A new Model towards Sustainable Socio-Economic Development using the principles of Bioregionalism, illustrated through a case study in SW Botswana

by Erica Ingrid Wiersma

ERICA INGRID WIERSMA (WRSERI002) in partial completion of MLA THESIS (APG5052S) October 2009
Head of Department : C. HINDES, UNIVERSITY OF CAPE TOWN
External Supervisor : PROF. W.F. VAN RIET

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Glossary

BIOREGION
Miller (1996) defines a bioregion as a *geographical space that contains one whole or several nested ecosystems characterised by landforms, vegetative cover, human culture and history as identified by local communities, governments and scientists'.*

The IUCN describes a bioregion as a *land and water territory, the limits of which are not defined by political but the geographical boundaries of human communities and ecological systems.*

The author has adopted the following definition for the purposes of this thesis. After Berg (2002), A unique overall pattern of natural characteristics that are found in a specific place: including biophysical systems, biota (native animals or plants) and anthropogenic influences such as indigenous knowledge, customs, traditions, social developments, art and history. Peter Berg sums it up as a geographic terrain and a terrain of consciousness.

CARRYING CAPACITY
The maximum number of individual users that a natural resource can support, without adversely affecting it's long term production capacity

CONSERVATION
It is not preservation at all costs, but covers protection of a resource as well as sustainable utilization, without the reduction in it's capacity, to be in some way beneficial to man immediately or at some point in the future.

COMMUNITY BASED NATURAL RESOURCE MANAGEMENT (CBNRM)
A major conservation and development strategy employed in southern Africa since the late 1980s and in Botswana since 1990 is known as community-based conservation (CBC) or community-based natural resource management (CBNRM). The main idea behind community-based conservation is that communities get the rights to the benefits from natural resources (Western, Wright, and Strum, 1994; Hulme and Murphree, 2001; Child and Lyman, 2005; Borgerhoff Mulder and Copolillo, 2005). This is done through the passage of legislation to allow local or regional bodies to profit from wildlife and other wild resources in communal areas. The CBNRM approach is different from the approach in which the state (i.e. the Government) controls natural resources. In the latter case, benefits from those natural resources go to the central government treasury to be used as the Government chooses.(Hitchcock, 2008)

NATURAL ECOSYSTEM
This is a system of interacting natural processes and biota, materially closed and energetically open. This cyclical system depends on all parts working together to complete the cycle.

HUMAN ECOLOGY
Study of human interaction with each other and their environments

LAND MANAGEMENT UNIT
For the purpose of this study, a land management unit means an area of a landscape delimited by the use of bio-geographical boundaries within a bioregion. Boundaries delineate homogeneous landscape characteristics. A landscape planning unit is the smallest unit of the bioregional planning model and contains unique (at least one) identifiable features, differentiating it from the others.

PHENOMENOLOGY
The description and classification of phenomena.

RESOURCES

NON-RENEWABLE : Physical and chemical assets such as fossil fuels, soils & minerals which are created over many many years.

NON-CONSUMPTIVE : Resources that can be enjoyed without consumption. e.g. pristine landscape.

RENEWABLE : Self-maintaining, self-producing resources which deliver services on a perpetual basis if not over exploited.

REPLENISHABLE : Resources that can recover after being severely degraded due to their origin in a greater global system. e.g. water

SALIENT FACTORS (after Van Riet, 1987)
Salient factors are those that are essential to the functioning of ecological processes. Their importance might not be easily identifiable. The ability to identify salient factors is essential to landscape planning as it is often necessary to work on a planning proposal where there is insufficient time to research all the ecological factors. The identification of salient factors must, however, not be used as a means of bypassing in-depth ecological research and is usually identified by specialists in each field, working in the multi-disciplinary team

SUSTAINABILITY
means using today's resources wisely for the future generation maintain the flow of production necessary to ensure non decreasing per capita consumption indefinitely, so that future generations can have a standard of living equal to or better than that of present generations (Olewiller, 2002).

SUSTAINABLE DEVELOPMENT
Development that is likely to achieve lasting satisfaction of human needs and improvement of the quality of human life (Kogan, 1980). Sustainable development covers a wide spectrum of facets; it encourages integration of socio-economic and ecological factors in planning, implementation and decision-making to ensure that development serves the present and the future generation in order to achieve a balance between natural and human needs (Gibson, 2005) The critical element of sustainability and sustainable development is

good governance as it encourages equity and fairness (Friedman, 2000) Good governance is both participatory and inclusive (Friedman, 2000). In summary, sustainable development is the integration of all the aforesaid elements **of sustainability in** decision making.

SUSTAINABLE DESIGN

Sustainable design as defined by Green Building Media (2009) also referred to as "green design", "eco-design", or "design for environment" is the art of designing physical objects and the built environment to comply with the principles of economic, social, and ecological sustainability. It ranges from the microcosm of designing small objects for everyday use, through to the macrocosm of designing buildings, cities, and the earth's physical surface. It is a growing trend within the fields of design & planning.

The aim of sustainable design is to produce places, products and services in a way that reduces the use of non-renewable resources, minimizes environmental impact, and relates people with the natural environment. Sustainable design is often viewed as a necessary tool for achieving sustainability.

WILDERNESS
A landscape where the influence of the activities or structures of man appears to be absent, can be described as wilderness. It is a visual category, as in an ecological sense, because the impact of man is not absent in any region

ZONING

Is a planning action that restricts activities to areas most suitable for it, thereby protecting and ensuring sustainability of valuable natural resources, whilst decreasing possible conflict with regard to those same resources.

Abbreviations

BNA	Botswana National Atlas
CBNRM	Community-based Natural Resource Management
CDA	Communal Development Area
CI	Conservation International
CHA	Controlled Hunting Area
CKGR	Central Kalahari Game Reserve
CSO	Central Statistics Office
DWA	Department of Water Affairs
DWNP	Department of Wildlife and National Parks
EIA	Environmental Impact Assessment
GIS	Geographic Information Systems
IUCN	International Union for the Conservation of Nature & Natural Resources
KCS	Kalahari Conservation Society
KDC	Kgalagadi District Council
KTP	Kalahari Transfrontier Park
LMU	Landscape Management Units

MAB	Man and the Biosphere programme
NGO	Non-governmental Organisation
NRM	Natural Resources Management
NRU	Natural Resource Utilisation
MEA	Millennium Ecosystem Assessment
PADUS	Protected Areas Development Unit (South)
RAD	Remote Area Dweller
RADO	Remote Area Dwellers Officer
SEIA	Socio-Economic Impact Assessment
TGLP	Tribal Grazing Land Policy
TKR	Trans Kgalagadi Road
VDC	Village Development Committee
VP	Veld Products
WCP	Wildlife Conservation Policy
WMA	Wildlife Management Area
WKCC	Western Kgalagadi Conservation Corridor

EXECUTIVE SUMMARY

According to Brunkhorst (2001) and Raeberg (1997), governments who are responsible for regional (territorial) planning are in effect planning blindly as they are not taking into account the brilliant work done in related fields which could change their attitude towards planning, design, ecology & technology. The global debates on scarce resources and climate change which are causing governments to have to take a stand, pose questions such as: How are Scarce Resources Managed? How will injustices to the poor be rectified? What policies and guidelines are in place to promote sustainability?

The theory is out there, but little or no practical implementation of the theory at broad scale through fine scale has been done to date. To this end I have created a model which takes into consideration these global issues, and tested it on the SW Wildlife ecosystem of Botswana which has all the characteristics mentioned above. Lessons have been learned from failures in Implementation Strategies at Gudigwe (N Botswana) where insufficient planning for the needs and capabilities of the local villagers created a mismatch of the socio-economic product created and the outcomes anticipated. Another example of failure was the unanticipated social culture of the Baswara who take care of each other above the needs of outsiders. The guests and management were at odds with the staff due to these cultural differences at Mababe Village Sankuyo Trust, NW Botswana.

The study will contribute a model of bioregional planning from broad to fine scale which can be used in the planning & design of such regions in the future. The macro biogeographic region is defined at the Broad Scale and at the Fine Scale appropriate socioeconomic sustainable interventions are detailed.

INTRODUCTION

Man and the Environment

Man has always been dependant on the environment for his existence and will continue to do so long as nature is able to comply. Man's cultural development, from hunter-gatherer through agro-pastoral to industrial and post-industrial periods was facilitated by technological improvements in his ability to tap into the earth's resources which in turn orchestrated great changes in his social structure. (van Riet, 1987)(McHarg, 1998) Nonetheless, his 'advancement' has unfortunately been accompanied by an increased capacity for disturbing and destroying the very ecosystems upon which he is so dependant for his existence. Although most people are physically removed from the natural environment today, they are no-less accountable to the natural laws than when they were 'hunter-gathers'. This resource dependence is clearly illustrated by McHarg(1969) and most recently by the Millenium Ecosystem Assessment (2005) which clearly outlines the staggering facts pertaining to global warming, population increases and scarce natural resources repeatedly stressing that we need to take care of these indispensible ecosystems, and ecosystem services.

Conditions affecting the Environment

Environmental health is the key to sustainable development. The primary threat to environmental health is fragmentation of community-supporting ecosystems. Fragmentation generally leads to a cycle of environmental degradation, which subsequently influences the well-being of the dependent communities. (PGWC, 2009)(MEA, 2005) The main factors affecting the state of the environment are levels of degradation indicating misuse of resources and / or land use incompatibility.

Factors affecting Planning Strategy

Degradation of natural resources leads to breakdown of Ecosystem Services on which we all rely for our existence, and to which the 'poor'(economically speaking) look for their subsistence.

Few Planning or EIA methodologies link human & natural systems, well-being and ecosystem services (Brownlie, 2009). The principles central to the bioregional planning methodology, however, provides an essential tool for addressing the conflicts between conservation and development, by incorporating sustainable development practices into the planning (and design) process. (Aberly, 2006)

EXAMINING THE CONCEPTS OF BIOREGIONALISM, ARCHITECTURE & PLANNING

> *'The concept of bioregionalism has resurfaced in the past three decades. It is as ancient as the human culture. Bioregionalism makes sense. Since our culture has lost its sense of direction, we now need a conceptual framework and theory to follow – bioregionalism can fulfil this need'* (Shapiro, 1993).

The bioregionalism vision is rooted in the human scale, the limited, coherent, nature-based region in which we take our place within the natural systems of the Earth and the natural interplay of species that inhabit there (Sale, 1986).

Bioregional planning implies an integrative concept, one that amalgamates the learning and perspectives of several similar concepts, such as ecosystem management and biosphere reserve planning. It is *'an organised process that enables people to work together, think carefully about the potential and problems of their region, set goals and objectives, define activities, implement projects, take actions agreed upon by the communities, evaluate progress and refine their approach'* (Miller, 1996).

Bioregional planning refers to the 'matching' of human settlement and land-use patterns with the parameters of ecological systems, and the planning, design and development of the human-made environment within these parameters in a manner that ensures environmental sustainability. Bioregional planning requires a value shift away from the sectoral nature of institutions , to an all-embracing approach where the sustainable development challenge is addressed in an integrated and holistic manner.(Raeberg, 1997)(Aberly, 2006)(Brownlie, 2009) (Arntzen, 2003) (Twyman, 1998)

After Berg (Carr, 2004) **Bioregionalism** utilizes bioregions to accomplish three main goals:

- Restore and maintain local *natural systems;*
- Practice sustainable ways to satisfy *basic human needs* such as food, water, energy, housing, and materials; and
- Support the work of *reinhabitation & rehabilitation* through *proactive projects, employment and education*

The bioregion is an effective planning unit for integrated planning on the level of the region, district (and greater municipal area)(PGWC,2009), and provides an effective intermediate framework to co-ordinate planning on other scales. (Carr, 2004)

Bioregional planning is characterised by the following (Miller,1996):

A. **Adaptive management:** Bioregional programmes are operated on an experimental basis, from which lessons may be drawn from experience to respond appropriately. (Brunkhorst, 2001)
B. **Biotic viability:** Bioregional management programmes embrace regions large enough to include the habitats and ecosystem functions and processes needed to make biotic communities and populations ecologically viable in the long-term. These regions must be able to accommodate migratory patterns, anticipate nature's time cycles and absorb the impacts of global change.

C. **Co-operative skills development:** Communities and public and private organisations, together, must locate and mobilise the skills, knowledge, and information needed to manage the area.
D. **Economic sustainability:** The maintenance of livelihoods and the economic wellbeing of people living and working within the bioregion, including those in industry must be encouraged.
E. **Full involvement of stakeholders:** All parties who can affect or benefit from the resources in the region should be fully involved in planning and managing the bioregional programme. Of primary importance in this regard, is building the local capacity to participate in, negotiate, and perform the various tasks involved.
F. **Institutional integration:** Alliances between institutions are to be forged to close gaps, minimise overlap and make management and investment in the region more efficient.
G. **International co-operation:** Because some ecosystems cross international boundaries and, in some cases, extend globally along animal migration routes or along venues where endangered species are traded, international co-operation agreements for debate, and mechanisms for joint research, information management and investments must be part of the biodiversity management programme. The MAB Programme is particularly suited to this purpose.
H. **Leadership and management:** The leadership to establish bioregional programmes may come from public agencies, or from the community of residents and resource users. The tasks of convening stakeholders, preparing and negotiating vision statements, and planning and implementing agreed-upon activities can be shared co-operatively between public and private entities, or be fully community based.
I. **Reliable and comprehensive information:** All stakeholders must have at their disposal the critical information needed to facilitate biodiversity management. GIS technology is to be used to help stakeholders envision their region and its distinctive features clearly. GIS will help them to model options and scenarios for the future. A bioregional information system can assemble a comprehensive and ecosystem-level GIS consisting of biophysical, social, economic, and cultural databases.
J. **Research and monitoring:** Research and inquiries should focus on people-environment interactions, the development of innovative methods for managing natural resources, and the long-term monitoring of environmental factors and the impact of management practices.
K. **Restoration:** Where the viability of some habitats or ecological functions have been impaired through excessive or inappropriate use, these areas are to be rehabilitated.
L. **Social acceptance:** Any proposals for changes in the way of life and livelihoods of the residents and local people, including indigenous communities, need to be acceptable to them. All stakeholders warrant the opportunity to participate in programme management and implementation.
M. **Structure of interrelated cores, corridors and matrices:** These programmes include core nature areas that feature representative samples of the region's characteristic biodiversity. Ideally such sites, which may already be designated as protected areas, should be linked by corridors of natural or restored natural plant cover to permit migration and adaptation to global change. Both the core sites and corridors should be nested within a matrix of mixed land uses and ownership patterns.
N. **Use of knowledge:** Scientific, local and traditional knowledge should be employed in planning and management activities. Biology, anthropology, economics, engineering and other related fields are to be tapped into. Such knowledge helps stakeholders and programme managers to anticipate nature's long and short cycles and to track global change.

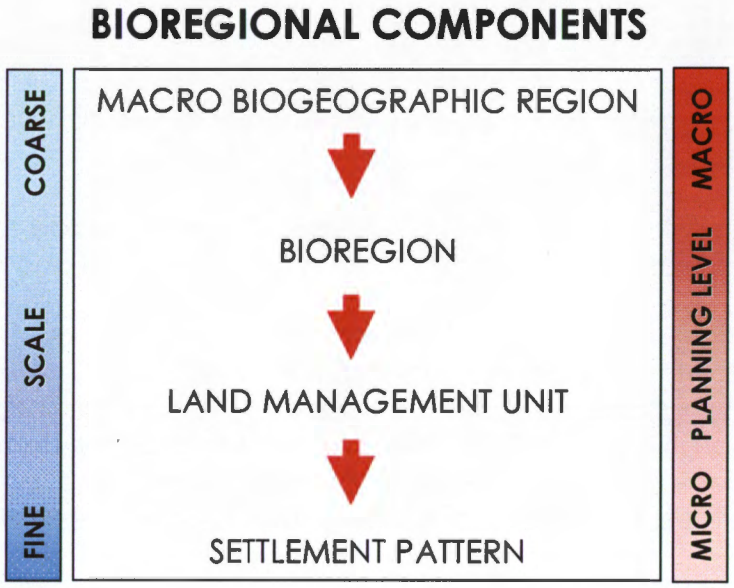


Figure 1 Bioregional Components

Landscape Architecture in General

"Landscape architecture can be described as the art, science and technique of planning and designing open space" (Van Riet, 1987:19) The term "open space" can be attributed to the space between buildings or at a greater scale to include planning of large regions covering millions of hectares such as the SW Wildlife System of Botswana

Bioregional Planning as an aspect of Landscape Architecture

> 'Changes in Land Use and Vegetation cover have shown a major role in climate change – compelling Landscape Architects to act (Thompson & Sorvig, 2008)
>
> 'Designers are used to focusing within their project boundaries. Thinking outside this box, more and more Landscape professionals approach each project as part of a regional system of natural and cultural elements.' (Thompson & Sorvig, 2008)

Traditionally landscape architecture was more focused on the design of smaller outdoor spaces, a more artistic approach. Today the landscape architect can also be involved with bioregional planning, EIA etc if suitably qualified. This change in emphasis from artistic design to environmentally sustainable planning and design in the scope of work of the landscape architect demands an expansion in knowledge from the landscape architect, (Van Riet, 2000). Bioregional planning further demands an expansion in the knowledge of the landscape architect to include socio-ecological and socio-economic factors over and above the terrain analysis knowledge already acquired. In order not to become overwhelmed the analysis of all these factors are more easily orchestrated with the aid of GIS.

Value of Bioregional planning in landscape architecture

"Landscape architecture is still a creative profession but it requires a far broader level of expertise with regards to social and ecological aspects" (Van Riet, 1987). This said, the landscape architect has a vital role to play in the promotion of sustainable resource utilization as part of his/her scope of work.

It was imperative then, as it is today that all disciplines integrate their knowledge for the greater good. We can see this developing as governments (IUCN; UN) and landscape architects, ecologists and planners pull together their strengths to implement essentially age old principles in a more co-ordinated co-operative manner under the banner of **bioregional planning** expressed as a unique blend of **tenets**:

- Biologically and culturally defined regions (bioregions) offer the most opportune spatial scale within which a great variety of forms of human governance and development can be practiced.
- Human governance within a bioregion should be democratic and responsible to local control, nurture a high quality of life, be judged by it's ability to achieve social justice.

- Economic development within a bioregion should be locally use appropriate technology, focus on self-reliance within limited value-added export manufacture to the point that resident ecosystems can support exploitation.
- Political / economic interdependence of bioregions needs to be acknowledged at state level.

Developing countries are characterized by deteriorating ecosystems, population increases and conflict over scarce resources which bioregional planning principles are well placed to address through a model orchestrated by the landscape architectural profession. Bioregional planning principles incorporate the following sustainability criteria which have been adapted from Gibson who succinctly stated how impacts could be mitigated by sustainable interventions which are addressed in the model

Sustainability criteria : (after Gibson, 2005)

- Environmental impacts:
  - Reduce impacts by developing creative alternatives
  - Increase Community environmental awareness
  - Seek to minimise adverse environmental impacts
- Social impacts: identify income generating schemes which:-
  - Ensure livelihood alternatives
  - Create opportunities that conserve cultural heritage (CBNRM)
- Economic Impacts: Reinvest a share of resources back into the community
  - Stimulate and enhance local entrepreneurship (Mentorship)
  - Reinvest a share of resources back into the community
- Governance: stakeholder participation throughout the planning process is imperative

ARGUMENT

Motivation

By not taking into account the need for co-management of resources throughout the region, existing methods of planning have failed in respect of the sustainability of livelihoods of the 'poor' people who depend heavily on good resource management: (continent and world). Sustainable management of the structure and function of ecosystems is a priority according to the Millennium Ecosystem assessment (MEA, 2005). Global debates surrounding the management of natural resources in protected areas advocate greater involvement of local populations in order to maintain sustainable resource use and conserve biological diversity (Arnstzen, 2008). The preservation of the 'ecosystems' of the rural (indigenous) people should be seen as equal in importance to those of other terrestrial ecosystems for the survival of the human race. Rural settlements and cultures that depend heavily on natural resources and indigenous knowledge gleaned from generations of consultation with Nature for their survival could be seen as indicators of the sustainability of interventions and policies when auditing the success thereof. The need to make better (more sustainable) use of the non-renewable (fossil fuel; indigenous knowledge) and renewable resources (solar; wind) by taking into consideration whole systems is not only a glaring issue for developing countries. According to Brunkhorst (2001), the 'booming' economies of many nations, particularly 'developed' countries, mask the continuing downward slide of the majority of rural communities and their natural resource base.

Historically speaking, planning has been in the hands of government officials planning for economically viable development but it has become increasingly important over the last four decades that the ecological, and recently the social factors, be taken into account when determining the opportunities for development.(Raeberg, 1997)(Carr, 2004) (Aberly, 2006) Increasingly, authoritative authors from a variety of disciplines (economics, social sciences, biological sciences etc) are also recognising the limited capacities of traditional forms of public sector organization to deal effectively with the scale, complexity and inter-relatedness of environmental problems for long term sustainability.(Brunkhorst, 2001:20) The sustainability plans and principles adopted by most countries around the world are not being nearly as effective as was initially predicted and the loss of biodiversity is continuing at an alarming rate, and most of the effects are felt by those closest to the land. (Sale 2002). Furthermore, they have not adequately addressed the received wisdoms on which many policy decisions are based and thus have essentially established country-wide projects with little regard to climatic, environmental and socio-economic differences and variability. This has significant implications for resource-based livelihood strategies in these rural areas, and there is evidence to suggest that the impacts of these projects on livelihoods have not been adequately addressed (Twyman, 1998)

Hypothesis

This thesis addresses the need for a new model for planning which encompasses whole ecosystems which can address natural resource management from a holistic perspective which will inform sustainable design:

- which can become the basis for structure plans that address socio-ecological and economic issues;
- which can develop design principles and guidelines for development;
- which can be implemented easily by a layman.

Justification

This dissertation asserts that Landscape Architects are well positioned to orchestrate such a model, due to their ability to, on the one hand, negotiate on an interdisciplinary level and on the other hand design with nature, both regionally and locally, using the principles of Bioregionalism as the primer.

A lot more can be done by first adopting the attitude of 'bigger is better' on policy scale by employing biodiversity sensitivity studies for whole countries and whole continents so that the strategies of smaller regions can be aligned with these larger 'Strategic Bioregional Plans' so that we don't repeat the irreversible mistakes of developing in zones that are going to be detrimental to the future existence of the human race and that of many other terrestrial and aquatic species.

Through a review of literature, the thesis will investigate the chronological history of the 'planning regime' and how this has served the entities for which they were created. It will also investigate the existing planning & design philosophies and how they contribute to the status quo.

Based on the findings of the investigation, a strategy will then be adopted or formulated based on this critique. The study will develop guidelines principles and methodologies for implementing this strategy, which will be tested on the SW Wildlife system in Botswana. The case study aims to test and prove the necessity to select sites within a larger strategic framework whether or not what is being designed and detailed is a $2m^2$ or $2km^2$ site. to the point that if the strategic framework doesn't exist, then it must be created. It is critical to select the site within the context of its broader framework based on whole ecosystems not artificial man made boundaries.

It is also important to note that indigenous knowledge is critical to any plan, out of respect for local culture and ownership of intervention to create the best fit.

LITERATURE REVIEW

For a long time we have been influenced by the propaganda of politicians in favour of a society of international mobility and extensive specialization. Decades of indoctrination by the mass-media have brain-washed us into believing that the holistically orientated local community along with its social structures, norms & aesthetic values are the 'decayed remains of a period passed its 'sell-by' date'. (Raeberg, 1997) The sectoral nature of the scientific world view is a paradigm gone wrong and it must be replaced.(Aberly, 2006 :5)

> "Our positive expectations of the social constructions of the technical society were dashed when it became apparent how flawed the actual gains in living quality were, and that fundamental human values had been lost." (Raeberg, 1997)

The political economy has long been regarded as 'untouchable' by theorists, the political & intellectual elite effectively shielding them against all sorts of criticism. Underlying this misplaced respect there is an accepted 'idea that the political economy represents an objective and exact science.' (Raeberg, 1997:417) The building of 'Theoretical Models' at a highly abstract level has promoted this myth. 'The theoretical vacuum of territorial planning is especially noticeable in tasks relating to the human sector.' (Raeberg, 1997:92) The trend in physical planning during this century, has been to shift powers of decision making to higher and more abstract levels of organization, further dehumanising the plans. The omnipresent planning machine has created a gigantic infrastructure, but socially the results are communities with no heart and apparently no working brain. The long term plans for local communities are drawn up by government departments supported by regional research from authors qualified in political science, economics and mathematics, with little or no regard for the spatial or ecological implications of their decisions. It is no wonder that these plans fail in implementation.

The accumulative impact of this 'politico-scientific world' has been wealth and power for relatively few and a naïve or purposeful disregard for all else. According to Aberly 'Much of the planets soil is tainted or blowing away, water sources are depleted or polluted, the air is dirty and pierced by radiation, and animal and plant populations are harried to extinction." (Aberly, 2006:4-5)

The most important underlying issue as pointed out by Aberly (2006) is that science neglected to acknowledge that all parts are irrevocably linked and when you change one part you have a knock-on effect on the other parts, a part being an ecosystem.

The arenas of science and politics are based on reductionist principles which do not take into account the effect they have on other areas of society or nature. (Courier, 2002)(Aberly, 2006)'It is clear that the spatial dimension is regarded by its own expertise as a fairly inessential aspect of the knowledge field of social planning.' (Raeberg, 1997:92) The theorists are plainly spelling out the fact that socio-ecological and socio-economic issues are unimportant to the spatial planning fraternity. This is paradoxical based on the fact that the main objective of spatial planning and design, is to create suitable spaces in which people can carry out their lives.

The golden thread that appears to be developing through this review is the lack of adequate social consideration at a spatial planning level.

The development of the position being followed is exposed through the following critiques:

The Garden City Movement championed by Ebenezer Howard in which he portrays a better healthier lifestyle for all as promoting a culture of social responsibility.

Patrick Geddes who focused more on the science of sociology and human ecology, was concerned with 'seeing life whole' noting the importance of locality, resources and landscape to the planning process. He pioneered practical techniques of ecological planning & systematic surveying of bioregions with the aim of to assist resident human populations to become self-determining and sustainable, which is highlighted as an important global issue today.
Ernst Haeckel spoke out on the fact that Humans and Nature are inextricably linked amidst the many open confrontations over the centralised political and economic control during this period; further cementing the issue that the planning regime adopted was not producing acceptable results on the ground.

MacKaye's (1928) new planning regime whose major structuring principle was that of the green matrixes along with Mumford's main concern to rediscover the organic balance between city and total environment inspired the City-Countryside-Wilderness philosophy, a 'unity of opposites', stating that a region has a specific geographic character and condition of dynamic balance without definite physical boundaries. The beginnings of the concept of bioregionalism are beginning to emerge.
Odum, on the other hand, was fighting for social equality and protection of cultural diversity as well as regional self-containment so as to keep the metropolitan sprawl from gobbling up the rural cultures by ruralising the city rather than urbanizing the countryside. Here we see the social issues re-emerging as an important part of protecting biodiversity.

This led to the examination of possible principles arising from these new positions which have been echoed to some degree by authors Aberly (2006) and Bill Mollison (2000) among others; noting that the new position must take into consideration that Systems are not isolated things and that one should take responsibility for ones' own existence and the effect one has on the existence of others. Further, it is important to highlight the connections, rather than depend on separation to determine outcomes as is prevalent in the sectoral nature of the present planning regime. Decentralization of decision-making enabling each region to become more 'self-sustaining' rather than centralization which follows the top-down , one-size-fits-all approach is encouraged. A cultivated or designed ecosystem where the majority of species are developed for use by humans and their livestock is not sustainable and it is therefore important to move towards a more biocentric regime to fall in line with IUCN guidelines and the Biosphere concept.
The main focus should be on co-operation not competition following natural processes toward beneficial design rather than prescription from what is wanted from the point of view of greed and power.

More recently, Ian McHarg developed an ecological method of planning, understanding processes and their reflection in 2D patterns and incorporating these into principles: work-performing processes or Eco-services; protection-offering / hostile processes (i.e. those areas unsuitable for human habitation); unique or precious resources & areas of interest; vulnerable areas like breeding grounds & dunes, which he expounded on in his seminal work Design with Nature in 1971.

KirkPatrick Sale followed with another remarkable work called Dwellers in the Land (1984) in which he promoted a combination of biological and ecological planning in which one comes to know the region in which one is planning intimately to the point that "we make its rhythms our patterns and its laws our guide; its fruit our bounty". He pointed out that a bioregion should be used as the unit of planning defined as a "part of the earth's surface whose rough boundaries are determined by natural rather than manmade boundaries."

Further to the above and in consultation with McHarg, Prof WF van Riet developed an Ecological planning method in 1987 which incorporated the use of GIS and computer modelling to assist in the analysis of large regions. This has been widely accepted in Southern Africa as a model for planning large regions in which the understanding of the ecosystems and man's activities within the region is a prerequisite for the Landscape Architect to determine suitable interventions at all scales. His thesis takes into account the value of resources to humans but not the implementation of sustainable socio-economic solutions to benefit the indigenous communities of that region.
We can no longer factor indigenous communities out of the equation if we are all to survive on earth. The biosphere reserve concept was developed by UNESCO 1979 as a starting point for promoting bioregional management by developing core (protected areas), inner buffer (activities compatible with core zone) and outer buffer (transitional) zones. (Sale 1985; Lang 1986).

The essential difference between bioregional planning and ecological planning is that not only are the natural eco-systems taken into account but also the human eco-systems, accounting for the input output and energy losses and gains within all systems enables them to be more self-reliant and sustainable.

Conclusion

The gap in implementation that has emerged will be the main thrust of this thesis. This being that the socio-economic factors, such as resource utilisation and resource conflict have not been widely incorporated as part of the ecological planning procedures and thereby often fall short in implementation, because the needs of that region haven't been adequately addressed at a regional level.
The fact that the problems of scarce resources and resource conflict can be mitigated to a large degree by forward planning on a bioregional or ecosystem scale with sustainable design principles makes the need for this model even more urgent. The way forward is for integrated disciplines overseen by a landscape architect to orchestrate more holistic sustainable spaces for living, livelihood and being for all the world's ecosystems, bioregion by bioregion.

It is clear from the review of Literature that a new model that can address the implementation of this profound body of theory at a broad and fine scale is necessary. Principles for the development of the model are imperative if the global socio-economic and sustainability issues are to be adequately addressed.

Guidelines and principles towards developing a model

- These principles need to be scale independent and implementable for the door sized space and the transfrontier park which cross international borders
- We need to start the process at the landuse level which means planning for mixed use as well as addressing areas of transition and integration
- In the long term, regions themselves must be functionally interconnected to allow long distance dispersal and migration in response to climate change.
- It is important that the basic needs of the people are put before the wants of privileged society noting that self-reliance and an ecological support base are paramount.
- Indigenous knowledge is crucial to the sustainability of the region and a concerted effort should be made to ensure that this knowledge is passed down to the next generation
- There is a need to address Land Use and Land Claim issues. The land use, Conservation, formerly associated with low impact on the environment to the exclusion of all human communities, needs to be redefined to include the needs of indigenous communities who depend heavily on free ecosystem services.
- Landscapes have their own unique structures which must be respected. Humans and animals inhabit these spaces which to them also have boundaries of significance.
- It is important to develop a design system that arranges what was already there in an aesthetically pleasing way, so that it works to conserve energy or generate more energy than it consumes.

BIOREGIONAL PLANNING MODEL

The Bioregional Planning Model was adapted from the conventional planning process by Lovejoy(1973), Hall (1975) and Duchhart (1989) to name a few, and the ecological planning process initially outlined by McHarg (1969) and adjusted to include sustainable socio-economic planning from the scale of the macro biogeographic region through to the fine detail at local scale , The aim of the model is to incorporate whole and nested ecosystems into bioregions for ease of planning and management due to their homogeneous nature. These bioregions then create a platform from which more inclusive planning and more sustainable design can be tackled in order to successfully incorporate socio-economic factors of resource utilization and resource conflict. Steps outlined in pages14-22

PHASE 1: MACRO BIOGEOGRAPHIC REGION
- Delimitation of the macro biogeographic region
- Identification conflict zones of land use and resource use

PHASE 2a: LAND USE : PRESENT & PROPOSED
- Land-use designation for desirable land usage in accordance with spatial planning categories; a system of values, ethics and a phenomenological understanding of the environment

PHASE 2b: SOCIO-ECONOMIC PLAN
- Mitigation of Areas of conflict into Opportunities

PHASE 2c: BIOREGIONS
- Delimitation of bioregions as planning units in terms of ecological, social and economic criteria
- Identification of bioregional/district boundary differences
- Informs structure plan,

PHASE 3: LAND MANAGEMENT UNITS
- Establishment of land management units
- Informs the framework plan

PHASE 4: FRAME WORK
- Qualitative development of the human-made environment through application of the principles of bioregionalism

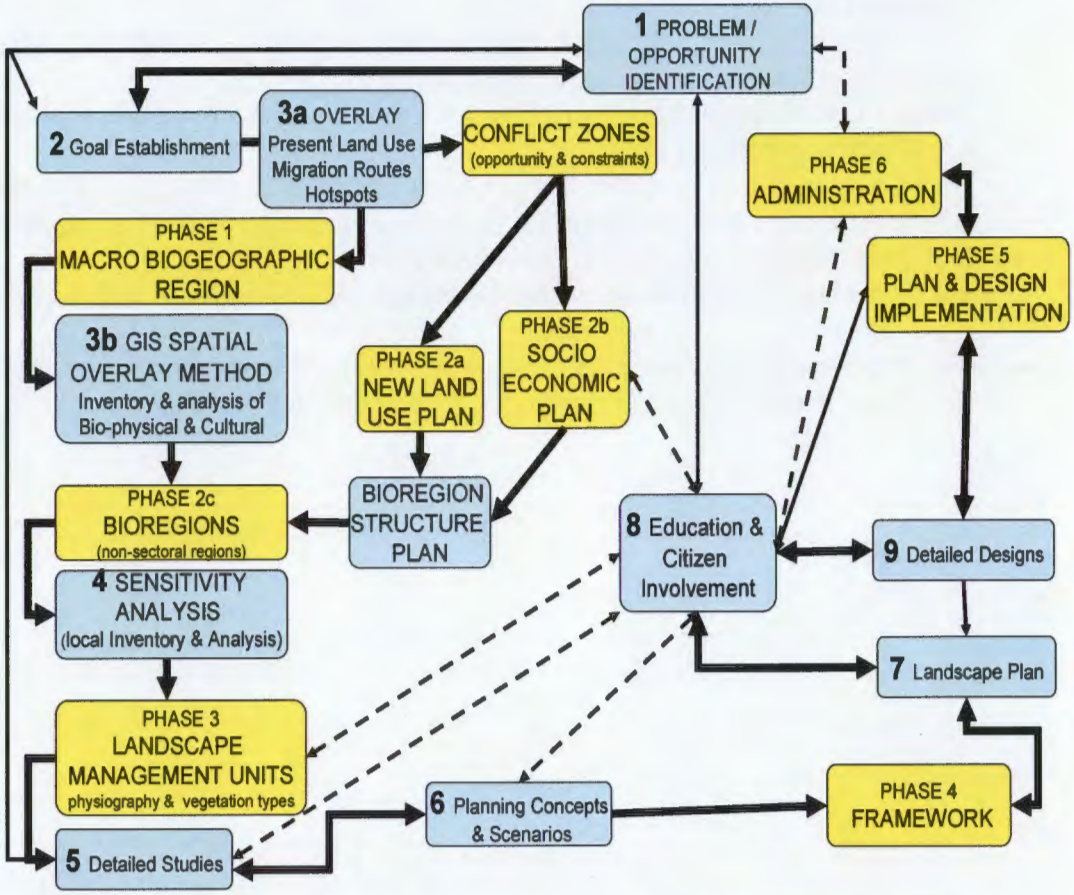


Figure 2 : Model Diagram

PHASE 5: IMPLEMENTATION
- Create appropriate data base links and management within the current administrative structure

PHASE 6: ADMINISTRATION based on Bioregional management: guidance, adaptive management, measuring and improving performance

Methodology

These steps refer to the methodology diagram on the preceding page where the phases of bioregional planning are clearly laid out.

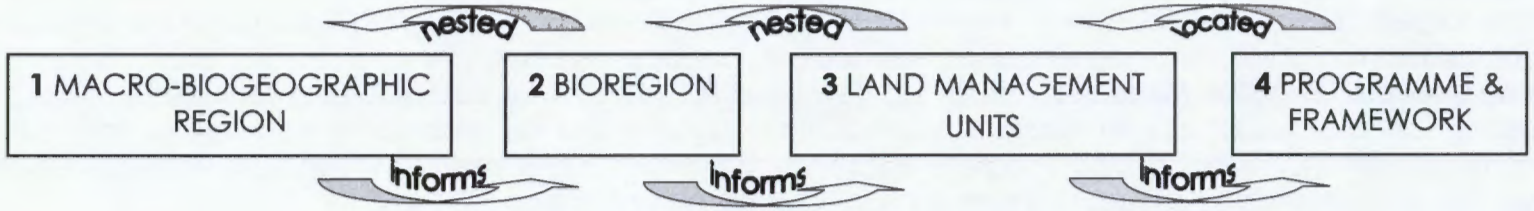
1. **Problem / Opportunity Identification** through global studies
2. **Initial Goal Establishment** (to be fine-tuned after review of detailed studies)
3. a. **Overlay Present Land Use, Migration Routes and Hotspots** which gives rise to the **Macro biogegraphic region** and **Conflict zones**
   Determine boundaries of the study area (Phase 1: Macro biogeographic region)
   Boundaries of the largest appropriate ecosystem within which other ecosystems are nested Use Migration routes of resident ungulates, Habitat zones of resident mammal populations such as Gemsbok, Haartebeest & Eland .
   Determine the appropriate Mitigation Measures (Phase 2a: New Land Use Plan; Phase 2b: Socio-Economic Plan)
   Broad scale existing Landuse is overlaid with wildlife & livestock habitats during the dry season, migration routes and settlement patterns to determine zones of conflict. Thereafter appropriate mitigation in the form of a proposed New Land Use Plan (core, buffer, transition zones, settlements & agriculture) and a Proposed plan for Socio-Economic upliftment
   Determine Bioregions within study area (Phase 2c: Bioregions)
   b.Overlay Broad scale Geology, Soils, Hydrology, Vegetation, Animal Habitats, Tribes (each with own traditions, customs, art, social organization)
4. **Sensitivity Analysis** must be drawn up to evaluate the status of the ecosystems in question, local knowledge is imperative unless year long studies have been executed. This includes Biophysical, Cultural, Visual Impact Analysis and Needs Analysis of Stakeholders
5. **Proposed Socio-Economic mitigation and site of intervention**
   Detailed Studies of the region were used to determine the areas for appropriate intervention and goals along with Indigenous knowledge of resource use and settlement patterns, socio-economic climate etc
6. **Planning Concepts and Scenarios :** The development proposals arise from the findings in step 4 and 5 informed by the Structure Plan **Framework : (Phase 4 : Framework)** A final selection is made from the Scenarios proposed for appropriate interventions at the selected site
7. **Layout of Intervention (Landscape Plan)** using Lessons learnt from previous studies and villagers involvement
8. **Public Particpation**
9. **Detailed design for the Intervention** and sustainable solutions at the selected site.

Phase 5 : **Implementation :** Construction of the Sustainable Socio-economically viable Design Intervention.

Phase 6 : **Administration :** Management of the Intervention from construction into the maintenance phase by local community.

Objectives

The ultimate objective is to develop a programme for the design intervention, based on the needs analysis and the opportunities and constraints revealed at each level of the Bioregional analysis. The design intervention is informed and developed utilizing the principles of bioregionalism to achieve a sustainable solution which incorporates the socio-economic and socio-ecological issues.



To understand the necessity for first planning at a macro-biogeographic level one needs to understand the previous planning mindset. Historically national parks and reserves were selected on aesthetic and recreational criteria or simply because they contained little value in terms of contractible resources. The result is that high elevation sites i.e. rocky, wetlands and other scenic but not particularly diverse lands dominated our system of protected areas. Hence, many ecosystem types are not represented in areas big enough to contain them sustainably.

The park boundaries do not conform to ecological boundaries because their biology was absent from the decision making process. Most parks are too small to maintain populations of wide-ranging animals (such as large ungulates) over the long term or to perpetuate natural processes. (Aberly, 2006:136)

In order to incorporate these issues in future planning, it is important to have an initial conservation strategy in the form of goal setting to establish at the outset the salient factors and indicators (species, climate change, sustainability) for which one is planning.

For example, Core Reserves and Primary Corridors in a regional network should link and enclose biological critical areas in a continuous system of natural habitat whenever possible. (Courier, 1992)

1 Delimitation of Macro Biogeographic Region

The macro biogeographic region should incorporate the largest entire ecosystem (vegetative/ wildlife / human), for example, the migration routes and core habitats of an endemic ungulate species.

Methodology for defining the macro biogeographic region

(Based on the Biosphere Reserve concept (UNESCO, 1997)(Aberly, 2006)

While investigating the extent of the macro biogeographic region (macro bioregion) it would be pertinent to include specialist studies and investigations to determine the level of protection awarded to rare and endangered ecosystems and species at the same time.

Steps to be followed in the delimitation process

1. Mapping of the distribution of rare species, communities and migration routes is the most important step in the network design process to determine hotspots and protected areas if not already designated (1:250000-1:1000000 data)
   1.1. Draw polygons around clusters of community types
   1.2. Routes of migration
   1.3. Rare species
2. Contain Hotspots within the corridors which are determined by linking the migration routes and rare species and communities (see no.1)
3. Map vegetation types
4. Map unprotected vegetation types and areas of species richness (gap analysis) and add these areas to the network(1:25000-50000 data)
5. These steps will determine the general location of your core reserves and same linkages between them
   5.1. Add more corridors so all sites that would be naturally linked are connected
   5.2. Envelope the entire network in a matrix of buffer zones e.g. inner & outer zones
   5.3. Overlay the previously designated protected areas
6. Adjust boundaries to indicate specific action to be taken to secure the system. i.e. Mineral or land rights acquisitions, reserve designations, road closures, underpasses to allow migration of animals under highways, restoration projects, borehole water management, mitigation of landuse conflicts.

The core zones are zones which are exclusionary to all other activities other than those of the habitats for which they are protected. Buffer zones form intermediate transition zones to protect the core zone and to create zones which are more inclusive of the needs of surrounding area with regards to resource utilisation and other non-consumptive activities. Certain consideration of needs and function must be given to these zones when delimiting their boundaries. These considerations are given under the headings of CORE,, BUFFER and CORRIDOR.

Core

The size of the core must take into account the degree of landuse conflict (hostility) with the surrounding area. The greater the conflict the larger the core needs to be, i.e. to encompass the viable mammal populations which means good buffer zones and interconnected corridors of between 110 million ha and 40 000 ha.(species dependant)

Buffer (Multiple Use Zones)

Two or more zones are recommended so that a graduation of use intensity exists between the core and the developed landscape. Examples of such zones can be Inner Zone and Outer Zone with particular functions and intensity of use.

INNER ZONE:
- Accommodates a low road density of 0.31km/km^2

Uses:
- Non-consumptive recreation (hiking, birding, cross country skiing)
- Primitive camping
- Wilderness hunting and fishing (designated by concessions)
- Low-intensity silviculture (light selective cutting)
- Limited habitat manipulation for target plant and animal species

OUTER ZONE:
- Accommodate a higher road density 0.62km/km^2

Uses:
- Heavier recreational use and campgrounds
- New forest silviculture (partial retention harvests, selection forestry, planting experiments)
- Habitat manipulation to favour target wildlife

Corridor

Function:
- Provide dwelling habitats as an extension of designated protected areas
- Provide for seasonal movements of wildlife
- Allow for latitudinal and elevational range shifts with climate changes
- Allow for genetic interchange between core reserves (Aberly:158)

How to design a corridor

Corridors can not be seen as a substitute for core protected areas, their main function is to accommodate migration between core areas

STEPS TO BE FOLLOWED IN THE DELIMITATION PROCESS

- Create a road-less core in the corridor surrounded by a buffer with the aim of creating a network of corridors mitigating against disturbance
- Connect small core reserves by corridors at the landscape scale (meso);
- Connect clusters of reserves by bigger corridors at the regional scale (macro).
- Corridors should be aligned up-slope, coast-inland and north-south to facilitate migration of species with climate change
- River corridor should be designated from ridge to ridge
- Ridge corridors should include riparian zones
- When roads intersect corridors, provide structures to allow animals(wildlife) to cross safely i.e. underpass, bridge, tunnels & channels
- The width of a corridor at the Regional scale should be 1/10 of length i.e. 20km wide/200km length accommodating ranging browsers.
- The width at the Landscape scale should be 3x wider than longest penetration by edge effect (200m) therefore 600m wide.
- Logically, long corridors will be wider than short corridors

Proposed Planning Zones

Core	Ecological Wilderness	Core protected areas and corridors; no other activities permitted Visual category: apparent absence of the impacts of activities of man
Inner Buffer	Non consumptive/sustainable activities Wilderness	Tourism, silviculture, hunter-gatherer Visual category: apparent absence of the impacts of activities of man
Outer buffer	Sustainable agriculture Sustainable /non-consumptive development	Cattle farming
Settlement/Development	Non-consumptive development Consumptive development Sustainable development	Recycle, rehabilitate, sustainable use of renewable resources

Implications for Development (Conflict Mitigation)

As a result of delimiting the macro-biogeographic region we are faced with conflict zones in the form of Landuse and Socio-economic Issues particularly over scare resource use, misuse and misappropriation – A global issue. The macro biogeographic region is, however, too large for effective planning. To create an effective planning unit for integrative planning, the macro biogeographic region must first be divided into more homogenous bioregions, *the limits of which are defined by the geographical boundaries of human communities and ecological systems.* The bioregion provides an effective intermediate framework to co-ordinate planning on other scales. (Carr, 2004)

The designation of core, corridor and buffer zones to reduce human wildlife conflict presupposes a new landuse plan. Which along with other mitigation measures create diversions in the form of products incorporating guidelines which can redirect development on both a spatial and a policy level in a sustainable inclusive manner. Resource Management and conflict resolution must incorporate sustainable Socio-Economic opportunities for the region e.g. an Eco-Tourism Route, a non-consumptive resource use.

The Socio-Economic Plan and the Land Use Plan are developed as a result of the delimiting of the macro-biogeographic region and are used in conjunction with the Bioregional Plan providing an effective intermediate framework to co-ordinate planning at the bioregional level and other scales.

2 Delimitation of Bioregions

The bioregions are determined by overlaying of the Biophysical, Biotic & Anthropogenic influences to form homogenous regions, geographic terrains and terrains of consciousness (Berg, 2002)

Courier 1992 defined a bioregion as a land & water territory whose limits are defined not by political boundaries but by the geographical limits of the human communities & ecological systems: Such an area must be large enough to encapsulate the systems i.e. maintain the integrity of the regions' biological communities, habitats and ecosystems. Support important ecological processes such as nutrient and waste cycling, migration and stream flow; meet the habitat requirements of keystone indicator species; and to include human community involvement in the management use & understanding of the region as a whole. And last but not least be small enough to call home. Brunkhorst 2002 also concluded that people are users and managers of the land and its bounty and unless the triad of resource: regulation; use & capacity was resolved the region would not be sustainable. He also pointed out that river basins are not an appropriate unit in which to undertake biodiversity management which is also crucial to the sustainability and integrity of the region. This then leads to the fact that the Value of Resources to the users and not just the resources themselves are important in delimiting bioregions.

Value of Resources

Values attributed to resources can be classified according to values to society and value to individuals such as desirable features (views, pristine habitats) and costs attributed to development (costs to environment, sustainable use of resources) Summarised as:

VALUE OF RESOURCES	**IMPLICATIONS FOR DEVELOPMENT**
SOCIETAL VALUES	
Life supporting:	Productive
Unique/rare features:	Unique
Vulnerable/hazardous:	Sensitive
INDIVIDUAL VALUES:	
Desirable Features:	Desirable
Cost of Development:	Environmental Cost
Sustainable resource use	Sustainability

Societal & Individual values can be attributed to Biophysical, Social & Economic Resources under the following categories:

Biophysical Resources: Geology, hydrology, soils, topography, vegetation, economic resources, migration corridors and animal habitats

Social Resources: Traditions, settlement patterns, culture, indigenous knowledge, social developments, art, history

Economic Resources: Skills base, resources, policies, education, income strategies

It is of paramount importance that issues, such as biodiversity conservation, economic growth, human resources development, and social development should be addressed when delimiting and managing bioregions.

Implications for Development (Bioregions)

Overlaying of the biophysical and social elements described will give rise to the more homogenous planning units which be used to develop the structure plan for the region along with the Land Use Plan and the Socio Economic Plan .

3 Delimitation of Landscape Management Units (LMU)

In order to understand the landscape more fully, it is necessary to subdivide the bioregions into smaller more manageable units which can add value to the planning and design of interventions as well as reflect upon the opportunities and constraints of the bioregion itself. As with bioregions, LMU's are based on biogeographical and ecological boundaries not cadastral as determined by government during traditional (sectorial) planning exercises. The LMU are determined by overlaying the geomorphological and soil type data which gives rise to vegetation communities (LMU's) which give more clues to available resources at a similar scale as well as opportunities and constraints which are revealed when overlaid with the land use for the area in question.

The delimitation of landscape management units (LMU) within the Bioregion should be undertaken in accordance with the following **guidelines to identify**:

- Biological diversity elements of national, regional and local significance, the extent to which they need to be protected, and the extent to which they already occur in protected areas in accordnace with the Macro biogeographic Region and Bioregions (e.g. migration route).
- Major activithies taking place within the region and in adjoining regions and analyse how these may adversely affect the region's biological diversity (e.g. cattle farming).
- Areas that are important for biological diversity conservation and require repair or rehabilitation (e.g. pan areas overgrazed by too many cattle – carrying capacity).
- Priority areas for biological diversity conservation and for ecologically sustainable use, and their relationship to essential community requirements, such as infrastructure and urban and industrial developments (e.g. conflict zones and areas of cultural importance).
- Provide mechanisms for genuine, continuing community participation and proper assessment and monitoring processes.(PGWC, 2009)(CBNRM Policy, 2007)

Sensitivity and Suitability of Landscape Management Units

Here we evaluate the intactness of the Landscape Management Unit within the Bioregion referring to the macro biogeographic region where necessary for clues to the sustainability of the larger ecosystems and migration patterns. The suitability of the LMU for a particular activity is determined by the sensitivity analysis and results in opportunities and constraints for development interventions. This is often only performed at site level in the form of terrain analysis. This methodology is described in detail under 4 methodology for framework development.

Implications for Development (LMU)

Overlaying the geomorphology and vegetation classes creates homogenous regions, Land Management Units (LMU), for planning at framework level. The LMU together with the proposed Socio-Economic Plan will suggest a site that matches the resource conflict, socio-economic and socio-ecological criteria.

4 Framework Development

With the sites selected within the framework of the Socio-Economic, Land Use and Structure Plans for the particular Bioregion we are now in a position to determine the appropriate development proposals for each site. The proposals must offer sustainable solutions to the socio-economic and resource conflict issues prevalent in the Bioregion. These proposals are managed within the Land Management Units.

Methodology for Framework Development

The development of the Framework for a site must happen within the bounds of the Structure Plan which contains the Vision & Objectives, Development Principles and Guidelines as well as Goals for the Bioregion. The Socio-Economic & Land-Use Plan are used as referral documents in terms of justification of the proposed development.

By overlaying the new landuse plan with the socio-economic plan and the landuse management units we can ascertain the most opportune sites for an appropriate design intervention. These areas can be highlighted by a study of the conflict zones within the region which give rise to areas of opportunity.

A detailed analysis of the terrain and cultural characteristics of the proposed site must be performed in order to determine the context for the intervention. In layman's terms the analysis will reveal where you can and cannot build which is called Site Suitability. A Visual Impact Assessment is performed on the context (buildable area) to determine what impact development would have on the surrounding area. A needs analysis is the next step, which gathers the community or user needs to develop a programme for the proposed site. The results of the Site Suitability analysis, a Visual Impact Assessment and a Needs Analysis of the Stakeholders (Visitors, Villagers, Wildlife) will provide a good brief for the proposed development scenarios. These are tested against Design Principles or Performance Criteria toward a final framework (concept) proposal for the site.

5 Detail Design

Now that the Final Concept Development Proposal has been approved it is time to consider the effective use of space including aesthetic and psychological issues after which careful consideration must be given to evaluation of these criteria within the context of the site. The concept for any site must be seen as contiguous with its surroundings - natural and man-made. The edge of the site must be seen as an interface between the site and its surroundings and as such is an important design element (Oberholzer, 2007). The criteria for evaluation of the impact of a design on its surroundings are typically those of feasibility, affordability, sustainability & compatibility (see Typical Evaluation Criteria)

Design detailing is the next step in the logical progression of the design from Concept to Implementation and must include the aspects of Sustainability with regards to Resource Use and Socio-Economic Empowerment which will become apparent during the Construction and Maintenance (Implementation) phase. It is crucial to this model that these steps are included in the design phase ensuring the success in Implementation of the intervention in the long term.

Typical Evaluation Criteria after Oberholzer (2007)

Not all criteria are always relevant but it is important to clarify the compatibility of the design with the context through these criteria

- Appropriateness, Responsiveness,Functionality, Usefulness
- Efficiency, Economy, Feasibility, Affordability
- Sustainability, Integrity, Durability, Robustness
- Adaptability, Flexibility, Multiple-Use

Considerations for Effective Use of Space

'Buildings are normally composed of a number of spaces that are related to one another by function, proximity or circulation path' (Ching 1996:194)

"Circulation patterns relate to the paths through the complex (rest camp) to reach rooms and spaces (Alexander,1977:628)

Spatial Relationships

Spaces that are closely related by function should be linked physically to eliminate stress and confusion (Alexander, 1977:481). This can be achieved by placing them on the same physical level or if this is not possible then linking them by obvious paths and direct routes to limit confusion.

Orientation

Consideration must be given to the direction which rooms and spaces should face according to:

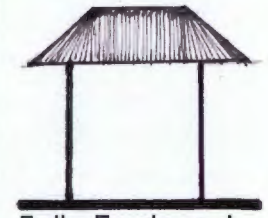
- Views
- Access by vehicle or on foot etc
- Function (Day/Night)
- Seasons
- Sun
- Shade
- Wind Direction

Image

- The Image,personality, of the structure must reflect the level of sophistication required
- Should reflect the indigenous culture and function of the space

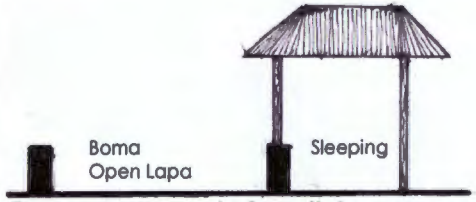
Typologies (after Steyn, 2000)

- Fully enclosed space: Appropriate solution when predators are a real threat
- Partially enclosed with a single roof structure (e.g. Pavillion)
  - Shelter from Sun or Rain
  - Ease of Access
  - Appropriate in a hot climate, accepting breezes from all directions
- Open Lapa (gathering space) with adjacent defensible space (e.g. sleeping space)
  - Creates a 'wilderness' feel
  - Increased flexibility for layout of the Rest Camp
  - Enforces contact with the natural environment
  - Guarantees a sense of informality
- Ablutions separated from Eating / Sleeping spaces
  - Important consideration when using alternatives to water-borne sewage systems (composting / French drain/ long drop) to relieve the guests of the odours associated with these types of ablutions
  - Ensure the shower unit encloses sufficient space for dressing as well, due to distance from the sleeping quarters.

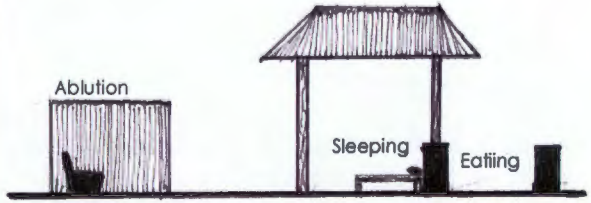


Fully Enclosed

Pavillion



Open Lapa, defensible space



Ablution separate from Eating,Sleeping

Typologies Figure 3 : Typologies (Steyn)

Technological Considerations (after Conroy,2002)

Technology that harmonises with the environment:

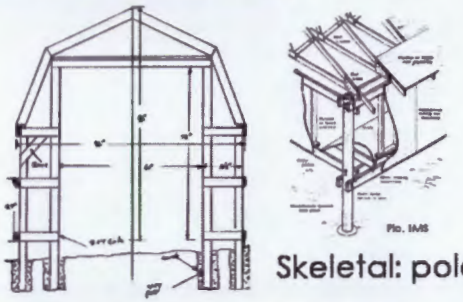
- Uses Indigenous locally available materials
- Uses Local / Traditional methods of construction
- Complements the surrounding environment
  - are subordinate to nature
  - Functional, convenient & safe
- Creates ease of Maintenance

Construction Methods

- Skeletal :
  - Timber frames either treated pole or stud is a common construction method which makes minimal use of concrete and perceived as a more sustainable method of construction through use of local materials
  - Emphasized by exposed construction details and lightweight construction
- Massive :
  - Load bearing walls of masonry and/or stone which is perceived as more permanent low maintenance solution.
  - Emphasized by heavyweight construction of rock concrete and masonry.
- Mixed :
  - Combination of Skeletal and Massive construction
  - The enclosed areas could make use of massive construction while the open covered (Pavillion) type spaces could be Skeletal

Structural Integrity

- Important to check construction details with the input of a qualified Structural engineer for:
  - safety;
  - appropriateness of method,
  - stability
  - suitability of materials



Construction Methods Figure 4 :

Services

Drainage Systems

The French drain (filter drain) needs to be placed at least 3m from the building, 50m from a borehole and have a carrying capacity of at least 24hrs. This standard distance does not take into account odours that may result from use of alternative sewage systems but purely drainage and seepage problems that may result from dysfunctional installations.

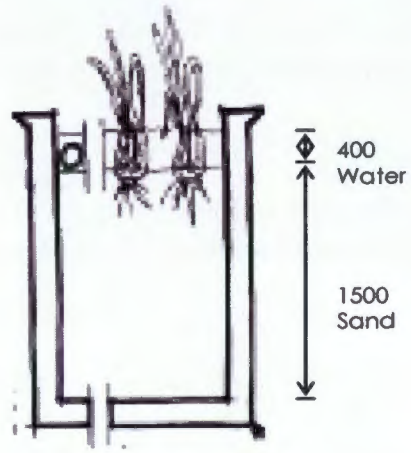
Use the Rotting-and-filter system if the area is subject to poor drainage and the Rotting-and-reed system if the area is subject to good drainage. Construct a filter drain more than 3m from a building and 50m from a borehole

how to determine drainage ability of the soil

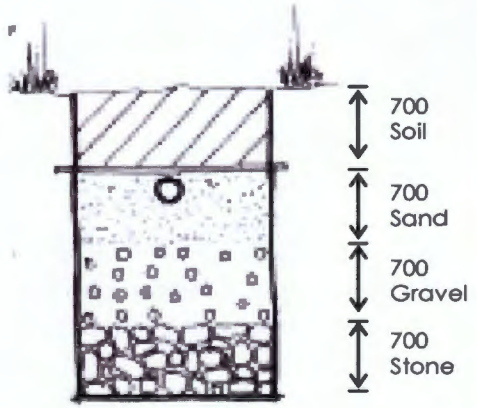
Using a test hole which is constructed by digging a hole .9m3 and at the base of that hole a further hole of .3x.3x.35m deep in the centre. Fill 50mm of the base of the small hole with gravel. Fill the hole with water and determine how long the water level takes to drop 25mm. The drainage speed as indicated in the table below will then determine the infiltration capacity of the soil.

SOIL	SPEED	TIME	INFILTRATION POTENTIAL
Sand	Fast	5 minutes	100m³/day
Sandy loam	Medium	5 – 15 minutes	65 – 99m³/day
Sandy clay	Slow	15 – 25 minutes	35 – 65m³/day
Clay rock	Very slow	25 – 30 minutes	Max 35m³/day

(Conroy, 2000d: 24)



Rotting-Reed System



Rotting-Filter System

Figure 5 **Drainage Systems**

Lighting and Electrical

Typical aspects that require electricity are lights, water pumping, water heating, cooling and administration and at the very least lighting. Considerations for placement of services:

- Views are aesthetically important
- Power connections allow for basic services such as lighting and water heating
- Placement of services in relation to camp and wind direction is crucial for ambience and experience. A smell or odour can ruin an experience

power generating options and implications

• Wood fires (for water heating)	fire hazard
• Solar voltaic	expensive, efficient, quiet, clean power, performs poorly in cloudy weather, aesthetically disturbing
• Wind power	not influenced by bad weather, dependant on wind, aesthetically disturbing and can be noisy
• Network electricity	very expensive
• Generator electricity	very noisy, units expensive to purchase and run and you need a back-up battery
• Gas	clean, effective for cooking and lighting, expensive and fire hazard

(Conroy, 2000c:38)

How to Design a Runway or Airstrip

- The Length of airstrip is determined by type of aircraft. If unsure, use minimum dimensions for a larger aircraft
- No high obstructions are allowed in approach zone
- A second runway is required if crosswinds exceeding 12knots more than 5% of time
- Landing and take-off must be into the wind
- Minimum width of the runway is 25m
- Gradient should be 1:7 up on either side and away from airstrip
- Minimum hangar dimensions should be 12m by 18m by 4m high
- Parking for aeroplanes should be situated more than 30m from runway

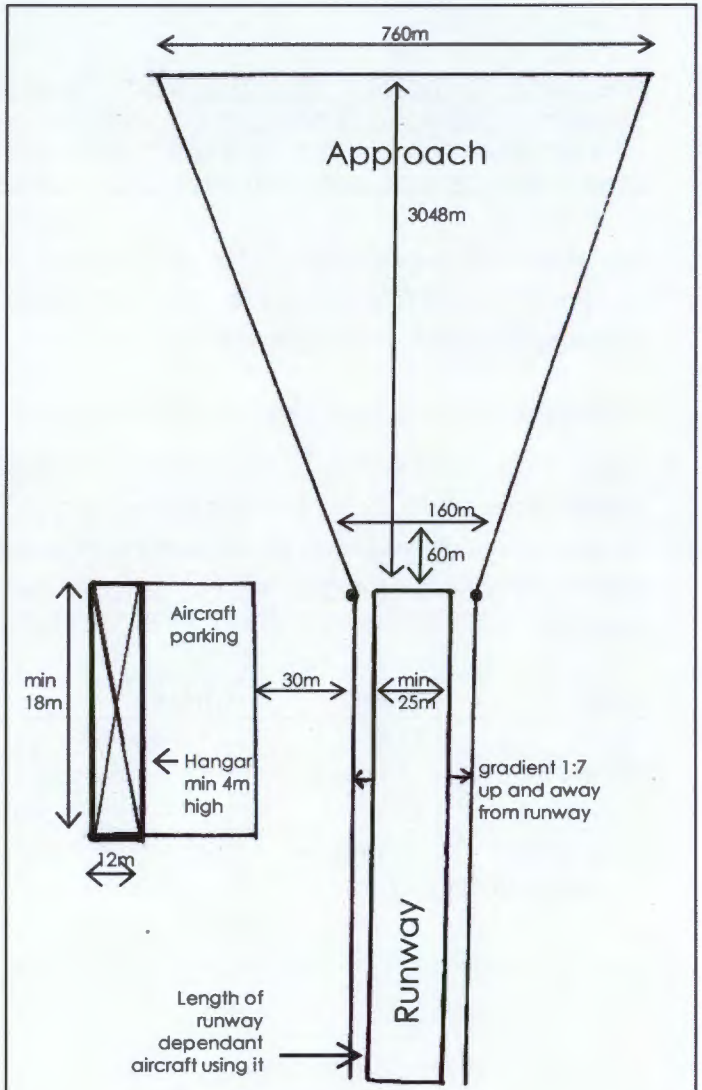


Figure 6 **Airstrip Design** (Dept.Transport,1977)

Relevant Design Considerations

Accommodation units

Select areas according to criteria of wind direction, tree groupings, visual absorption, view sheds, topography and surveillance ability to ensure the best use of available free ecosystem services.

Mark these positions on aerial photos which could then be evaluated and changed on site to meet exact prevailing conditions.

Roads and road surface options

In practice, it works effectively to place roads on the separation line between different plant communities on areas with low slopes or on firm, maintained, raised surfaces with sufficient drainage (Oosthuizen, 2000)

- 4x4 Tracks can be a minimum width of 2.5m, but period passing bays must be accommodated at regular intervals along the route
- Vehicle routes in camps should be located down-wind from buildings and outside the camp so they do not interfere with the aesthetic experience
- Covered vehicle parking areas should be placed with the opening facing south so that if the sides were closed off the vehicles would have ease of access and shade all day long

Implications for Design (Conroy, 2002a:33)

- A sand road will be dusty
- A gravel road will be more noisy
- A tar road will develop an unpleasant smell when heated
- Concrete paving will be relatively dust free and is available in different colours

Pedestrian routes

- Minimum 1.2m wide for 2 people to pass, but a private path can be 0.6m wide
- Use these pathways as routes for drainage, terrain, service lighting, water pipes etc (Conroy, 2000a:33)
- Compacted ant-heap works well as an alternative to regular paving materials
- Avoid large un-filled joints as these can become tripping hazards

Sustainable Design

Sustainable Design is the art of designing physical objects and the built environment to comply with the principles of economic, social, and ecological sustainability.

The types of design interventions that can be considered as contributing to sustainability are those which employ techniques for improving the sustainability of the region. This means taking action wherever possible to utilise local resources wisely. For example, water utilisation will be crucial to an arid environment, whereas, use of local skills and labour will be important to a region with little or no economic opportunities.

CONCLUSION

This step concludes the development of the model towards Sustainable Socio-economic Development using the principles of Bioregionalism. In the next section the model will be tested in a case study of the SW Botswana Region.

CASE STUDY: SOUTH WESTERN BOTSWANA WILDLIFE ECOSYSTEM

The previous section developed the model acontextually. This section applies the model to the SW Wildlfe Ecosystem of Botswana which historically stretched SW to Namibia and S.Africa and to NE Botswana, now blocked by Vet cordon and Country Boundary fences except in the case of the KTP. It will be broadly structured in the following way. Firstly, by defining the objectives which are then elaborated upon thoughout the case study from the broad to fine scale until the model is applied to a particular site.

The Kalahari ecosystem is characterized by natural resource conflicts and land-use pressure resulting from intensification of human activities.(Moleela & Mainah, 2003).

Objectives

- Delimit the **Macro biogeographic region** and evaluate the landuse and human-wildlife conflict zones
- Delimit the **bioregions** within the macro biogeographic region to create homogenous planning regions which can inform the structure plan for the region
- Delimit **land management units** within a selected bioregion to create more manageable homogenous planning units which can inform the framework plan
- **Select a site within the land management unit** which can manifest the appropriate solutions for scarce resource management, conflict resolution or mitigation as a model for future interventions in the region using the principles of Bioregionalism, hence sustainability toward a **framework**
- **Detail** Sustainable socio-economic interventions orchestrated within the final proposed framework.

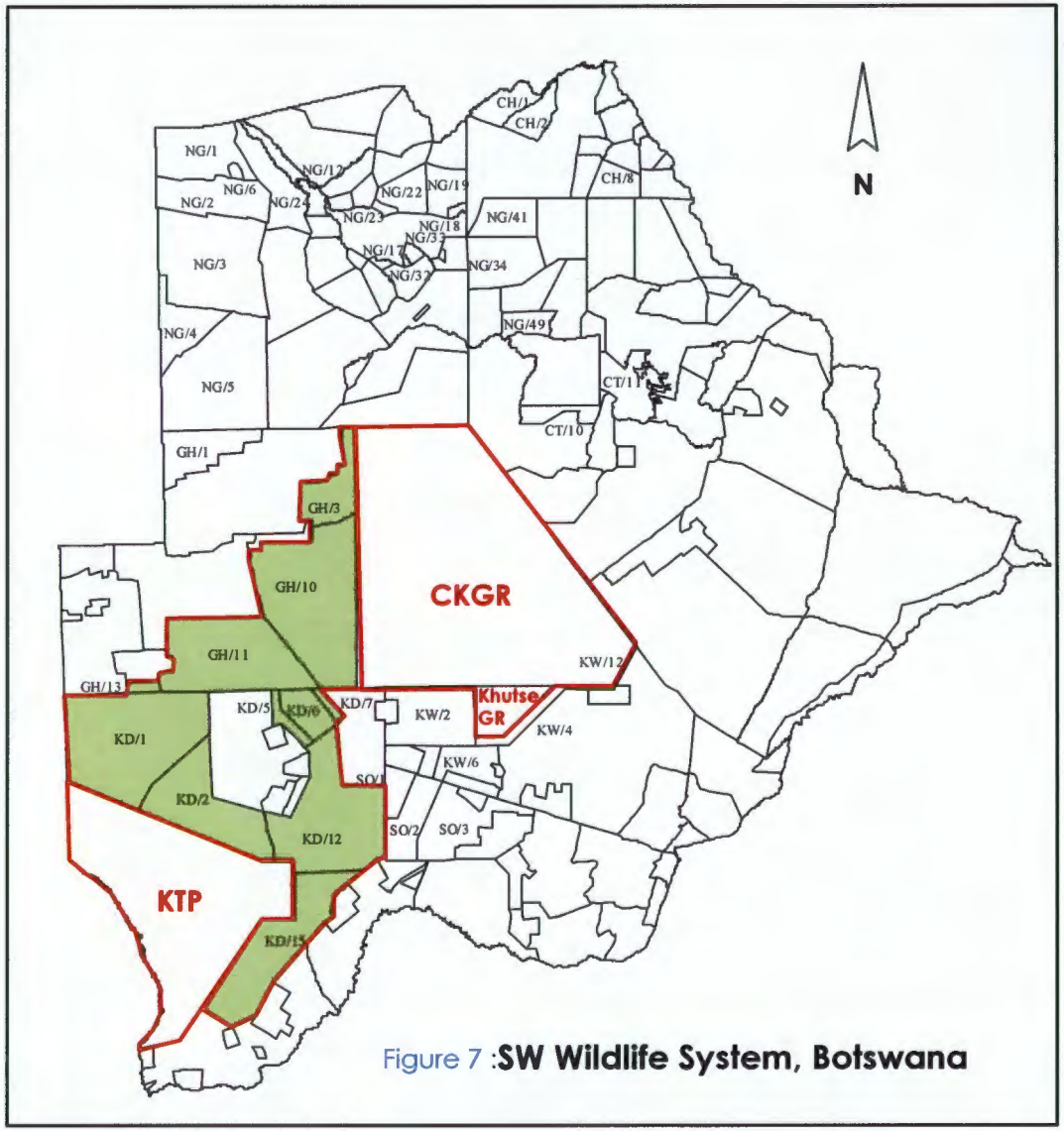


Figure 7 :**SW Wildlife System, Botswana**

Context

Protected areas have stereotypically restricted resource use for local populations and customarily led to extensive resource alienation and economic hardship for many rural groups (Ghimire & Pimbert, 1997). Rural groups depend heavily on free ecosystem services for their survival and it is therefore critically important to keep these services in mind when planning and designing for sustainable interventions.

Key Dryland Ecosystem Services (MEA, 2005)

Provisioning Services Goods produced or provided by ecosystems

- provisions derived from biological productivity: food, fiber, forage, fuelwood, and biochemicals
- fresh water

Regulating Services Benefits obtained from regulation of ecosystem processes

- **water purification and regulation**
- pollination and seed dispersal
- climate regulation (local through vegetation cover and global through carbon sequestration)

Cultural Services Nonmaterial benefits obtained from ecosystems:

- **recreation and tourism**
- **cultural identity and diversity**
- cultural landscapes and heritage values
- **indigenous knowledge systems**
- spiritual, aesthetic, and inspirational services

Implications for Development

- Semi-arid region is characterized by **scarce resources**
- Desertification is a result of a long-term failure to balance demand for and supply of **ecosystem services** in drylands.
- Poverty-ecosystem links are typically ignored in poverty reduction policies. (MEA, 2005)

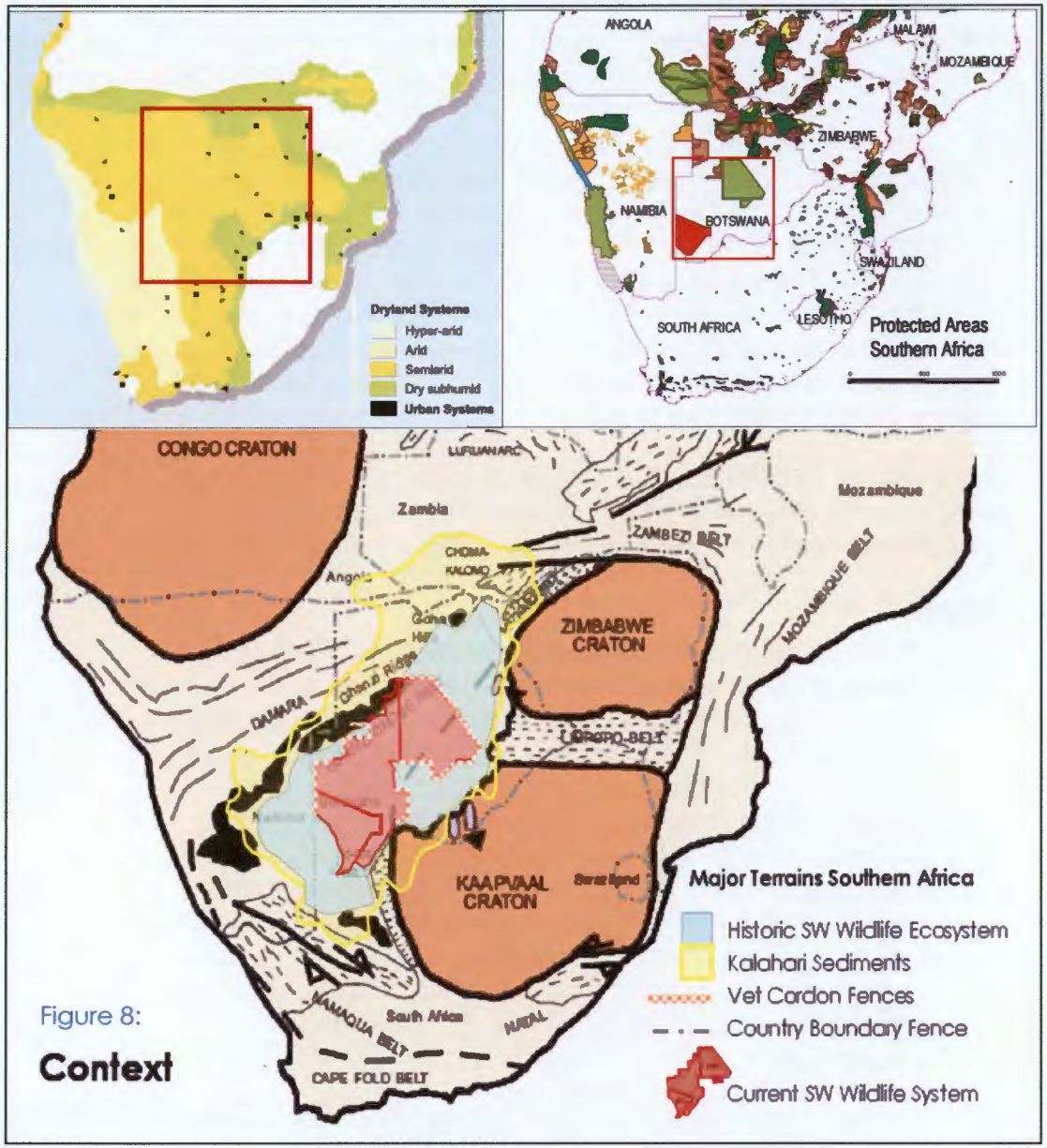


Figure 8:

Context

Figure 9Methodology

These steps refer to the methodology diagram on the preceding page where the phases of bioregional planning are clearly laid out.

1. **Problem / Opportunity Identification** through global studies
2. **Initial Goal Establishment** (to be fine-tuned after review of detailed studies)
3. a. **Overlay Present Land Use, Migration Routes and Hotspots** which gives rise to the **Macro biogegraphic region** and **Conflict zones**
   Determine boundaries of the study area (Phase 1: Macro biogeographic region)
   Boundaries of the largest appropriate ecosystem within which other ecosystems are nested Use Migration routes of resident ungulates, Habitat zones of resident mammal populations such as Gemsbok, Haartebeest & Eland .
   Determine the appropriate Mitigation Measures (Phase 2a: New Land Use Plan; Phase 2b: Socio-Economic Plan)
   Broad scale existing Landuse is overlaid with wildlife & livestock habitats during the dry season, migration routes and settlement patterns to determine zones of conflict. Thereafter appropriate mitigation in the form of a proposed New Land Use Plan (core, buffer, transition zones, settlements & agriculture) and a Proposed plan for Socio-Economic upliftment
   Determine Bioregions within study area (Phase 2c: Bioregions)
   b.Overlay Broad scale Geology, Soils, Hydrology, Vegetation, Animal Habitats, Tribes (each with own traditions, customs, art, social organization)
4. **Sensitivity Analysis** must be drawn up to evaluate the status of the ecosystems in question, local knowledge is imperative unless year long studies have been executed. This includes Biophysical, Cultural, Visual Impact Analysis and Needs Analysis of Stakeholders
5. **Proposed Socio-Economic mitigation and site of intervention**
   Detailed Studies of the region were used to determine the areas for appropriate intervention and goals along with Indigenous knowledge of resource use and settlement patterns, socio-economic climate etc
6. **Planning Concepts and Scenarios :** The development proposals arise from the findings in step 4 and 5 informed by the Structure Plan
   Framework : (Phase 4 : Framework) A final selection is made from the Scenarios proposed for appropriate interventions at the selected site
7. **Layout of Intervention (Landscape Plan)** using Lessons learnt from previous studies and villagers involvement
8. **Public Particpation**
9. **Detailed design for the Intervention** and sustainable solutions at the selected site.

Phase 5 : **Implementation :** Construction of the Sustainable Socio-economically viable Design Intervention.

Phase 6 : **Administration :** Management of the Intervention during and post construction into the maintenance phase by local community.

Methodology Diagram

PHASE 1: MACRO BIOGEOGRAPHIC REGION
- Delimitation of macro biogeographic region
- Identification conflict zones with regard to land use and resource use

PHASE 2a: LAND USE : PRESENT & PROPOSED
- Land-use designation for desirable land usage in accordance with spatial planning categories; a system of values, ethics and a phenomenological understanding of the environment

PHASE 2b: SOCIO-ECONOMIC PLAN
- Mitigation of Areas of conflict into Opportunities

PHASE 2c: BIOREGIONS
- Delimitation of bioregions as planning units in terms of ecological, social and economic criteria
- Identification of bioregional/district boundary differences
- Informs structure plan,

PHASE 3: LAND MANAGEMENT UNITS
- Establishment of land management units
- Informs the framework plan

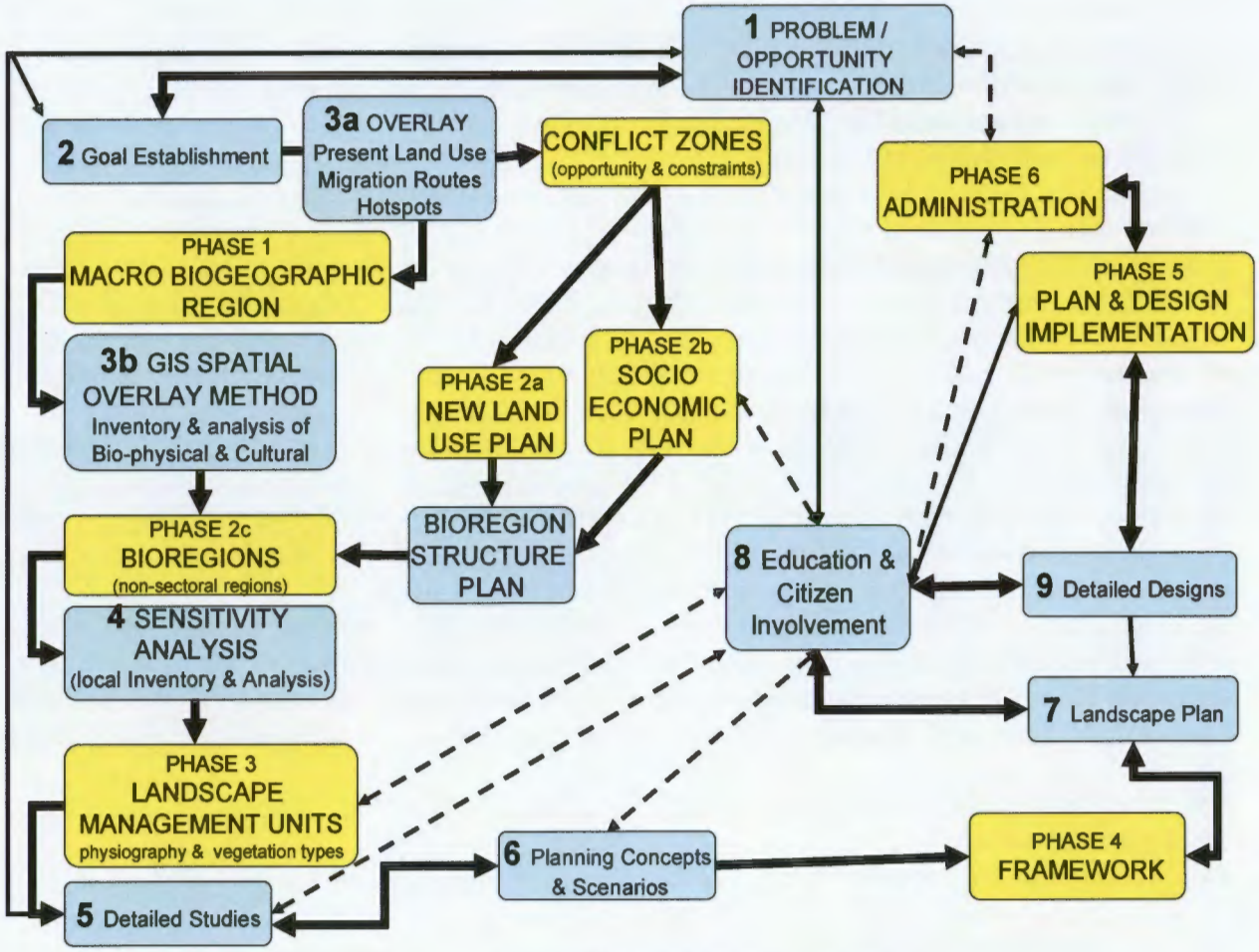


Figure 10 Methodology Diagram

PHASE 4: FRAME WORK
- a qualitative development of the human-made environment through application of the principles of bioregionalism

PHASE 5: IMPLEMENTATION
- Create appropriate data base links and management within the current administrative structure

PHASE 6: ADMINISTRATION
- Bioregional management: guidance, adaptive management, measuring and improving performance.

1 Delimitation of Macro biogeographic Region

As a first step it is important to indicate endemic mammal distribution patterns and habitats to delimit SW Wildlife System in Botswana as this ecosystem represents by far the largest entire ecological system which will then be used to delimit the macro biogeographic region.

As this is a momentous task, salient factors such as Dry season distribution were taken into account to reduce the overwhelming amount of information under consideration. The Dry Season indicates the period of greatest stress with regards to resources and conflict due to scarse food & water supplies in this region. In theory, It follows that If dry season habitats are protected then the mammal populations under consideration will also be protected. Reports and Data received from DWNP in Botswana for distribution of all mammal populations over the last 20 years was generalised taking trends into account to develop the Distribution Map. (Fig.11)

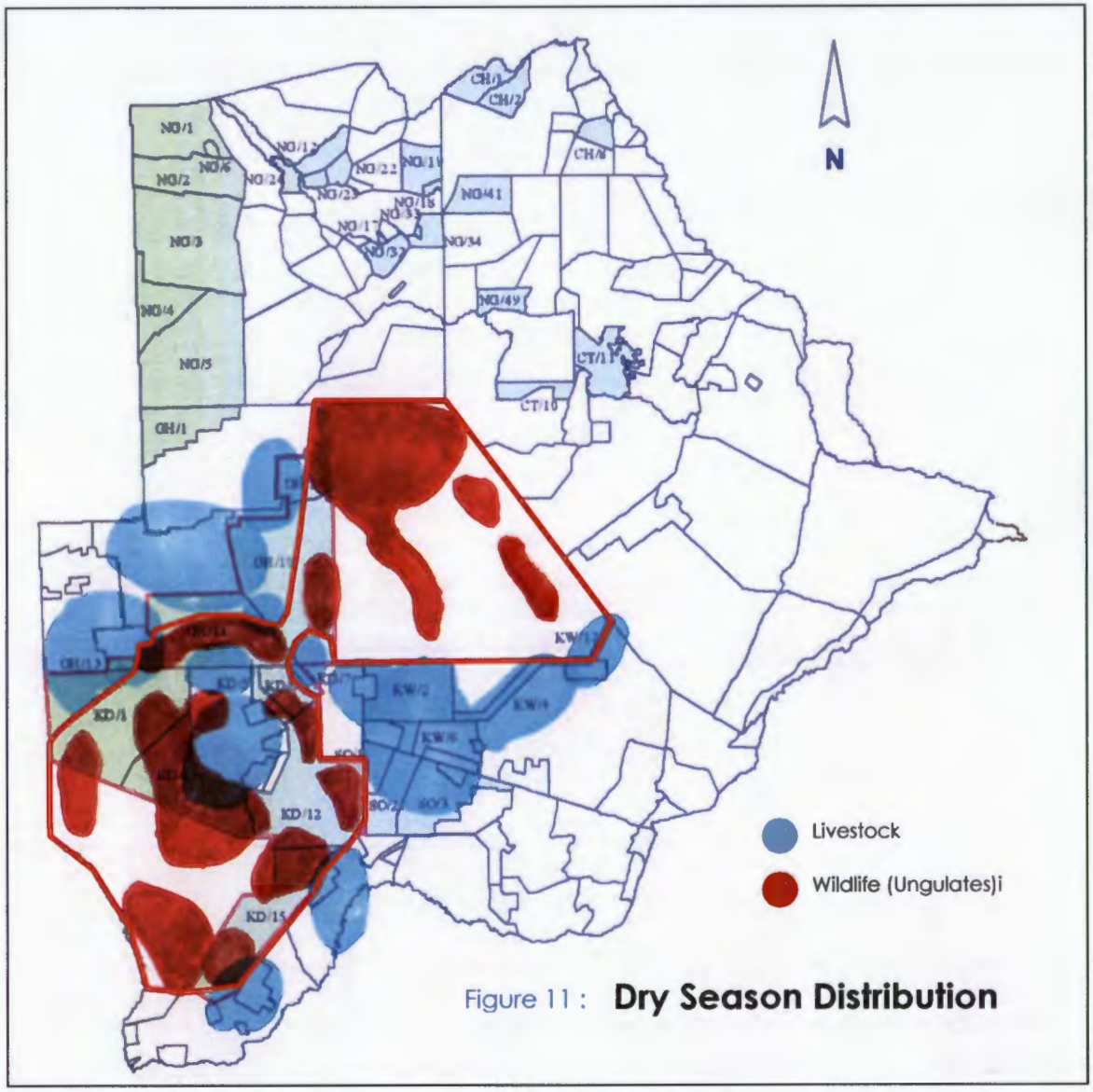


Figure 11 : **Dry Season Distribution**

Conflict zones

Factors affecting Wildlife Distribution

Historically, Sandveld areas of SW Botswana between KTP and CKGR were mainly used by wildlife that were independent of surface water this has changed since borehole technology was introduced in 1930's (Cooke, 1985). The new technology has led to subsequent increases in human population and consequently cattle (Moleele, 2002). As a result, cattle farming has become the dominant rangeland user over wildlife with the pans being heavily grazed by livestock (Campbell & Child, 1971). These factors have interfered with the habitat and migratory routes of the wildlife between the reserves (Arntzen & Veerendal, 1986) The variety and quantity of wildlife has declined markedly over the years (Arntzen, 1998)

The likely causes of decline in wildlife numbers in the Kgalagadi region have included the expansion of the livestock sector, increasing hunting pressure, drought, declining surface water and the erection of cordon fences which interfere with the migratory patterns of wildlife from the Kalahari to the Okavango delta with far reaching reduction effect on wildlife (Pearce, 1995; Arntzen *et al.*, 1998;). This decline in wildlife numbers in the district has resulted in (1) reduction in wildlife products for subsistence and commercial use; (2) reduction in wildlife processing activities; (3) increased hunting efforts and opportunity costs (Arntzen *et al.*, 1998) and (4) decline in subsistence income levels.

Impact of Human Activities on the SW Wildlife System

Communities in the RAD settlements have low regard for predators because of the high levels of conflict and stock loss. Most respondents to a survey conducted in 2008 (Selebatso, 2008), reported having removed a predator in the last 5 years. The methods utilized included shooting, hunting with dogs, gin traps, live trapping, driving down with vehicles, removal by DWNP, chasing away and use of poison. At least 30% of the cases of predation could be mitigated through more appropriate livestock management. The predation of livestock could also be managed by non-lethal predator control, for example, darting and rehabilitation. An education programme which can increase awareness of the benefits and necessity of predators in the Wildlife Management Areas can bring with it new eco-tourism products to diversify the livelihoods of the rural people in these areas.

If implemented, there is a strong possibility that conflict can be decreased and communities will see the great potential for livelihood improvement that can be realised.

Mining, and prospecting for minerals (Fig. 12) is another human activity that very easily slips under the radar, due to the fact that prospecting licences are easily obtained. The accumulative impact of all the possible prospecting and mining that could potentially destroy or encroach on the already tenuous migration routes of the SW Wildlife system might not be detected until it is too late.

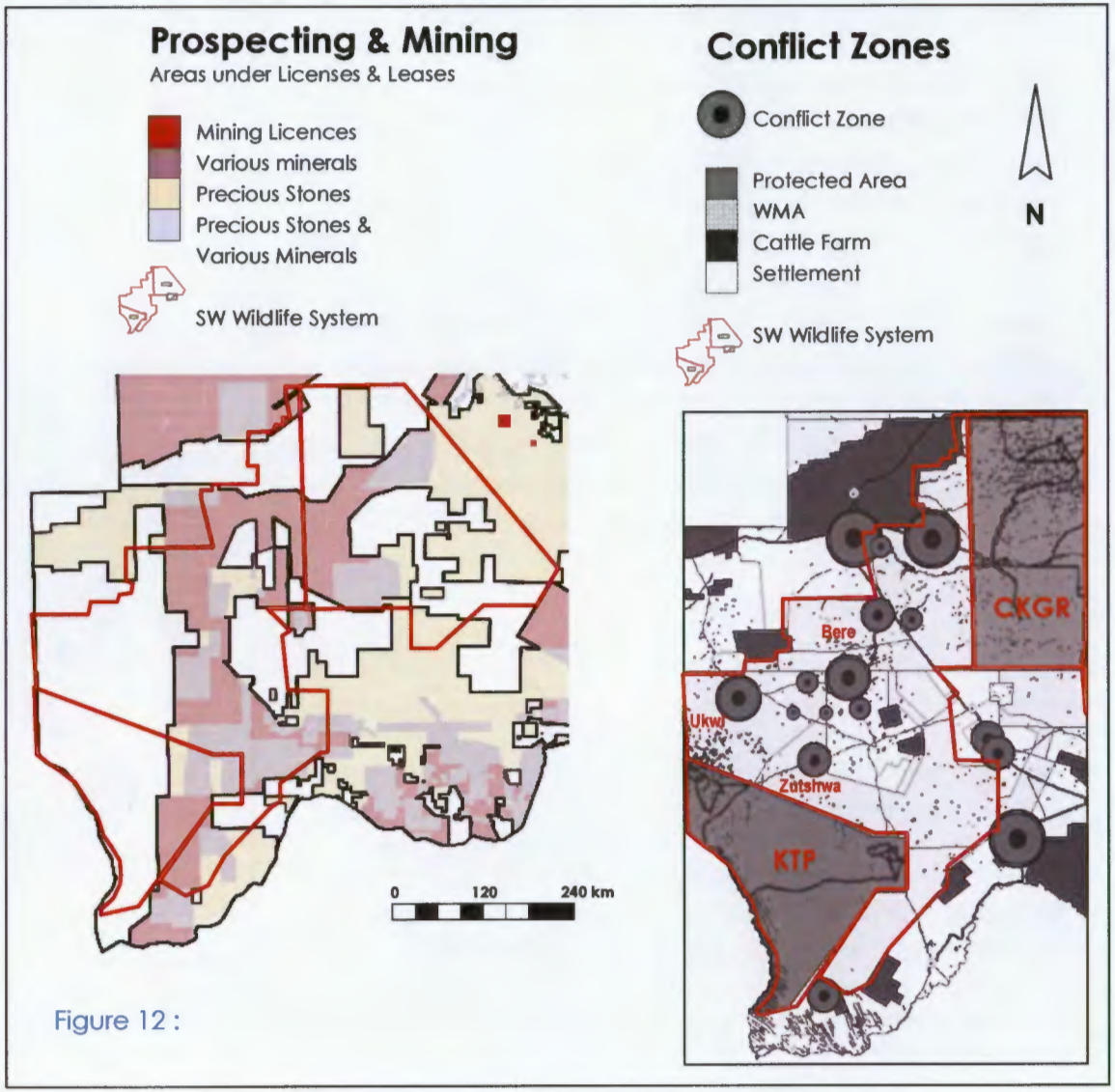


Figure 12 :

Assessment of Road Interference

Corridor 1 (11100km2) roads = 0.1km/km2

Corridor 2 (10500km2) roads = 0.08km/km2

Corridor 3 (8850km2) roads = 0.07km/km2

Corridor 4 (7500km2) roads : 0.1km/km2

The Viability of proposed Migration Corridors

Based on ranges of collared wildebeest within the region, 30km represents an average minimum width of range required by wildebeest and hartebeest to comfortably forage and move from the CKGR and KTP. The diagram shows the main corridor (Corridor 1) which is 370km in length and has minimum narrow section is 32.5km (>30km) due to encroachment by cattle farming. The second alternative Corridor 2 shown is 350km in length and has a minimum narrow section of 30km (=30km) mostly due to settlement encroachment from both sides. In Corridor 3, a bottleneck of 15km wide (<30km shown in red) for a distance of 40km of the length of 315km creates, a blockage making this corridor presently unviable. Corridor 4 runs in a NW-SE direction from KD1 (Ukwi) to KD12() via KD2 (Zutshwa) and has very few constraints.

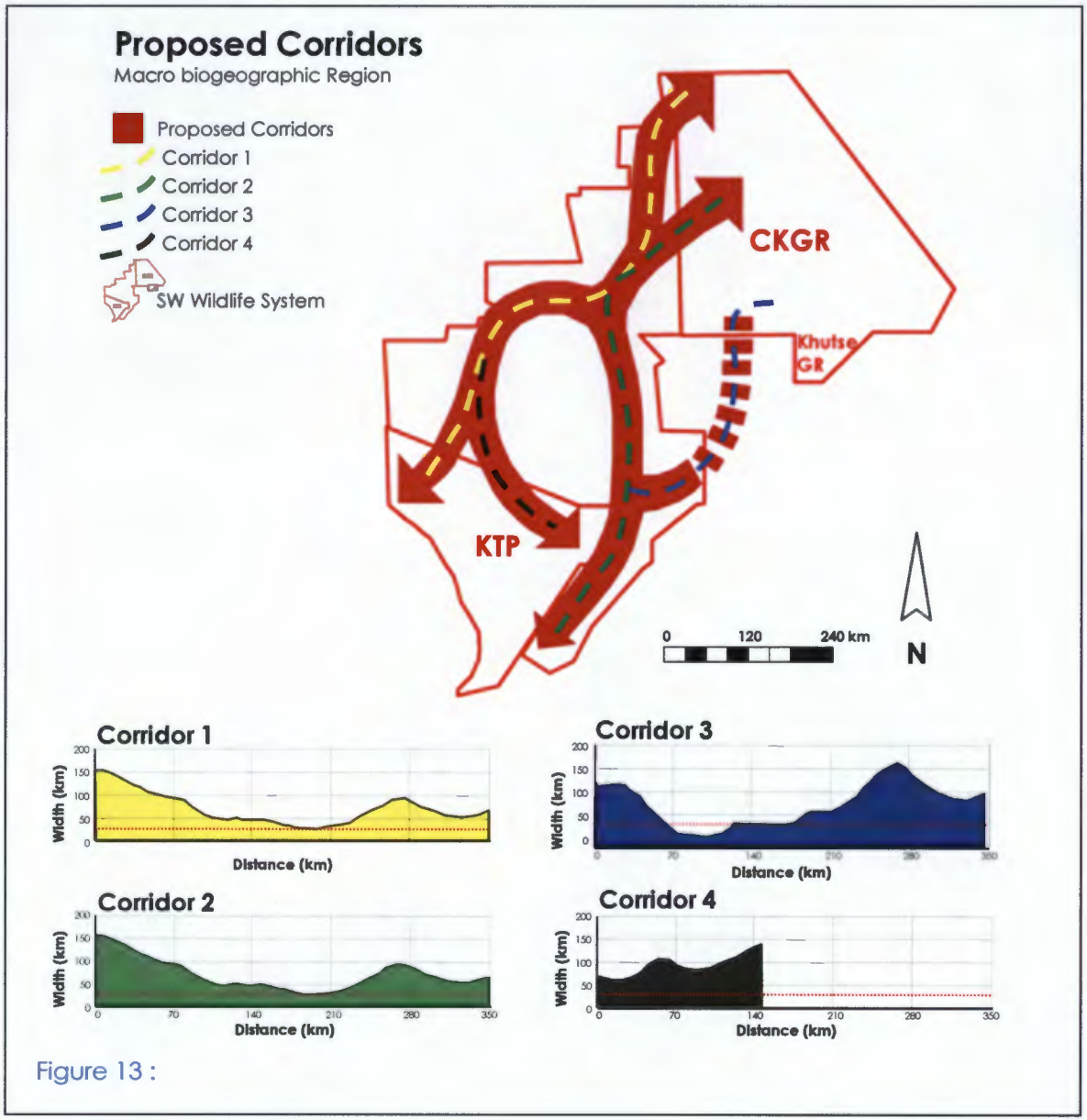


Figure 13 :

Implications for Development

FINDINGS

Conflict is prevalent in Land Use issues with regard to Cattle Faming and Wildlife as well as encroachment of settlements into the core habitats of the wildlife. Resource misuse is paramount where a few rich cattle barons monopolise the water resources (boreholes) earmarked for the RAD communities.

IMPLICATIONS

Decreased ecosystem functioning due to encroachment by human activities including settlement, and displayed as reduced resource availability in an already resource-scarce region has a limiting effect on the socio-economic opportunities available to the rural communities. One of major factors affecting delimiting of the region are the Vet Cordon Fences which have effectively cut the wildlife off from their seasonal habitats, most of which cannot be easily restored due to the existing settlements and cattle farming activities.

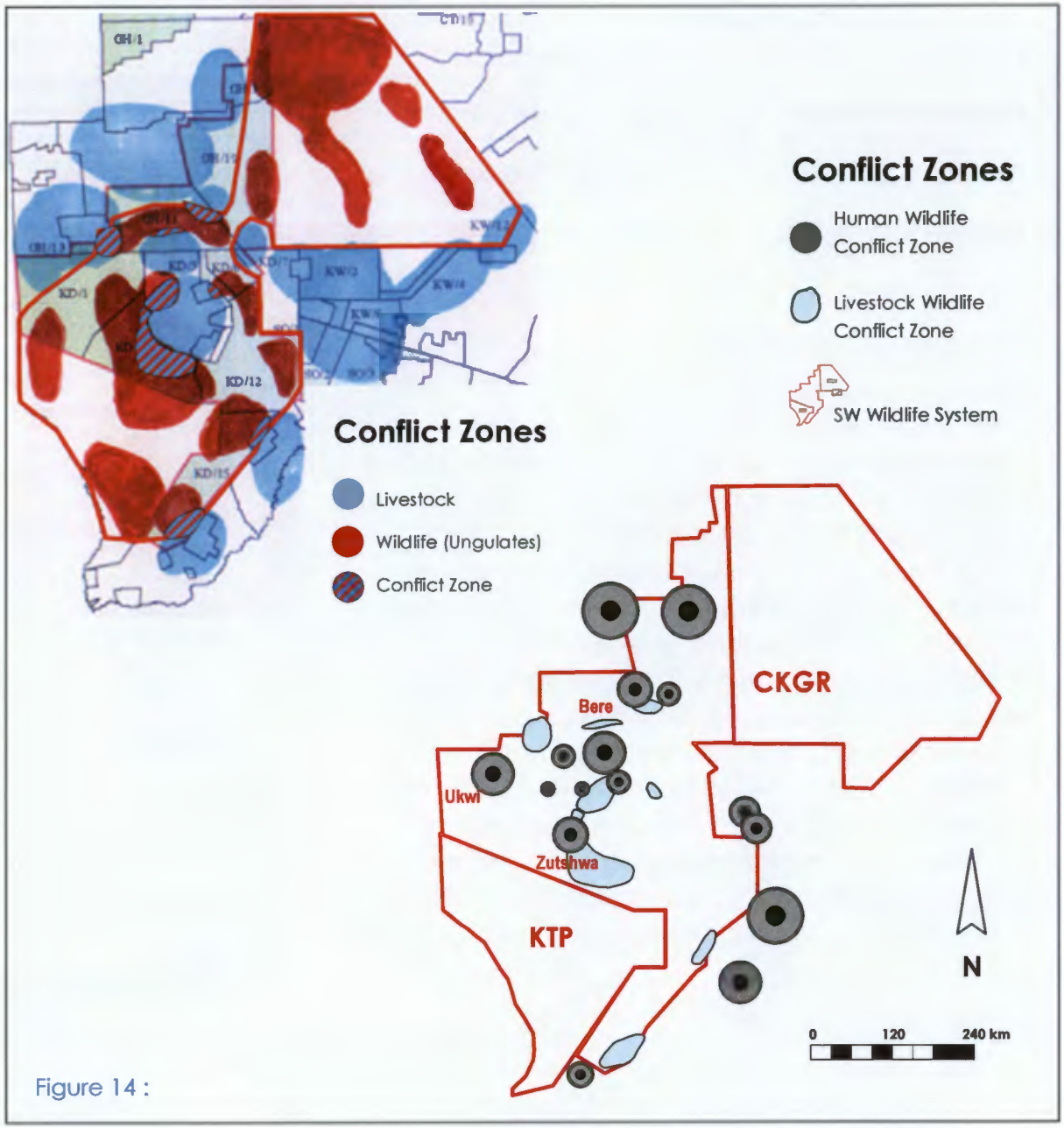


Figure 14 :

Conclusion : Delimitation of Macro biogeographic region

It is apparent from analysis that creating diversions away from the conflict toward better resource use management and new non-consumptive routes for socio-economic opportunities is the way forward. They following Products and Tools are explored in detail in the next section.

2a. New Land Use Plan utilizing Core Protected Areas surrounded by Buffer zones and linked by migration corridors permitting particular activities, to mitigate for Livestock-Wildlife conflict.

2b. Delimitation of the Bioregion. Analysis of the Macro biogeographic region delimits biogeographic units called bioregions making it simpler to determine the needs of each region due to the homogenous nature of each bioregion.

2c. Eco-Tourism Route a non-consumptive form of economic activity to mitigate for more sustainable use of scarce resources while at the same time addressing Predator-Livestock conflict and thereby increasing socio-economic activities among other benefits.

2 a Proposed New Land Use Plan

Zoning

Core, Buffers & Corridors were determined via the methodology set out in the model (pp17-19)

Inner Buffer (non-consumptive zone)

-If the corridor is sandwiched between settlements then the minimum zone is 10km on either side of the corridor
-The buffer must be 20km if the corridor is on a hostile boundary e.g. agriculture (cattle farming)

Outer Buffer

Between the Inner Buffer and the Settlement creating a Transition Zone between development, agriculture and non-consumptive land uses.

Farms

mainly cattle farming being private and government cattle farms

Settlements

RAD village boundaries have been set at a radius of 4km from the central kgotla and the boundaries of larger Villages such as Hukuntsi are set at a 10km radius from central administrative offices

Protected Areas

Areas that are already designated such as KTP and CKGR

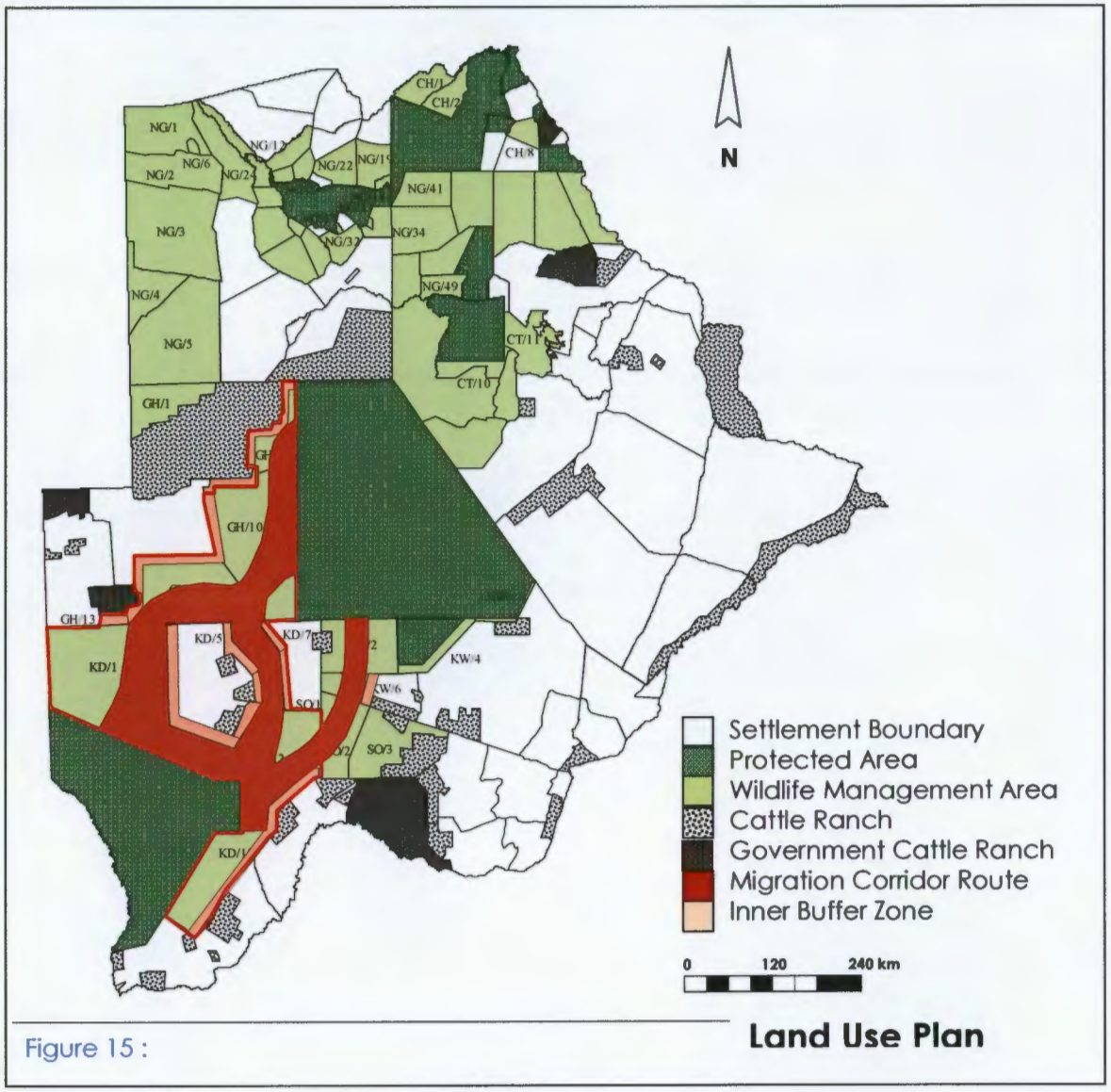


Figure 15 : **Land Use Plan**

Implications for Development (Land Use)

Cattle numbers are increasing, settlements are spreading, water availability is decreasing ; migrating animals are being cut off from their habitats and rural communities need assistance to survive. The New core, corridor and buffer zones which designates new land uses for certain areas aims to mitigate the land use conflict. Migration corridors will assist in time to some degree to restore the wildlife numbers by protecting habitats more vigorously.

2 b Delimitation of Bioregions

Social

The SW Botswana Wildlife Region forms part of the Kalahari Desert Region. The communities that would later grow into the Bakgalagadi, Batswana and Basotho tribes began to form in the Northwest province of South Africa around 1200AD and grew out of the intermarriage between the first Bantu-speaking farmers, the San and the Khoe. The San generally had the lowest position in the tribal hierarchy and lived in serf-like conditions. (Dekker, 2008: 2) The following main tribes (Fig.16) still live within the SW Wildlife region and on its borders: the !Kung Bushmen. the Khomani San, the /Gwi, //Ganaa, Kua and !Xo. The !Kung and /Kwe were employed by the South African Army as trackers and interpreters. A small number of 'Bushmen' still live their ancestral lives as hunters-gatherers, a truly stone-age way of life, to which they have clung for at least 20 thousand years. A traditional way of life is now very scarce, and becoming scarcer by the day. They have maintained their way of life against all odds, including many dedicated extermination campaigns! 25 languages have now been identified and they refer to themselves in the aggregate as "Saasi", and their language as "!Kabee". The very distinct cultures, languages and traditions of these tribes, makes this an important distinguishing characteristic of the bioregions.

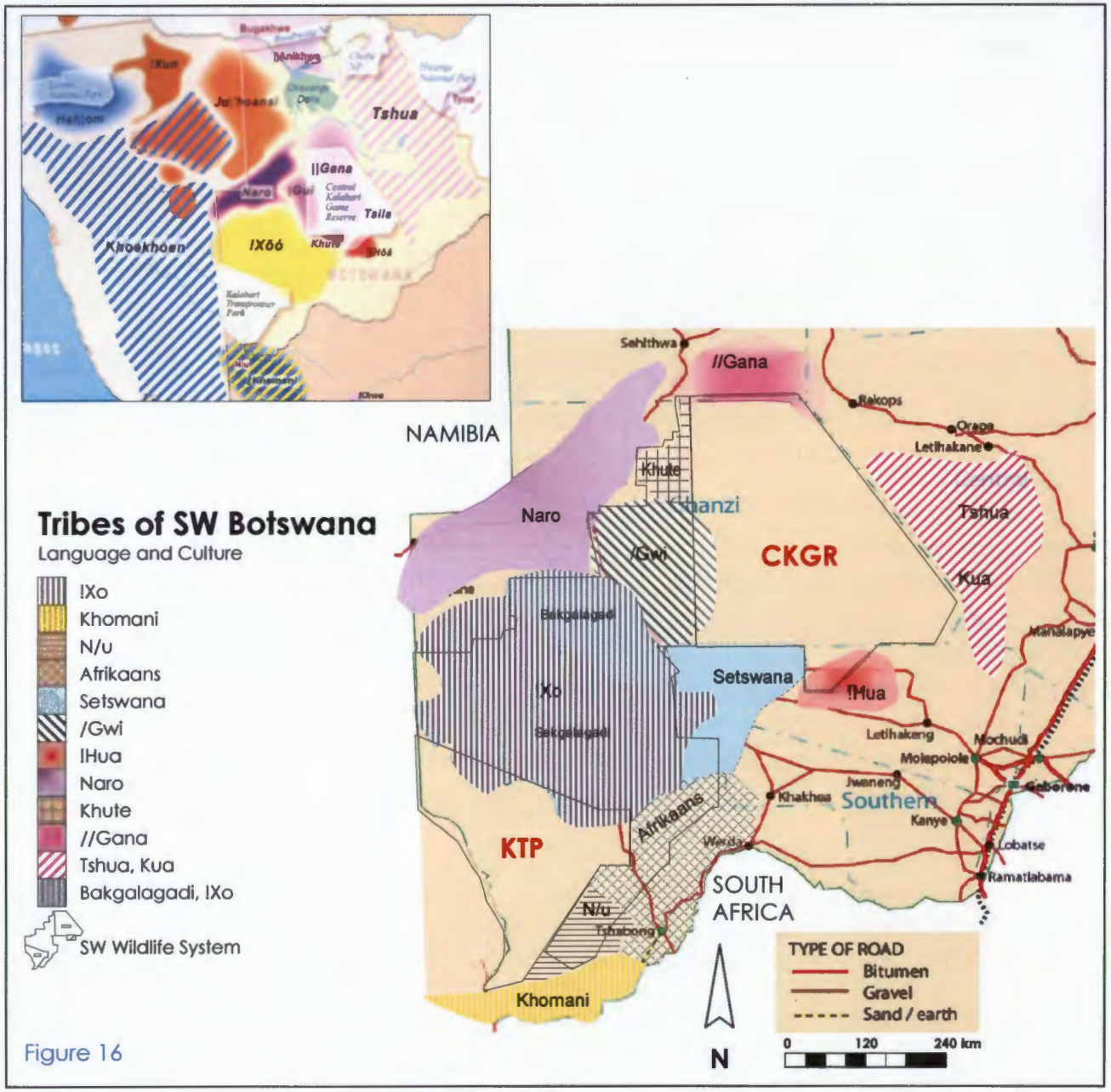


Figure 16

Geology

The Kgalagadi depression was created by the break up of Gondwanaland during the late carboniferous period. The surrounding highlands of Namaqua in Namibia and those in the East contributed to the huge sand deposits that filled the depression. This explains the 120m thick sand stratum found in the Kgalagadi today. (Dekker, 2008:1) Some of the sands do come from weathering of the pre-kgalagadi basement rocks although the sand deposits are largely of aeolian origin. (Guenther 1986:98)

Botswana is roughly divided into the sandveld and hardveld physiographic regions.

The study area falls into the Sandveld Region and is dotted with many pans which hold water during the rainy season important to the survival of wildlife and scattered settlements within the Kgalagadi region. Settlements are generally situated close to pans, the rims of which contain duricrusts (calcretes and silcretes or a combination of these) which are utilized in construction of roads, buildings and as the source of essential nutrients by ungulates on their migratory routes.(BNA, 2000)

Implications for bioregional analysis

The underlying geology has very little effect on the delimitation of the macro biogeographic region into bioregions due to the 120m thick sand stratum overlying the basal rocks. The entire SW Wildlife system is classified geologically as Sandveld.

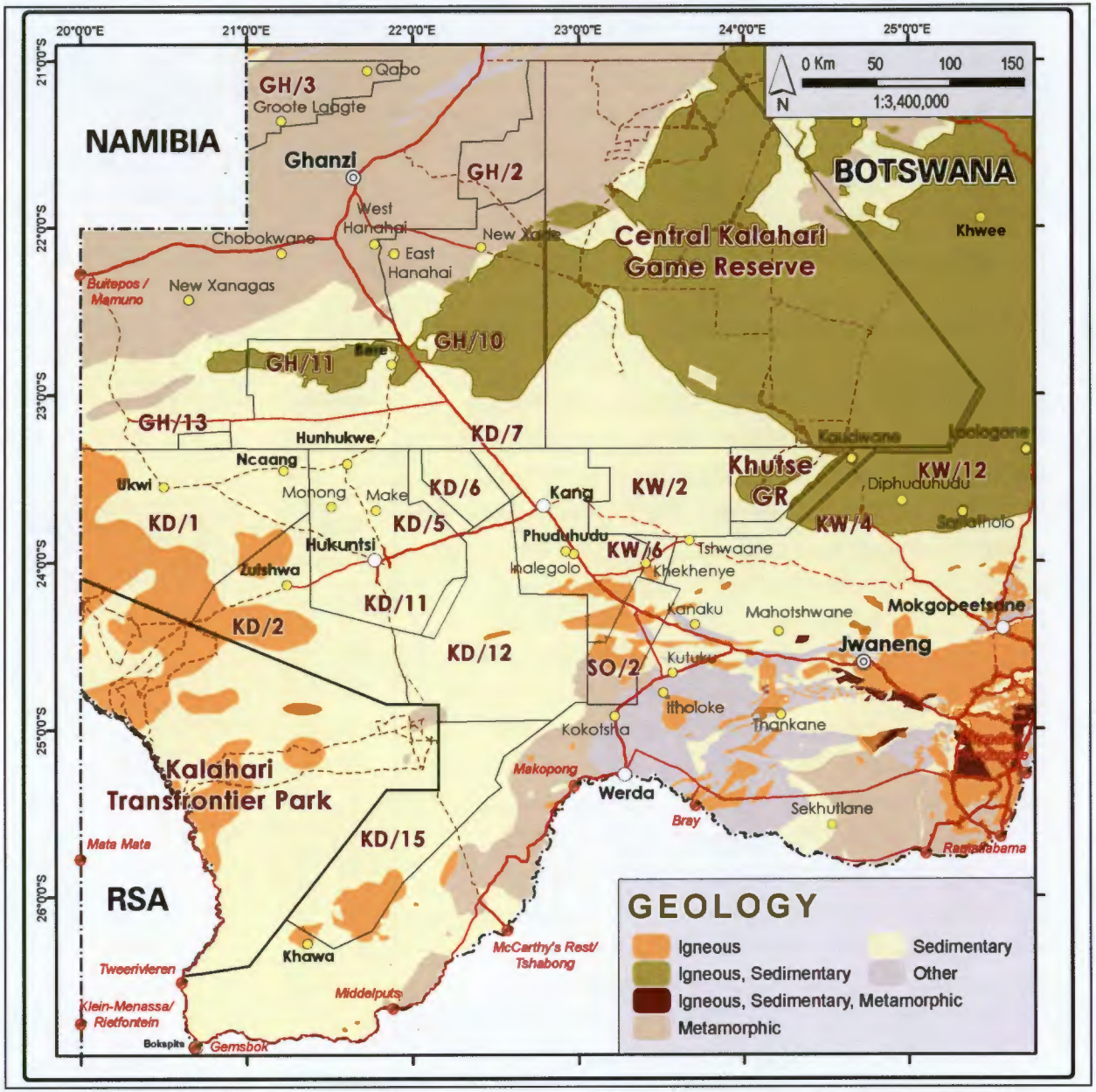


Figure 17 :

Topography

The topography consists of a vast almost uniform plateau with an average altitude of 1,000m, but the elevation generally ranges between 700m and 1300m.

It is located in the latitude of the Tropic of Capricorn and is transversed by latitude 23.5° S in the centre of the large landmass of southern Africa. In terms of global circulation patterns, it lies in a zone where air is tending to descend and therefore to compress and warm-up, so that pressure is generally high and the air is dry. This is the same latitude zone where one finds most of the worlds arid to semi-arid lands

Climate

The study area is arid, with most of the rain falling in the hot summers. Long term average rainfall decreases from north to south and from east to west (Bhalotra, 1985). Average annual rainfall in Tsabong is 296.8mm, in Ghanzi 433.5mm, while in Kanye it is 528.7mm and at Rakops, 355.5mm (SMEC, 1991). The most significant aspect of the rainfall is its extreme variability. Heavy thundershowers may account for over 25% of the expected annual average rainfall within a period of 48 hours. (Ecosurv, 1997) Winter and summer rainfall occur in this region, mostly of the winter rain is confined to the South. Winter rain accounts for about 10% of annual rainfall.

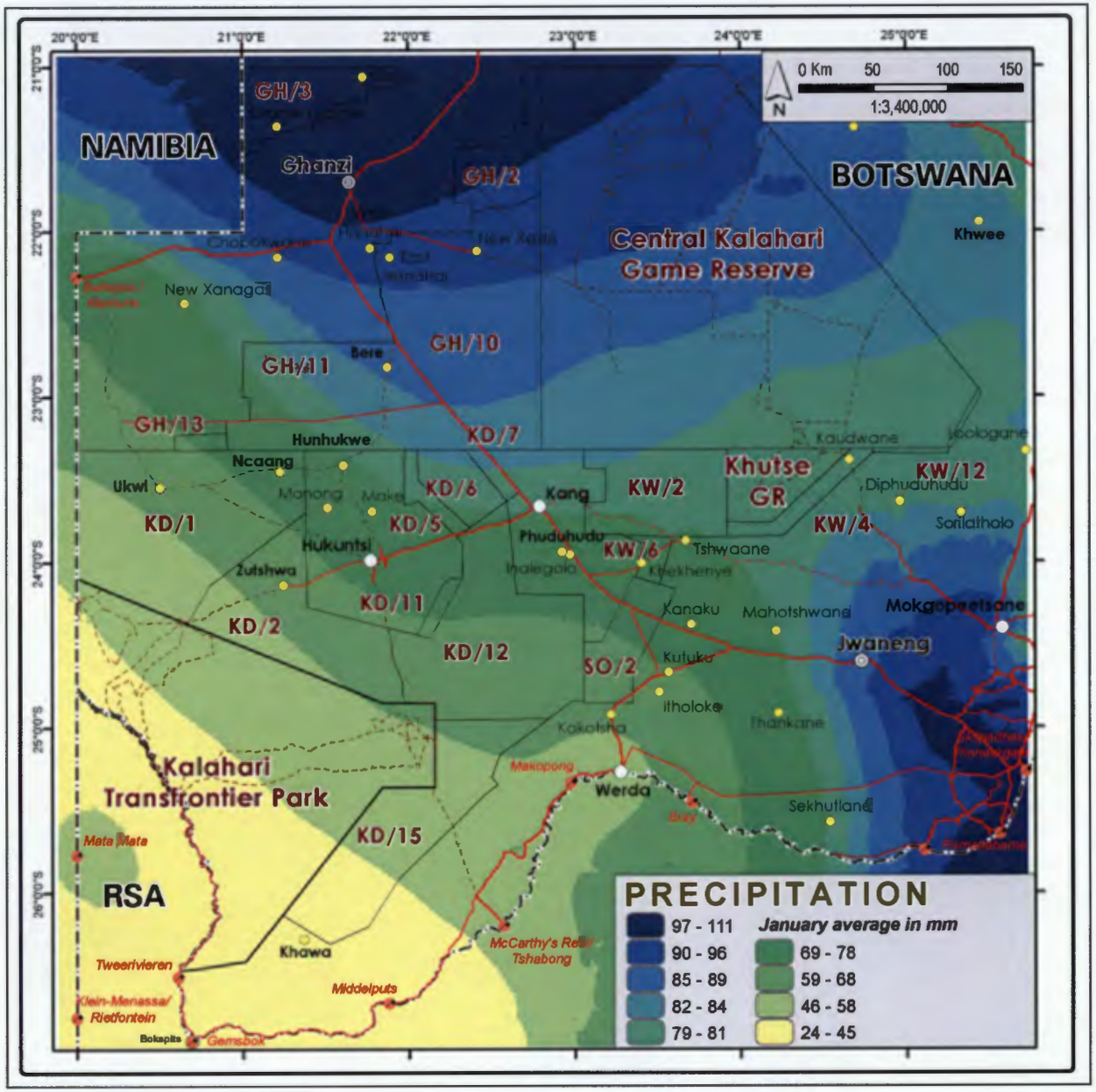


Figure 18 :

Case Study : SW Botswana

Temperatures are diurnally and seasonally extreme which is characteristic of an arid flat terrain: (BNA, 2000) The south western parts of the country experience the least rainfall and cloudiness, therefore logically have the highest number of sunshine hours. The values are, generally, highest in December (summer) and lowest in June (winter) 14 – 28MJ/ sqm per day.

	Mean Max.	Abs. Max.	Mean Min.	Abs Min.	Days Ground Frost
Ghanzi	33.3°C Dec	42.2°C Dec	4°C July	-8°C July	37.3
Tsabong	34.8° C Jan	42.6°C Jan	1.9°C July	-15.2°C July	72.1

Wind

North and North Easterlies are the prevailing winds of the region.
Dust devils are frequent in Botswana and form in fair weather particularly during the dry season with tangental (horizontal) and vertical winds of about 10ms^{-1} as they form and distribute dust and debris upwards before dying away.

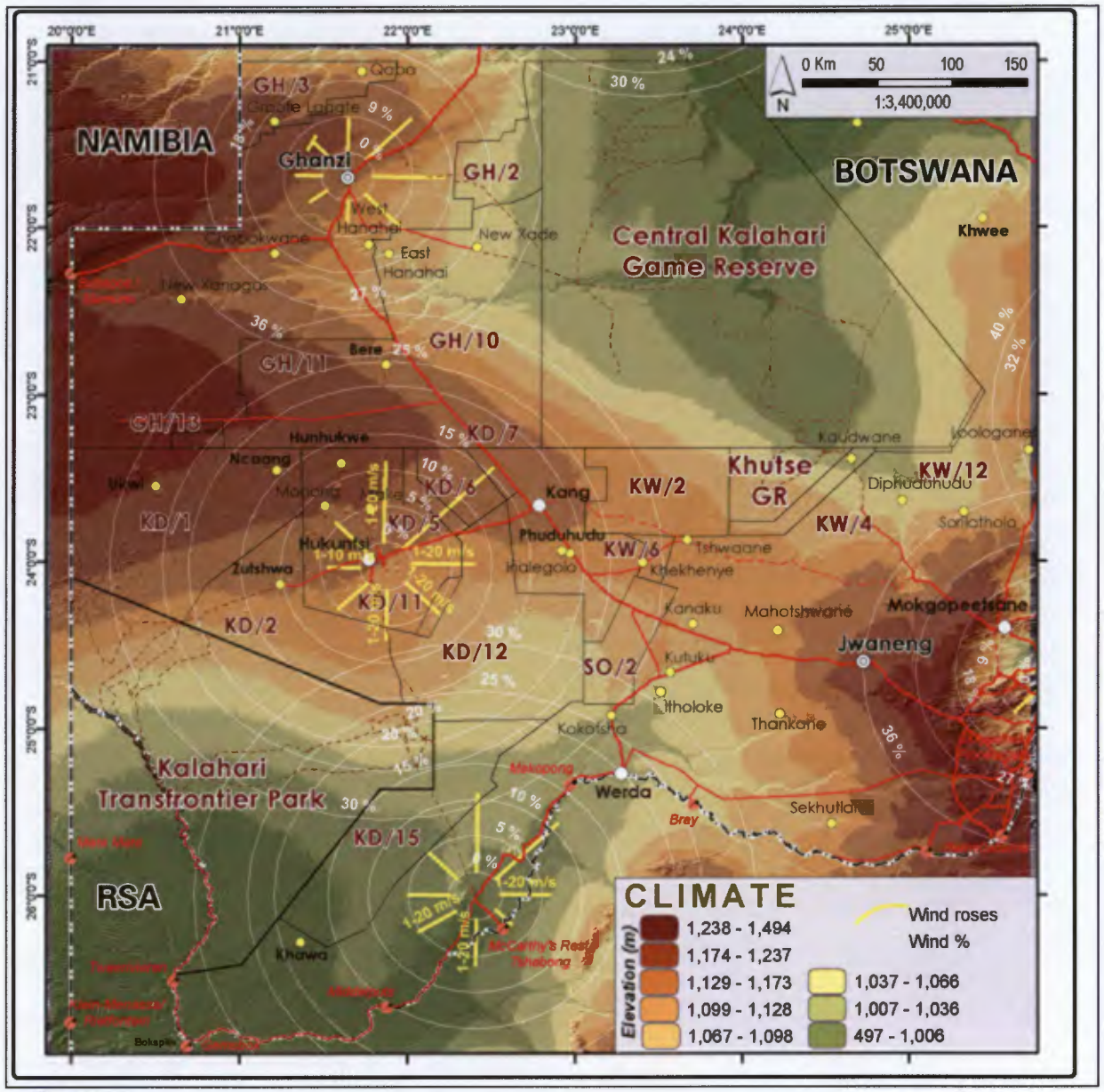


Figure 19 :

Hydrology

The study area is classified as arid and there is no surface water except for that which collects in pans during the rainy season. Water is abstracted from aquifers by means of boreholes and harvested from roofs and stored in tanks for use during the dry season. Water is also trucked to remote settlements during dry periods.(NBA, 2000)

Implications for bioregional analysis

There is no surface water and the presence of the aquifers means that water can be obtained by drilling a borehole. The pans are distributed throughout the region. Therefore the hydrology does not have any marked effect on the delimiting of the bioregions.

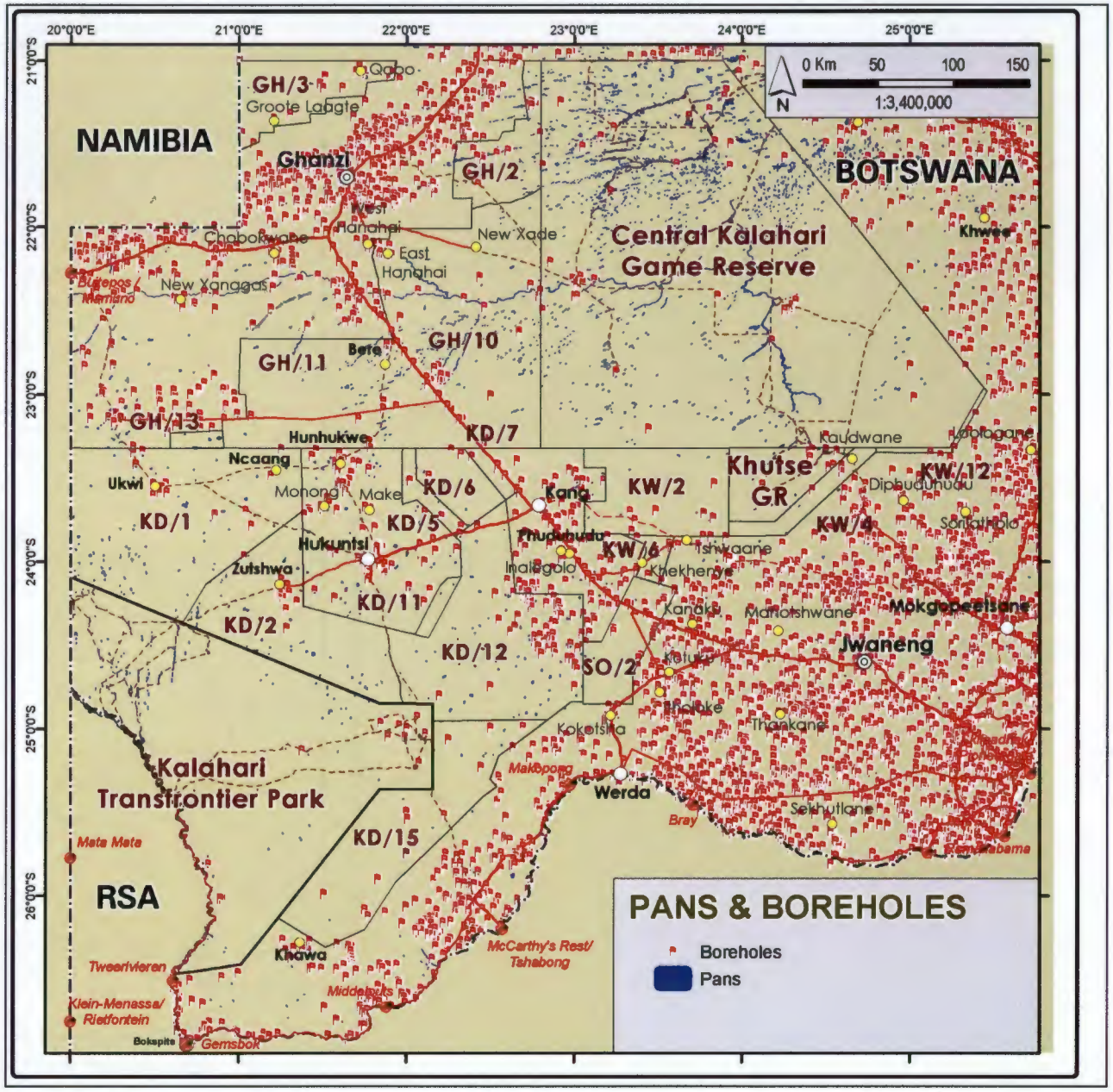


Figure 20 :

Soils

Generally speaking, soils are formed by the interaction of five factors namely: parent material, relief, climate, soil organisms and time. The soils of this region are developed from sand deposits derived from the weathering of medium grained rocks. In Botswana these are often derived from the underlying karoo sediments. The sandy soils tend to be relatively deep although they are frequently interspersed with calcrete. While the texture suggests a low moisture holding capacity, most moisture is available for shallow rooting plants after rains to about 10 metres. Because of their deep sandy profiles, some older trees have adopted a deep rooting drought adaptive strategy with rooting depths down to 60 metres.

Implications for bioregional analysis

Arenosols cover 98% of the region, indicating that soil type does not have a marked effect on the delimiting of the bioregions in this region.

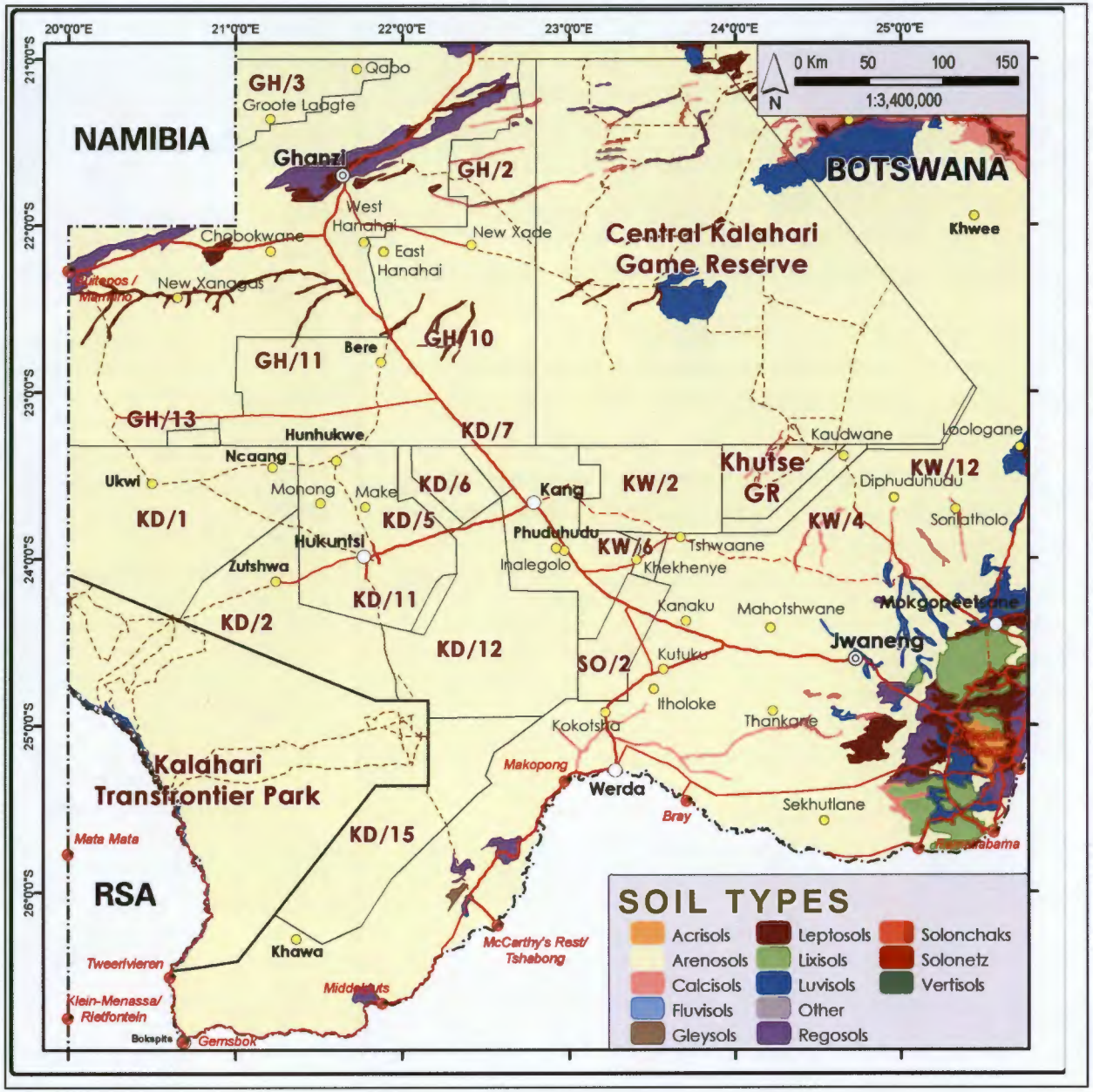


Figure 21

Vegetation

As a net result of the relatively uniform soils and geology of the study area, the vegetation is generally similar in composition throughout. Some variation occurs along the fossil river valleys and within the Schwelle pan regions. There is a gradual change in species composition and biomass from the NE to the SW as the average annual rainfall decreases and changes from a summer rainfall regime to a mixed summer and winter regime. (Bonifica, 1992)

Similarly, there are two main types of vegetation structure in the Kgalagadi district; Tree savanna and shrub savanna with the tree savanna dominated by Acacia erioloba, an important fodder source for animals through its pods and to a lesser extent Terminalia sericea. The shrub layer is dominated by Grewia retinervis, Gnidia polycephala and Tarconanthus camphorates (Kgalagadi District Development Plan 5; Thomas and Twyman,2004). The "under storey" grassland vegetation is characterized by perennial Stipagrostis obtusa and Eragrostis lehmanniana. Other grasses Schimidtia and Aristida species grow abundantly especially after heavy rain. The more herb-like sweet grasses and groundcover type plants grow along pan edges, for example Rhigozym and Tribulus sp.

Implications for bioregional analysis

The region displays four vegetation structures which assist in the delimitation of the bioregion.

Figure 22 :

Conclusion : Delimitation of Bioregions

The social and vegetation factors are the main delimiting factors as indicated by the bioregional analysis. The social factors present as the tribal groups which have distinct languages, traditions and cultures giving distinct boundaries to the regions which are further subdivided by the vegetation classification which will determine resources available in those regions.(Fig. 23)

Implications for Development (Bioregions)

Overlaying of the biophysical and social elements described will give rise to the more homogenous planning units which be used to develop the structure plan for the region along with the Land Use Plan (2a)and the Socio Economic Plan (2c).

Deep sand with low productivity on this fairly flat terrain appears to pose few constraints with regard to development, but on closer inspection many challenges are revealed. Due to the fact that this is an arid region with a water scarcity issue, most settlements occur near the ephemeral pans with low rainfall and great diurnal variation in temperature (42 deg to -7deg) it is clear that many development constraints exist. Wildlife migration routes further complicate matters as delimited core and buffer zones pose further restrictions on development.

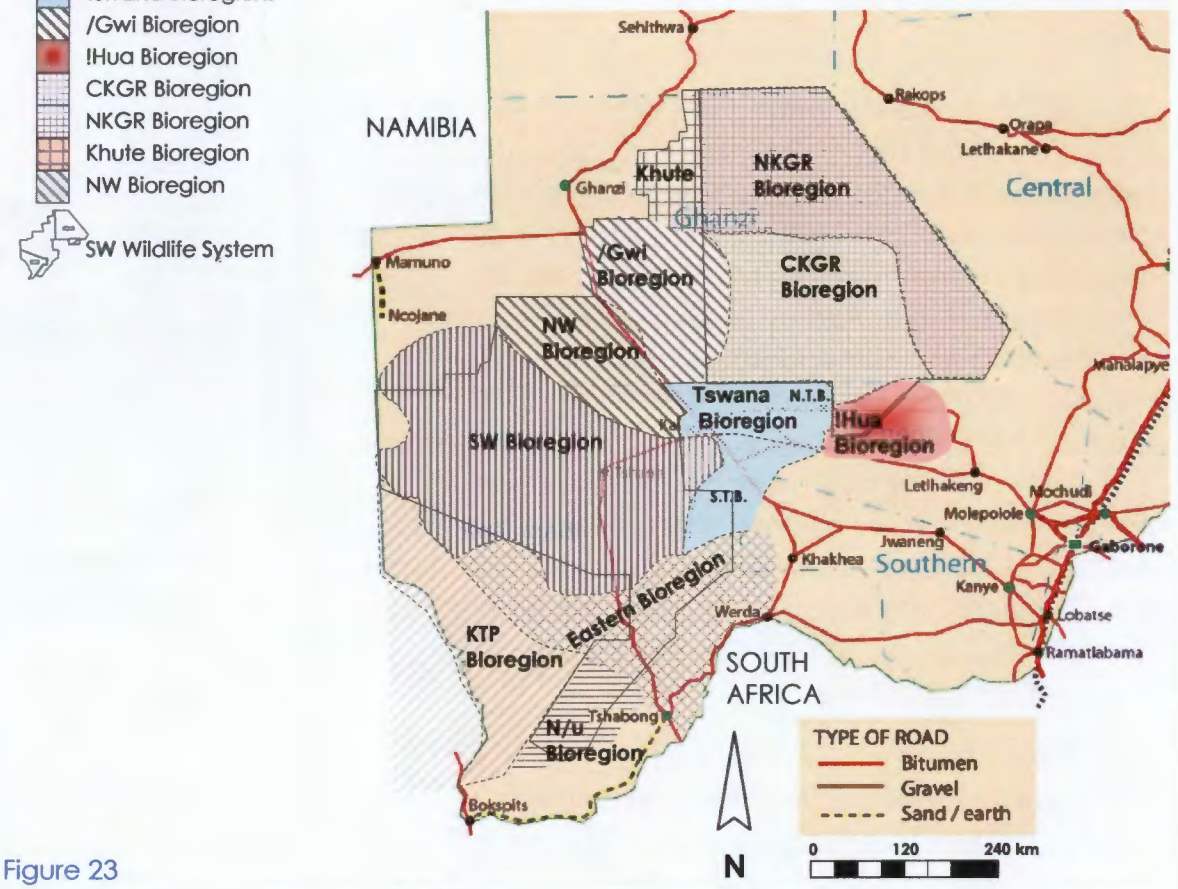


Figure 23

2 c Proposed New Socio-Economic Route

Existing Routes

According to the Tourism Masterplan of the NW Province in South Africa which is the region which adjoins SW Botswana, one of the main aims is to strengthen links with Botswana and Namibia.

The existing routes (Fig. 24) are well placed to act as launch points into the Kgalagadi Region, SW Botswana.

1 W. Cape, S. Africa to Maun, Botswana via Namibia

2 NW Province, S. Africa to Maun, Botswana

3 NW Province, S. Africa to Namibia via Botswana

4 Kalahari Transfrontier Park - South Africa and Botswana

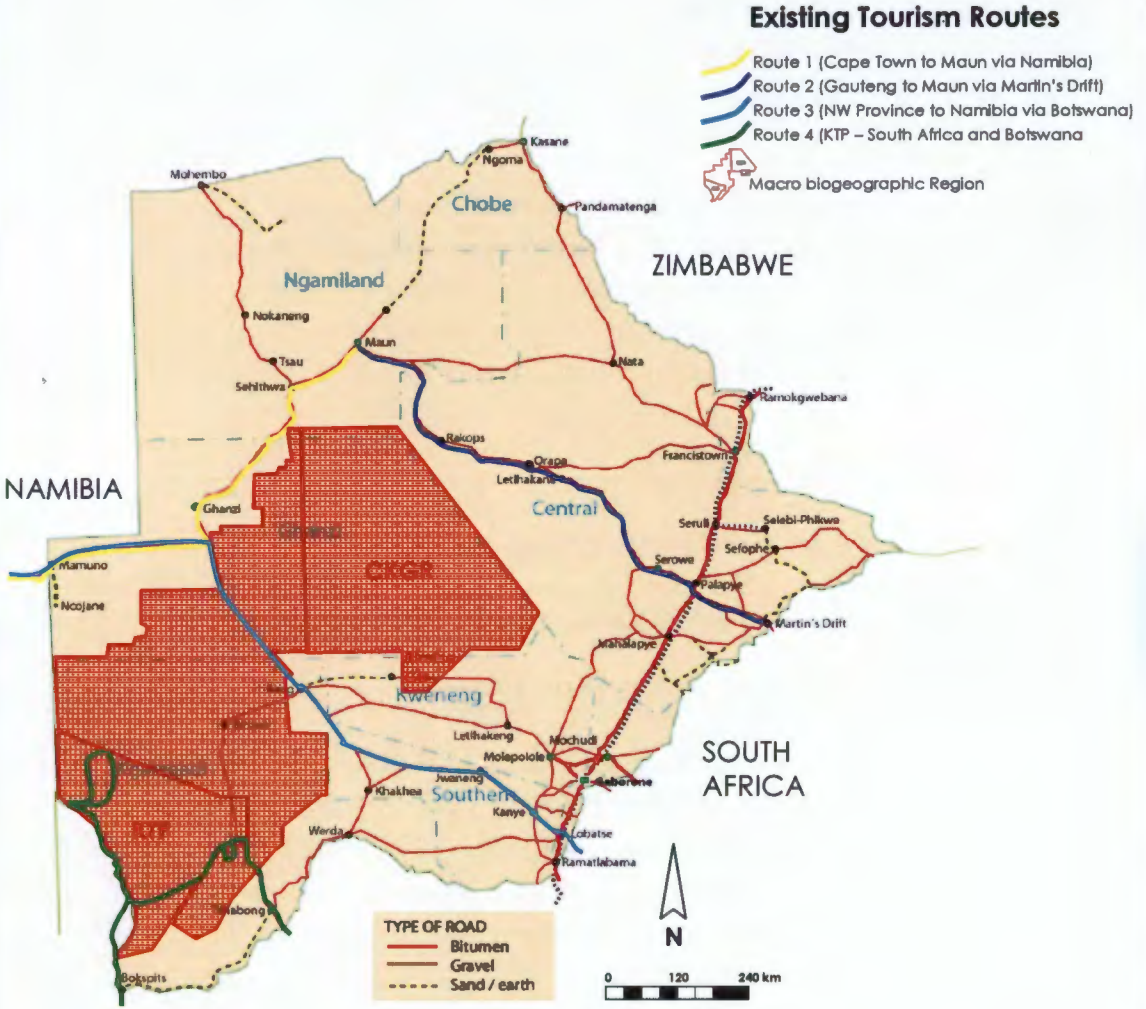


Figure 24 :

Possible New Routes

The proposed new routes which take into consideration the areas of conflict (Fig. 25) with the greatest need for scarce resource management and socio-economic upliftment

These proposed new routes also engage with the Tourism Plans for Botswana and South Africa (NW Province) and extract most probable directions of flow of visitors to the region by determining the desire lines from the Tourism Surveys conducted in KTP & Botswana (2003, 2008, 2009). (Fig. 26)

1 **KTP Extension from Kaa to Mammuno** via Zutshwa

2 **Lobatse to Kaa** (KTP) via Hukuntsi & Zutshwa

3 **McCarthy's Rest to Maun** via Mabuasehube & Bere

4 **KTP to Khutse GR** via Zutshwa and Kang

Implications for Development (Eco-Route)

The New Routes will inform the selection of a site for more equitable sustainable resource use; reduction in Wildlife-Livestock conflict through intervention and mitigation thereby strengthening the socio-economic sector and empowering the local community.

Figure 25 :

Site Selection as part of Eco-Route

Methodology

The migration corridors have been identified by an overlay method taking into account biophysical characteristics of the region including positions of boreholes and pans as well as settlement, land use and migration patterns over several years to include dry and wet season migration.(2a New Land Use Plan)

Hotspots (Conflict Zones) have been identified throughout the corridors determined by a display of conflict between livestock and wildlife, predation, settlement, landuse as well as resource scarcity. These hotspots (Conflict Zones) are then examined with regard to viability for inclusion in socio-economic upliftment schemes (routes) which could tap into already existing markets to create a sustainable solution for the hotspots in question.(2c Selection for Eco-Route)

The site having met the above criteria will then follow an intense scrutiny of design and development opportunities, out of which the most practical strategy would be adopted and detailed up for presentation. Indigenous knowledge and practices are inseparable from this process. (Scenarios toward a Framework)

Very important, is the replicable nature of the process so it may be implemented as a model for future development within a conservation corridor.

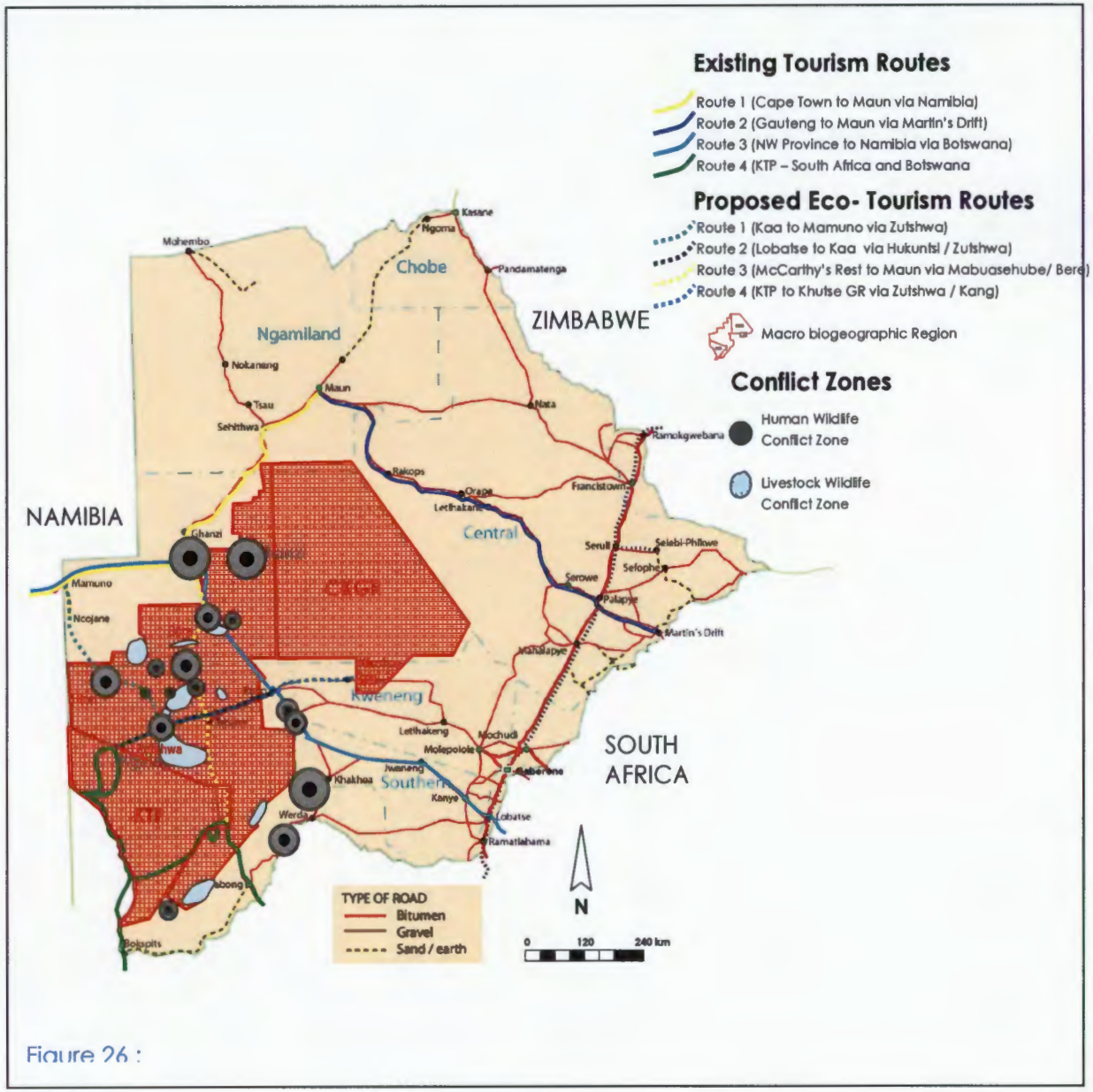


Figure 26 :

Performance Criteria for Site Identification

The Site should encompass a human settlement within the identified migration corridor.

The site should display conflict between livestock and wildlife as well as resource scarcity offering opportunities for conflict resolution

The site should also provide a viable interface with other opportunities, such as resource-based economic ventures and sustainable tourism possibilities to facilitate socio-economic upliftment and develop a best fit scenario.

The Potential Sites of Zutshwa; Bere; Ukwi; Kawa; Hunhukwe or Ncaang which have been identified as hotspots display: conflict between wildlife and livestock with regard to scarce resources and predation; include a settlement with socio-economic constraints due to a lack of livelihood opportunities; land use conflicts due to scarce resources.

Zutshwa is closest to KTP which makes it an obvious choice as the first stop along a route extension from Kaa Gate to Mammuno (Namibia); Kaa to Khutse (Central Botswana) or Kaa to Maun (N Botswana) which are all well marketed and well-populated destinations. (Fig. 27)

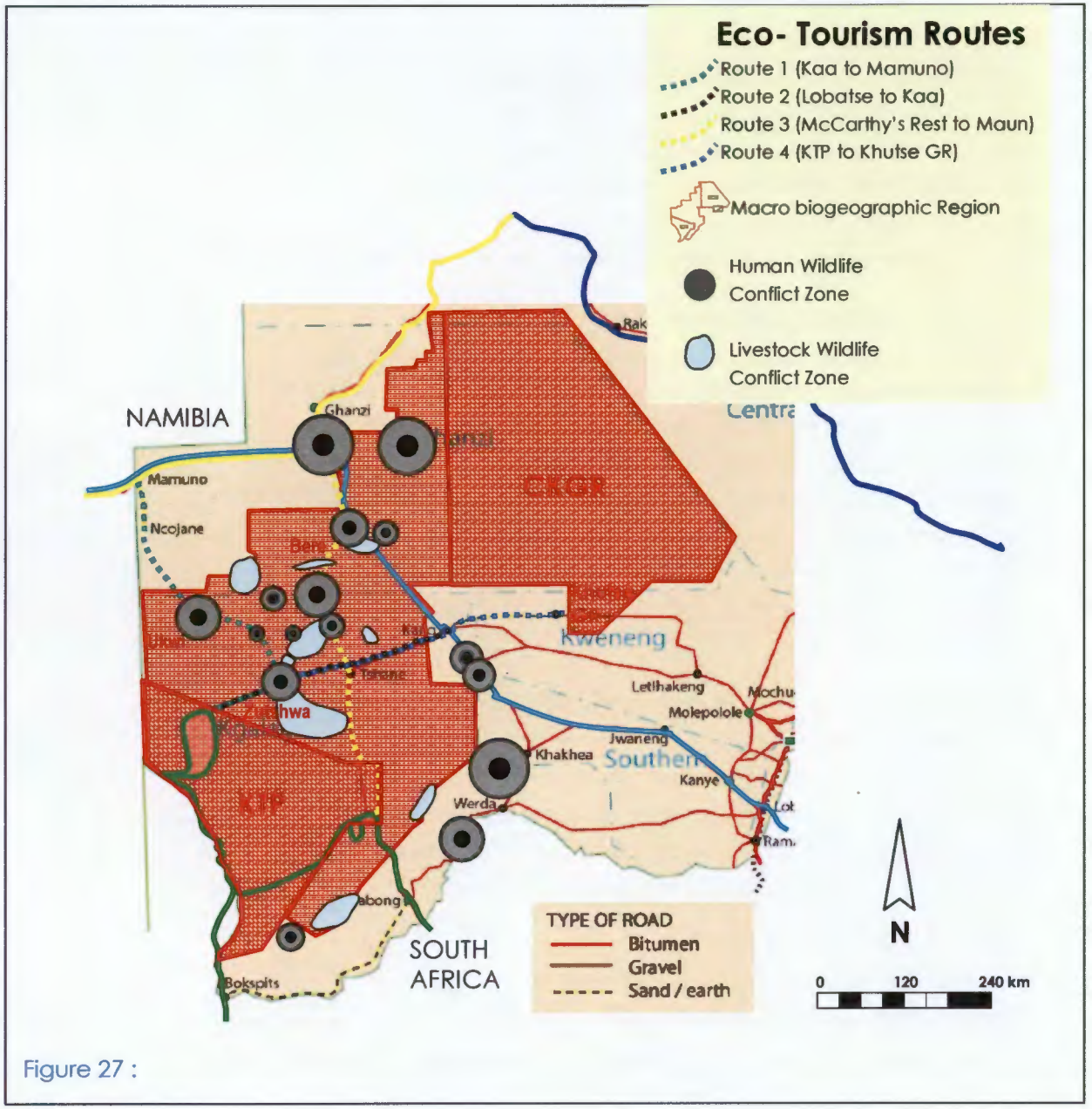


Figure 27 :

3 Delimitation of Landscape Management Units (LMU) with the SW Bioregion

Linking community development to wildlife management is increasingly being seen as the way forward, both for the establishment of self-sustaining economies in the remote areas and to fulfil the objectives of the wildlife conservationists. Countries such as Zimbabwe have approached this through their community development project CAMPFIRE (Child & Peterson, 1991), while other countries such as Namibia and South Africa are establishing similar initiatives. In an attempt to bring conservation and development together the government of Botswana proposed that 20% of the land in Botswana should be zoned for this dual purpose. Thus in 1986 Wildlife Management Areas were established. (Arnsten, 2003:49)

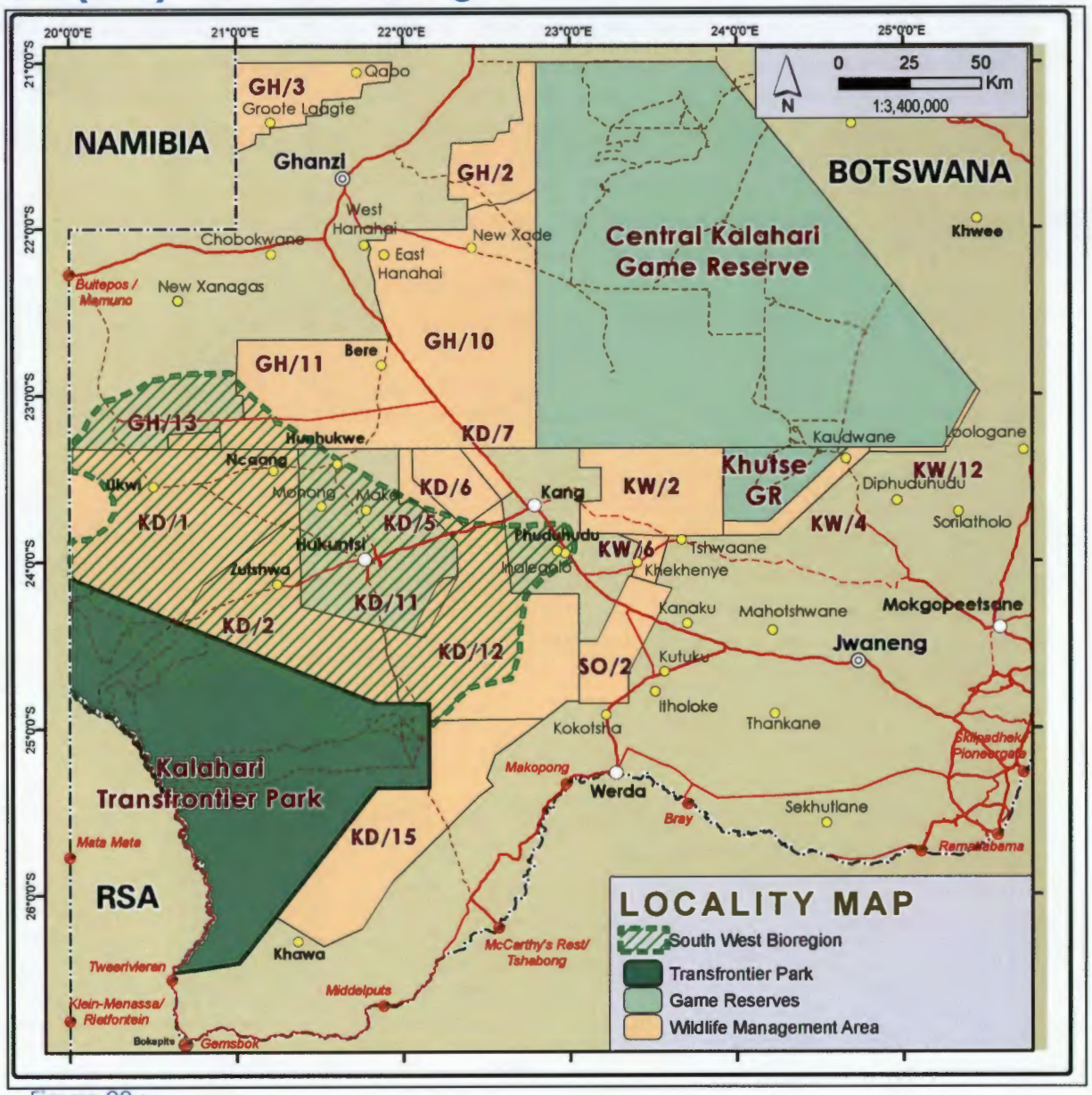


Figure 28 :

Socio-Economic Factors

The south-western bioregion is considered to be the poorest of Botswana. The lack of employment opportunities, the poor education and low literacy levels, the high consumption of alcohol and ethnic tensions all contribute to overall social and economic problems.

The average income of respondents interviewed was not high, at P567/month (skewed by cattle farmers), although it is encouraging to see that the respondents interviewed have a reasonably broad income base, with 44% of respondents generating income from their natural resources such as veld products and wildlife products. However, livestock remains a key activity for the majority of respondents with 82% of people interviewed owning livestock and utilizing them for food and income. The biggest problem for livestock farmers is commonly considered to be predator conflict. Levels of conflict need to be reduced and community perceptions towards predator species significantly improved if conservation of predators is going to be successful in the region (Klein, 2008)

Geology

The underlying geology in this case does not have an effect on the bioregional analysis due to the fact that it is up to 120m below the surface so that it has very little effect on vegetation and a minor effect on soil composition. See Soils section on the next page.

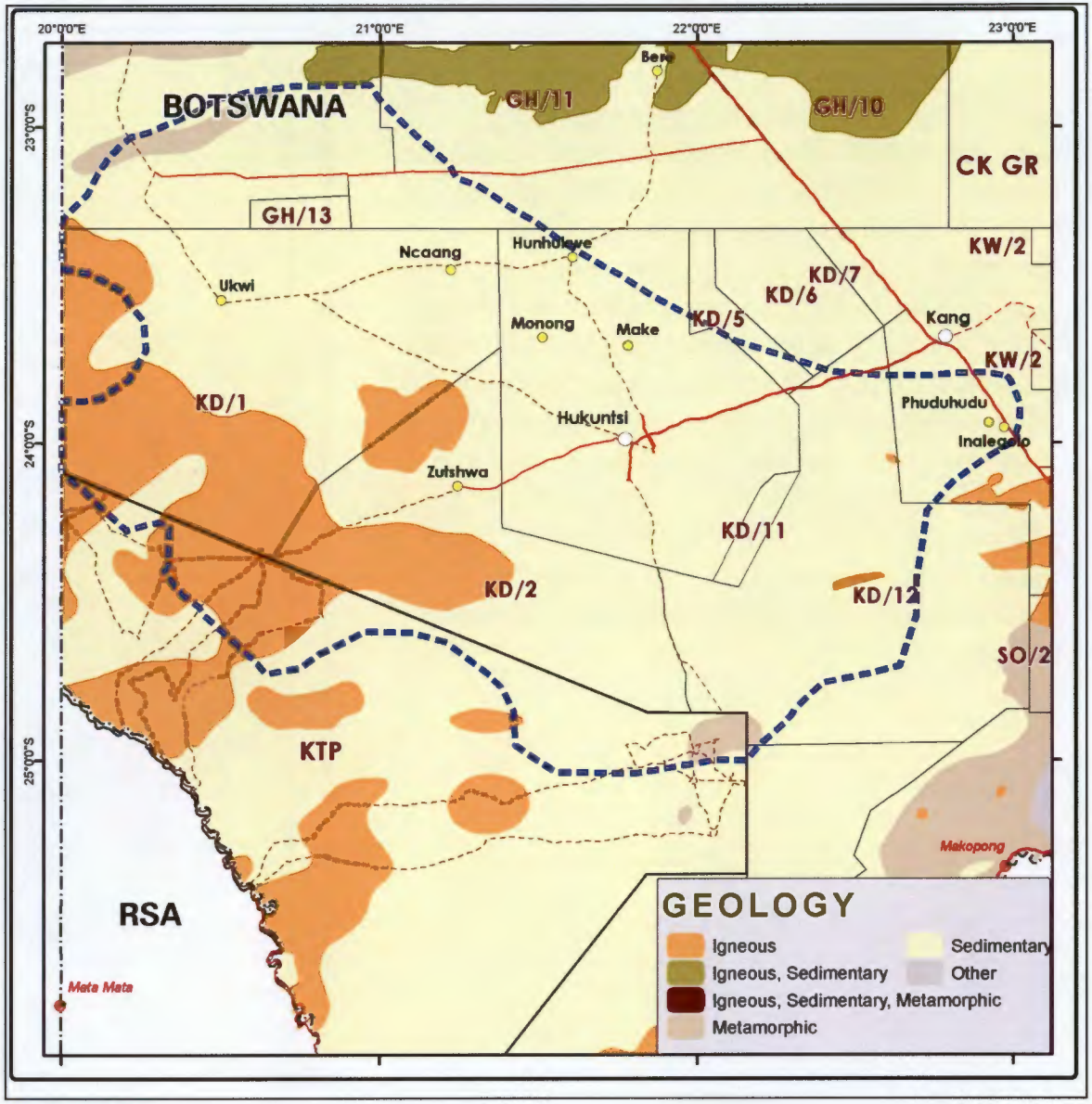


Figure 29 :

Soils

Important to note that is now the soil type that is evaluated not its distribution. The soil type of this region is Arenosols. Some Arenosols have white powdery lime in their soil profiles and these are very rich in basic ions, especially cations, and they normally appear greyish in colour. Arenosols which appear reddish in colour are typically leached and acidic and are very poor in all nutrients. Fine sand is the dominant size fraction in Arenosols, indicating the predominantly aeolian nature of the parent material. The infiltration rates of Arenosols are high. The modal values of the basic infiltration rates for these soils are in the range 25 -30 cm/hr, with the initial rates being much higher.

Implications for development

Crop production is very limited in these soils due to moisture stress. Plants can survive only with very frequent rains, even if it is small amounts. The use and management of Arenosols depend primarily on the seasonal rainfall. However, under semi-arid conditions of Botswana, dryland farming is possible under sprinkler or drip irrigation.

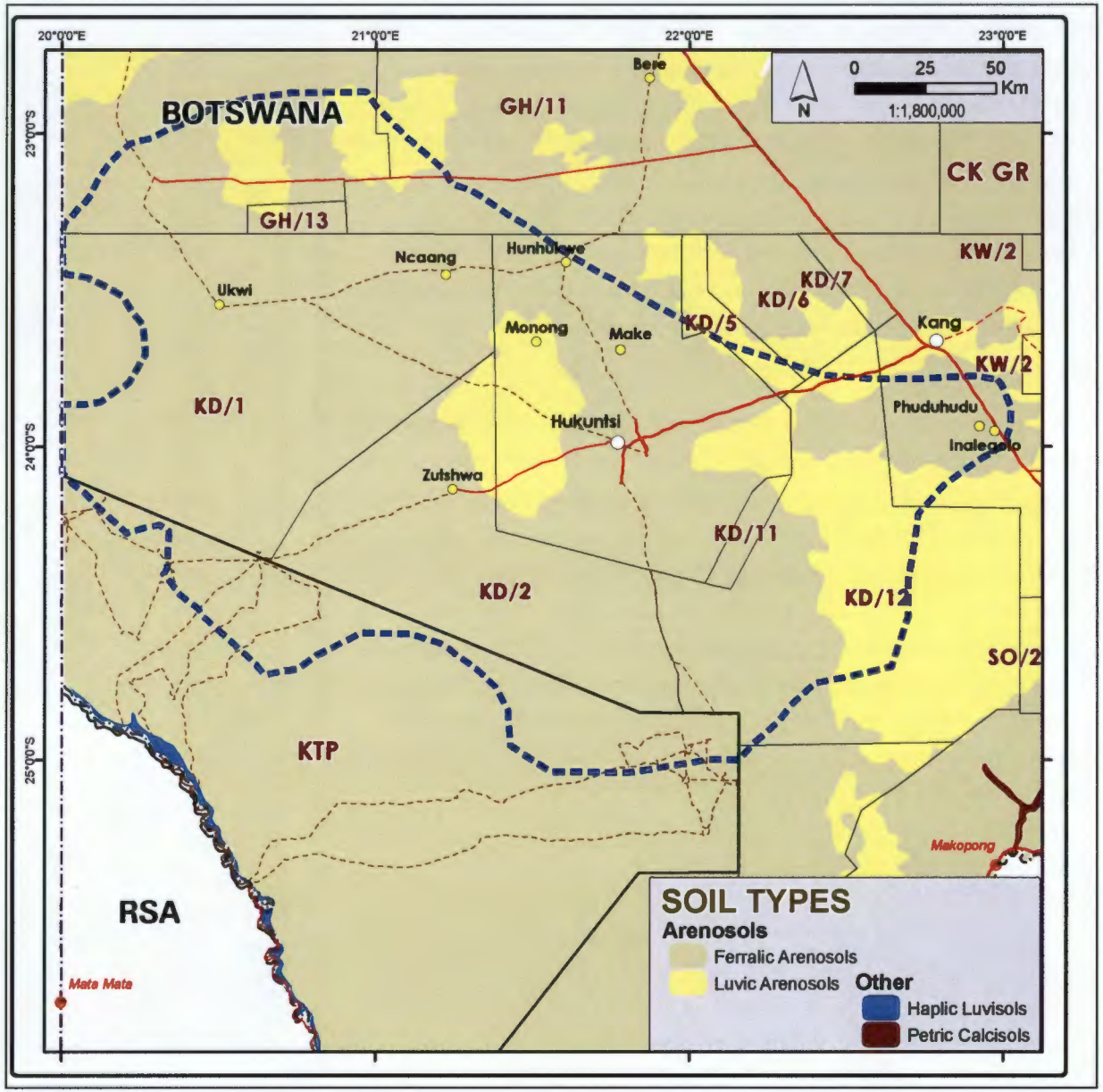


Figure 30 :

Hydrology (Surface & Ground Water)

Over the past decade, developments in the desert have led to the emergence of the present remote area settlements. These settlements should be seen as a direct result of the settling down of the traditional San and other non-San hunter gatherers. With the encroachment into the desert by the cattle economy, a lot of boreholes were drilled for private use. At the same time, a lot of mineral prospecting has been ongoing and this exercise has definitely had an impact on the RADs in terms of employment and mobility patterns. (IDRC, 1998)

Water consumption trends in the bigger villages including Hukuntsi & Kang has since 1979 indicates that 'per capita consumption by stand-pipe users remains steady at 15 Lt per person per day but consumption by people with private connections has risen from 40 to 80 litres per person per day"' (NDP 6: 200). As opposed to water figures in Remote Area Settlements e.g. Zutshwa, Ukwi, Ngwatle, & Bere, which are both under desalination and water trucking. The target in RAD's is about 2 litres per person per day as the bare minimum, to be strictly used for drinking and cooking.

Implications for development

The ever deteriorating water situation has resulted in a call for new technologies such as desalination, and age old techniques such as rain water harvesting. Due to water stress new developments should be self-sufficient with regards to water requirements.

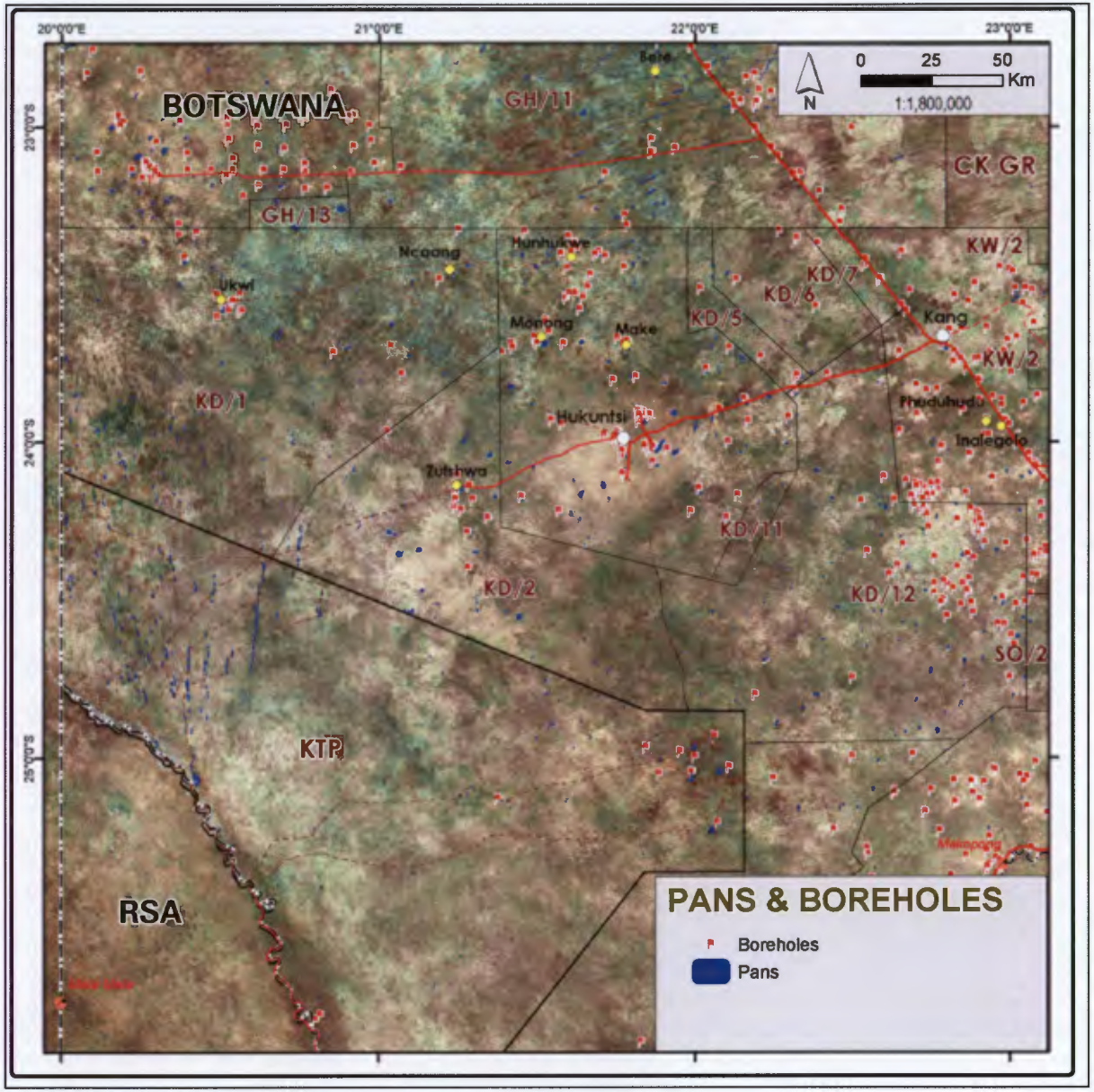


Figure 31 :

Vegetation

Mostly the surface of the pans comprises silt or salt encrustations which prohibit plant growth. Wildlife are attracted to the pans because they provide intermittent water sources (freshwater collects in hollows after rains) and also because of the minerals (mainly salt) which is found in the pan sediments. On numerous pans small pits can be found which result from gemsbok digging into the surface with their horns. Vegetation which is adapted to the arid microclimate, is however found on the edges of pans. Here the vegetation cover includes Rhizogum trichotomum, R.brevispinosum and Tribulus sp. (see Addendum : Vegetation Classes of SW Bioregion)

Much of the Sandveld natural vegetation cover readily supports cattle, just as previously it supported wildlife. The cattle consume large quantities of herbaceous cover mostly during the wet seasons and rely on senesced grasses and browse during the dry season.

The grass species form the so-called Sweetveld because the Acacias in particular add nutrients to the soil producing relatively high quality grazing, at least after rains.

Implications for development

Resources conflict between the cattle and wildlife indicated as degradation of vegetation which is prevalent near cattle farming areas, is. This degradation speaks to carrying capacity which must be addressed for more sustainable landuse. i.e. reducing the number of cattle per square kilometer of land.

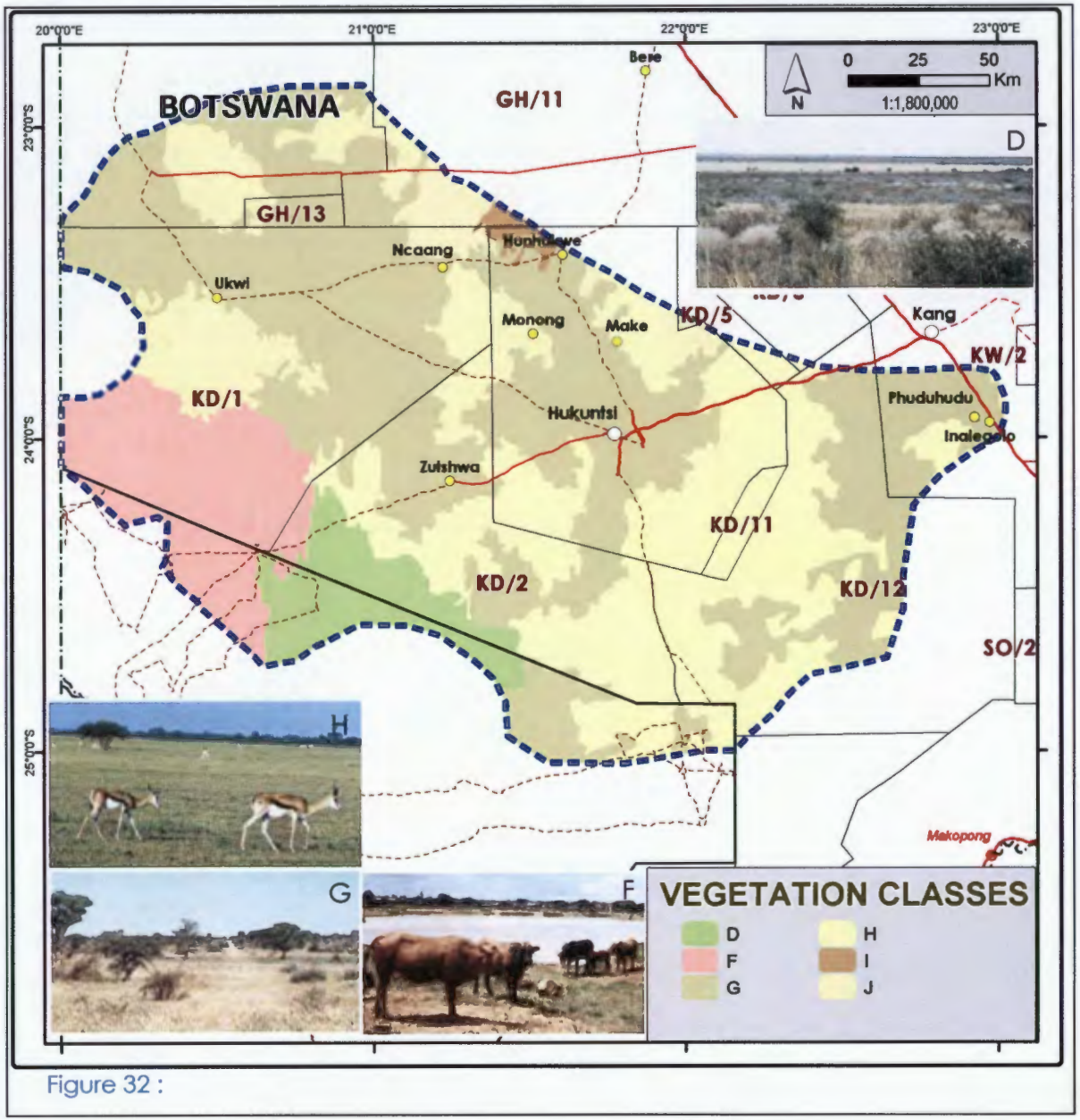


Figure 32 :

Landscape Management Units

Overlaying the soils and vegetation classes created homogenous regions for planning at framework level. Together with the proposed Socio-Economic Plan of an Eco-Route will suggest a site that matches the resource conflict, socio-economic and socio-ecological criteria.

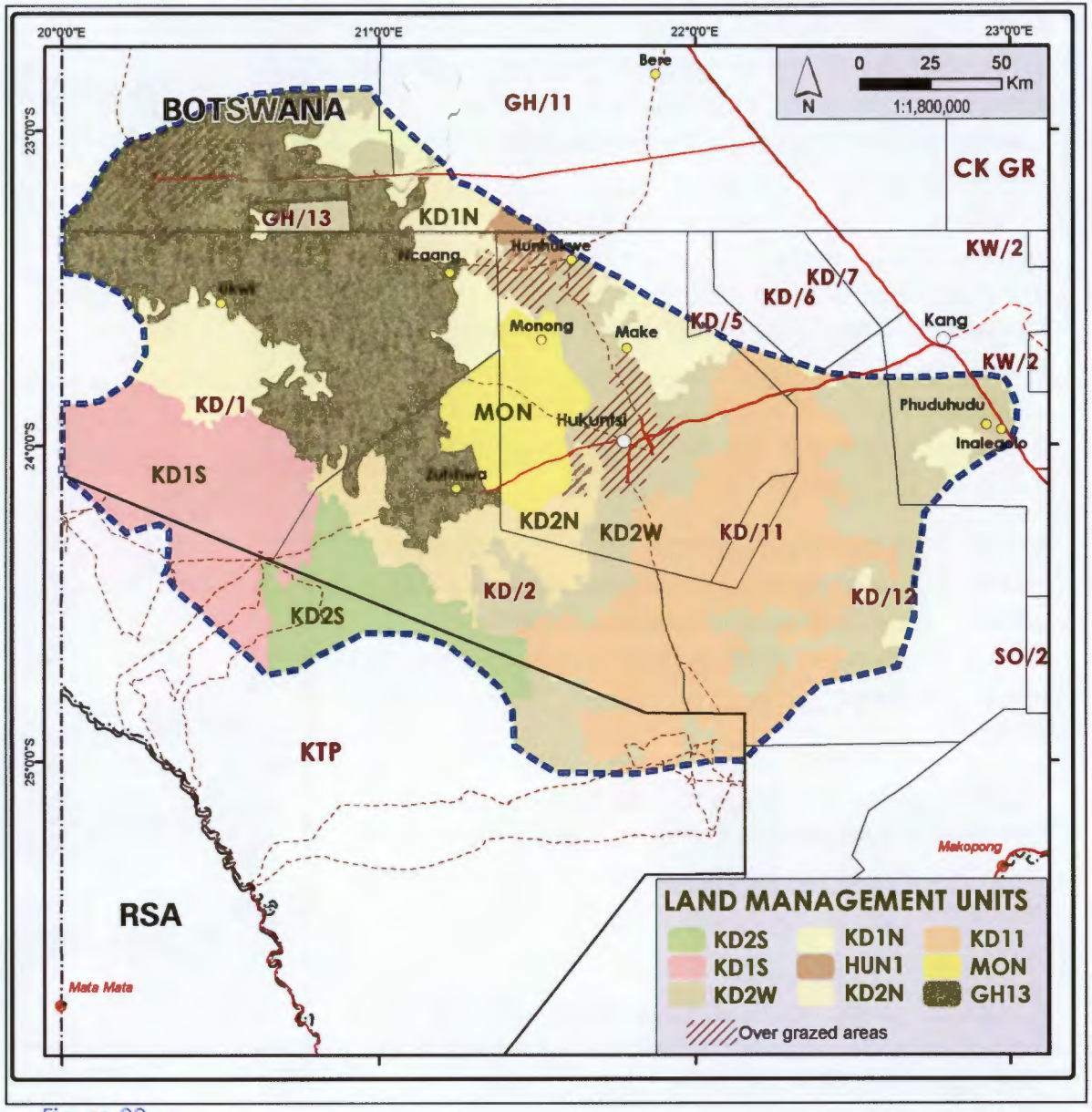


Figure 33 :

Conclusion : Site for Design Intervention

By overlaying the new landuse plan with the socio-economic plan and the landuse management units we can ascertain the most opportune site for an appropriate design intervention.

From the eco-tourism proposed routes and the new landuse plan it is clear that the most opportune route for this region which will reach the most communities in need and deliver the best return with regards to more sustainable resource use is the eco-route situated in LMU GH/13. Zutshwa, Ukwi and Ngwatle are all situated within proposed route 1. According to the analysis of the conflict zones these three settlements were part of five that were earmarked reflecting all the characteristics of landuse conflict, predation and misuse or unsustainable resource use within regions of scarce resources. These settlements also reflected areas of few or no existing income generating opportunites.

We will now perform a detailed anaylsis of the terrain and cultural characteristics of Zutshwa. The results of this analysis along with a visual impact assessment and a needs analysis of visitors, villagers & wildlife will provide a good base for the development of scenarios toward a development framework for Zutshwa.

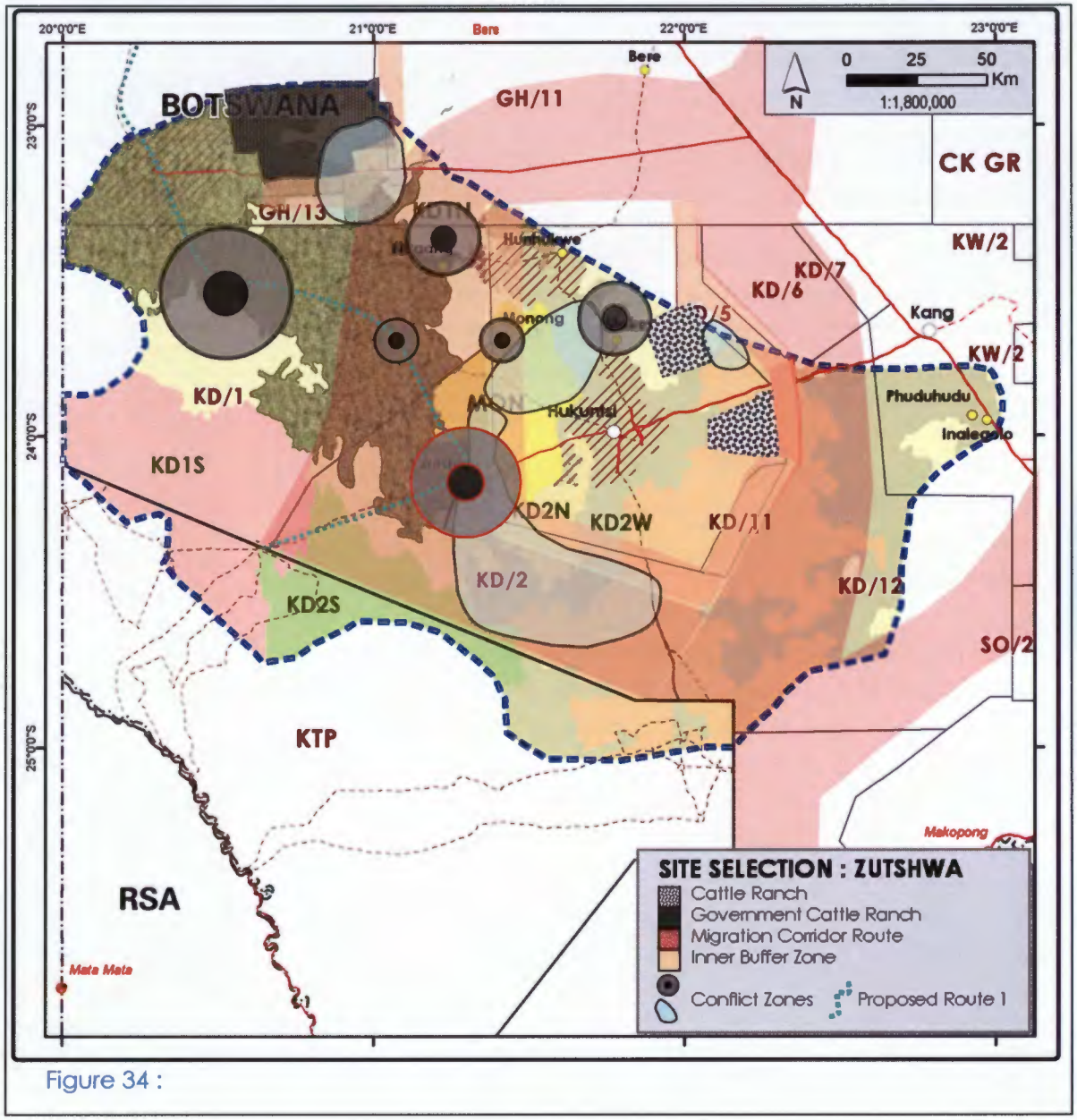


Figure 34 :

4 Framework Contextual Analysis

Biophysical Analysis : Zutshwa

Zutshwa is situated in the Landscape Management unit GH13 in SW Bioregion of the SW Wildlife System of Botswana.

This site has been earmarked as the initial site for an intervention to improve socio-economic opportunities and mitigate for conflict resolution in the region as a destination along the new Eco-Tourism route between Kaa and Mamuno

The analysis of the site with regard to resources, habitats and migration routes of macro biogeographic and regional importance has already been performed in the analysis of the bioregion. We must now focus on gathering and analyzing information that will assist with the understanding of the implications for site planning and design. Here we determine the inherent suitability of the site for development, by identifying the context , the buildable land.

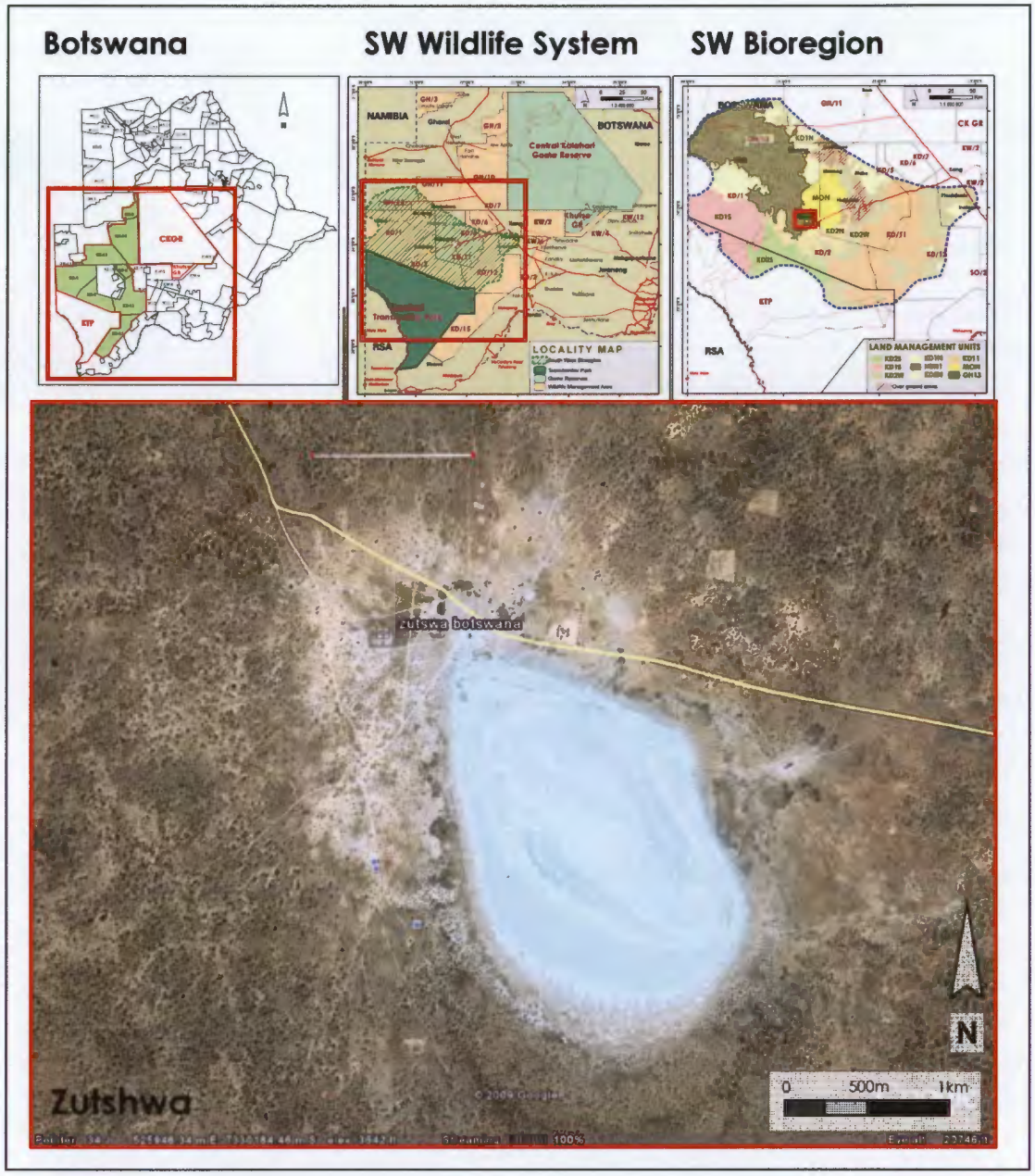


Figure 35 :

Zoning (Core, Corridor, Buffer 1& 2)

The Land in and around Zutshwa is zoned as Tribal Land. The Tribal Land has been to a large extent been absorbed into the WildLife Management Zone since 1986. Wildlife Management Areas (WMA) have been designated within the WMZ with the express purpose of protecting the biodiversity of the region. Some of these WMA 's are gazetted and some not, which poses a problem for policing of these areas by DWNP. Further more, All citizens of Botswana are entitled to three forms of land ownership, the residence in the village (20x30m) and agricultural land as well as a cattlepost at varying distance from the village. This land can be applied for officially and will not cost anything. Most people do not apply.

The proposed migration corridor which contains the migration routes of large ungulates is situated to the SE of the village. This is a no build zone. The Inner Buffer Zone allows for non-consumptive use only and selected silviculture. The Outer Buffer Zone which surrounds the settlement is designated for agriculture and sustainable development.

Implications for development

Eco-Tourism related trails can be situated in the Inner Buffer Zone. Sustainable development can be accommodated in the Outer Buffer Zone along with Conflict Mitigation Measures such as a Predator Rehabilitation and Education Centre.

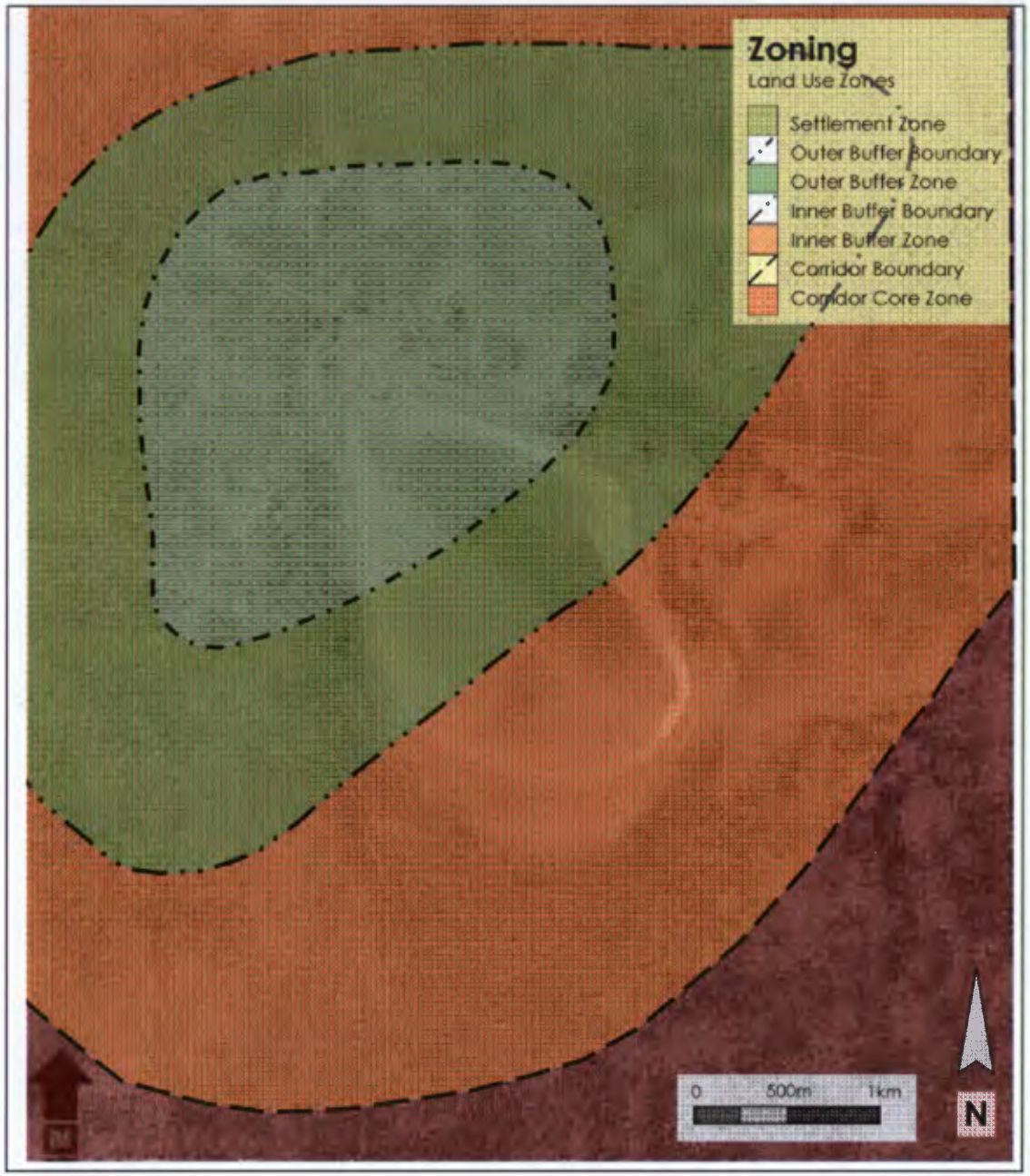


Figure 36 :

Roads & Access

Access to Zutshwa from the nearest large Vilage, Hukuntsi, is along the gravel and sand road from the East which is also the route to the Trans Kalahari Highway.

The shortest route for travellers from Namibia is along a mixture of gravel road and deep sand track from Mamuno.

Visitors from South Africa will most likely access Zutshwa from the East unkess they are coming from Cape Town in which case through the Kalahari Transfrontier Park (KTP) will make the most sense. This access route is a deep sand track from the border with South Africa.

Most of the roads within the village are deep sand tracks which is only accessible by 4x4 and horse/donkey.

Implications for development

Access to Zutshwa is only recommended by 4x4 unless the roads are upgraded to accommodate other forms of transport. This will be a limiting factor with regard to development due to the high costs of paved road surfaces.

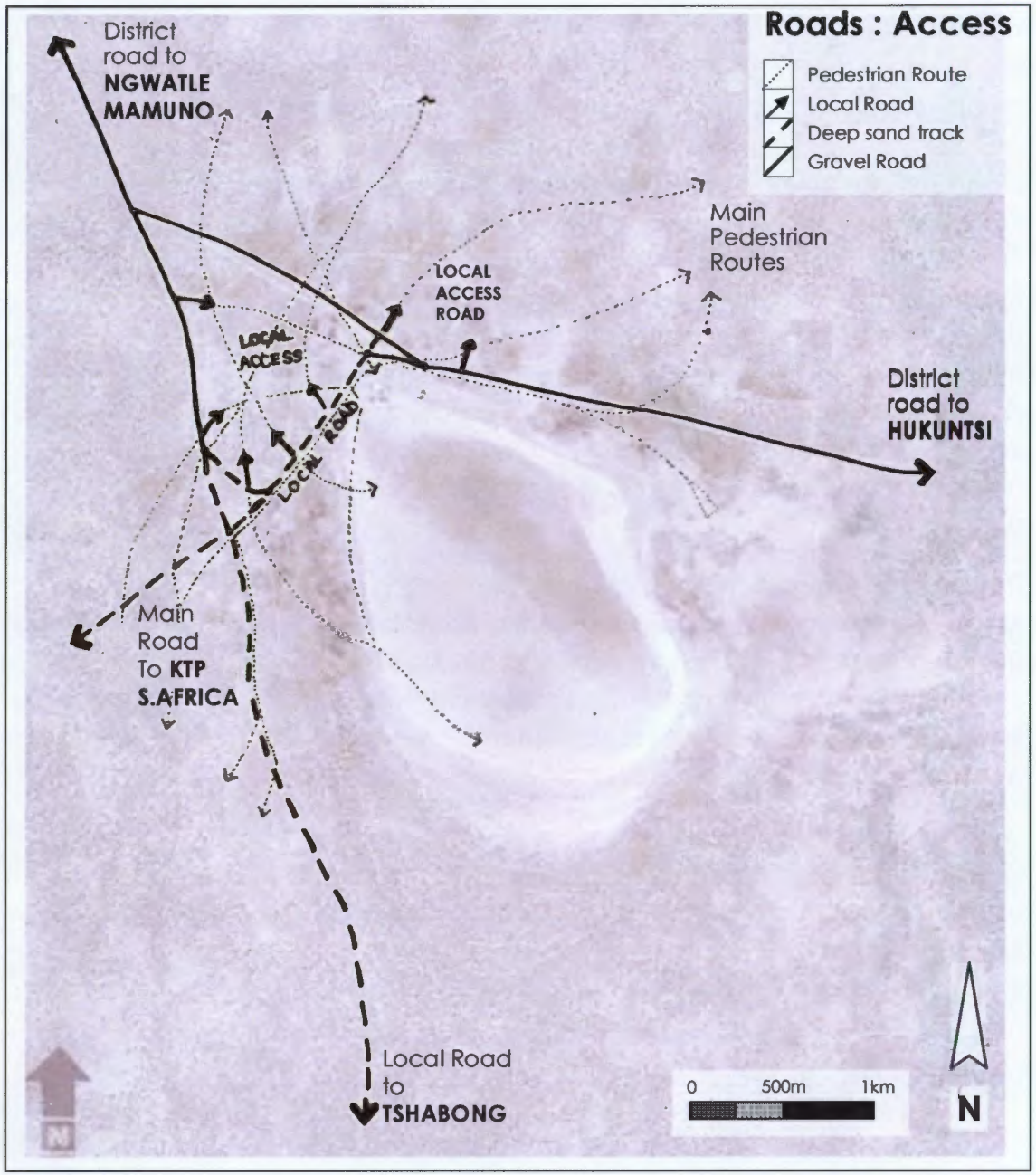


Figure 37 :

Economic Resources

Many opportunities exist for use of natural resources for building, crafts and subsistence living.

Good supplies of thatching grass can be found south of the village e.g. Aristida sp. Other grasses that are used for matting and beds are available seasonally.

The deep calcrete beds that line the pan make good building material for roads and buildings. Calcrete cobbles can also be found in a single stone carpet for a good distance all around the pan.

Aeolian sand is 75% fine grained which makes very good building material. Most of the deep sand deposits found in this area is Aeolian in nature. Terminalia sericea and Acacia erioloba are abundant and a good source of wood for building and carpentry. The seed pods of the Acacia erioloba tree make good fodder for animals and are used extensively for other crafts.

Other Veld Products like berries from the Grewia flava bush and the Tsamma melon and gemsbok cucumber are found mostly in the open grass and shrubland.
(see Addendum : Vegetation as a Resource)

Implications for development

It would be wise not to build over valuable resources with regards to subsistence living as well as physical building material, as this is an area of scarce resources due to the very low rainfall and low soil potential for agriculture.

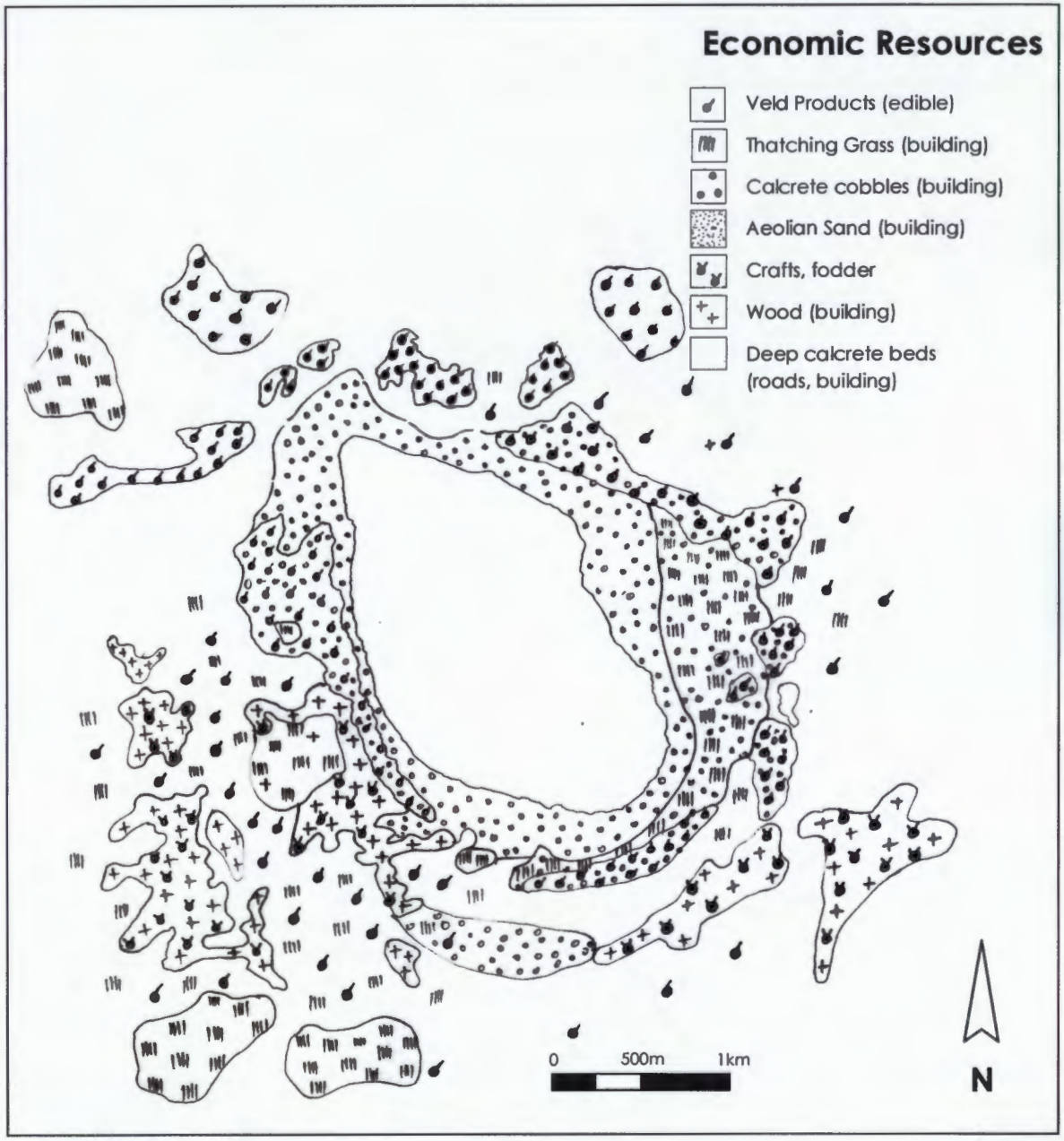


Figure 38 :

Topography

The terrain is relatively flat with the steepest slope at 1:9 at the pan edge but more commonly between 1:40 to 1:80.

Implications for development

Physiographically speaking there are little or no building constraints for this area, but one should take into account the visual absorption capacity which is undoubtedly low for a great deal of the area.

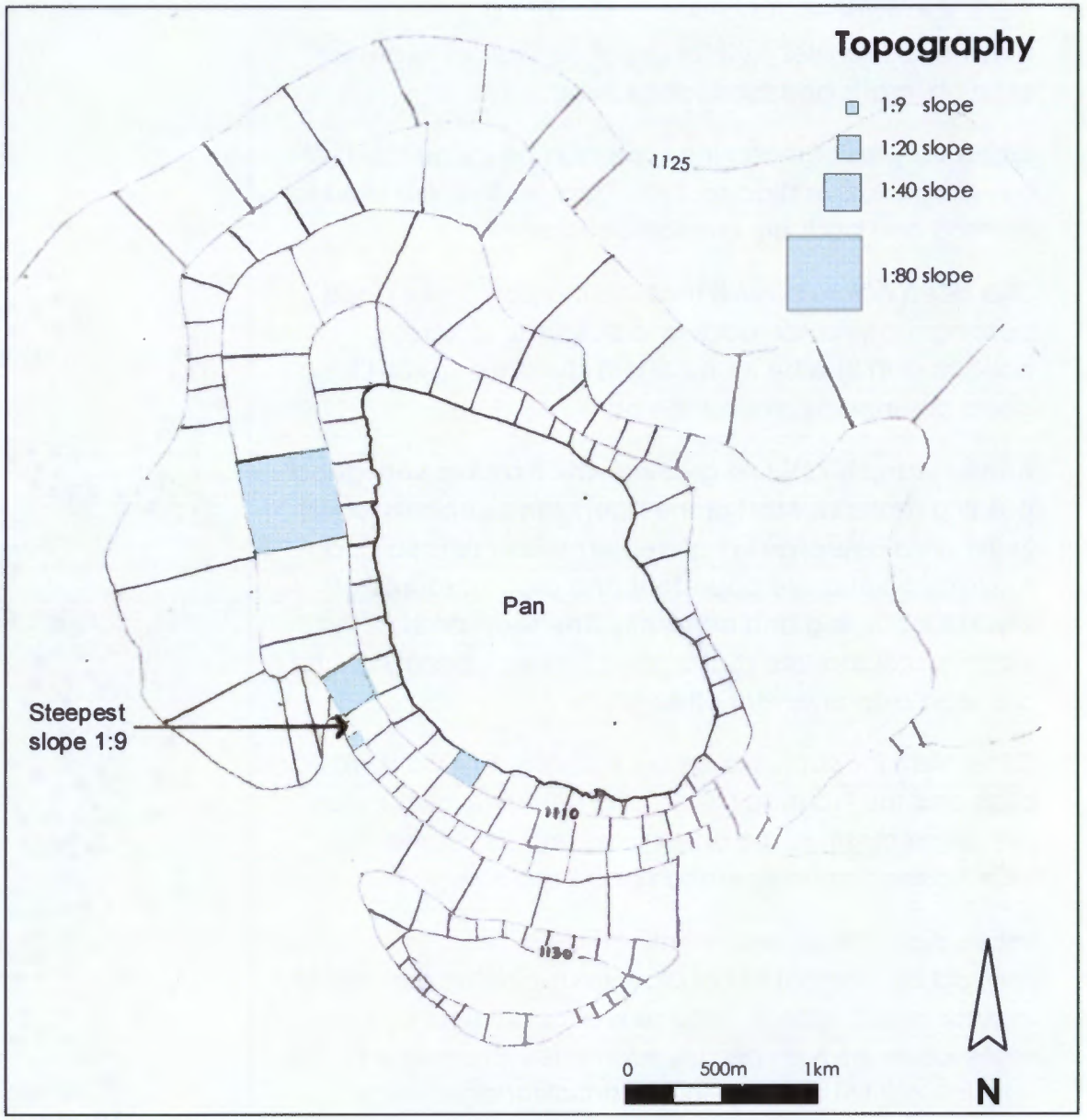


Figure 39 :

Geology & Soils

The area is mostly under deep sand which is 75% Aeolian in nature, except for around the pans which is encrusted with several metres deep layers of calcrete duricrust.

Talus and lag gravels of calcrete cobbles are prevalent in the seasonal flood zone forming a 1-stone-thick carpet which thins out to a sprinkling of gravel as one approaches the high water mark

The steep slopes (1:9) to the South West and South East of the pan are occupied by loose cobbles and the hillock to the South West is strewn by large loose boulders on the lee side.

Implications for development

The 'steep' slopes with loose cobbles; the calcrete encrusted pan; and the hillock lee side are all no build zones.

The 'cobble-carpet' poses a moderate constraint in that the cobbles would need to be cleared in order to effect any structures.

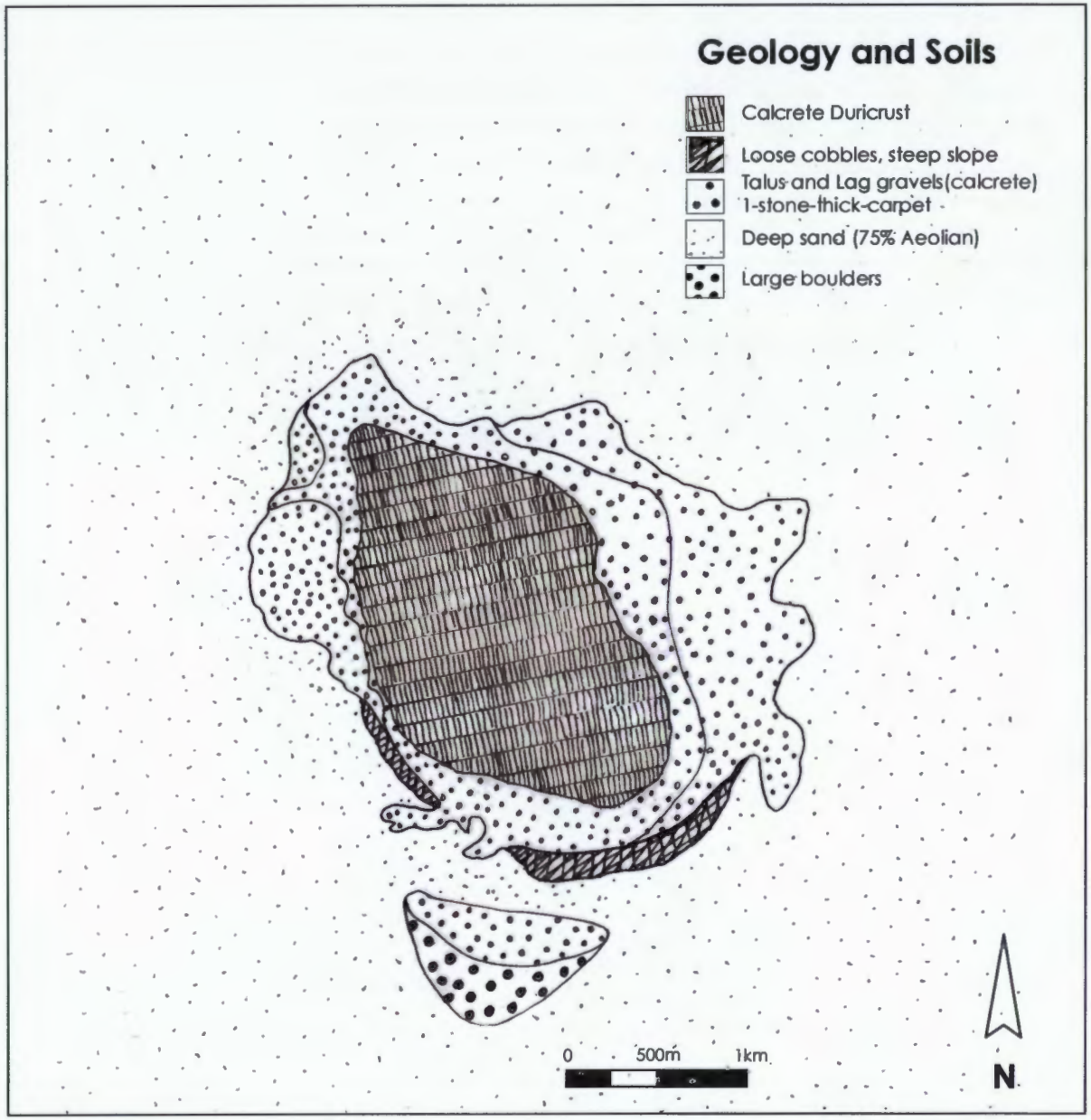


Figure 40 :

Hydrology (Surface & Ground Water)

There is no surface water except that which occurs seasonally in the pans between November and March. The unconfined aquifers occur beneath the deep sand beds. This water is extracted by means of boreholes drilled up to 120m into the earth.

Rainfall which is often experienced as heavy downpours (25% of p.a. rainfall in 48hrs) drains into the pan from the surrounding higher lying areas.

Implications for development

The pan itself up to the high water mark constitutes a no-build zone because it is seasonally wet. A buffer zone taking into account the 50 year flood line is also contained in the no development zone.

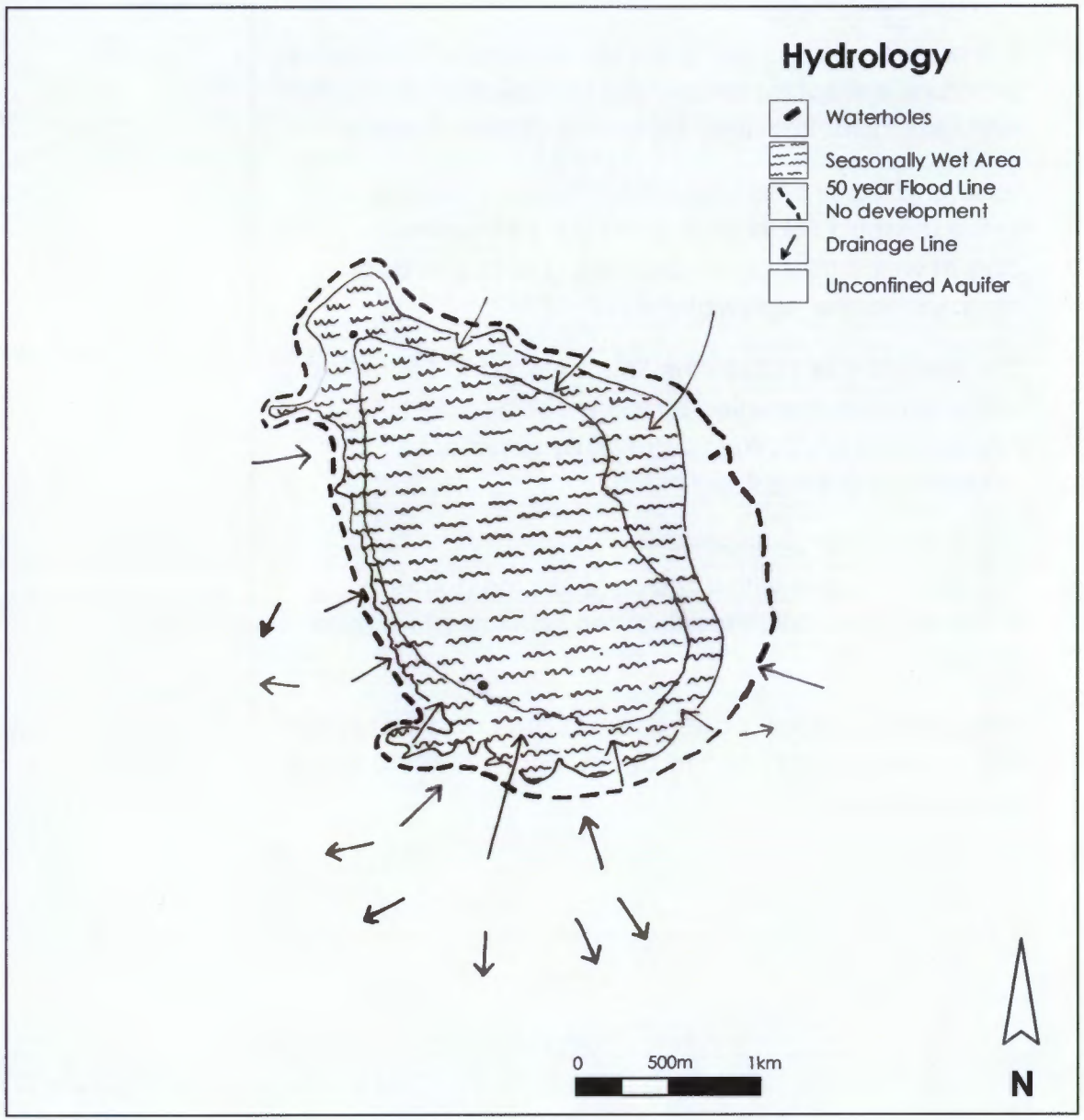


Figure 41 :

Vegetation

Little or no vegetation grows on the pan surface due to the deep calcrete layer. Although immediately on its perimeter 'sweet' grass or herb annual grasses provide essential fodder for migrating ungulates and livestock. The minerals in the duricrusts are of equal importance to the wildlife who have been seen digging into the crust with their horns and then eating the spoils. The pitting along the SW pan edge speaks to this phenomenon. The shrub layer is perennial with a prevalence of Tarconanthus and Grewia species. The Open Tree Savanna with a10-30% tree coverage is dominated by A.erioloba and C.glauca. The denser 50% tree covered areas dominated by A.erioloba and T.sericea have a grass understory of Eragrostis and Stipagrostis Sp.

Implications for development

The visual absorption of this landscape is generally very low meaning that any development of any significance could easily turn into an eyesore if not well orchestrated. (see VIA :90)

Sustainable use of the natural resources and veld products is imperative in the region characterised by scarce resources. (see Addendum : Vegetation as a Resource)

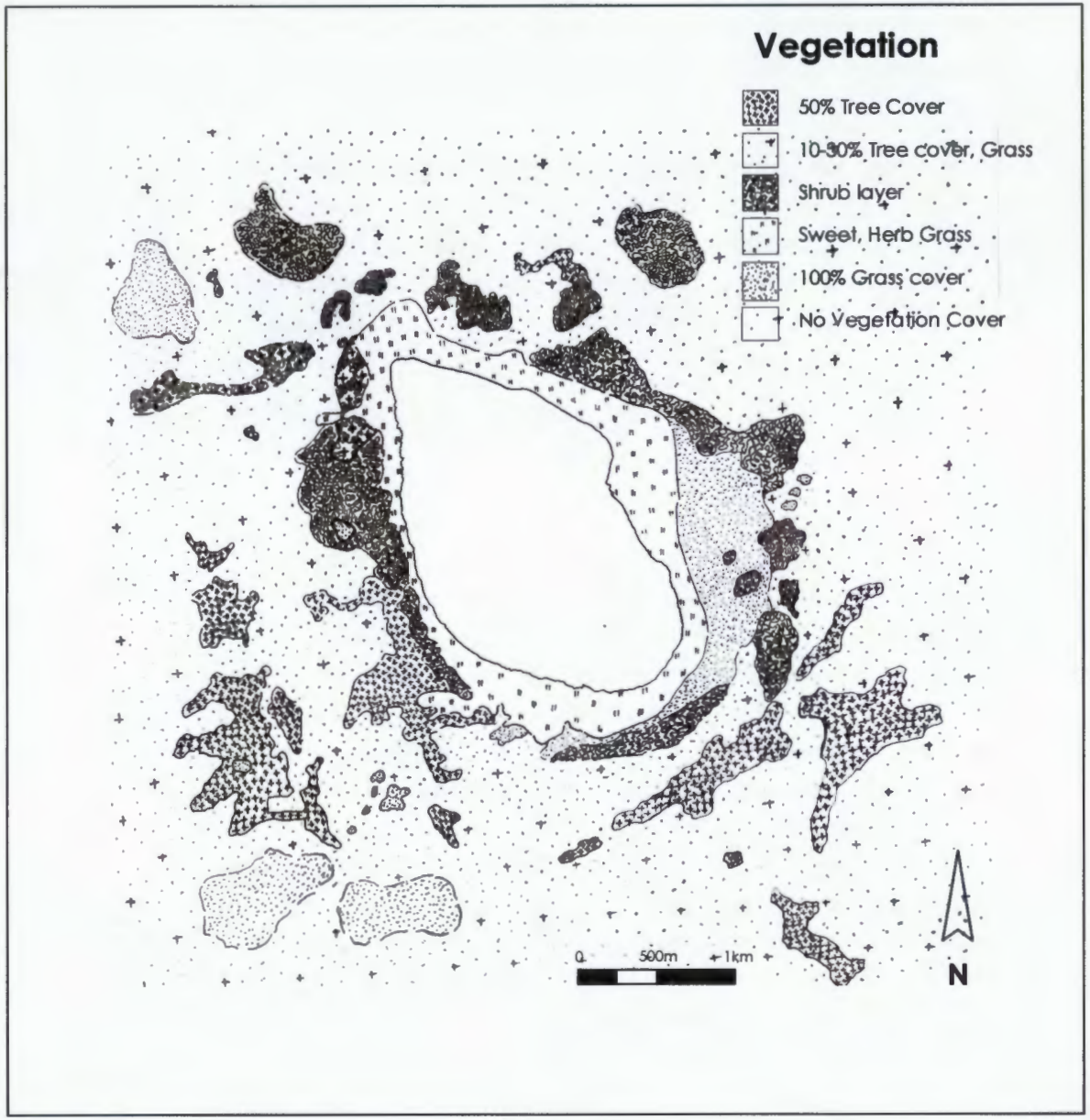


Figure 42 :

Microclimate

The most disturbing interruption in this peaceful and pristine environment is the vehicle traffic noise on the main gravel road between Hukuntsi and Zutshwa.

The prevailing winds are from the North Easterly direction and bring with them dust storms during the dry season, winter, which is when the low lying ground is covered with frost for at least 2 months during the night and early morning the effect of which is even more pronounced on the cold south facing slopes.

On the positive side the natural beauty of the area especially along the pan edge far outweighs any of the negative microclimate conditions.

Implications for development

Taking into account future development, the amount and speed of traffic on the Zutshwa road must be kept to acceptable levels to protect the aesthetic value of this pristine environment for the visitors and inhabitants alike. It is important to take into account the prevalence of frost in winter when designing any structure so that it also accommodates the vehicles to avoid any constraints with regard to enjoyment of activities such as game viewing in the early morning. This frosty condition is further exacerbated on the cold south facing slopes. During the dry season dust storms can reek havoc at short notice, the bush camp accommodation should also make provision for this phenomenon.

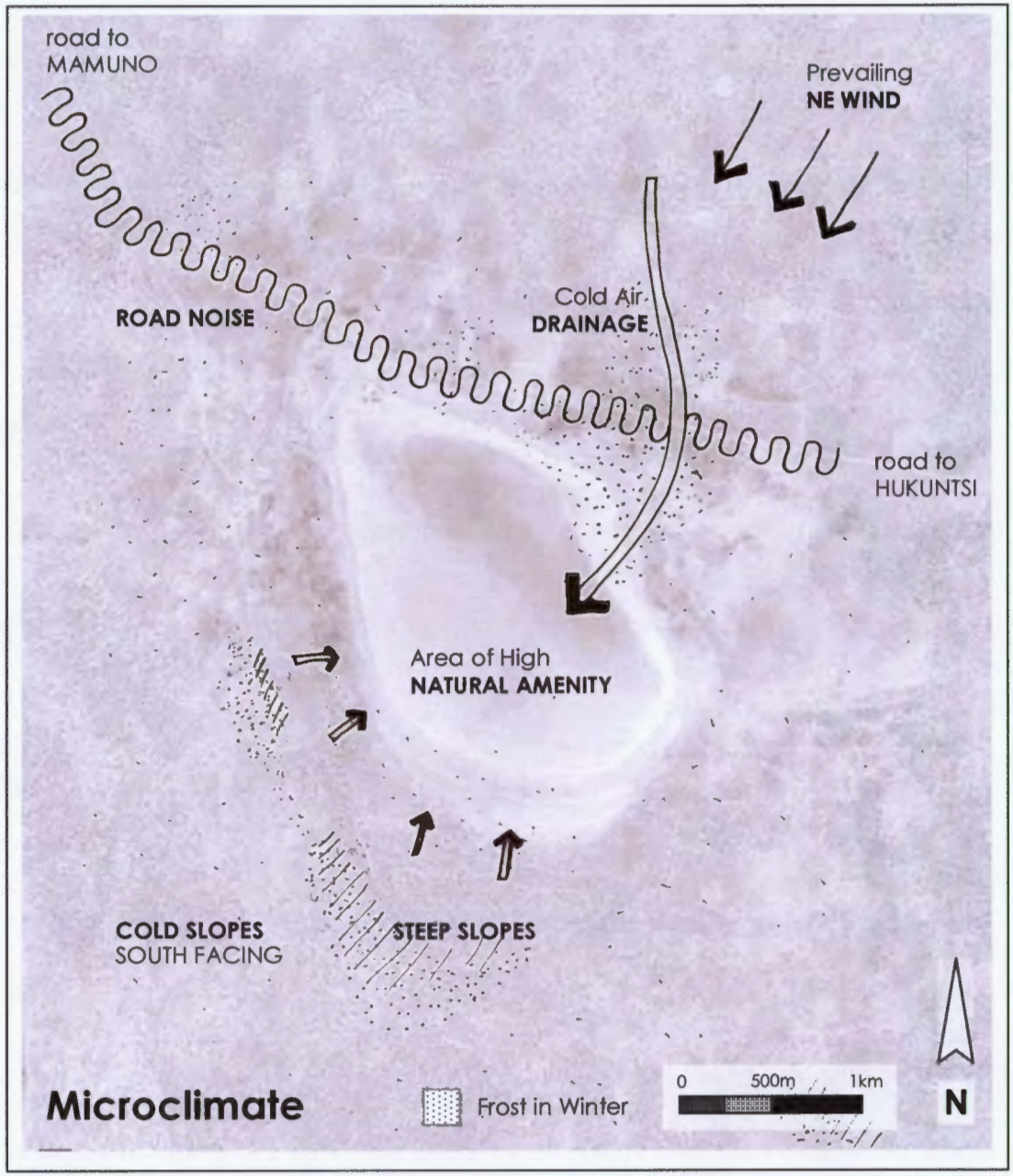


Figure 43 :

Site Suitability

The site suitability is determined by overlaying all the constraints to establish the severity of the accumulated effect. The darker areas with moderate to severe and severe constraints will be no build zones. The lighter areas of moderate to few constraints will be those areas more suitable for development.

There is only one area within 200m of the pan that is suitable for development and it lies to the SW of the pan in the 50% tree cover zone. The area of the existing saltworks is under severe constraints due to seasonal flooding as well as being situated on a building resource. To retain any development in this area would mean building on stilts.

Figure 44 :

Cultural Analysis : Zutshwa

Settlement

Physical structure

The open structure of the rural community (Fig.45) does have definite patterns of development which are easily discernible after careful study of the aerial photos.

The homesteads are arranged in groups of family members where houses are similar and 20m apart; close 'neighbours' from different families but same tribe, the houses (plots) are placed 50m away from the rest of the group. Different familes or tribe groups are situated between 150 and 250m from their nearest neighbour (Fig.45)

Historically Most Batswana settled on hill tops and in big villages (not including the Baswara)for defensive purposes starting from the period 14th century to the beginning of the 20th century. The villages were surrounded by defensive stone walls with cattle kraals in the centre of the village where small stock was also kept. Livestock during this period was held a communal property where all members had access to cattle products. In the Kgalagadi most settlements were around the pans. People built metse (villages) which were their permanent residences and made up the political capital of dikgosi. Then

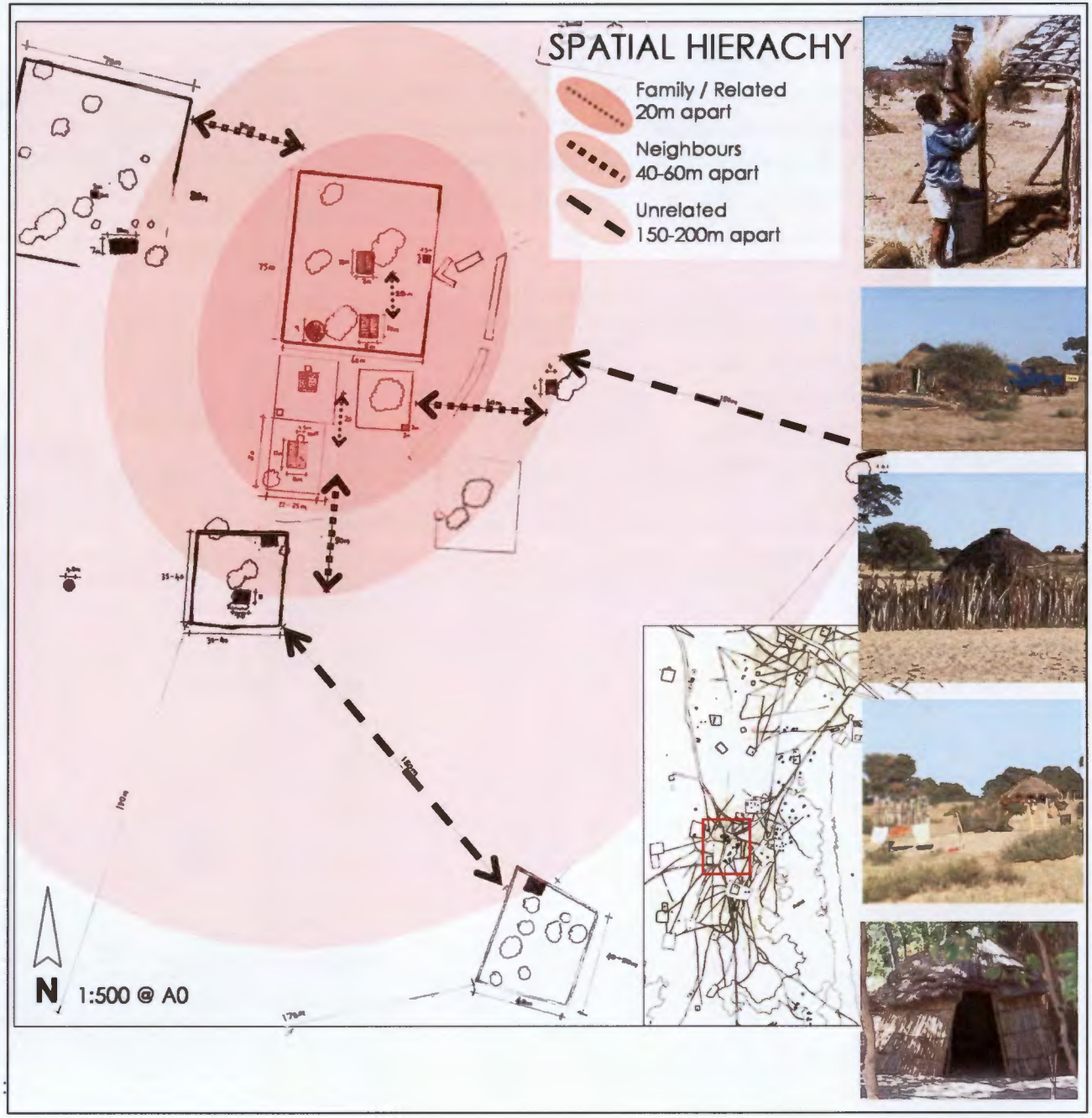


Figure 45 :

they maintained masimo (lands/fields) and meraka (cattleposts) at varying distances from the villages. These cattleposts and fields were settled seasonally for ploughing and herding livestock. The Baswara on the other hand lead a more nomadic lifestyle with few possessions. Child-rearing and children are an important feature in this tribe. The lifestyle and livelihood was mostly hunter gatherer not agro-pastoral as in the case of the Tswana and other Batswana tribes.

The significance of the Kgotla

The kgotla is built as a semi-circular court with wooden poles near the royal residence. In the ward the kgotla is built in the middle of an open space between malwapa (yards) which encircle it. The Kgotla serves as meeting place for people, including visitors. The kgotla is regarded as a sacred place in many Tswana societies. It serves many purposes such as political deliberations, graduation of initiates "Bogwera" and rain making ceremonies. After a potential site for a kgotla is selected by the members the village, medicine practitioners are called to doctor the place "go thaya Kgotla" for the safety of the chief and the welfare of the people.

The fire place is doctored and the different cardinal positions of the Kgotla are "pegged" or doctored to guard against potential dangers from malignant forces (BNA, 2000:338)

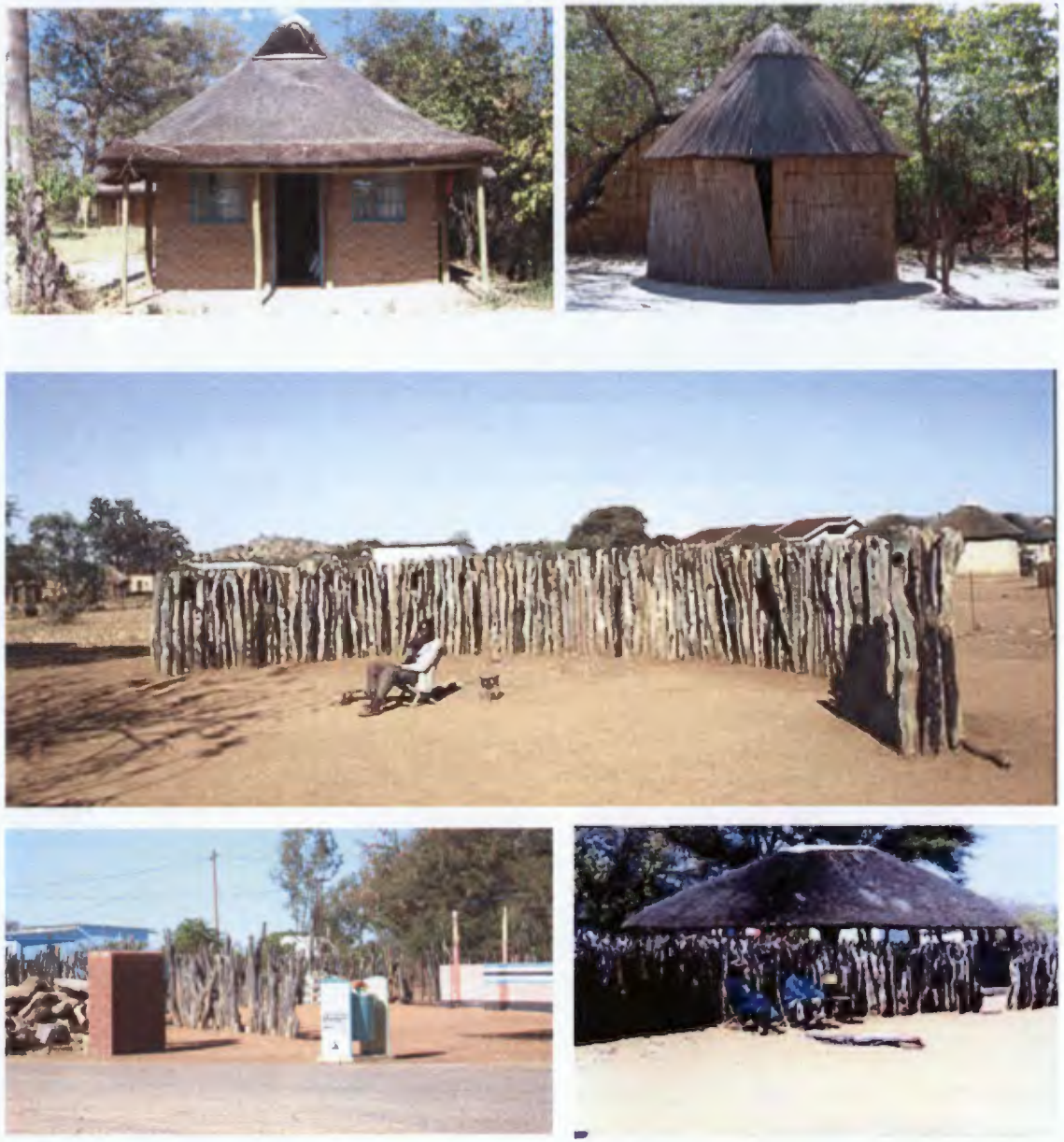


Figure 46 : Typical house typologies and examples of the Kgotla

Social structure

Historically speaking, in Zutshwa, the !Xo people used to hunt on behalf of the 'dominant' Bakgalagadi. (Painter, 1997). "despite the paternalistic affection a (Bantu) patron may feel for his Bushman client, the Kgalagadi and Tswana as a whole look down on the Bushmen, whom they deem inferior and servile people" (Guenther 1986:179). Today the Baswara are in the majority (85%) at this settlement but are by no means leaders. The Bagatla or Bakgalagadi people of this settlement openly disregard and disrespect the Baswara (San) people. The only pub in the village does not welcome the Baswara community members and hence there is plenty of tension in this RAD (Remote Area Dwelling) settlement of less than 500 people. (Fig. 47) Most of the households are headed by women, that said, the women and men are still involved in particular different productive activities for sustaining the household. Understanding ethnic divisions and division of labour within the community and how they relate to rules of resource use is crucial (Painter, 1997) for development of any socio-economic empowerment projects that aimed to be sustainable in the long term. For example, attempts to reduce direct consumptive use of wildlife in favour of more remunerative commercial non-consumptive uses such as Tourism is constrained by the historically based ethnic division of labour as mentioned above. (CBNRM Project Report KD1, 2006)

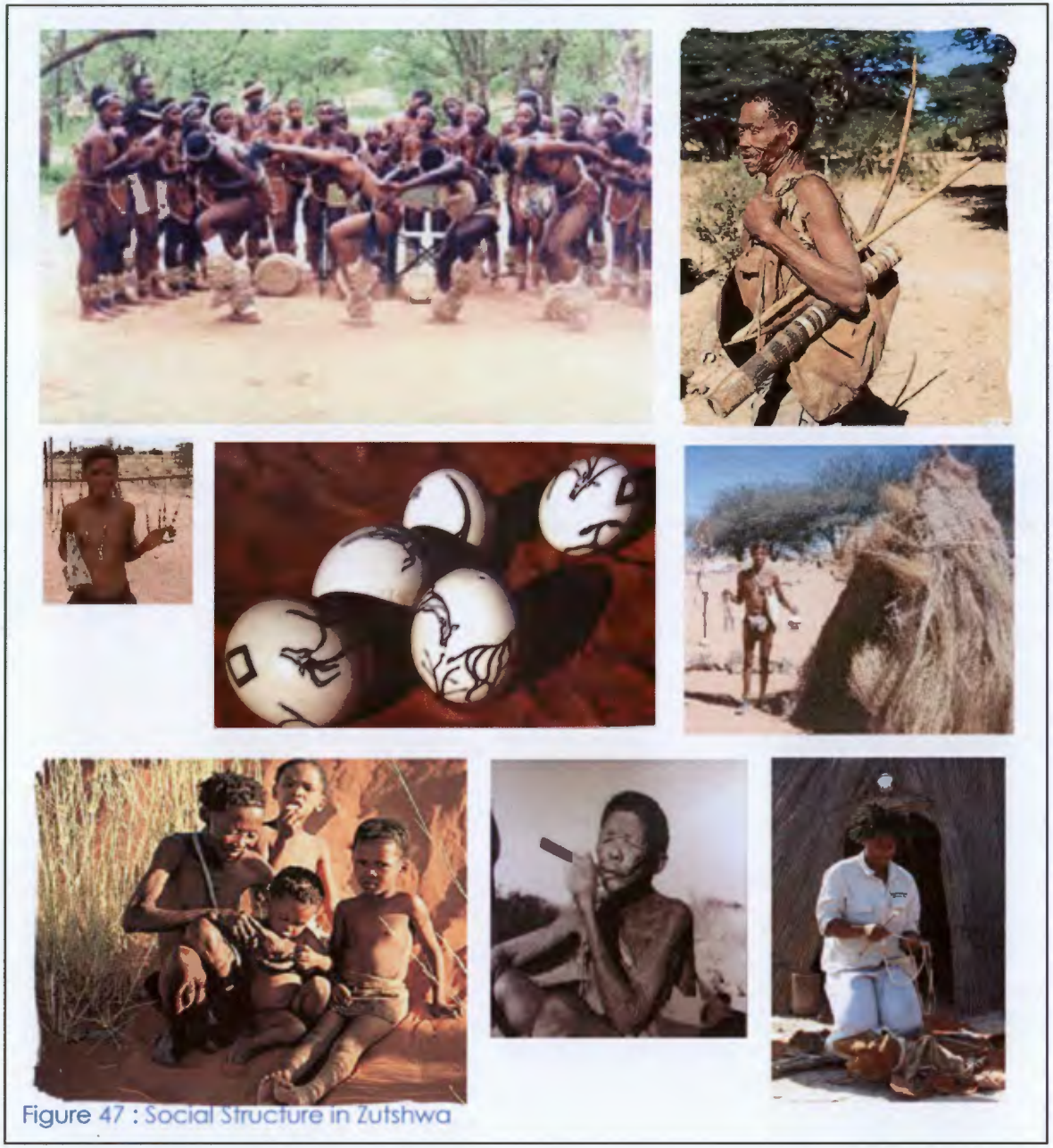


Figure 47 : Social Structure in Zutshwa

Livelihood

The semi-arid environment has between 250-500mm of rain p.a. and no permanent water sources apart from the boreholes and experimental Rainwater Harvesting Projects. The mainly subsistence livelihoods of the community are eaked out within the bounds of their immediate environment. The Bakgalagadi are agropastoralists and the Baswara the hunter-gatherers. (Fig.48) 'They are perhaps the people on earth that live the closest to nature, and scientists are often amazed at the accurate knowledge and fine observational skills of the San Bushmen of the Kalahari'.(Tribes of the Kalahari) Batswana were great navigators dependent on the stars since there were no highways or established roads. They had complex knowledge of the "heavens" from which they could establish direction, seasons and weather (BNA, 2000:338) Totems are an important identity marker for many ethnic groups in Botswana. Totems are usually animals such as the crocodile (kwena), eland (phofu) and duiker (phuti).(BNA, 2000:339) The animal totem of the Baswara is the Eland.(Fig.48)

Figure 48 : Livelihoods in Zutshwa

Visual Impactment Assessment : Zutshwa

Description of Affected Area

Extent of affected Area for the Site of the intervention is approximately 70x400m (28 000sqm=28km2=2800Ha). The visual setting in which the rest camp is located is on the plateau area at 1120m of the low ridge which runs along the south western boundary of the Zutshwa Pan. The site is bounded visually by the hillock to the south with an elevation of 1135m amsl. The visual boundary of the horizon in the west and east and a distant hillock to the north east.

Topography

The dominant landscape type is the Southern Kalahari Bush Savannah characterized by 10-50% Tree coverage interspersed with shrubs and an almost continuous understorey of grassland except around the pans which constitute a unique landscape facet. The terrain is gently undulating almost flat.(BNA, 2000).

Views

The terrain creates an almost uninterrupted viewshed from the site to the west, north and east of the site extending for several kilometers, the views to the south are partly interrupted by the small hillock. The small hillock rising from the plateau to the southeast will offer some camouflage to the proposed development when viewed from the road, The Salt works site and Central Village which are situated North of the site. (Fig. 49)

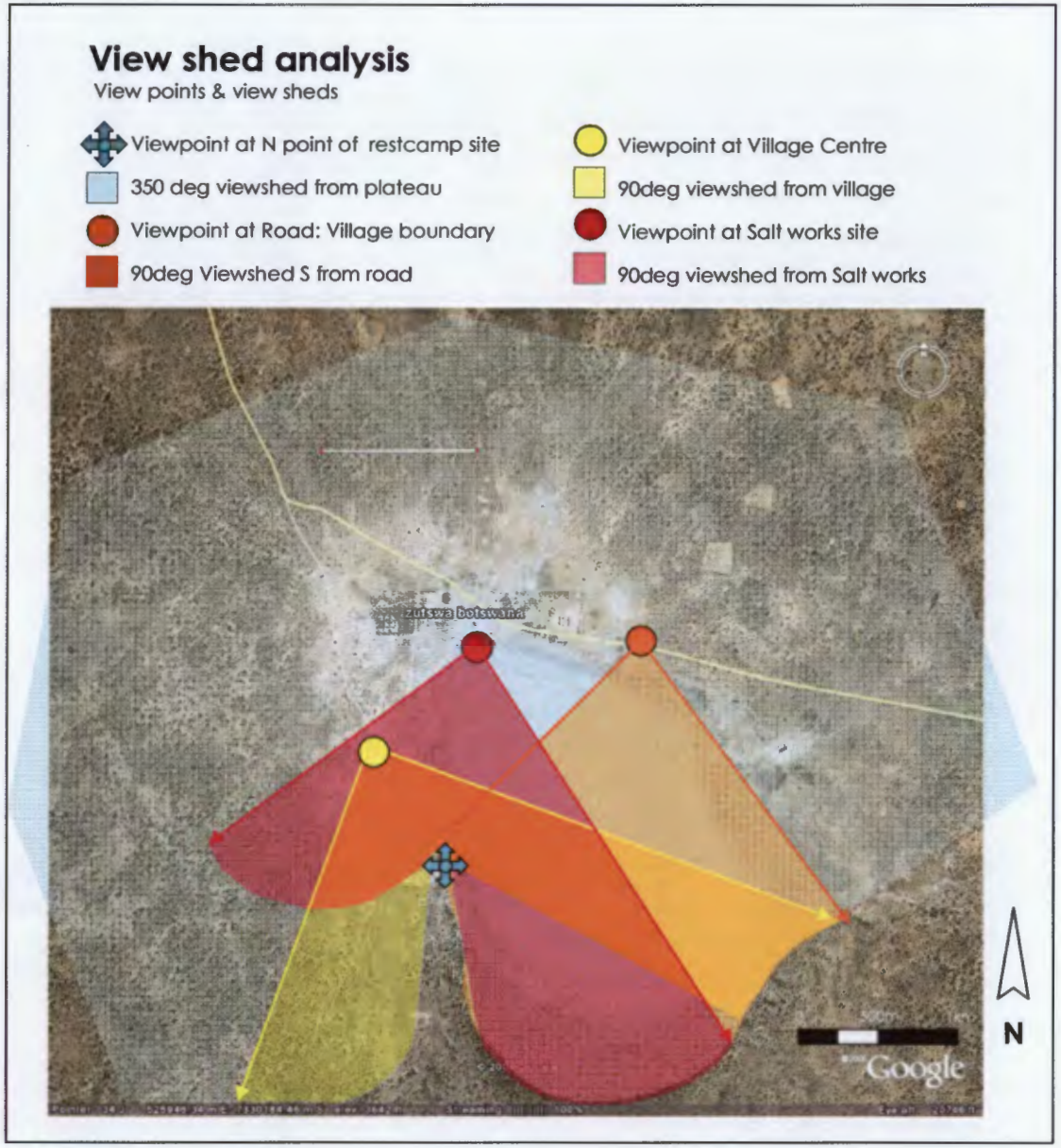


Figure 49 :

Scale of Landscape

There is very little vertical definition which emphasizes the horizontal scale of the landscape. Any new structures breaking the skyline, above the height of the existing tree canopy (+/- 6m), will not be readily absorbed into the landscape which is relatively flat and horizontal in nature.

View Shed

Topographically defined by the all points from which the intervention will be viewed. The boundary of the view shed which connects all high points of the landscape is the limit of the visual impact (Alonso et al, 1986)(Oberholzer, 2008)(Fig. 49)

Viewing Distance

The distance at which objects in the landscape can be viewed, i.e. 500m, 1000m, 2500m, 5000m. Objects diminish in size and detectability exponentially with increased distance. Colour plays a role in this instance in that an object whose colours blends with surrounding environment, is less easily detected than an object of a complementary colour.

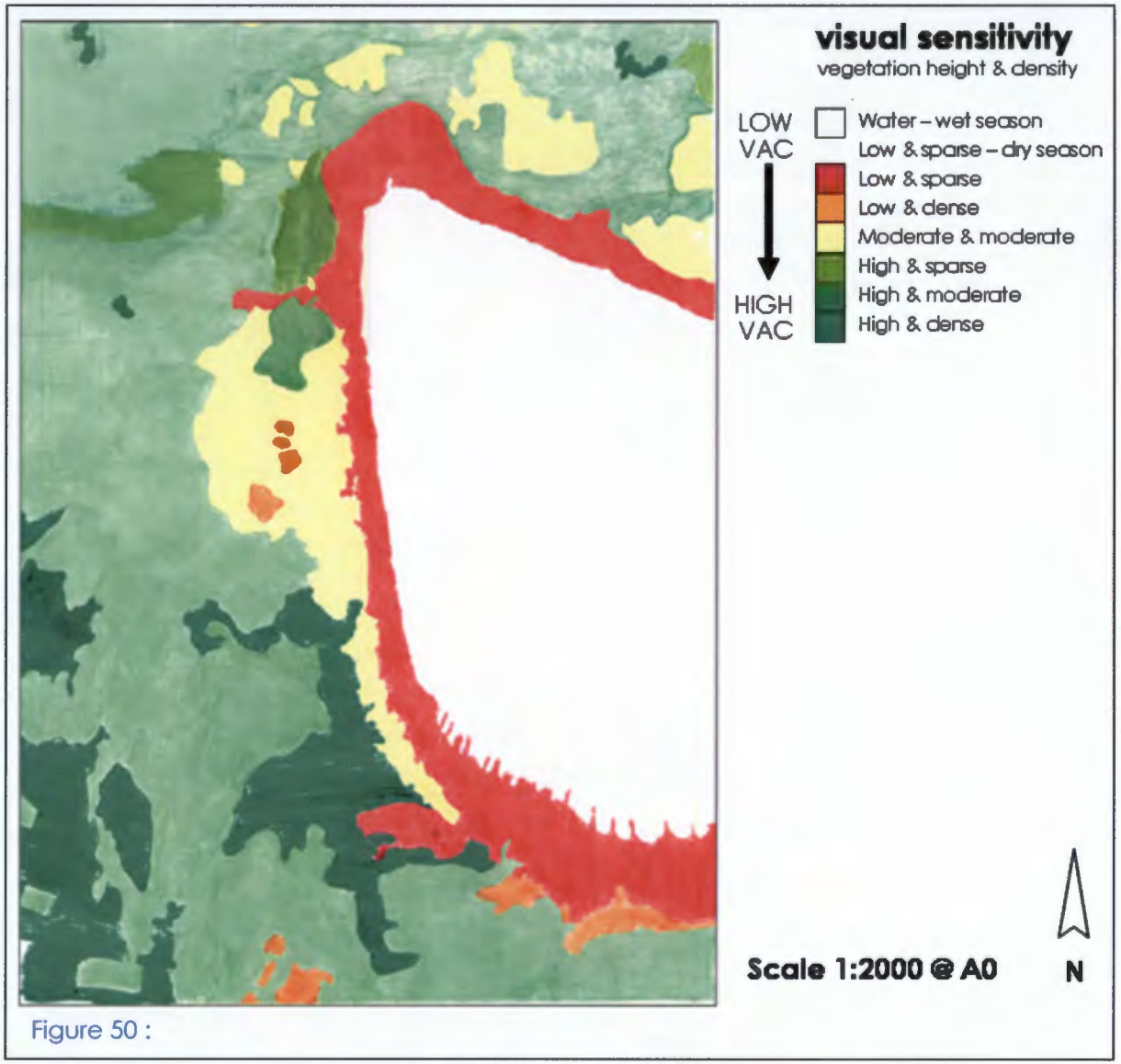


Figure 50 :

Conclusion

The VAC (Fig.50) of the landscape is dependant on the landscape facet within which it is situated, for example the Landscape Facet dominated by 50% Tree Cover (A.erioloba) has a Low VAC whereas the Landscape facet of the Pan with little or no vegetation coverage and a slope of 0-3% has a HIGH VAC. Concluding that, visually speaking, the proposed development will be more easily embraced by the landscape if accommodated within the 50% Tree density Facet than at the edge of the Pan or in the Pan.

Needs Analysis : Zutshwa

Tourist and Visitor Needs

With reference to the Botswana Tourism Survey conducted in June/July 2009 by Conservation International it was reported that most tourists would be interested to travel to the SW Botswana if facilities were provided to cater for their needs. The report also noted that there was an over-supply to the mid-upmarket accommodation and an under-supply to the mid-budget market. The proposed expansion products include Mid- market Family Resorts, Adventure Centres and Bush Camps. These conclusions were echoed by the NW Tourism Masterplan. The needs of the visitor in respect of access, safety, comfort, privacy and legibility will be addressed with detailed analysis of the site as appropriate.

Social and Village Needs

The landowners are in favour of the concept of the Eco-Tourism Route as a means to socio-economic upliftment, provided that adequate benefits from the projects accrue to the community and that the cultural heritage of the Baswara and Bakgatla is preserved and respected. The Villagers are also of the strong opinion that an intervention within their village would be an unacceptable invasion of privacy.

Wildlife Needs

The wildife needs have already been addressed in 2a The proposed new landuse plan with regards to designated corridors and buffer zones to limit the conflict with regards to resource use and landuse incompatibility. Formalizing the proposed corridors will hopefully put an end to further encroachment of settlements and livestock.

Design Intervention Informants

A detailed analysis of the terrain and cultural characteristics of the proposed site has been performed in order to determine the context for the intervention. In layman's terms the analysis will reveal where you can and cannot build which is called Site Suitability. A Visual Impact Assessment performed on the context (buildable area) determines what impact development will have on the surrounding area. A needs analysis gathers the community or user needs to develop a programme for the proposed site. The results of the Site Suitability analysis, a Visual Impact Assessment and a Needs Analysis of the Stakeholders (Visitors, Villagers, Wildlife) provides a good brief for the proposed development scenarios. These are tested against Design Principles or Performance Criteria toward a final framework (concept) proposal for the site. (see Addendum : Considerations for proposed development)

Concept Development

The other Influences for the concept came from the natural surroundings:

A. The canopy effect and clumping nature of A.erioloba

B. Sociable Weaver Nest in a Tree

C. The Eland an important totem for the majority tribe in Zutshwa (Baswara)As well as the local methods of construction for shelter - grass, wood & calcrete

Figure 51 : Concept Development for the accommodation unit

Precedent

It is imperative to learn from previous experience. To this end studying existing interventions of a similar nature can highlight issues that must be taken into consideration when effecting the design intervention.

The trend in modern camp design is to plan for a fixed number of guests within a specific target market (van Riet, 1987:293, 2000)

On investigating bush camps in and around the Kgalagadi region and the Kruger National Park, a recurring pattern emerged of what was working and not working. On the basis of these findings key issues for design guidelines developed which could be utilized to model a new concept for a bush camp. The main design issues being that:

A. The car shelter was rated as very important due to the vast diurnal temperature range, freezing at night (July, -7 deg C) and stiflingly hot during the day (Nov-Feb,42 deg C)

   i.e. Grootkolk; Gharagag; Bitterpan (fig 52 A)

B. The Shelter for sleeping should be raised off the ground due to the very serious threat of predators in a non-fenced camp

   i.e. Thakadu, Madiwe; Social Weavers' Nest (Fig 52 B)

C. The Bush Camps built of locally found materials lent themselves to better visual absorption than those that were not. i.e. Chobokwane; Mababe (Fig 52 C)

D. None of the camps made use of sustainable solutions such as rainwater harvesting or composting toilets which I feel is imperative in view of the scarce resources issue in this region

A. Car Shelter is necessary for comfort

B. Sleeping quarters raised off the ground for safety

c. Local materials lend an air of authenticity & uniqueness

Figure 52 :

Development Proposals

Scenario 1

Lodge within the Village

- In this scenario, the road from Hukuntsi is paved for ease of access to Zutshwa by Sedan(2x4) vehicles. The Lodge is positioned near the Saltworks and proposed Desalination plant creating a Tourist Precinct as a gateway to the Village. The Lodge will be raised from the ground due to seasonal flooding during the rainy season (Dec-Jan). A shared zone is created between the gateway and the village centre enabling economic opportunities to be showcased along a walking trail which extends right around the pan. These trails offer guided opportunities for game viewing and birding. Guides are armed due to the very real threat of predators.

The disadvantages of this scenario far outweigh the advantages of: Convenient facilities; ease of access by sedan and proximity to the Cultural Centre of the Village; due to the fat that;

It is imposing on the privacy of Village Residents as 90% are against it. The proximity to the main road detracts from Wilderness experience due to noise pollution. The Mid-upmarket facility has a bulky footprint as all facilities are linked by covered or screened walkways. Comfort is an advantage, but you are not actually dwelling within the elements which loses the point of a new authentic experience. The intervention will be very expensive due to training and initial outlay costs. Due to the large footprint and insular nature of a lodge the limited use of locals due to skills and culture constraints spells incompatibility with the surrounding area. Therefore the Lodge has a low feasibility except with massive donor input and ongoing training and management.

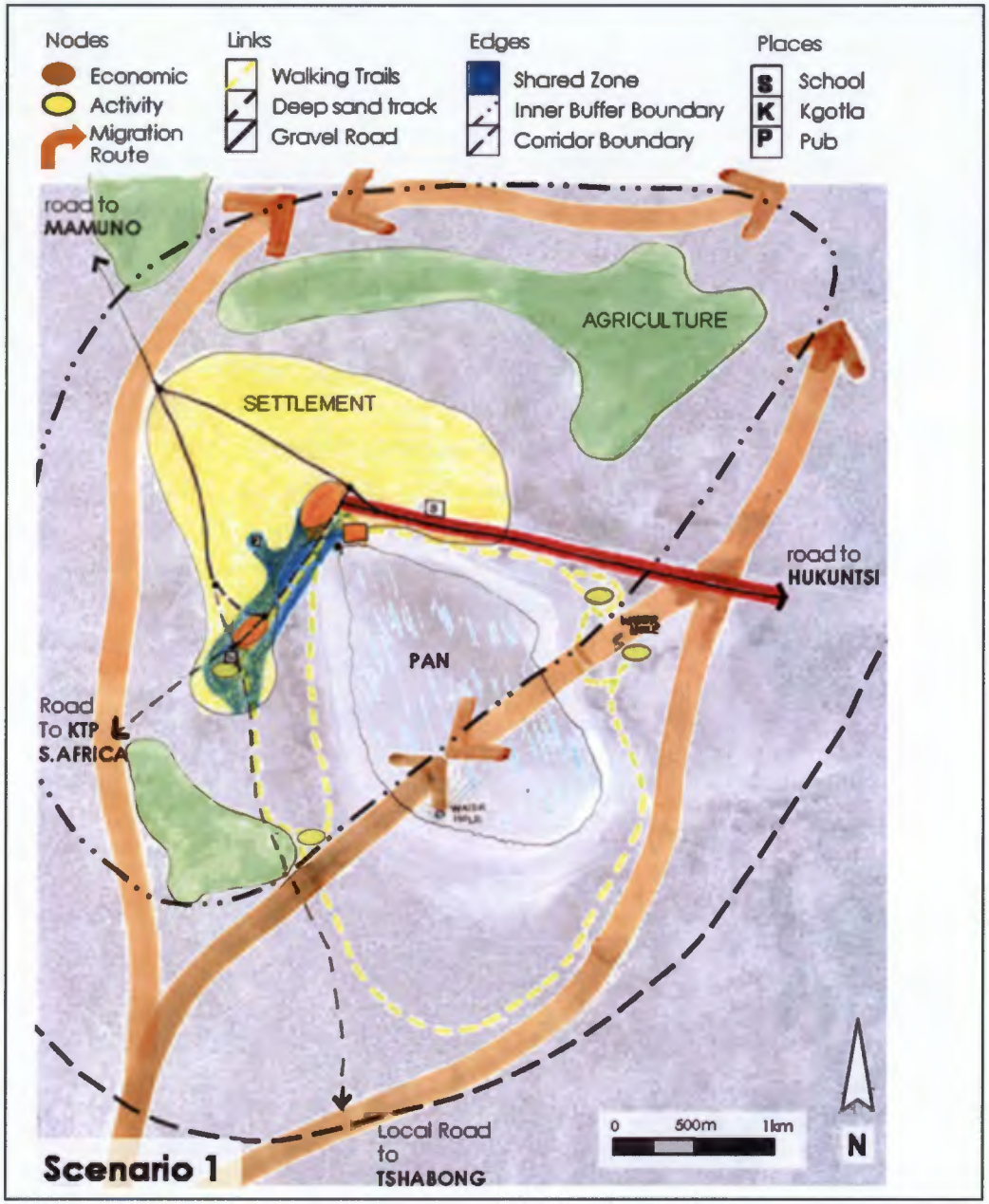


Figure 53 :

Scenario 2

Bush Camp 5-10km away from the Village

- In this scenario, the turn off to the Bush Camp is 2km before the Village. The Bush Camp is located in a pristine setting on the SW edge of a smaller pan NE of Zutshwa. The access is by 4x4 track due to the proximity of the migration corridor. A shared zone accommodating day visitors is created between the school and the village centre enabling economic and cultural opportunities to be showcased along two walking and 4x4 trails which end at the Kgotla in the village centre and the waterhole 1km from the school respectively. These trails offer guided or unguided opportunities for interaction with the villagers and game viewing or birding to lesser degree. The village draw card will be more of a cultural nature.

The disadvantages to the scenario are mostly due to the fact that the Intervention is at a great distance from the Village causing the Village not to benefit from development in terms of missed socio-economic opportunities and higher logistical costs in terms of construction and management thereafter. The distance from the Village also detracts from the cultural experience and the feasibility of this scenario.

Perhaps in mitigation the positive aspects of the Pristine Wilderness experience near the pan and the proximity of the migration route shows promise due to compatibility with the surrounding land use.

Figure 54 :

Scenario 3

Bush Camp within walking distance of the Village

- In this scenario, the Bush Camp is located within 1km of the village centre. A 4x4 track takes you from the village to your ultimate destination at the SW edge of the pan within close proximity of the migration corridor. A Shared zone has been established between the Market Area at the village centre and the Saltworks at the Village Gateway. Walking trails link the Bush Camp with the Shared zone and various other adventure Activities which extend right around the pan. The Shared Zone enables the cultural & socio-economic opportunities to be showcased along the walking trail. Activities can be booked at the administrative office in the Village Centre. The Predator Rehabilitation Centre located west of the Bush Camp provides opportunities to engage with lions and wild dogs.

This scenario poses no disadvantages due to the proximity to the Village as it is close enough to engage with Village without imposing on privacy. This scenario utilises the smallest possible footprint without denying the visitor reasonable comfort through sustainable facilities. The Socio-economic benefits to the Village are without costs, meaning that villagers employed can walk to work. All facilities that are required ie Shelter, Privacy, Safety and Activities such as eating, sleeping and socialising are catered for in a sustainable intervention. The Bush Camp is compatible with surrounding landuse . This is the most feasible scenario due to the low initial outlay for construction, labour and management.

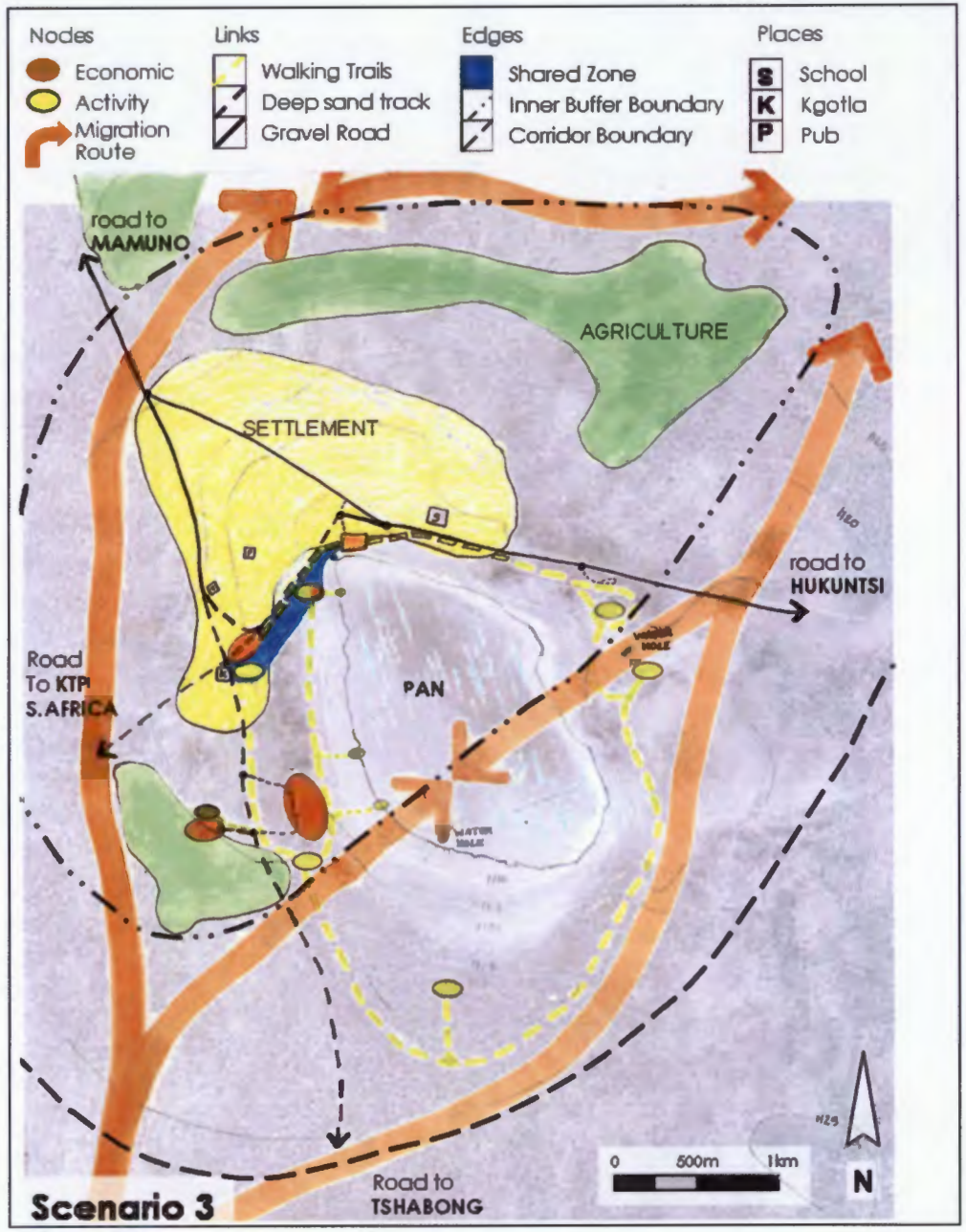


Figure 55 :

Framework : Zutshwa

Based on the three scenarios that were put forward as development proposals, scenario 3 mostly fulfilled the criteria outlined in the terrain, cultural and needs analysis as well as those of Feasibility, Compatibility and Afforability Study. The Final Proposal will work towards a sustainable village for Zutshwa with the incorporation of a Bush camp within walking distance of the village centre. Zutshwa will eventually be incorporated into the new Eco-Tourism Route extension between Kaa and Mamuno. The table summarizes the site selection criteria for the Bush Camp and the reasoning behind the criteria.

Bush Camp Site Selection Criteria	Reasons for Criteria
Site should be on the outskirts of the human settlement within the fringe of the identified migration corridor	• Increased incidence of Predators (Lions, Wild dogs, Leopards due to nearby cattleposts promote viewing possibilities for visitors. • proximity of migration corridor is important for game viewing • 90% of the Villagers are against a restcamp facility within the confines of the village (Kgotla meeting, June 2009).
Situate camp within 200m of the pan Elevated Camp Site with a view of the Pan	• Increased ambience due to the proximity of the vast water body • Buffer Zone of 20-50m surrounding the water body to accommodate the high water mark during years of good rainfall • Viewing of game (all year round) & birdlife (wet season)
Rest Camp should be sited on the SW of the Pan as wind is predominately from NE / ENE / N direction	• Reduces the possibility of animals perceiving human presence as the migration routes are predominantly along the S / SE and Eastern Border of the Pan during the wet season (dec/jan) and right across the Pan from SW to NE during the dry season.(• Abandoned Salt works situated NW of Pan which will be rehabilitated as part of the economic empowerment plan.
Selection of site within the 50% tree density Tree Cover vegetation facet	• Rest camp will be less conspicuous – greater visual absorption • Tree cover will create more shade and shelter from the elements • Anthropogenic disturbance results in bush densification • Retain as much of the natural vegetation as possible (van Riet, 1987),
Rest Camp Site within 1km of the settlement to make use of inhabitants Indigenous knowledge (culture, resources)	• Socio-economic opportunities associated with the camp must be within walking of the village for the inhabitants to benefit
Wildlife vs Livestock / Human conflict	• Opportunities for Socio-economic empowerment, education resource management and predator rehabilitation

Facilities

This table summarises the facilities that will be included at Zutshwa and what will be on offer as a result of their implementation

FACILITIES FOR ECONOMIC & EDUCATION ACTIVITIES	**DETAILS**
Predator Rehabilitation Centre (z sqm) and education facility (adults and children)	Tours; courses; mentorships; employment
Cultural Village & Administration (y sqm) • Market Space along main routes where the artist can work as well (not much traffic) • Traditional knowledge Centre • Kgotla, Headman, Kgosi	Administration of bookings: Saltworks; Rest Camp; Predator Facility Water collection facilities should form the roof structures of the market Doctor (traditional healer); museum/gallery of indigenous knowledge; courses for locals (marketing, NB of resource management and other skills) Chief of the village where bookings with locals can be requested.
Hides (x sqm)	Bird watching during wet season
San Adventure Centre (outskirts) • Medicinal courses • Survival courses • bush walks	
Desalination Plant and Saltworks (site of present abandoned saltworks)	Tours; employment; water provision (government funding), salt products for animals and people.

FACILITIES FOR ACCOMMODATION	DETAILS
BUSH CAMP (z sqm) Divide into Clusters to minimise impact	Parties usually travel in convoy of 2-3 vehicles with a maximum of 4 pax / vehicle (Botswana Tourism survey July 2009)
Cluster (y sqm) Clusters consist of 2-4 units, a Boma and Guard Shelter where necessary.	Accommodation: 2-4 units consisting of a vehicle shelter and rooftop bed for 4 **Unit:** Ablution unit : Shower / Toilet / Wash-up station Socialising: Boma for group interaction 1 Water Tank (rain water fed / borehole) 1 Guard shelter 1 Hide 1 Rubbish Bin (contents taken on leaving) Walking Trails that link clusters and hides
Unit (x sqm)	1 Shelter on Cement / Stone / Calcrete Slab Including a rooftop bed (as per SAN traditional grass bed)
Shelter A Shelter B	Wooden construction (A.erioloba, Terminalia sp) Grass Thatch Roof (local Stipagrostis sp) Low wall (local igneous stone & calcrete) Local Bakgatla style bungalow within walking distance of saltworks accommodating sedan drivers from Hukuntzi and guests wishing for traditional style accommodation.
Boma	Stone surrounded by Grass / Rhizogym (Driedoring) for protection
Guard Shelter	As per local traditional hut. (Wood & grass)

Framework

1:7500

One of the ways to preserve the character of the community is to secure the way in which the community live and move. It is not so much the space as what is happening in the space (Gooding, 2002:125). This character is captured in the patterns the community engrave on the landscape in the form of narrow dust roads that are widens at places where people congregate. According to Betsky (2006) Landscape architects can think of design as the thoughtful gathering together of what already exists to reveal the nature of the place.

The intervention of a sustainable village within which a BUSH CAMP (including sustainable water and material use); SALT WORKS (incl. desalination plant); MARKET (central economic area and socialising); PREDATOR REHABILITATION CENTRE (improve education and livelihoods through rehabilitation of lions and wild dogs)

This sustainable village would bring the most benefit with the least outlay utilizing (management and building) skills that already exist within the community. Together with appropriate patterning at the planning stage, it could quite quickly minimise conflicts by providing a more sustainable solution in keeping with the lifestyle and traditions and culture of the inhabitants of Zutshwa and the wildlife.

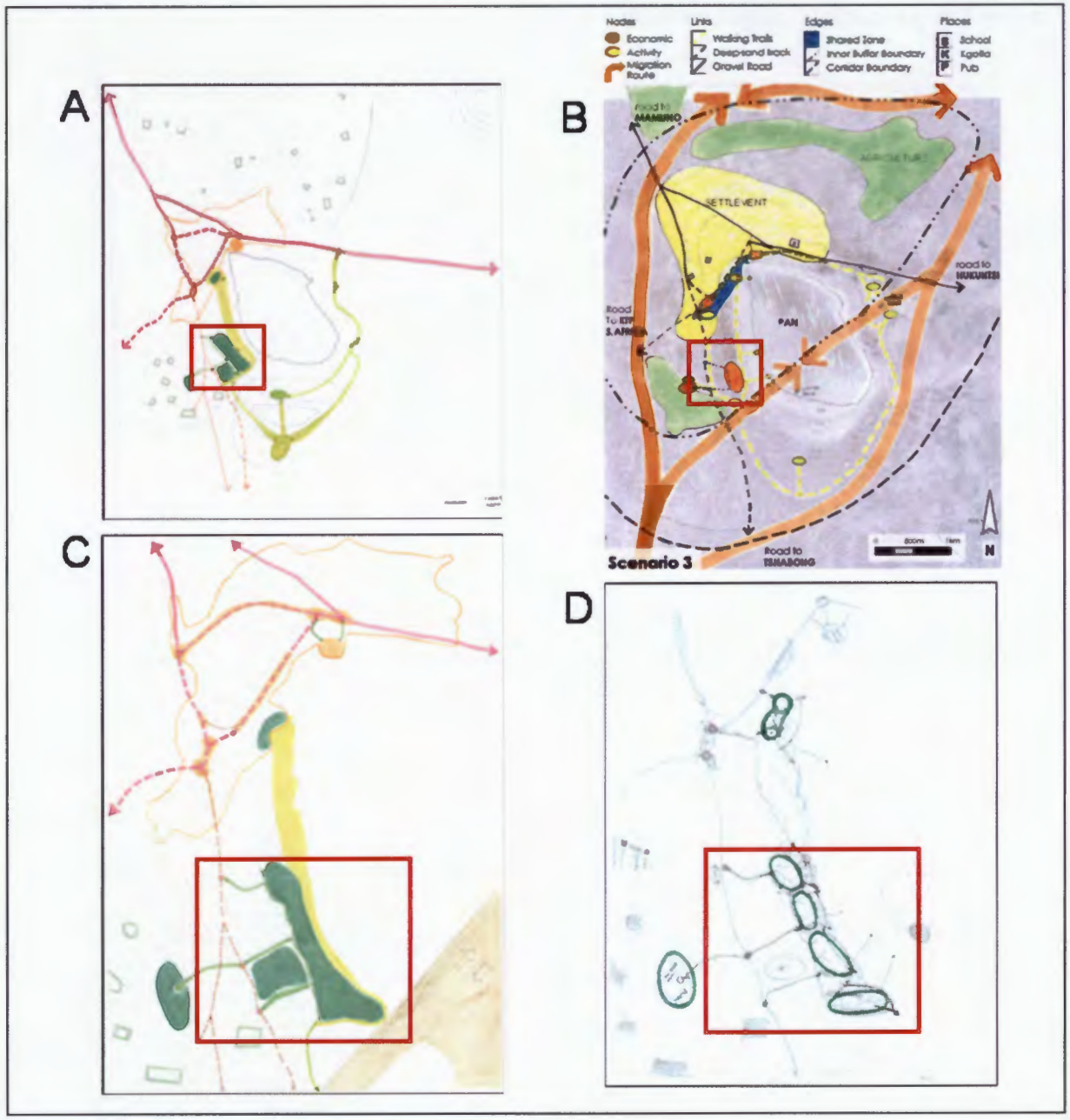


Figure 56 : Framework development

5 Detail Design : Zutshwa

Bush Camp

1:1000

According to Conroy (1995), the effectiveness of camp developments is determined mainly by the quality of planning actions. With effective planning, the appropriate type of camp, at the appropriate location for the market concerned, could lead to a successful development. However, if any errors occur during the planning phase, the possibility exists that the camp will not function at optimum level.

From the Terrain Analysis, Cultural Analysis and VIA we have established the ideal position for the BushCamp within the 50% tree cover vegetation class. The walking distance from of 1km from the vilage with the needs of tourists for privacy and aesthetic experience as well as the villagers for an intervention outside the Village. We have also accommodated the migration routes and habitats of the wildlife by situating the Bush Camp (Fig. 57) in the outer Buffer Zone which adheres to the new landuse criteria. The placement of the units in clusters is seen as the most suitable design layout acording to Van Riet and Young. The distance of each unit from another, and each cluster from the next has been taken from the local settlement pattern and hierachy of dwelling placements in the Village of Zutshwa. (Fig. 45)

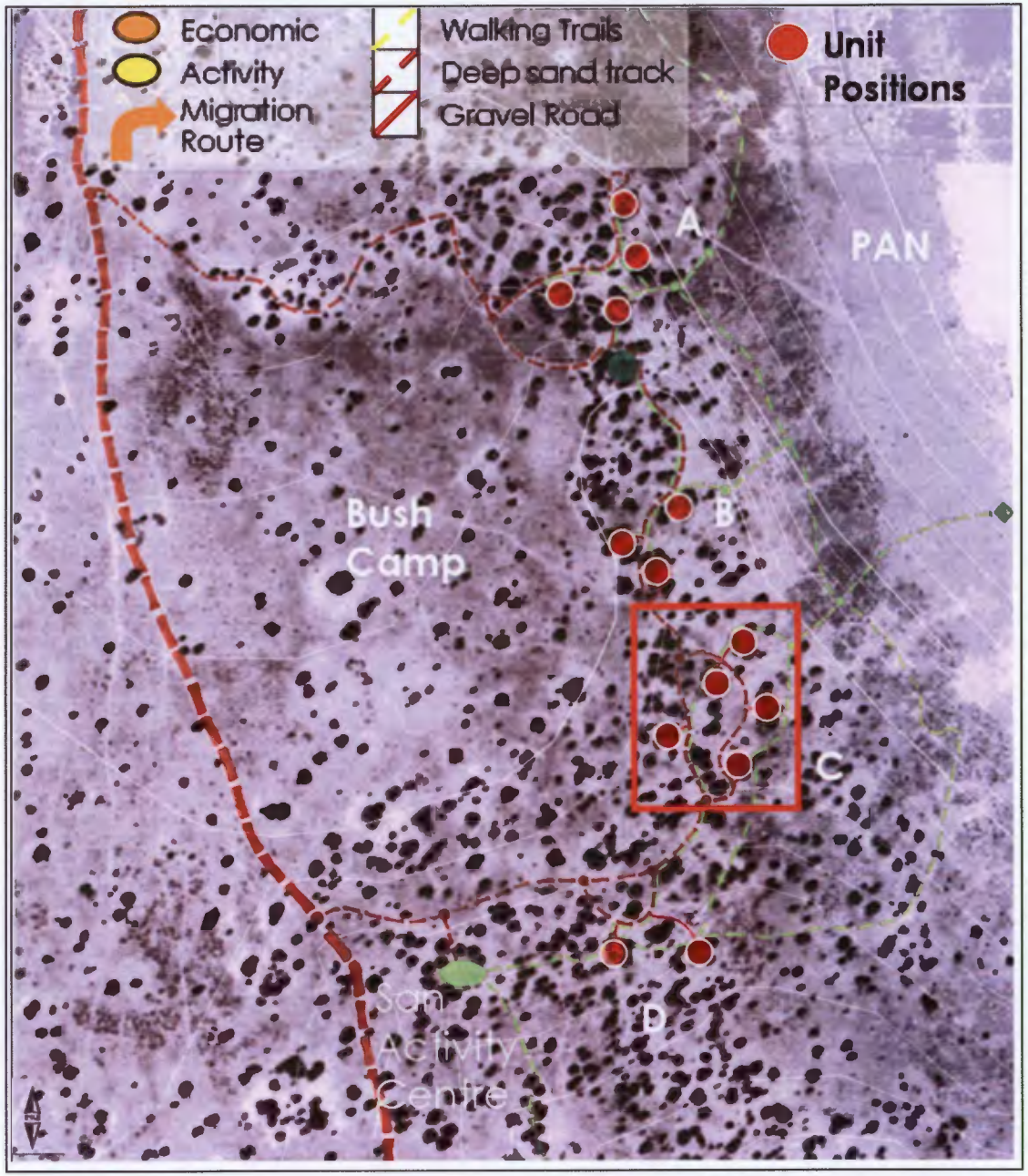


Figure 57 : Bush Camp

Considerations for Unit Placement

A building should offer a defined environment (sense of place) and an image to which people can relate. Norburg-Shultz, (1985:103,104)

This requires deliberate ordered organisation of space into patterns (Alexander, 1977). The need to order comes from greater functionality and understanding of relationship between reality and abstract thought (Leupen, 1997:25)

Spatial Organisation

According to Steyn (2000) the following spatial organisations are found:

- Centralised: Central dominant space around which secondary spaces are grouped (Fig. 58 A)
- Clustered: Spaces grouped by proximity or by sharing a relationship. They can be clustered around a large defined field which is essentially a centralized pattern but not compact and geometrically regular (Fig. 58 B)
- Radial: A dominant central space from which linear organisations extend in a radial manner. Whereas a centralised scheme is introverted, this scheme is extroverted and reaches out to it's context (Fig. 58 C)
- Linear: Linear sequences of space then can enclose a field of exterior space on their concave sides (e.g. Kalahari tented camp) (Fig. 58 D)

The most effective use of space is a combination of cluster and linear arrangement which could comprise separate buildings along river edge or around waterhole. The combination of cluster and linear spatial organisation is the most feasible use of space. The "clustered units" should be separated by belts of green to enhance "living in the wilderness" and create a noise and visual buffer. Plant materials should be left as undisturbed as possible and any additional material should be endemic. Selective clearing should take place only for circulation and safety. (Young, 1981)(Van Riet, 1987)

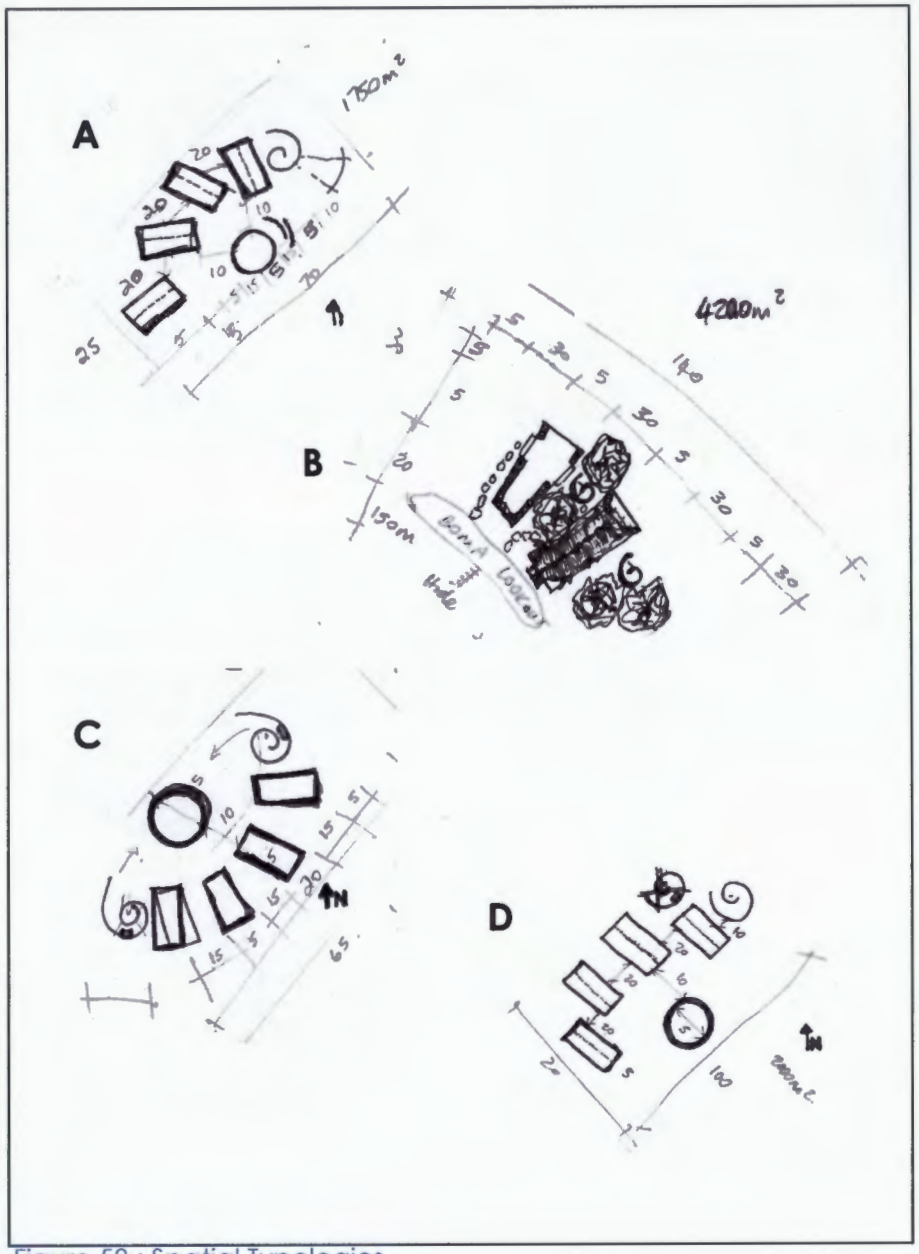


Figure 58 : Spatial Typologies

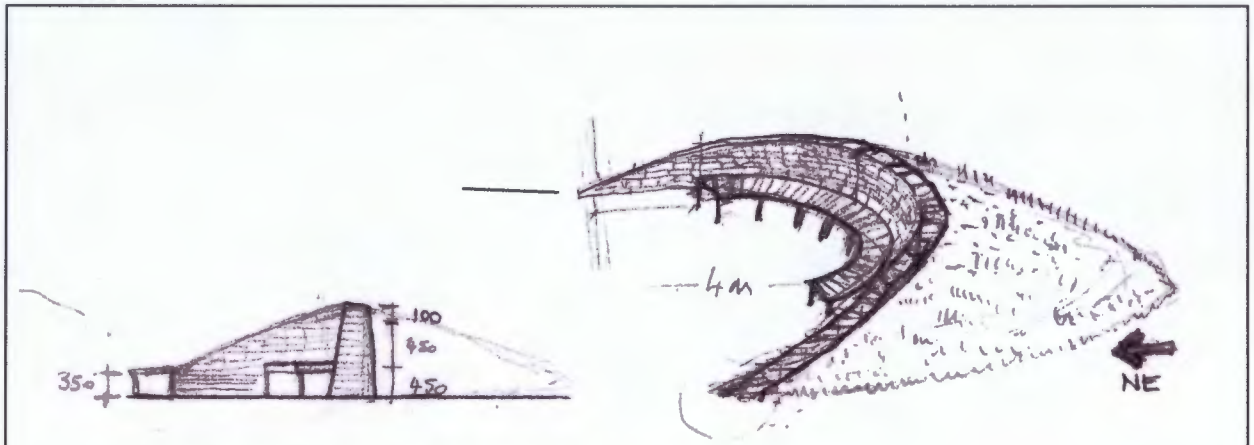
INFORMANTS FOR UNIT POSITION	REASONS FOR INFORMANTS FOR POSITIONING OF A UNIT WITHIN THE BUSHCAMP
Orientation: The Unit should face SE / East	• Shelter from the strong winds from the NE. • The occupants will feel beneficial warmth of the first rays of the rising sun, especially in winter when the temperatures often dip below freezing.(NBA, 2000)(C&C, July 2002)
Safety: Sleeping quarters raised off the ground	• The camp is unfenced and therefore wild animals including lions are free to roam, which they do mainly at night.(CCB July 2008), Crafford & Crafford, July 2002)
Legilbility: Group units in small clusters	• Minimise the footprint of the restcamp within the pristine environment.(van Riet, 2000) • Maximize privacy by accommodating small groups separately • Maximize protection from predators (safety in numbers due to greater surveillance)
Sustainability: Minimise the impact on the Environment	• No piped running water, all water is rain harvested or trucked in from Hukuntsi (65km away to East) in the dry season • Solar power to provide essential lighting • Visitors must be self-sufficient: There are provisions such as bottled water, meat, eggs and milk available. No fuel, firewood or fresh greens.(June 2009) • Retain as much of the natural vegetation as possible, existing trees & shrubs and enhance production of veld products using waste water for irrigation
Wilderness Edge: Unit Concept design	• 85% of the villagers belong to the !Xoo tribe (Baswara) (CI, 2008) • The Eland is an important totem to many aspects of the !Xoo culture with regard to coming of age and acceptance as a full member of the tribe (Kritzinger, 2001) • The Acacia erioloba trees and Stipagrostis sp create a definite canopy and ground cover effect (Twyman, 2000) which is an important consideration to retain the look and feel of the area • The sociable weaver birds make themselves heard and seen with their huge nests within the Boscia albitrunca (Shepherds Bush) (Arntzen, 1986) and an obvious association with the Kalahari within the birding community (SA Tourism, 2009) • Visual Continuity (Young, 1981)The construction & materials used for shelter & protective barriers created by the local & indigenous people give clues to the type of shelter that would reflect the culture and local materials within the context of the restcamp.
Socio-Economic Issues: Wildlife vs Livestock & Human conflict	• Opportunities for Socio-economic empowerment, education resource management and predator rehabilitation which aim to reduce conflict is the way to go (Klein, 2008)

Considerations for Design of a Unit

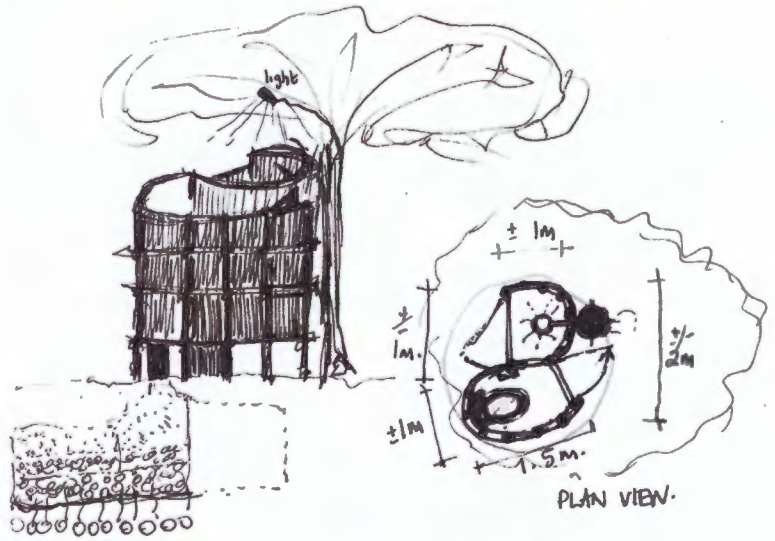
A building should offer a defined environment (sense of place) and an image to which people can relate. Norburg-Shultz, (1985:103,104)

This requires deliberate ordered organisation of space into patterns (Alexander, 1977). The need to order comes from greater functionality and understanding of relationship between reality and abstract thought (Leupen, 1997:25)

The concept of Wilderness Edge is brought though strongly in the design. The bush camp is unfenced which means that the wildlife can travel freely through the camp. Bulk enclosures have been avoided in favour of minimal use of massive construction techniques and a focus on more sustainable skeletal construction utilising local materials to blend in with the surroundings. The image of canopy and understorey so prevalent in the Savanna is used to good effect by placing the unit in a Cluster of Trees e.g. A.erioloba. Local materials will be used to demarcate the perimeter of the unit, as was done for centuries by the Bakgatla communities, with low stone walls. Other enclosures such as ablutions and the Boma mimic enclosures in the nearby settlement using T.sericea poles rammed into the ground and joined together by Sanserveria ropes which are locally made.



PERSEPECTIVE & SECTION : Sand Dune Shelter, C3



PERSEPECTIVE & PLAN : Ablution Areas, C3

Figure 59 : A single cluster in the Bush Camp

Case Study : SW Botswana

Cluster within the Bush Camp

1:250

Here we take an in depth look at a cluster and how the units were placed to effect the key performance criteria of:

Orientation

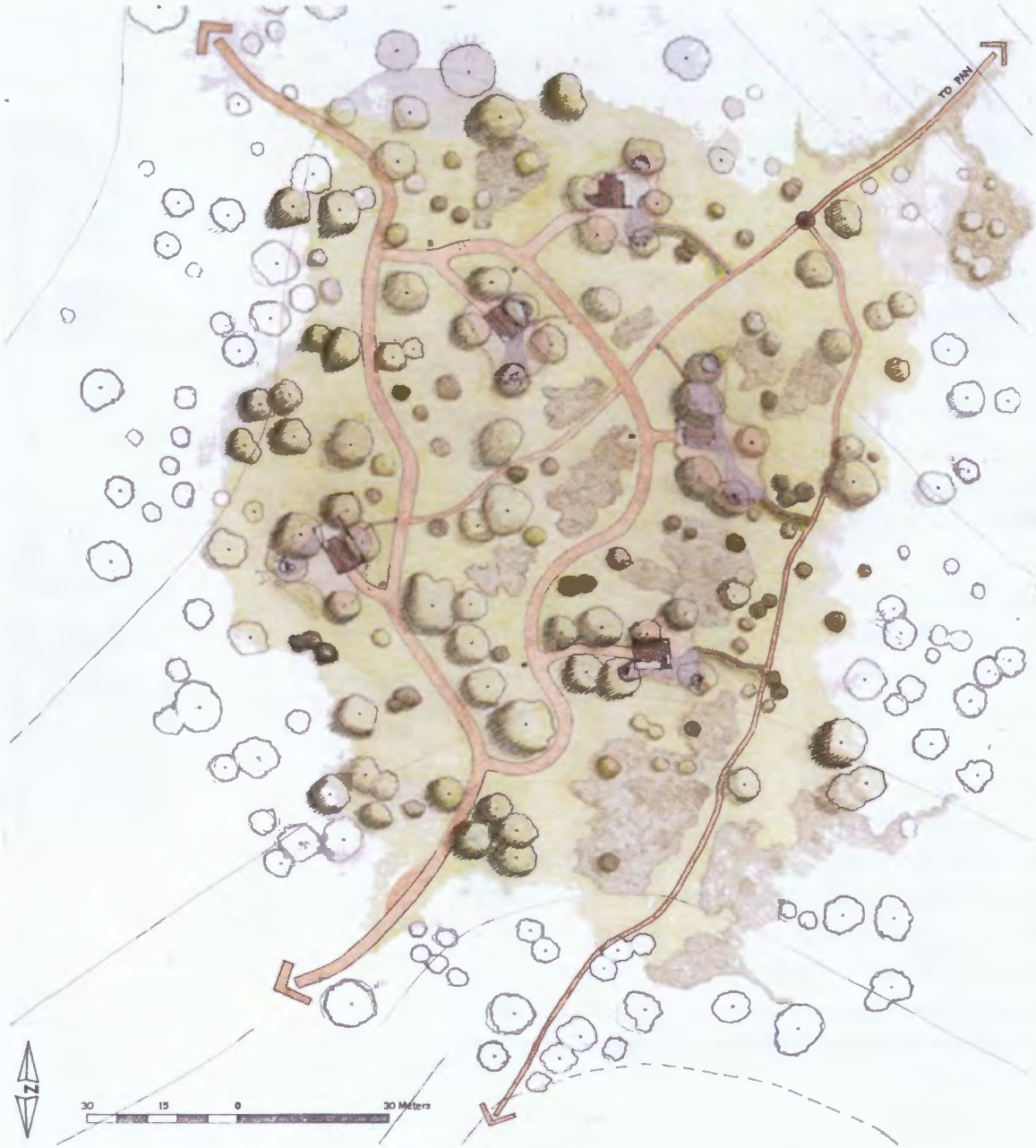
The units of the cluster have been orientated so that each unit has a unique viewshed, but also receives protection against the prevailing north easterly wind. The living area is carefully positioned in the shade

Image

The personality of the structure is informal reflecting important Totems of the Indigenous Culture. i.e the Eland has been used to give form to the canopy structure along with the form of the Nest of the Sociable Weaver.

Typology

Fully enclosed space is an appropriate solution when predators are a real threat, but to create a wilderness feel in keeping with the concept of Wilderness Edge an open lapa with adjacent defensible space (sleeping space) has been used as a compromise to ensure a sense of informality and enforce contact with the natural environment.



Access
Circulation patterns are easily discernable and have been developed in a hierarchical manner to increase legibility and eliminate stress and confusion Signage is positioned at all intersections

Safety
The immediate defensible area of each unit is cleared for safety against fire and predators.

Comfort
The unit has been ergonomically designed to include the correct heights and spacing for movement, sitting and lying down.

Privacy
Each unit is between 40-50m from the next using the settlement spatial relationship concept of 'neighbours'. Each unit is placed to partially obscure its view from the neighbour.

Compatibility
Local materials are used in construction of all the structures, utilising techniques employed in the local settlement as far as possible.

Legibility
Signage at each intersection and a hierarchy of pathways increase the legibility of this Bush Camp

A Unit of the Cluster in the Bush Camp

1:50 plan & section

The spaces that are related by function are linked by obvious paths and direct routes to eliminate confusion. Those functions that are closely related are placed on the same level to eliminate stress. These features add to the already aesthetically pleasing and locally compatible design enhancing the unique experience of the pristine and naturally beautiful environment. The fact that wild animals may come marching through the Camp at any time is both exhilarating and daunting. Performance criteria employed in the detail design are as follows:

Safety

The perimeter of the unit is cut short with a panga, the same width as the private pedestrian path, to increase the surveillance ability of the visitor. Obvious design decisions e.g. foldup stair ladder and rooftop sleeping quarters have been included to limit intimidation by predators.

Legibility

Related functions are connected by the same physical level or clear direct paths

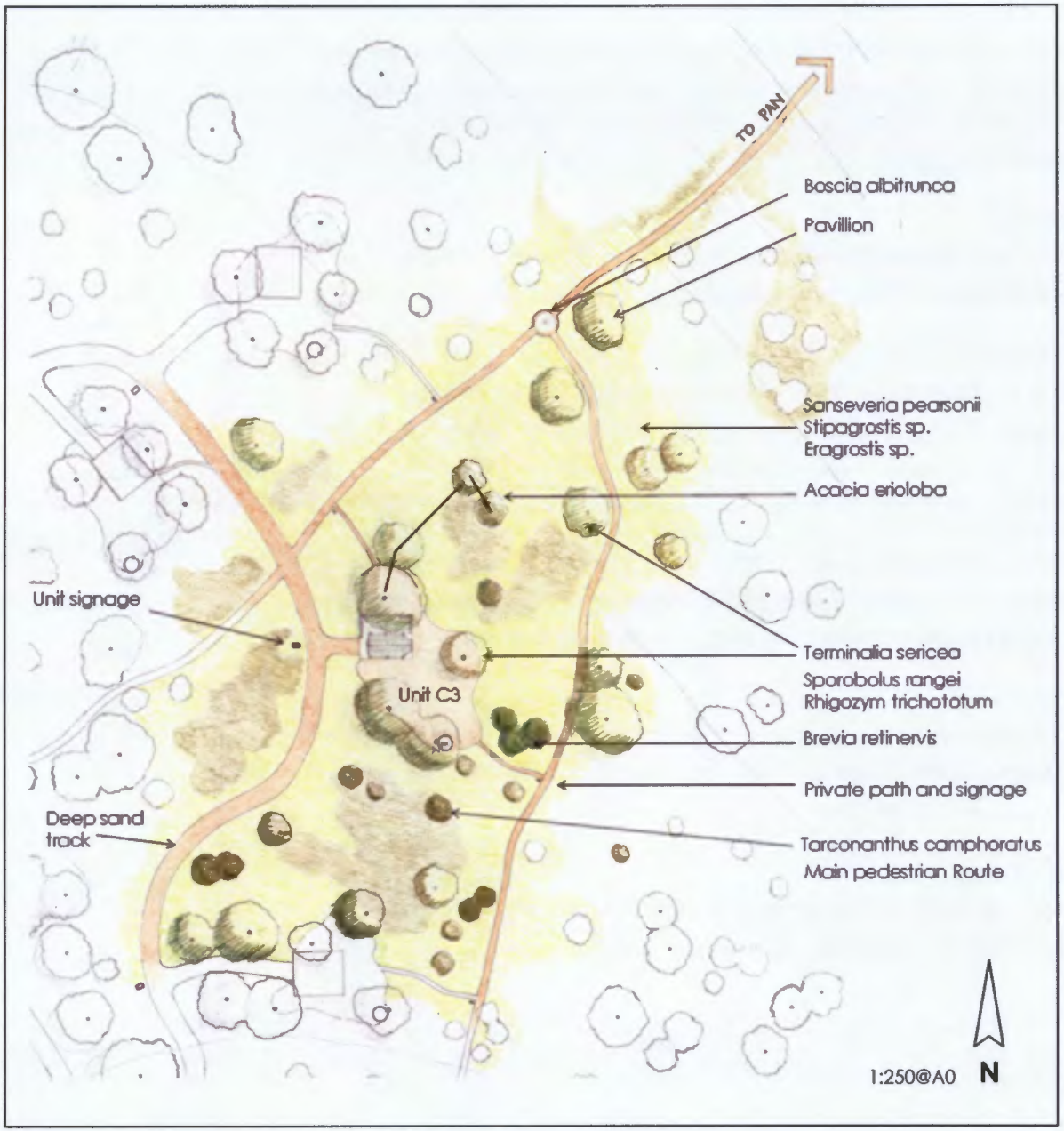


Figure 60 : Context for Unit at 1:250 @ A0

Comfort

The shower includes sufficient space to act as a dressing room as well. Ablutions are placed more than 5m from the sleeping spaces as a more sustainable composting solution is being employed, hereby relieving guests of the odour associated with these types of ablutions.

Privacy

Private Sleeping, Ablution and Relaxation spaces have been created as a retreat

Compatibility

The technology employed harmonises with the surrounding environment in the use of locally available materials and using traditional methods of construction i.e. low walls and ablution walls . The design complements the surrounding environment in that the units are subordinate to nature but also functional, convenient and safe with regard to method of construction. Mixing crushed calcrete with a small portion of Portland cement will exceed building standards for unfired building construction materials.(Calcrete Profiles of Botswana)

Sustainability

Ease of maintenance is one of the most important considerations for sustainability. These units can be maintained completely within the local community.

Figure 61 : Plan & Section of a Unit of the Bush Camp

Design Detailing for unit in Restcamp

Sustainability Detailing for the Unit : 1

Shower Filtration System and Swale for Urban Agriculture:

The Shower drain is attached to a filtration system which is directed under ground to a swale next to pedestrian path south of the unit. This 900mm wide swale runs along the contour as does the path which is lined with bidem cloth on the up hill side to retain water and soil. The agricultural drain is attached to the outlet of the filter system thus feeding the plants in the swale every time the shower and/ hand basin are used.

The crops that will be grown here are Tsamma Melon, Gemsbok cucumber and other endemic plants which can sustain the Villagers and the Wildlife during the dry season.

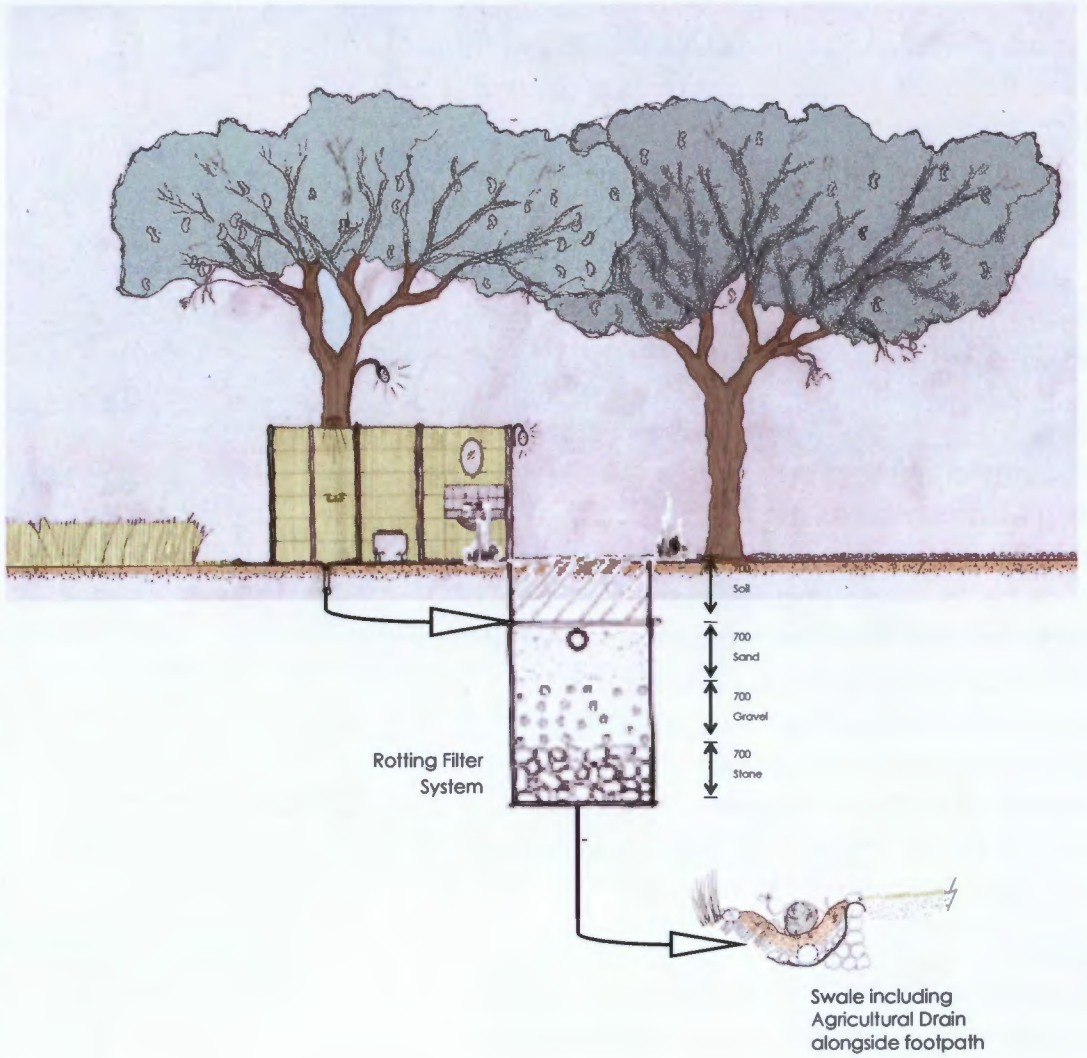


Figure 62 : Urban Agriculture

Sustainability Detailing for the Unit : 2

Rain Water Harvesting Techniques at the market and the Bush camp unit

Method to Determine the amount of water accessed by harvesting and how much is required for running of the camp is a key sustainability issue in this arid region.

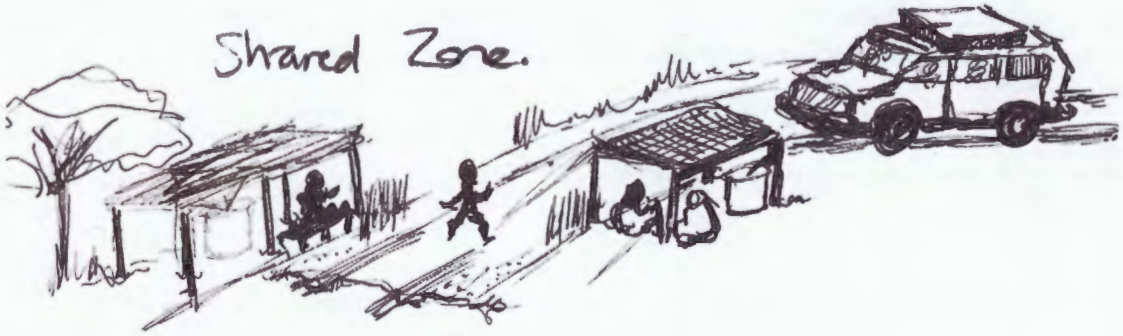
The water needs for the 469 villagers must also be taken into account when calculating water requirements as it is unsustainable to attempt to accommodate visitors when the local needs are not being met. This will increase rather than decrease conflict.

Rain water harvesting is an age old technique of collecting water from plants, roofs of dwellings and by digging wells for storage. The very important consideration of the nature of the rainfall will provide clues to the method of harvesting and storage required. 25% of the annual rainfall can fall in 48hrs due to a thunderstorm. Once the amount and nature of precipitation is established, the amount available for collection can be determined as well as design interventions which can manipulate these facts to best effect.

Water Needs of Zutshwa per annum:

469 x 2L x 365 = 342370L p.a. minimum to drink & cook

469 x 15L x 365 = 2567775L p.a. standpipe equivalent



The suggestion is that a Market Area is established in the shared zone. The roofs of which are multi-purpose, creating shade and shelter, harvesting rainwater and creating a sense of place for social gathering.

How much roof sqm. Is required to collect enough rainwater for Zutshwa and Visitors, taking into account evaporation.

Storage capacity :
25% of p.a. rain in 48hrs: 300mm/4=75mm
Yield from one Market Roof: 6x8=48sqm x 75mm = 3600L
Yield from one Visitor Unit Roof:5.4x6.5=35sqm x 75mm = 2625L
Initially 10 market roofs and 14 accommodation units are planned. This will provide:
24 x 6225L x 4 = 597 600L per annum which provides the minimum water requirement with a percentage for visitors.

Figure 63 : Rain Water Harvesting

Sustainability Detailing for the Unit : 3

Desalination Units for use at the Saltwork s

A solar still consists of a basin with a sloping glass cover; the walls are low and it looks like a house with a glass roof. At the bottom edge of the glass, on the inside, runs a gutter. The bottom of the basin is black and is well insulated.

Salty water (30-40 mm. deep is optimal) is introduced in the basin, heats up when the sun shines, and evaporates. The heat is absorbed by the black surface, and the hotter the basin becomes, the faster the evaporation. The insulation prevents the heat from being lost to the earth.

The air inside the unit becomes saturated, and then water vapour condenses on the coolest available surface, the glass. The water flows down the inside of the glass as a thin film and collects in the gutter. From there, it is directed to a storage tank. The glass must be set at an angle, be kept clean and be free of cracks so that the water does not form droplets that fall back into the salt water.

Each still has access doors so that the inside can be properly cleaned. However, when the doors are closed, the unit must be airtight for optimal operation.

The Mexican solar stills (MK II) of the Rural Industries Innovation Centre in Kanye are made of fibreglass and resin mixtures. They are designed to withstand transport over unpaved roads and to operate under the harsh conditions in rural Botswana. (Yates, 1985)

The moulded basin has 1.6 m^2 of evaporator area, two gutters for collection of the distillate as it runs down the glass, and gables that support the glass. The shape is like a tent with two pieces of glass for the roof (Fig. 64). The fibreglass is strong and resistant to salt, heat and sunlight; it is dyed black before it hardens.

This modular unit is easy to transport and would be an ideal back-up to rain water harvesting. Salt can also be marketed as products for human and animal consumption.

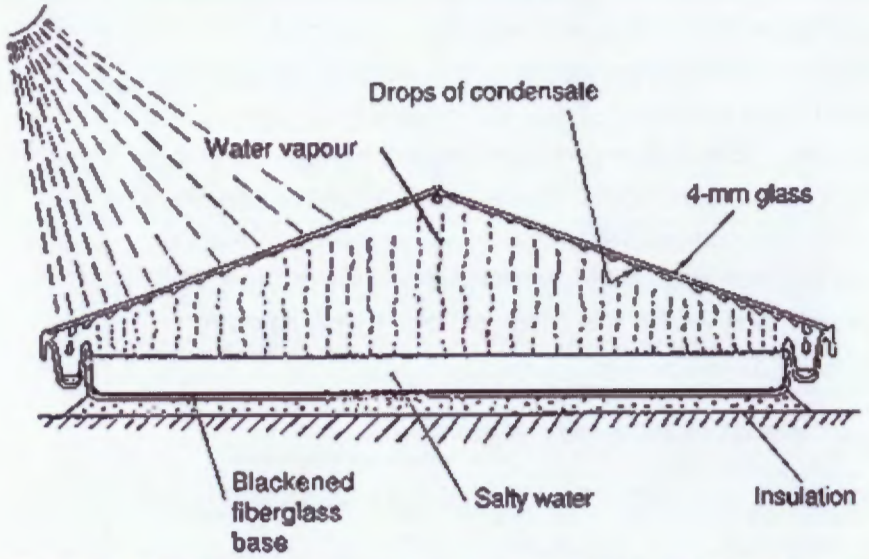


Figure 64 : Desalination Technique using glass and solar power (Yates)

CONCLUSION

From the review of literature it became clear that a new model addressing the implementation of bioregional theory with accompanying principles at a broad and fine scale would be necessary if the global socio-economic and sustainability issues are to be adequately addressed.

Bioregional planning refers to the 'matching' of human settlement and land-use patterns with the parameters of ecological systems, and the planning, design and development of the human-made environment within these parameters in a manner that ensures environmental sustainability.

Bioregional principles are scale independent and based on the global issue of Sustainability which are implementable at a macro biogeographic scale through the Landuse Planning Tool. The delimiting of the macro biogeographic region highlights broad scale conflict, with regard to resource and landuse, which results in new landuse proposals mitigating for this conflict and encroachment on vital habitats and movement corridors. New Landuse plans influence the decisions at the local scale. As a result of delimiting the macro-biogeographic region we are also faced with conflict zones in the form of Socio-economic Issues particularly over scare resource use, misuse and misappropriation – another global issue.

It is apparent that creating diversions away from the conflict toward better resource use management and new non-consumptive routes for socio-economic opportunities is the way forward. Mapping of the conflict zones gives spatiality to the social considerations and an indication of the mitigation measures required.

The macro biogeographic region is, however, too large for effective planning. To create an effective planning unit for integrative planning, the macro biogeographic region must first be divided into more homogenous planning units, bioregions, which can be used to develop the structure plan for the region along with the Land Use Plan and the Socio Economic Plan. The bioregion provides an effective intermediate framework to co-ordinate planning at other scales.

In order to understand the landscape more fully, the bioregions are subdivided into smaller more manageable units, called land management units (LMU) which add value to the planning and design of interventions, reflect upon the opportunities and constraints of the bioregion itself and create boundaries for effective management of local Interventions whether it is a door-sized space or a part of the Transfrontier Park.

We need to resurrect the holistically orientated local community along with its social structures, norms & aesthetic values to rehumanise our world. This model differs from previous models in that it addresses this issue by incorporating the socio-economic factors such as resource utilisation and resource conflict at a bioregional level paving the way for successful implementation at a local scale.

Conclusion

Contrary to popular belief Indigenous peoples have a strong tradition of caring for their environment and the importance of a healthy relationship with the earth is central to most traditions. By honouring ancient wisdom we ensure the survival of our heritage. The indigenous peoples chose not to tame the wild, could they perhaps see where this would lead? Accounting to our children and future generations here on earth is a sobering thought indeed.

We can see from the case study that if Landscape Architects, ecologists and planners pull together their strengths to implement essentially age old principles in a more co-ordinated co-operative manner sustainable socio-economic development is possible. The model has rearranged a planning and design system that was already there in a more logical way, so that it works to conserve energy and generate more sustainable solutions.

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ADDENDUM

VEGETATION AS A RESOURCE : A selection of the Most Commonly used Plants

BOTANICAL NAME	COMMON NAME	RESOURCE USE
Aristida sp. (Leffers, 2003:37)	Bristle grass; N#a 'an	Mechanical water purification, the grass acts as a straw Thatching material for traditional & 'modern' huts (Stipagrostis obtusa and the Schimidtia kalahariensis are used for this purpose)
Acacia erioloba (Roodt, 1998:158)	Camel thorn Tree; L'ana	Very hard wood used in construction; also popular as firewood ; Valuable as animal fodder, known to increase milk production; Great shade tree, only looses leaves for a very short period
Acanthosicyos naudinianus (Leffers, 2003:25)	Gemsbok cucumber; dca'a	Yellow fruits yield refreshing jelly-like pulp for humans & animals Firm stems make great skipping ropes for children Warmed fruit halves rubbed on hide prepare leather for use
Boscia albitrunca (Roodt, 1998:28-29)	Shepherd's Tree; Motlopi	Provides deep shade up to 21°C cooler than ambient temperature, occur in all vegetation types as isolated individuals Leaves have same feeding value as lucerne Milk treated with pulverized root remains fresh for 24hrs (2x longer)
Citrillus lanatus (Leffers, 2003:60)	Tsamma melon; tamah; kgengwes	Watermelon-like fruit common, but not abundant is an integral part of the diet of the San people; In addition to the flesh, which is pounded into a pulp and then eaten and drunk, the seeds are considered a delicacy. Roasted, sieved and winnowed, they are ground on a flat stone into a coarse, whitish meal, which is a nutritious and pleasantly nutty-tasting food. (SA Tourism) Eaten by migrating ungulates in dry season & times of drought

BOTANICAL NAME	COMMON NAME	RESOURCE USE
Grewia retinervis; Grewia flava (Roodt, 1998:82-83)	False sandpaper raisin & brandy or raisin bush	Berries are eaten by birds, animals & humans (either dried or fresh), Berries also used to produce an alcoholic beverage Branches are ideal for making bows & arrow shafts Wood is used to start a fire 'by friction' by placing a pointed hardwood stick into the hollow of this softwood till it smolders
Rhigozym brevispinosum Rhigozym trichototum (Roodt,1998:60-61)(Leffers:167)	Western Rhigozym; !aq'ari	Wood is used for digging sticks and fence poles
Sanseveria aethopica; S.pearsonii (Leffers,2003:170&171)(Roodt:79)	Mother-in-laws's tongue; Bowstring hemp; !hui	Fibre is produced mechanically by scraping the flesh from the leaf used for making carrying bags, ropes and a multitude of other uses including construction of traditional huts.
Terminalia sericea (Leffers, 2003:186-187)(Roodt:50)	Silver Terminalia; za'o	Multipurpose Tree, favoured for construction and household items; Chew bark to relieve 'malaria' systems, severe headaches and coughs and colds
Tarconanthus camphoratus (Leffers, 2003:184)	Camphor bush; gl'o	Used as a cure all especially for chest ailments; A tradition among hunters is to hold arrows in the smoke of *Tarchonanthus* branches when somebody in the family has died - failure to do this will result in an unsuccessful hunt
Terfezia sp. (Leffers, 2003:185)	Kalahari truffle; dcoodcoo	Fungi found below the soil where the surface has 'cracked', can be baked in a fire or boiled – taste like mushrooms

CONSIDERATIONS FOR PROPOSED DEVELOPMENT : Scenario Informants

SCENARIO PERFORM CRITERIA	OPTIONS	IMPLICATIONS	OUTCOMES		FEASIBILITY	COMPAT-IBILITY	AFFORD-ABILITY
ACCESS	AIR	Closest airstrip is in Hukuntsi (65km) Select a method to transport guests to Zutshwa Build a new airstrip in Zutshwa	Helicopter	Create a helipad			
				Guests must be provided with fully equipped accommodation			
			by 4x4	Management will need to own a 4x4			
				car hire depot developed in Hukuntsi			
			improve the road to Zutshwa to accommodate 2x4 vehicles	car hire depot in Hukuntsi			
				camp/ village will need to own a 2x4			
				Guests need fully equipped accommodation			
			High outlay for airstrip				
			Increased Noise pollution far out ways the benefit of the airstrip				
	SEDAN (2x4)	improve the road to Zutshwa to accommodate 2x4 vehicles					
		car hire depot developed in Hukuntsi					
		rest camp/ village will need to own a 2x4					
		Guests must be provided with fully equipped accommodation					
	TRUCK (4x4)	Full access due to 4-wheel drive capacity; no additional cost to village or camp					
		Guests are self-reliant and self-sufficient					
TYPE OF DEVELOPMENT	RESORT	High initial outlay					
		Infrastructure	Large building footprint				
			Running water & Reliable Electricity				
			Highly trained staff				
			Upmarket facilities				
	LODGE	High initial outlay					
		Infrastructure	Large building footprint				
			Running water & Reliable Electricity				
			Highly trained staff				
			Upmarket facilities				
	BUSH CAMP	Low initial outlay					
		Infrastructure	small building footprint				
			No Running water & Solar Power only				
			Locally skilled staff				
			Facilitiies in keeping with pristine environment				

ACTIVITES	Educational	Short Courses	Indigenous Medicine			
			Traditional Cooking			
			Hut Building			
		Survival Skills	Walking with the San			
		Tours	Predator Rehabilitation Centre			
			Salt Works & Desalination Plant			
			Village			
	Cultural	Traditional Healer				
		Crafts & Skills				
		Language Guides & Interpretor				
		Story-telling				
	Adventure	Hunting				
		Quad-biking				
		Balloon Rides				
		Animal Rides				
		Survival Skills				
Construction Material	Local					
	Imported					
Height of Structure	Above the Tree Canopy	Low VAC				
		Great Views				
	On the Ground Under the Tree Canopy	High VAC				
		Same level as predators				
		Restricted View				
	Above the Ground, Under Tree Canopy	High VAC				
		Physically removed from Predators				
		Better Views				
POSITION OF STRUCTURE IN THE LANDSCAPE	On the Plateau	High VAC				
		Easy of construction, lowest costs				
		Ease of Access				
	On the Slope	Medium/Low VAC				
		Moderate difficultly w.r.t. construction, increased building costs				
		Access more labour intensive, therefore more costly				
	In the Water Wet Season	Low VAC				
		Building construction more problematic, highest building /maintenance costs.				
		Access costly (create floating jetty-style walkway for wet season)				

ANALYSIS OF PRECEDENT: Scenario Informants

PRECEDENT: DESIGN INFORMANT	EXTENT OF CAMP	DISTANCE BETWEEN UNITS	EXTENT OF EACH UNIT	SEPARATE ABLUTIONS	NO. OF PAX PER UNIT	NO. OF UNITS	ROAD	RATE WATER	BUILDING MATERIAL
Gharagab Tented camp	80x65m	25m	10x5m	Yes (attached to unit)	2	4	Deep sand	R720/unit No	Wooden shelter, canvas tent
www.northerncape-direct.com/gharagab/gharagab-wilderness-camp									
Grootkolk Wilderness camp Elevation 1036m, Facing NE. Wind SSW	200x15m	40m	20x125m	Yes Provide own water, wood, food, solar and fire place common	2	4	Gravel	R760/unit	Sandbags and canvas shelter
www.northerncape-direct.com/grootkolk/grootkolk-wilderness-camp									
Audi camp	50x100m	3m	3x6m	No	2/4	10	Gravel		Wood, shade cloth pavillion
Kielie Krankie	160x15m	35m	10x5m	Yes	2	4	Deep sand	No	Wood, shade cloth , canvas tent
Urikaruus	160x15m	35m	10x5m	Yes	2	4	Deep sand	No	
Kalahan Tented camp	420x60	20m	14x5.5m	Yes	2	15 4 Family 10 2pax 1 luxury	Gravel		Wood, sandbags, canvas tent
Mabuasehube Camp SW of Pan, 200m from water, elevation 1040m	140x60	30-70m	4x4m (picnic) 6x8m (shelter)	Yes	?	4	Deep sand	No	Wooden shelter
Khiding Pan Mabuasehube, SW of Pan, 120m from road		150m	8x6m	Yes	2	4	Deep sand	No	Wooden A-frame pavillion

TABLE OF FIGURES