

1. *Medicinal Plants* – The area provides local people with medicinal plants, which they sell or use to cure a variety of ailments. This has led to the depletion of some of these plants which are in demand.
2. *Forest and grassland products* – A number of forest and grassland products such as grass, fruits, poles are being used by the locals. The grass is used for thatching and handicraft. Marula fruits are collected for the traditional brew during its season. The

poles are mainly used for house building. A few tree species are specifically used for kraal building and fencing.

3. *Firewood* – Dead trees provide a good source of fuel for cooking and warming up during cold seasons.
4. *Hunting* – Hunting of the few remaining mammal species is carried out in the area. Some of these species that were mentioned are impunzi (grey duiker), umsumpe (red duiker), logwajwa (scrub hare), and imbolwane (slender mongoose), emavondvo, impala, ingulube yesiganga, imbabala.

The survey was able to include the overseer of the King’s farm at Nyonyane, the inner council of the area, Indvuuna of Entsanjeni, indvuna of Madlangemphisi, and the Field Manager of Ekuvinjelweni Farmers Association. The Indvuna of Ntsanjeni felt that conservation of the area could be promoted as long as it does not affect the current farm activities. The inner council also liked the idea of conserving the area because they feel it would reduce land degradation and restore natural resources. The others saw this idea as vehicle to economic development through employment and promotion of local tourism.

Most of the local people interviewed had no objection to the idea. They believe there will be employment opportunities, tourists would buy their wares, and natural resources would be conserved. Some would like to see the project on the hills where they do not use the land for farming. Those who did not like the idea complained that the cattle herders would lose jobs and they feel the land is good for farming. For further details see Appendix 9.

Table 10: Scores of social importance of Nyonyane PWA, based on qualitative assessment of results.

Criterion	Score	Remarks
1. Proportion of people willing to manage for conservation	8/10	
2. Level of usage of PWA by locals	4/10	
3. Presence of areas of religious, spiritual or historical significance	4/10	
4. Occurrence of species of high social or economic value	5/10	
5. Locals’ access to centers of education and health	6/10	
6. The importance of ecosystem services provided by the PWA to the community	6/10	
7. People’s dependance, either economically or otherwise upon PWA resources	4/10	

Tourism

This area combines mountaintop views with densely vegetated valleys and some potential game-viewing areas. There are a number of large streams in the area and the Komati River itself is one of Swaziland's major watercourses. Due to the size of this PWA, there are a lot of undisturbed views, although habitation and resettlement along the Komati River has compromised the full potential of this area for the long-term. There is limited true wilderness, however within the valleys and lower ground of the PWA there are fairly extensive areas where a definite feeling of space, and seclusion can be achieved. This PWA is almost totally surrounded by SNL or farmland and will continue to be settled into the future, especially with the investments made in infrastructure in the area downstream of Maguga Dam.

This PWA is in the proposed Biodiversity and Tourism Corridor, linking South Africa with Mozambique through Swaziland and therefore this area is of great importance. This area would be a valuable component of any National Trail Network. Climate and trails are suitable for horses. Horse riding along the crest Malanzela range would be an incredible product. Although brutally steep in places, the nature of the area and the presence of numerous small single-track paths make the area attractive for mountain biking. A number of all-weather roads have been developed on the periphery of the area. There is definite potential for 2-wheel drive access to various potential lodge and development sites. Travel within the area would however be difficult as gradients are steep and roads will be very expensive to develop and maintain. 4x4's would no doubt be the preferred means of transport for sightseeing tours and game viewing. Local buses can reach the periphery without difficulty, however tourist coach access is unlikely.

The PWA is definitely not adjacent to any major tourism routes. However a Biodiversity and Tourism Corridor marketing could change this. No unique marketable features stand out and there would need to be extensive marketing to put this PWA on the map (see Table 13). The best opportunity would be a game lodge style development, invested in or run by an international chain hotel group. Target markets could be a mixture of niche markets associated with the activities listed below, and more mainstream tourism attracted by a game lodge and scenery orientated product. Early stages of development could attract pioneering style operations such as overland tour groups and volunteer tourism. Domestic tourism potential is fairly limited due to the traveling distances required to reach here, although a strong game focused product may draw some interest. Due to the size of the area, this PWA has good potential as an activity hub, as activities could easily be zoned. Possible attractions include:

- Day walks or overnight trekking between camps and/or trekking cabins
- Mountain Biking (MTB), and horse-riding (game area or along main ridge)
- Paragliding – lot of opportunity
- Canoeing and tubing could be possible if Maguga releases water regularly
- 4x4 routes, quad bikes – possibly on zoned routes
- Bird-watching on foot if suitable trails are cut
- Sundowner view sites
- Clay pigeon shooting
- Fishing – dam/lake (one small artificial dam)
- Game-viewing by vehicle or on foot

- Hunting
- Volunteer tourism on social or environmental programs

Although not linked to any one particular feature – any facilities built on the high ground of this area would be able to trade off the scenic values of this area. This area has potential to develop a major game and nature-based product. Potential exists for the re-introduction of high profile species such as black rhino. From provision of lodging in peripheral areas to offering of guiding services for the variety of potential activities there is good potential for community involvement and interaction in this area. The potential for local school children to access an educational style facility or for game viewing in the lower area exists. There is also potential for a youth leadership style of training center, focusing on outdoor activities, as well as environmental and social issues.

A manned control point could be established near the main access point to the area (south-west corner) with an additional access points in west. Trekking cabins or campgrounds could be easily developed and could double as overnight facilities for 4x4 groups, horse-riding trails or mountain bikers. A large rest camp would be feasible either on the high ground or down in the valley. A game type attraction can pull mass-market support. A circular vehicle route around this PWA, either for 4x4, but preferably for 2-wheel drive as well – would be very valuable. A tented camp or small character lodge would be good if looking down into Melete Valley. A medium-sized hotel (large game lodge) is possible, particularly if linked or managed by an international tourism group with strong marketing capacity. A small conferencing facility could be part of this. Most sites have access to water, although mountaintop sites would need to pump water considerable distances. The larger development sites should ideally be on the periphery of the area so as to access electricity and telephone supply points.

The area is owned by Tibiyo TakaNgwane. This organisation has stated interests in expanding its tourism portfolio and has a large investment portfolio and a history of attracting international co-finance. The presence of private land and a major local shareholder to share the risks of investment are a definite incentive for external investment, as is the shared marketing cost of having Biodiversity and Tourism Corridors project umbrella marketing in place. Game species could be introduced and farmed for sale, hunting or meat.

An estimate of revenue-earning potential ranges from a conservative E 13 416 600 per annum for a full scale investment at high occupancies down to E 4 302 000 per annum for low occupancies. Over 200 jobs could be feasibly created. For further details see Appendices 10 and 14.

Table 11: Tourism rating of Nyonyane PWA

	Nyonyane	Max Rating
1. Product Potential		
Location and setting	19	40
Aesthetic value	8	10
Extent and quality of wilderness	5	10
Unique natural features	0	10
Compatibility of neighbouring areas	6	10
Ease and variety of access	38	80
Access by foot	5	5
Access by horse	5	5
Access by bicycle	4	5
Access by 2-wheel drive	7	10
Access by 4-wheel drive	5	5
Access by coach	0	10
Access by train	0	5
Access by air	0	5
Distance from main tourist route	10	20
Alternate route potential	2	10
Marketability	32	60
Unique marketable features	2	10
Identifiable and accessible target markets	7	10
Linkages to tourism flows	3	10
Absence of safety risks	8	10
Absence of health risk factors	8	10
Attractiveness for domestic tourism	4	10
Nature and variety of product	51	80
Potential as activity hub (quality/variety of activities)	7	10
Potential for a scenery-based product	6	10
Potential for a biodiversity-based product	7	10
Potential for species specific tourism	6	10
Potential for historical or cultural product	4	10
Potential for community-based product	5	10
Potential for educational facilities	8	10
Potential for volunteer tourism	8	10
Potential for revenue-earning infrastructure	62	100
Potential for entry gate & fees	10	10
Potential for restaurant development	0	10
Potential for camp ground / trekking cabins	3	5
Potential for self-catering rest camp	8	10
Potential for tented camp	10	10
Potential for small character lodge	10	10
Potential for community tourism lodging	5	5
Potential for hotel / conference center	6	10
Accessibility of H ² O, electricity, telecom	10	30

2. Analysis of overall economic potential		
Factors enhancing economic potential	85	120
Length of potential stay in area	5	10
Variety of economic earning opportunities	6	10
Presence of local interest in development	7	10
Presence of local management/tourism skills	2	5
Investment capacity of local interests	5	5
Re-intro of species of economic value	10	10
Linkages to existing tourism infrastructure	10	20
Linkages to potential tourism initiative	10	10
Potential to stimulate local supply	8	10
Potential for self sustainability	7	10
Attractiveness for external investors	15	20
Development risk factors	(16)	(30)
Economic risks	(8)	(10)
Environmental risks	(4)	(10)
Health risks	(4)	(10)
Totals	271	480
3. Estimate of revenue earning potential		
Annual turnover category – high scenario	A	
Annual turnover category – med scenario	B	
Annual turnover category – low scenario	E	
4. Estimate of potential job creation	B	
	244	
Full-time skilled employment	100	
Full-time unskilled employment	30	
Part-time employment (number divided by 2)	16	
Indirect employment	44	
Employment during constr./development (number divided by 4)	54	

Comparison of Makhonjwa, Manzimnyame, Sibebe and Nyonyane PWA's

Biological

Ecosystems

From a global perspective, the Manzimnyame PWA is of greatest importance since it is within the ecoregion of highest global priority, while the Nyonyane PWA is within the ecoregion of lowest priority (see Table 14). From a national perspective the picture is reversed. The Nyonyane PWA is the only one that contains a vegetation type not yet protected within the country and it also contains the next most under conserved vegetation type of the four areas, whereas a relatively high proportion of the vegetation of Manzimnyame is currently conserved. In terms of local ecosystem diversity Makhonjwa is greatest, with all 4 biomes and 11 ecosystem types represented. Sibebe has the lowest diversity with 3 biomes and 7 ecosystem types represented. The Manzimnyame ecosystems are generally in best condition largely owing to the lack of human disturbance the area.

Table 12: Summary ecosystem information for Makhonjwa, Manzimnyame, Sibebe and Nyonyane PWAs. (All areas in Km² all distances in Km).

Criterion			Makhonjwa	Sibebe	Manzimnyame	Nyonyane
Global ecoregions present		Drakensberg Afro-montane Grassland and Woodland (priority index 3)	Yes	Yes		
		Zambezi and Mopane Woodland (priority index 2)				Yes
	Priority	Maputoland Coastal Forest (priority index 4)			Yes	
National % of vegetation types present	In PA	Barberton Sourveld Grassland (1.4% protected)	9.59	0.50		
		Swaziland Sour Bushveld (0.8% protected)	0.67	0.32		1.97
		KaNgwane Montane Grassland (1.3% protected)				0.89
	Not in PA	Southern Lebombo Bushveld (4.5% protected)			9.35	
		Granitic Lowveld Bushveld				2.13
Local ecosystems present	Forest	Mistbelt Forest	Yes			
		Scarp Forest	Yes	Yes	Yes	Yes
		Riverine Forest	Yes			Yes
		Lubombo Dry Forest			Yes	
	Grassland	Montane Grassland	Yes			
		Highveld Grassland	Yes	Yes		Yes
		Tall Grassland Slopes	Yes	Yes	Yes	Yes
	Savanna	Broadleaved Savanna Slopes	Yes		Yes	Yes
		Bushclump savanna			Yes	
		Mixed savanna				Yes
		Thorn thicket				
			Dry Acacia savanna		Yes	
			Moist Acacia savanna			Yes
	Aquatic		Perennial Headwater Streams	8	15	0

Perennial Rivers	2	1	0	2
Seasonal rivers			1	
Seasonal pans				
Perennial marshes and pools	1	1	8	2
Seasonal marshes and pools			yes	
Freshwater springs	Yes	Yes		
Cave water systems				
Size of area (Km ²)	45	28.6	123.5	192.9
Perimeter of area (Km)	43	25.5	54.2	91.5
Area:Perimeter ratio	1.05	1.12	2.28	2.11
Distance to nearest PA (not only in Swaziland)	0	8	3.6	17.9

Flora

In terms of total number of species, Nyonyane has the highest recordings of plant species numbers followed by Makhonjwa then Manzimnyame and Sibebe (refer Table 15 below). However, this is not necessarily an accurate reflection of the total species richness as Nyonyane was surveyed in greater detail to that of the other PWAs, hence more species were captured.

Makhonjwa and Manzimnyame support the most threatened species, and Manzimnyame and Sibebe both support endemics. All except Sibebe host a couple of regionally (found in South Africa) significant Red Data species.

Sibebe has the highest mean species richness (19.8 per 100m²) and Makhonjwa the lowest (12.9 per 100m²) but the difference between them all is relatively low.

Table 13: Comparative plant species richness, number of threatened species, mean species richness of the four PWAs. The latter calculated from the plots and transects.

	Makhonjwa	Manzimnyame	Sibebe	Nyonyane
Number of indigenous species	299	251	165	508
Number of exotic species	15	6	2	30
Total number of plant species	314	257	167	538
Percentage of Swaziland's flora %	9	8	5	15
Number of new records for Swaziland	6	4	0	0
Number of endemic species	0	1	1	0
Number of species with restricted distributions	20	6	11	15
Number of species found only in Swaziland and one other country	15	1	4	3
Number of species found only in Swaziland and two other countries	5	5	7	12
Number of Swaziland Plant Red Data species	16	17	5	9
Number of Regional Plant Red Data species (South Africa)	3	2	1	2
Number of red data species present not occurring in PAs	7	4	2	2
Mean species richness (per 100 m ²)	12.9	15.6	19.8	15.9

Makhonjwa harbors the highest number of species with restricted distributions and Manzimnyame the lowest, yet Makhonjwa and Manzimnyame support the highest numbers of

red data species present not occurring in any Protected Areas in the country, which highlights their importance as conservation areas.

At present, Makhonjwa is highly threatened in terms of potential habitat destruction from dagga cultivation and commercial plantations.

Nyonyane is threatened by increased settlements and related sugar cane cultivation even though these practices are supposed to be managed and confined to the limits of the host area, which is fenced in.

Sibebe is threatened by increased settlement in the area, the invasive *Acacia mearnsii* and improved accessibility. Manzimnyame is the least threatened in terms of habitat destruction as it is the most inaccessible and least developed of the three areas. All four areas are threatened by alien invasive plants, either *Chromolaena odorata* and/or *Lantana camara* and/or *Acacia mearnsii* but Manzimnyame is to a lesser extent.

With all these factors together it would be wise for Swaziland to conserve all four areas as soon as possible because they all contribute significantly to Swaziland's natural vegetation.

Makhonjwa and Manzimnyame, being part of the centres of Plant Endemism are vitally important areas for conservation in the country, supporting very different plant species.

Nyonyane and Sibebe are very important areas linking the two Centres and support certain species that are not found in either of other two PWAs.

Fish, Amphibians and Reptiles

The four PWAs surveyed represent a cross section of the natural habitats found in Swaziland. Two of the areas, Makhonjwa and Sibebe, are located in the highveld region where the dominant habitats include Afromontane grassland and Afromontane forest; Amanzimnyame, located in the Lubombo region, has a range of arid savanna, bushclump and tropical forest habitats; and Nyonyane located in the ecotone between the middleveld and lowveld has a mosaic of savanna, bushveld and grassland habitats. A wide range of wetland habitats is also present in the four areas including upland seepage areas and sponges, seasonal streams and rivers, perennial headwater streams, perennial pools in riverbeds, medium and large rivers. This range of habitats provides suitable habitat for a wide variety of fish, amphibians and reptiles.

A total of one-hundred-and-sixty-four (164) fish, amphibian and reptile species are recorded from the four Protection-worthy areas (Table 16). Thirty-seven (37) species of fish representing 74% (37/50) of Swaziland's fish fauna have been recorded from the four areas. Thirty-eight (38) species of amphibians representing 86.4% (38/44) of the amphibian fauna and eighty-nine (89) species of reptiles representing 80.1% (89/111) of the reptile fauna have been recorded from the four areas.

One-hundred-and-seventeen (117) species, composed of 20 fish, 30 amphibians and 67 reptiles, are recorded from the Manzimnyame area. This is followed by 104 species (25 fish, 29 amphibians, 50 reptiles) from Nyonyane, 99 species (21 fish, 20 amphibians, 58 reptiles) from Makhonjwa and 59 species (15 amphibians, 44 reptiles) from Sibebe (Table 16). Twenty-nine (29) threatened species of fish (11), amphibians (4) and reptiles (14) are listed for Swaziland (Monadjem *et al.* in prep) and for neighbouring South Africa, 16 species (6 fish, 1 amphibian and 9 reptiles) that occur in Swaziland, are listed (Skelton 1987; Branch 1988) (Table 16). The

Makhonjwa area has eight Swaziland listed species (6 fish and 2 reptiles) and five South African listed species (3 fish and 2 reptiles). Seven Swaziland (4 fish, 1 amphibian, 2 reptiles) and six South African (3 fish, 1 amphibian, 2 reptiles) listed species are recorded from Nyonyane and six Swaziland (1 fish, 1 amphibian, 4 reptiles) and six South African (1 fish, 1 amphibian, 4 reptiles) listed species are recorded from the Amanzimnyame area. Amongst the fish, amphibian and reptile faunas there is one Swaziland endemic species. This is the Swazi thick-tailed rock gecko (*Afroedura major*) and out of all four areas it occurs only in the Sibebe area. Twenty (20) species of the 164 recorded from the four areas, composed of 9 fish and 11 reptiles, have restricted distributions.

For fish a restricted species is a species restricted to one, two or three river systems (in Swaziland and South Africa) whereas for the amphibians and reptiles if a species' total distribution in southern Africa is less than 50 000 sq. km it is considered a restricted species. Of the 20 restricted species the majority 55% (11/20), composed of 5 fish and 6 reptiles, occur in the Makhonjwa area. Nyonyane has six (4 fish, 2 reptiles) restricted species whereas Manzimnyame and Sibebe each have five (all reptiles). While the Makhonjwa area may be critically important, in respect of threatened species, for the fish fauna the Manzimnyame and Sibebe areas are as important for the reptile fauna. As may be seen from the above whether one considers pure numbers of species, threatened species, endemic species or species with restricted distribution ranges, all four areas are equally important for the protection of a wide variety of species. The biodiversity and conservation importance of each area in respect of the fish, amphibian and reptile fauna is shown in the table (Table 16).

Table 14: Summary of biodiversity and conservation importance for fish, amphibians and reptiles from the Makhonjwa, Manzimnyame, Sibebe and Nyonyane PWAs. (Note. Totals of fish, amphibian and reptile species are given in sequential order in parenthesis)

CATEGORIES	SWAZILAND TOTALS	MAKHONJWA	MANZIMNYAME	SIBEBE	NYONYANE
All species (Fish, amphibians, reptiles)	164 (37+38+89)	99 (21+20+58)	117 (20+30+67)	59 (0+15+44)	104 (25+29+50)
SD Red Data species	29 (11+4+14)	8 (6+0+2)	6 (1+1+4)	4 (0+0+4)	7 (4+1+2)
SA Red Data species	16 (6+1+9)	5 (3+0+2)	6 (1+1+4)	1 (0+0+1)	6 (3+1+2)
Endemic species	1 (0+0+1)	0 (0+0+0)	0 (0+0+0)	1 (0+0+1)	0 (0+0+0)
Restricted range species	20 (9+0+11)	11 (5+0+6)	5 (0+0+5)	5 (0+0+5)	6 (4+0+2)

Birds

In total, 184 bird species were recorded in the four areas representing just 37% of the country's avian diversity. More importantly, 15 threatened species were recorded representing 27% of the nationally threatened species. Considering that these four areas support a large range of the natural habitats available to birds in Swaziland, one would have expected a far greater number of

species to have been recorded. However, it must be borne in mind that these areas were only surveyed for three days, and not necessarily at the best time of the year. It would, therefore, be invalid to compare these figures with those from existing protected areas where more complete survey work has been conducted. Comparisons should be restricted to between the four study areas (refer Table 17, below).

Makhonjwa, Manzimnyame and Nyonyane all support similar avian richness. Manzimnyame supported, by far, the largest number of threatened species, while Nyonyane supported just two such species. Sibebe and Makhonjwa supported intermediate numbers. Based solely on these figures, it would appear that Manzimnyame has the highest significance for bird conservation in Swaziland. But this is not necessarily so. All the threatened species recorded at Manzimnyame have also been recorded at Hlane or Mlawula reserves. In contrast, Makhonjwa supports at least one threatened species not recorded elsewhere in Swaziland (Yellowstreaked Bulbul) and several others with extremely limited distributions in Swaziland (Orange Ground Thrush and Brown Robin). This illustrates the point that the use of species numbers alone may provide misleading interpretations, and that species composition needs to be incorporated into such analyses.

Sibebe's main contribution to bird conservation is the fact that it supports a small breeding population of the critically endangered Blue Swallow. The Sibebe population is almost certainly not viable (probably only 2-3 pairs breed there). However, it forms part of a greater meta-population that includes the Malolotja and Pine valley birds. Only around 80 pairs of these swallows breed south of the Limpopo River. In this context, the Sibebe population (and especially the Swazi meta-population) is highly significant.

Mean species richness and mean relative density values were calculated from the timed-count transects and are also presented in Table 17 below. Time-counts were not performed at Sibebe and hence mean richness and density could not be calculated for that site. Manzimnyame had the highest mean species richness, followed by Nyonyane and Makhonjwa, respectively. The three areas have similar total species richness. Differences in mean species richness, therefore, suggest differences in species turn-over. At Makhonjwa, where mean species richness was lowest, fewer species were recorded per transect and a greater number of new species were recorded in different transects. In contrast, Manzimnyame recorded more species per transect, many of which were recorded in subsequent transects. This has implications for bird watching. At Makhonjwa, fewer species are seen per unit time, but new species are continuously added at a high rate. The opposite would hold true for Manzimnyame.

Mean relative density is a reflection of the population densities of birds. Highest densities were recorded at Nyonyane and lowest densities at Makhonjwa. This follows the well-known trend of high bird densities in savannas, with lower densities in grasslands and forest. Relative density, in itself, does not have much bearing on the conservation potential of an area. However, it is a useful tool in situations where sites have similar biodiversity parameters (such as total richness, number of threatened species, etc). This does not appear to be the case here.

In summary, Makhonjwa and Manzimnyame appear to have greater conservation value for birds than the other two sites. However, Sibebe's role in supporting the critically threatened Blue Swallow, should not be under-estimated.

Table 15: Comparative avian richness, number of threatened species (Swaziland), mean species richness and mean relative density of the four PWAs. The latter two scores were calculated from the timed-count transects.

	Makhonjwa	Manzimnyame	Sibebe	Nyonyane
Total number of species	94	88	45	90
Percent of Swaziland's birds	19	18	9	18
Number of species with restricted distributions	4	9	2	0
Number of nationally threatened species (Swaziland)	5	9	4	2
Number of regionally threatened species (South Africa)	5	9	4	2
Number of red data species present not occurring in PAs	3	2	2	2
Mean species richness	8.4	13.4	-	11.8
Mean relative density	14.2	18.4	-	23.7

Mammals

Overall, 50 mammal species were recorded in the four areas; this is 39% of the country's mammal species. Of these 10 are locally threatened which represents 21% of the nationally threatened mammal species. Furthermore, 5 species are regionally threatened and 3 globally threatened. The number of mammal species recorded could have been higher but for several factors. Fewer small mammals were caught than anticipated probably a consequence of the unpredictable rains and the time of year when sampling was done in some of the areas. The larger mammals have generally been hunted out of Swazi Nation Land and those on private lands are under severe poaching pressure. This means very low numbers of mammals (especially the medium- to large-sized ones) exist outside of protected areas.

These four areas are similar in that they have been subjected to various pressures resulting in low numbers of mammals and mammal species. Makhonjwa, however, supports the largest number of mammal species with Manzimnyame, Sibebe and Nyonyane supporting similar numbers. Makhonjwa supports a greater number of threatened species, 4 locally threatened and 3 regionally threatened. In this regard Makhonjwa is followed by Sibebe (3 locally threatened and 1 regionally threatened), then Nyonyane (1 locally threatened and 1 regionally threatened). Sibebe had no mammal species that are locally or regionally threatened. This however should not detract from the value of each of these areas towards mammal conservation. Species numbers are generally misleading as within reserves the numbers are high as a result of heavy protection and occasionally low predation pressure whereas outside reserves the numbers are low due to habitat alteration and poaching.

Makhonjwa, Manzimnyame and Sibebe have possible linkages with adjacent protected areas and this adds to their value. Nyonyane's value lies in its large size. From a mammalian perspective, the importance of each of the PWAs was determined taking into account the size of the area, its condition, the type and quality of available habitats. Proximity and density of the adjacent community and its dependence on the area also counted. Importantly, the number of mammal species recorded in the area (and the number of red data book species) was also taken into

consideration. Manzimnyame was of highest importance followed by Makhonjwa with Sibebe and Nyonyane ranking equally. Though Sibebe is not a particularly large area, it is as important as Nyonyane due to its threatened highveld grassland. This area could be linked to Hawane Nature Reserve and possibly Malolotja thus increasing the total area of highveld grassland under protection.

Table 16: Summary mammal information for Makhonjwa, Manzimnyame, Sibebe and Nyonyane PWAs.

	Makhonjwa	Manzimnyame	Sibebe	Nyonyane
Number of indigenous species	28	20	16	18
Percentage of Swaziland's indigenous mammals	22	16	13	14
Number of endemic species				
Number of species with restricted distribution				
Number of Swaziland's RDB species	4	3		1
Number of regional RDB species	3	1		1

Socio-economic

Social

Three of the four areas are either title deed land (privately owned) or crown land. Only Sibebe falls on Swazi Nation Land. Nyonyane and Mazimnyame are crown land while Makhonjwa is largely privately owned.

Makhonjwa, Sibebe and Nyonyane showed the highest proportion of people willing to have the areas managed for conservation. In Makhonjwa this is greatly influenced by the fact that most of the landowners clearly want to have the area protected. Many of the locals are also not opposed to this, though there are some concerns about losing dagga growing and cattle grazing opportunities. In Sibebe, the people are not opposed to managing the area for conservation though they seem to be concerned about loss of grazing and certainly do not want dangerous animals. In the case of Nyonyane the major reason why people are indifferent to managing the area for conservation is that they have always been excluded from the area. Manzimnyame has lower proportion of people willing to have the area managed for conservation and this is largely because the Farmers' Association is using part of the land and have plans on it for the future.

The communities around Nyonyane and Manzimnyame appeared to use the respective areas least while greater usage was detected from Makhonjwa and Sibebe. In fact on top of Sibebe there are few households of the Gama extended family. All the PWAs recorded low for areas of religious, spiritual or historical significance with the exception of Sibebe, which recorded slightly higher due to the granite boulder.

On the occurrence of species of high social or economic value Makhonjwa and Manzimnyame recorded very high and this was also influenced by the occurrence of plant species used by royalty for various functions including Incwala. People are very secretive about the actual names of species.

The people of around Makhonjwa PWA rated highly the ecosystem services provided by the PWA. This was mainly due to the availability of water and the medicinal plants. People's dependence on the PWA's was also highest in Mkhonjwa (medicinal plants, cattle grazing, dagga cultivation) and Manzimnyame (farmers association current use and future plans).

From a social perspective the different PWAs rank as follows: Makhonjwa, Manzimnyame, Sibebe and Nyonyane (see Table 19).

Table 17: Scores of social importance for Makhonjwa, Manzimnyame, Sibebe and Nyonyane PWAs, based on qualitative assessment of results.

Criterion	Makhonjwa	Manzimnyame	Sibebe	Nyonyane
1. Proportion of people willing to manage for conservation	8/10	6/10	8/10	8/10
2. Level of usage of PWA by locals	7/10	5/10	6/10	4/10
3. Presence of areas of religious, spiritual or historical significance	4/10	4/10	6/10	4/10
4. Occurrence of species of high social or economic value	9/10	9/10	6/10	5/10
5. Locals' access to centers of education and health	4/10	7/10	6/10	6/10
6. The importance of ecosystem services provided by the PWA to the community	9/10	5/10	6/10	6/10
7. People's dependence, either economically or otherwise upon PWA resources	8/10	7/10	4/10	4/10

Tourism

In terms of product potential the smallest area came out tops (see Table 20). The Sibebe PWA is the least remote and probably the least protectionworthy from a biodiversity perspective, yet in the commercial world its combination of accessibility, unique marketability and potential for revenue earning infrastructure make it a clear leader with a score of 250. Next is the Nyonyane PWA, which again due to the "dreams" built on its natural features is a healthy bet for commercial success. The Makhonjwa PWA is a close third and in fact hardly different in score at 192. In contrast, the Manzimnyame PWA, which in his own opinion the author found most appealing and emotionally most worthy of protection, came a distant forth with 160 points.

When looking at economic potential the top two above, were tied at 69 points a piece. If looking at the significance of this measure, the economic factors here include a lot more reality then the collection of dreams that make up the product potential. Makhonjwa was again third with 58 points whilst Manzimnyame again trailed with 23 points.

In an attempt to put figures to this theoretical potential the Nyonyane PWA came out significantly ahead of the rest as an A category area, capable in the best scenario of generating

over E 13m per annum, if the projected investment was made. All the others were F category, with revenues predicted at approximately E 2m per annum, with surprisingly no real difference between the projected turnovers of the high product and economic potential Sibebe PWA and the least conceptually attractive Manzimnyame PWA.

In terms of employment generation, this mirrored the projected revenue figures, with Nyonyane being a major employer of over 250 jobs whilst Makhonjwa and Manzimnyame both had projections of around 100 positions. Sibebe trailed with a little over 50 positions, however it should be remembered that this study only counted likely statistics within the PWA's. Sibebe's protection would have a more significant positive impact its surrounding area than any of the other areas surveyed. Although, that said, without the Nyonyane PWA there is likely to be a huge gap in the globally important Biodiversity and Tourism Corridor, which also includes Makhonjwa and Manzimnyame.

Table 18: Comparison of Results

	Makhonjwa	Manzimnyame	Sibebe	Nyonyane	Max Rating
1. Product Potential					
Location and setting	20	30	23	19	40
Aesthetic value	7	10	10	8	10
Extent and quality of wilderness	4	9	1	5	10
Unique natural features	0	4	10	0	10
Compatibility of neighbouring areas	9	7	2	6	10
Ease and variety of access	38	26	57	38	80
Access by foot	5	3	5	5	5
Access by horse	5	1	5	5	5
Access by bicycle	4	1	5	4	5
Access by 2-wheel drive	1	1	5	7	10
Access by 4-wheel drive	5	4	5	5	5
Access by coach	0	0	8	0	10
Access by train	0	0	0	0	5
Access by air	0	0	0	0	5
Distance from main tourist route	16	10	18	10	20
Alternate route potential	2	6	6	2	10
Marketability	33	25	56	32	60
Unique marketable features	2	6	10	2	10
Identifiable and accessible target markets	7	6	10	7	10
Linkages to tourism flows	8	5	10	3	10
Absence of safety risks	7	5	6	8	10
Absence of health risk factors	6	1	10	8	10
Attractiveness for domestic tourism	3	2	10	4	10
Nature and variety of product	47	25	47	51	80
Potential as activity hub (quality/variety of activities)	10	2	8	7	10
Potential for a scenery-based product	2	8	9	6	10
Potential for a biodiversity-based product	3	7	1	7	10
Potential for species specific tourism	0	4	1	6	10
Potential for historical or cultural product	8	1	8	4	10
Potential for community-based product	8	2	8	5	10
Potential for educational facilities	6	0	8	8	10
Potential for volunteer tourism	10	1	4	8	10
Potential for revenue-earning infrastructure	54	54	67	62	100
Potential for entry gate & fees	10	8	10	10	10
Potential for restaurant development	0	0	9	0	10
Potential for camp ground / trekking cabins	5	5	3	3	5
Potential for self-catering rest camp	2	6	1	8	10
Potential for tented camp	8	8	2	10	10
Potential for small character lodge	8	7	10	10	10
Potential for community tourism lodging	5	3	5	5	5
Potential for hotel / conference center	6	2	2	6	10
Accessibility of H ² O, electricity, telecom	10	15	25	10	30

2. Analysis of overall economic potential					
Factors enhancing economic potential	67	39	77	85	120
Length of potential stay in area	9	7	5	5	10
Variety of economic earning opportunities	7	3	7	6	10
Presence of local interest in development	8	2	8	7	10
Presence of local management/tourism skills	2	1	4	2	5
Investment capacity of local interests	1	1	3	5	5
Re-intro of species of economic value	3	1	1	10	10
Linkages to existing tourism infrastructure	14	2	18	10	20
Linkages to potential tourism initiative	7	9	5	10	10
Potential to stimulate local supply	6	3	4	8	10
Potential for self sustainability	5	5	9	7	10
Attractiveness for external investors	5	5	13	15	20
Development risk factors	(9)	(16)	(8)	(16)	(30)
Economic risks	(5)	(5)	(2)	(8)	(10)
Environmental risks	(2)	(2)	(4)	(4)	(10)
Health risks	(2)	(9)	(2)	(4)	(10)
Tourism Product Potential (subtotal)	192	160	250	202	
Overall Economic Potential (subtotal)	58	23	69	69	120
Total of all quantitative assessments	250	183	319	271	480
3. Estimate of revenue earning potential					
Annual turnover category – high scenario	F	F	F	A	
Annual turnover category – med scenario	G	G	G	B	
Annual turnover category – low scenario	G	G	G	E	
4. Estimate of potential job creation	E	E	G	B	
	(114)	(106)	(55)	244	
Full-time skilled employment	36	37	18	100	
Full-time unskilled employment	20	20	8	30	
Part-time employment (number divided by 2)	15	6	10	16	
Indirect employment	18	24	9	44	
Employment during constr./development (number divided by 4)	25	19	10	54	

It should be noted that of all the studies undertaken in these PWAs, the tourism analysis is the most subjective and the least tied to actual collectable data. Tourism is an industry of dreams. It is a “can do” industry that can make forests appear in deserts and beaches appear thousands of miles from the sea. In recent times, tourism has been harnessed for the benefit of the environment. Ecotourism is now a key tool for generating revenue flows that provide the economic safety net for threatened environments and species. Its nonconsumptive nature allows otherwise threatened resources to be managed sustainably, in a world where diminishing space and diminishing resources is putting incredible pressure on the global environment.

In looking at this analysis it should be remembered that tourism can be made to do anything its proponents wish it to achieve. The product potential here is merely a listing of dreams not fact. Although it is a guideline, the actual fact is that with enthusiasm, dedication and suitable investment two lodges could be built instead of one, a ten trekking lodges could be built instead

of five and species could be re-introduced that have not even been considered here. The whole scenerio could change with just one or two unique marketing ideas.

So if anything – the value of this analysis is to stimulate dreams and enthusiasm for making tourism work for the environment. The figures and the potential projects they represent are not cast in stone and they can be pushed, bent and stretched to achieve what is needed of them.

Recommendations

It is recommended that the remaining 12 high priority areas be surveyed using similar methods and that the results of these surveys be compared to prioritize areas for legal proclamation and initiate realistic levels of conservation management of all of these PWAs.

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