

City of Joburg

Biodiversity Strategy and Action Plan 2015

An action plan for implementation

Joburg

a world class african city

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Executive summary

This document, the first Biodiversity Strategy and Action Plan for the City of Joburg, articulates actions through which to implement the vision, strategic objectives and actions necessary for the conservation, protection, use and development of biodiversity.

The Biodiversity Strategy and Action Plan is a tool by which the city, it's departments, municipal owned entities, partners and the local community can work together to deliver continuing action for biodiversity stewardship.

Part 1 describes the current state of biodiversity within the City. Part 2 provides an overview of the local, provincial, national and international laws and obligations for biodiversity. Part 3 sets out the vision, strategic objectives and guiding principles for biodiversity within the City. Part 4 provides details on the action plans. Part 5 illustrates how a monitoring and evaluation framework should be developed to monitor progress towards the biodiversity vision. Finally, a way forward is identified along with five priority projects for immediate consideration.

The City of Joburg is a major metropolitan area and economic growth node for the region as well as Southern Africa. Environmental Management in the city is shaped by a number of drivers and forces that shape the growth and development of the city.

The CoJ Biodiversity Strategy and Action Plan (BSAP) sets out a framework and a plan of action for the conservation and sustainable use of biological diversity and the equitable sharing of benefits derived from this use. It provides an overview of key issues, constraints and opportunities identified in the stocktaking and assessment phase.

The strategy that follows sets out the strategic objectives, outcomes and activities needed to achieve the overarching goals of conservation, sustainable use and equity. An implementation framework sets out high priority activities which are needed to achieve the objectives, including lead agents, partners, targets and indicators.

The term 'urban biodiversity' refers to the biological diversity located within urban areas. The character and quality of urban ecosystems is reflected by the plant and animal species that are present in the urban ecosystem, their interactions with one another and with their surrounding environment. Urban biodiversity is constantly influenced by human activity and our social, economic and cultural dynamics. The benefits from healthy ecosystems provide ecological goods and services that include:

- provisioning services – including the production of energy and water;
- regulating services – including the control of climate and waste;
- supporting services – including nutrient cycles and crop pollination;
- cultural services – including research, education, spiritual and recreational benefits; and
- preserving services – including guarding against uncertainty through the maintenance of diversity.

The overall biodiversity vision for the city

The overall biodiversity vision for the city is to "Conserve and manage biodiversity and the city's environmental heritage to ensure the delivery of sustainable and equitable ecological goods and services to the citizens of Johannesburg, now and in the future".

The BSAP recommends 6 priority projects for implementation:

1. Set the Biodiversity objectives
2. Develop an understanding of the biodiversity resources in the city (biodiversity audit)
3. Set up an institutional system at aligns planning and biodiversity in the city
4. Ecosystem services for water
5. Awareness and education on the value of urban biodiversity
6. Conservation of grassland habitat

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Acronyms

CBD	Convention on Biological Diversity
CBO	Community Based Organisation
CoJ	City of Johannesburg
C-Plan	Conservation Plan
DEAT	Department of Environmental Affairs and Tourism
DoA	Department of Agriculture
DWAF	Department of Water Affairs and Forestry
EWT	Endangered Wildlife Trust
GDACE	Gauteng Department of Agriculture, Conservation and Environment
GDP	Gross Domestic Product
GIS	Geographic Information System
GMO	Genetically Modified Organisms
GMS	Growth Management Strategy
GPGDS	Gauteng Provincial Growth and Development Strategy
IAPs	Invasive alien plant species
ICLEI	International Council for Local Environmental Initiatives
IDP	Integrated Development Plan
JMOSS	Joburg Metropolitan Open Space System
JPC	Johannesburg Property Company
JRA	Johannesburg Roads Agency
LAB	Local Action for Biodiversity
LBSAP	Local Biodiversity Strategy and Action Plan
MOE	Municipal Owned Entity
NBSAP	National Biodiversity Strategy and Action Plans
NEMA	National Environmental Management Act
NEMA: BA	National Environmental Management Act: Biodiversity Act
NGO	Non governmental organisation
NSBA	National Spatial Biodiversity Assessment
NWRS	National Water Resource Strategy
OSF	Open Space Framework
RDL	Red data listed
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
WMLC	Western Metropolitan Local Council

Introduction

Purpose of this document

The purpose of this document is to present the vision, guiding principles, strategic objectives, goals and action plans for the protection, use and conservation of biodiversity within the City of Johannesburg.

The LAB process

LAB (Local Action for Biodiversity) is an ICLEI initiative for the protection of biodiversity at a local level. Joburg is one of the cities with a track record of involvement and interest in biodiversity initiatives that has been invited to participate in LAB. Joburg is now in the process of completing various deliverables by June 2009, including this BSAP.

The LAB Local Biodiversity Strategy and Action Plan (LBSAP) are the required participant deliverables for step 3 of the LAB 5-step process. The LAB biodiversity reports (step 1) detailed the current status of biodiversity and biodiversity management in each local government; the LBSAP follows on from this by providing the strategy and detailed actions for how to improve that current status. Step 2 (formalization of long-term commitment to biodiversity conservation through signing of the Durban Commitment) also complements the LBSAP, by facilitating support for biodiversity action. Step 4 is directly related to the LBSAP, being a commitment by local government to fulfil the LBSAP's objectives. Lastly, step 5 of the LAB 5-step process is where the plans in the LBSAP actually translate to action that makes a positive difference to biodiversity by beginning five new biodiversity initiatives.

Urban biodiversity is defined as the biological diversity of urban areas by ICLEI and is heavily influenced by the built environment and the economic, social and cultural dynamics of these densely populated places. A BSAP for an urban area differs from a strategy for untransformed regions as it recognises the role of the built environment for biodiversity conservation. A good example for Joburg is the role of the Johannesburg Zoo and Zoo Lake area. While the lake is a man made structure and landscaped park the area plays an important role in open space system of the city and provides important ecological services like flood regulation and habitat provision.

In the past, biodiversity conservation and protection has been viewed as the responsibility of national and provincial government with less attention on local government and the contribution it can make. More recently, city governments globally have started to recognize that their role is increasingly relevant, especially in light of increasing urbanization, and so highlighting the importance of this LAB process.

The goal of the LAB Project is to bring together cities from a range of global contexts, to explore the best ways for local governments to engage in effective biodiversity management, and to profile their efforts.

LAB Project Goals

There is a well recognised deep inter-connectivity between conservation of biodiversity, poverty alleviation and sustainable development. Humankind, as well as all other forms of life, directly depends on biodiversity, the "web of life" for its very existence. For example, natural vegetation purifies water and air and prevents soil erosion; insects and birds pollinate crops; and our rich variety of species form an ecological treasure chest used by humankind for agricultural, medicinal, horticultural, structural, spiritual and many other purposes. Cities take up only about 2% of the world's land area, but they consume 75% of all resources consumed by humankind. This means that biodiversity in urban areas is generally under high levels of threat; it also indicates that cities utilise far more of the Earth's resources than those contained within their boundaries.

This further highlights the importance of, and need for, conservation action in the urban context, and the critical role that local governments, who are the front-line managers of biodiversity in cities, play in sustainably conserving and managing the world's biodiversity. ICLEI's LAB project recognises the need for increased political support for

biodiversity at local level and the integration of biodiversity considerations into all aspects of local governance, and we aim to address these concerns through the following project goals:

- Profile, advocate and promote the importance of urban biodiversity worldwide.
- Raise the status of local government's management of urban biodiversity.
- Actively mainstream biodiversity into all decision-making and planning processes at local level.
- Facilitate lesson-sharing among local authorities across the globe.
- Produce and disseminate good practice biodiversity case examples.
- Lead the way for the next generation of participating cities in future ICLEI / LAB initiatives.
- Cooperate and network globally with a wide range of stakeholders.

LAB will also focus on developing a local government network for biodiversity action, which will promote a greater understanding of local government biodiversity issues leading to the implementation of appropriate measures within the participant local governments.

Part 1: State of Johannesburg's Biodiversity

Johannesburg like many other highly urbanised cities is densely populated and the natural land cover has therefore experienced significant transformation into urban activities.

Joburg is located in the heart of south eastern South Africa, within the Gauteng Province. The City area is approximately 1 645 square kilometres, or just under 10% of the total land of the Province. The population of the city is approximately 3.8 million, and as a high population growth rate of 20.5% (StatsSA, 2007, Community Survery). The population density is high at approximately 2 363.6 persons per km^2.

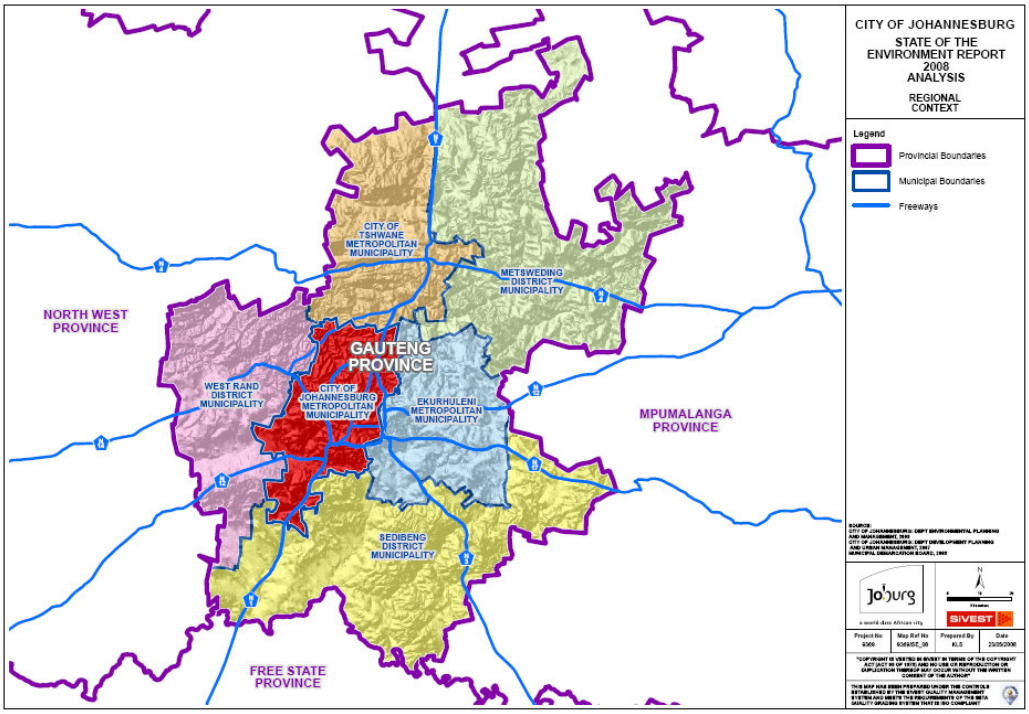

Figure 1: City of Joburg, regional context (CoJ, Biodiversity Assessment 2009).

The central regions of the Joburg are densely covered by the built form and mostly transformed. These regions are characterized by commercial, industrial, mining and residential land uses. To the north and south of the central region, the land cover is dominated by residential land use and its associated activities. City suburbs are predominantly vegetated with trees and bushes, many of which are not indigenous and even invasive alien species. The residential areas gradually decrease in density as one nears the northern and southern boundaries of the city. The most northern portion of the city is characterised by smallholdings, parks and open spaces, although the area is fast expanding into the remaining undeveloped spaces. The vegetation in this area is dominated by irrigated and natural grassland. Small areas of scattered residential and commercial land uses are also present.

Social and Economic Activities

Joburg is generally perceived as the 'economic hub' of South Africa, the Gauteng Province accounts for 33% of South Africa's Gross Domestic Product (GDP) and is the largest sub-national African economy (GPDDS, 2005). Population growth and development are a major driving force behind the degradation of the ecological environment in the City. There are large pressures for land for new developments and increasing pressure to provide infrastructure for the growing population. There are still high levels of unemployment and the resultant high levels of poverty evident in the Province (CoJ SoER, 2009).

The provision of housing is one of the foremost drivers of the current state of the environment of the City (SoER, 2009). Much of the low cost housing has been built in low density developments on the outskirts of the city. This has increased the loss of natural land cover and increased the impact of infrastructure systems on the city.

Local Authority

The City of Joburg Metropolitan Municipality is the authority responsible for the management of the City. The Metro is responsible for implementing sustainable environmental practices while promoting the development of the social and economic environment of the city.

The Integrated Development Plan (IDP) for the CoJ states the vision for the City: *"…a world class city with service deliverables and efficiencies which meet world best practice. Its economy and labour force will specialise in the service sector and will be strongly outward oriented such that the City operates on a global scale. The strong economic growth resultant from this competitive economic behaviour will drive up City tax revenues, private sector profits and individual disposable income levels such that the standard of living and quality of life of all the city's inhabitants will increase in a sustainable manner."*

In order to achieve this vision the City has several strategic interventions and sector strategies in place. In addition, the CoJ is committed to the following objectives:

- Air quality management
- Energy provision
- Noise pollution management
- Waste minimisation
- Water conservation
- Water pollution and protection of water resources
- Adequate sanitation
- Biodiversity protection.

The Biodiversity Assessment

The CoJ has completed its Biodiversity Assessment as the first part of the LAB process during 2009. This report has highlighted the way forward for Biodiversity in the City and forms the main platform for the development of the strategy and action plans in this document.

Biodiversity hotspots

Careful planning and consideration needs to be implemented to prioritise the most ecologically viable of these hotspots as conservation areas and to manage these areas appropriately. Biodiversity hotspots have been identified that are pertinent to the conservation of aquatic ecosystems and Red Data Listed terrestrial biodiversity. The conservation of all these hotspots is neither practical nor viable in a municipality that has to cope with ever-increasing urban expansion.

Flora

From a biodiversity point of view, the flora in CoJ is compromised. A large proportion of the habitats in the CoJ have been transformed and, for some vegetation types, only small proportions may remain of the original extent. Of those vegetation types occurring in the CoJ, Egoli Granite Grassland, classified as an Endangered vegetation type, is considered to be the highest conservation priority. The CoJ has a high responsibility with respect to conservation of this vegetation type due to the fact that a large proportion of this vegetation type (64.5%) occurs within the

municipal area (Driver et al, 2005). However, given that the data used to determine the ecosystem status of these vegetation types is over 5 years old, along with the high level of development within the City it is expected that far less of the vegetation types may be left. The biodiversity action plans highlight the urgency of protecting the remaining intact areas of grasslands.

A total of 1 374 plant species have been previously recorded within the CoJ. This is relatively high species richness and indicates high habitat diversity and geographical variation in species composition. Factors that promote high species richness include geological and topographical variation (different slopes, aspects, and surface rockiness).

There are twenty seven Red List or Orange List plant species that occur in the general geographic area, of which nine have a high chance of occurring there or have been recently recorded there and twelve species for which there is a moderate chance of them occurring there. A preliminary qualitative assessment of which habitats are important for the conservation of threatened plant species indicates that the most important habitats are the koppies and ridge habitats and wetland habitats. Habitats for threatened plant species should be carefully managed to ensure that none of these species become extinct or are categorised into higher threat categories.

Ridges and hydrological systems are considered to be important for the maintenance of ecological processes. These areas should be carefully managed in order to maintain linkages between ecosystems and to limit habitat loss within this most diverse part of the landscape.

Areas underlain by dolomite tend to have high local species richness. There are few threatened plant species restricted to this vegetation type in the CoJ and Carletonville Dolomite Grassland is not considered to be threatened, but it is important for biodiversity conservation within the CoJ that conservation of these areas takes place.

It is essential that remaining indigenous riparian zones are protected within the Municipality to ensure that the essential functions that this vegetation provides can continue. In areas where vegetation has been cleared in a riparian zone, rehabilitation measures will be required to reinstate the functioning of the riparian zone. Alien vegetation needs to be cleared along river banks and replaced with indigenous species.

Surface waters

The CoJ is a highly-urbanised municipal area that suffers a high degree of negative ecological impacts and environmental pressures through an ever-increasing population density. Service delivery in terms of supplying potable water and water-borne sewerage disposal systems that can adequately cater for the needs of this recent influx of people remains a significant challenge to the CoJ. Poverty of many of the rural communities has lead to the establishment of informal settlements and overloaded (and often failing) present infrastructure means that rural people are ever-reliant on natural resources to satisfy their basic every day service needs for consumption as well as waste disposal. This situation has placed large pressures on surface waters throughout the region and has ultimately lead to the situation that none of the surface waters within the CoJ are fit for consumption, with much of it being regarded as having either chemical or bacterial contents that constitute a serious human health risk. Contamination of the surface waters from large industries has also degraded aquatic ecosystems throughout the CoJ. This situation has lead to water bodies of the CoJ supporting only the most tolerant of aquatic biota. It is therefore absolutely imperative that sewerage infrastructure be upgraded and failing infrastructure be repaired and adequately maintained to protect the surface water resource throughout the CoJ. Upgrading of the wastewater treatment works so that they can be managed well within their capacity loads is also highly recommended to ensure that negative ecological impacts are minimized by reducing the overall bacterial and chemical contamination of the receiving waters.

Riverine habitat was found to be readily subjected to physical alterations in the form of impoundment structures that effectively act as migratory barriers to aquatic biota. These impoundments are in the form of low-level bridges, weirs or culverts. The isolation of fish communities and the fact that fish cannot exploit suitable upstream habitats for breeding purposes is regarded as one of the greatest long term threats to fish conservation. It is therefore recommended that non-essential impoundment structures be removed and, if found to be an essential structure, a fish bypass facility be implemented.

Terrestrial habitats

The highly-urbanised character of the CoJ means that the encroachment into otherwise natural habitats for the purpose of urban expansion has placed great pressure on the terrestrial habitats that potentially support Red Data Listed (RDL) biota within the region. Natural grasslands do, however, still exist that remain as important areas for biodiversity conservation and these areas should be preserved to conserve the RDL species that occur within the region. Rocky ridge habitat found throughout the CoJ was also found to retain the ecological processes capable of supporting a high biodiversity, especially RDL species. These areas should also be conserved to preserve this ecological functionality.

Areas requiring attention

The compilation of the Biodiversity Conservation Value Map (CoJ Biodiversity Assessment, 2009) highlighted a few areas which require more urgent attention. Of major concern is the amount of ridges that are located in areas which are becoming more and more isolated regardless of their sensitivity. In addition, a large portion of the areas which are important for ecological processes are located in heavily transformed stretches of the CoJ. Special attention needs to be placed on these areas in order to ensure that these processes are retained. Several of the municipal parks within the CoJ are located within areas which are considered to have a high conservation priority. Improved landscaping (i.e. plant choices and maintenance practices) and improved ecological functioning of these areas is thus important to maintain linkages and improve functionality.

The final conclusion from the Biodiversity assessment is that improved ground truthing of sensitive areas and refinement of the Gauteng Conservation data is essential to accurately pin pointing and maintaining sensitive features within the CoJ and the Province.

Part 2: Obligations and responsibilities

There is an extensive set of national and international policies and treaties that exist and will affect the implementation of a LBSAP for Joburg. Many of these contain norms, values and aspirations of societies where the City of Joburg may be legally or morally bound to implement. This section will also provide an overview of existing CoJ and Gauteng policies and guidelines that affect Biodiversity (e.g. Ridges Policy, Gauteng C-Plan) and also touch on various governance issues. This section will provide a brief overview of what these national and international policies and treaties are including Ramsar Convention, Convention on Biological Diversity, the South African National Biodiversity Strategy, and national legislation.

Local and regional policies and guidelines that impact on Biodiversity in Joburg

There are a range of policies, strategies and guidelines that the CoJ has developed and implemented that affect biodiversity in Joburg. This section provides an overview of these.

Biodiversity assessment

According to the National Environmental Management Biodiversity Act, 2004, the aim is to provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising form bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute and for matters connected therewith.

The main goal of National Biodiversity Strategy is to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of South Africa, now and in the future. The strategic objectives of the National Biodiversity Strategy are to form an enabling policy and legislative framework that integrates biodiversity management objectives into the economy; to enhance institutional effectiveness and efficiency and ensure good governance in the biodiversity sector; to assure integrated terrestrial and aquatic management minimizes the impacts of threatening processes on biodiversity, enhances ecosystem services and improves social and economic security; to assure human development and well being is enhanced through sustainable use of biological resources and equitable sharing of the benefits; and to establish a network of conservation areas conserves a representative sample of biodiversity and maintains key ecological processes across the landscape and seascape.

Animal species within the CoJ depend heavily on intact habitat. The presence of available habitat is thus essential to the longevity of animal species in the CoJ. Evidence suggests that intact vegetation within the CoJ is diminishing which is concerning. This will result in the decline in animal species found within these areas.

The identification of biodiversity hot spots and the implementation of action plans to maintain these areas have thus been developed to ensure the preservation of biodiversity in the CoJ.

The most significant cause of biodiversity loss throughout the world is loss or severe degradation of natural habitat. Most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including cultivation, rural and urban development, industry and infrastructure. In addition there are indirect impacts on natural habitat such as alien invasive plant species, overgrazing and overexploitation of biodiversity. The resulting impacts on ecosystems are loss of biodiversity, habitat degradation and fragmentation, and deterioration of ecosystem health and the goods and services provided.

Impaired ecosystem health can lead to reduced goods and services that they provide which results in costs to social and economic systems. Impacts lead to loss of diversity and deterioration of ecosystem health, which can reduce services that ecosystems provide. In summary, the potential impacts of loss of biodiversity and compromised ecosystem function are likely to be:

- Extinction or economic extinction of useful species,
- Decreased carrying capacity for domestic livestock,
- Soil erosion,
- Loss in quantity and quality of water resources, and
- Ecosystem instability.

Within the City, one of the major drivers of transformation is residential development. The dramatic increase in the human population in the City has resulted in a need for more housing and associated infrastructural services. In addition, the government has a social mandate to ensure previously disadvantaged individuals receive housing and services.

Floristic biodiversity is highest in those areas with variable local topography and thus high habitat diversity. High habitat diversity is a primary environmental factor linked to high local diversity in plants. These areas are the ridge systems, which consists primarily of the three Mountain Woodland vegetation types:

- Gold Reef Mountain Bushveld,
- Andesite Mountain Bushveld, and
- Gauteng Shale Mountain Bushveld.

In addition, due to the geology and associated soil characteristics, the dolomite areas (represented by Carletonville Dolomite Grassland) tend to support very high local species richness (often in excess of 60 plant species per $100m^2$).

A preliminary qualitative assessment of which habitats contain high biodiversity and are important for the conservation of threatened species indicates that the most important habitats are the koppies and ridge habitats, dolomite grassland and then the remaining untransformed natural habitats.

On the basis of the assessments above, the following areas in the landscape within the CoJ have high value for the conservation of biodiversity, specifically with reference to vegetation and plant species (flora):

- Location and potential habitats for Red/ Orange List plant species,
- Remaining areas of Egoli Granite Grassland,
- Dolomite areas, especially where there are chert outcrops, and
- Ridges and koppies

A total of 1 374 plant species have been recorded in the quarter degree grids that are primarily contained within the CoJ.

Developments that are undertaken within sensitive areas (rocky ridges, grasslands or wetland habitats) should make provision for linkages to similar and suitable habitat further away to allow for free interaction and utilization of the sensitive habitats associated with the site and these outlying areas by mobile faunal species. Conservation buffer zone allocation should be taken into consideration during the planning phases of developments and these areas should, not only remain undeveloped, but remain unimpacted by development activities. This is especially pertinent during the preconstruction and construction phases of a development, where earthmoving equipment can easily create devastating and irreversible environmental impacts in a short space of time.

The integration of the Biodiversity Assessment into the Open Space Framework is recommended to ensure that important biodiversity areas are effectively conserved.

Greater co-ordination between GDACE and CoJ will streamline data sharing regarding biodiversity issues.

State of Environment Report

The purpose of The State of Environment Report (SoER) for the City of Johannesburg is to provide information in a user-friendly format on the state of the environment and to show trends against a number of predetermined environmental parameters. The report reviews whether environmental conditions within the city have improved, worsened or remained the same, as well as identify what the drivers of change are. Recommendations are made to assist in the management of key environmental issues and reverse negative trends. The report is updated on a five yearly basis.

The CoJ SoER report examines themes under two sections of the socio-economic environment and the biophysical environment. The key challenges identified by the SoER is the continuing pressure for development, expansion of industrial and mining activities, the need to establish new infrastructure and upgrade current infrastructure, an increasing population and the economic growth of the city.

The 2003 SoER identified that the most important environmental issues for the city are:

- Poor air quality
- Poor surface water quality
- Waste management
- Land and open space
- Conservation and biodiversity

Wetland Audit

The Wetland Audit for the City of Joburg Indicates that the metropolitan area is currently experiencing escalating rates of urbanization and development pressure. As a result of the expansion of urban developments, valuable wetlands are lost and deterioration and destruction or wetland areas have resulted from infilling and drainage, location of buildings, roads and other hard surfaces in and through wetlands. Maintenance of biodiversity and the ability of wetlands to act as ecological corridors are valuable opportunities provided by wetlands that link untransformed open areas and other areas of high conservation value.

Wetlands are in invaluable and critical component of the water cycle and maintenance of biodiversity. They provide ecological corridors, natural storage and filtration functions and assist with flood management. They are fundamental to the sustainable management of the country's scarce water resources and play an important role in the support of ecological systems by providing habits for water birds and other aquatic life.

The Wetlands are discussed in the context of the seven regional management units into which the City of Joburg is divided. Regional recommendations include:

- Prioritise the conservation of wetlands outside the urban edge;
- Prioritise the rehabilitation and conservation of wetlands upstream from informal settlements and townships;
- Prioritise the upgrade and maintenance of failing infrastructure which results in release of sewerage into drainage systems; and
- Upgrade road ad storm water infrastructure to include wetland- friendly interventions.

Catchment Policy

The catchment management policy has been prepared to meet the City's obligations to the protection and management of its water catchments by using an integrated approach in line with legislative requirements and best management practices and in the interests of environmental and economic sustainability and the amenity and safety of all the City's residents.

A water Catchment is defined as a drainage basin which acts as a collecting basin for all water runoff into the watercourses flowing through that basin.

The Catchment policy Vision is:

> *"To conserve and enhance the watercourses and riparian zones within Johannesburg through implementing integrated catchment planning and management practices in order to protect water resources and to promote healthy aquatic ecosystems and riverine areas which support sustainable social and economic use to the optimal benefit of all stakeholders, including the environment."*

No development of any sort may take place within the riparian area and 30 metre buffer zone of any riparian area or wetland or within the 100 year floodline, without the approval of the CoJ Environmental Management Department on behalf of the CoJ.

Riparian zones or areas have been defined in several ways, but they are essentially the narrow strips of land that border creeks, rivers or other bodies of water. Because of their proximity to water, plant species and topography of riparian zones differ considerably from those of adjacent uplands. Although riparian areas may occupy only a small percentage of the area of a watershed, they represent an extremely important component of the overall landscape. A healthy, functioning riparian area and associated uplands dramatically increase benefits such as fish and wildlife habitat, erosion control, forage, late season streamflow, and water quality. Management decisions must be designed with these processes in mind.

Gauteng Ridges Policy

According to the Gauteng development guidelines for ridges, a ridge includes hills, koppies, mountains, kloofs and gorges or a landscape type or topographic feature that is characterized by two or more of the following features crest, plateau, cliff or footslopes; while Biodiversity is the variation of life forms within a given ecosystem, biome, or for the entire Earth. Biodiversity is often used as a measure of the health of biological systems. Ridges play a vital role in ecosystem sustenance and biodiversity as they provide habitats for certain fauna and flora. Valid topography is recognized as one of the most powerful influences contributing to the high biodiversity of southern Africa. The diversity of plants on ridges can easily be observed, with grassland communities associated with the crests of hills and the southern slopes while woody species grow on warmer northern aspect as well as on protected areas on southern slopes band on rocky outcrops.

The conservation of biodiversity will contribute significantly by the protection of the ridges in Gauteng as the ridges were found to be important predictors of biodiversity. The ridges of Gauteng form vital habitat for many threatened or Red Data plant species and the conservation of ridges in Gauteng will provide habitat for significantly high number of species allowing for their continued survival in a rapidly urbanizing province, a desirable long term conservation plan.

Ridges contribute greatly to the most scenic areas in CoJ and the value of ridges from a property perspective clearly shows how much these areas are admired. Amongst other, the Rietfontein Nature Reserve is an example of a popular recreation area on a ridge and the Melville Koppies Nature Reserve nature reserve hosts over 200 birds and a range of small mammals with 50 varieties of grass which makes it great area for nature walks. Ridges in Gauteng are determined by their topographic features, more importantly their slope. Slopes of 5° or more as determined by a GIS digital elevation model are defined as a ridge.

Joburg Metropolitan Open Space Policy, JMOSS Strategy, and Joburg Open Space Framework

The Joburg Metropolitan Open Space System (JMOSS) is a system which addresses the management of the natural open space resources. JMOSS is regarded as a tool to conserve and protect biodiversity during development planning.

The JMOSS II Management Strategy document identifies the specific and general actions and responsibilities required for:

- Determining the status and importance of primary open space;
- Specific management guidelines where sensitive environmental features, such as ridges, occur;
- Guidelines for the general management of open space, including actions for the control of alien and invasive species, access control and disposal of waste;
- Mechanisms for involvement of stakeholders in open space management;
- Mechanisms to control development and land use within and around primary open space;
- Mechanisms to control the sustainable use of natural resources within primary open spaces;
- Funding of open space; and
- Performance management indicators.

In terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), the scientific authority may assist in the identification of listed species or ecosystems and the identification and control of alien and invasive species. The South African National Biodiversity Institute can assist in the compilation of biodiversity management plans and is responsible for managing botanical gardens.

Red Data species locations must be documented and no development or access should be permitted within the Red Data habitats, potential habitats or buffer zones as per the GDACE Red Data Plants Policy (GDACE, 2001 b).

Any of the indigenous plants can be used in the natural/ semi-natural open space areas. Selection of the specific plants must be guided by the function of the area and the role of vegetation in respect to rehabilitation and erosion control requirements. Where necessary, the vegetation should be supported by mechanical interventions to ensure initial growth and to protect newly rehabilitated areas against erosion damage. Control of alien and invasive species is required for management of primary open spaces. There is opportunity for partnerships with local stakeholders and organizations, such as Working for Water and the Department of Water Affairs and Forestry (DWAF).

Indigenous plant species should be used to rehabilitate degraded primary open spaces. The spread of invasive exotic species should be controlled. Removal of vegetation should be limited to the footprints of structures. Trees should be established in locations where they can reach full size without damaging existing structures or underground services or power lines. Planting areas should be selected in terms of drainage and availability of water and sunlight.

Growth Management Strategy

The Growth Management Strategy (GMS) was formally adopted by the City in 2008 and seeks to detail where Joburg is prepared to invest in infrastructure over the medium and long-term. Five functional Growth Management Areas have been designated which direct the City's priorities in terms of its Capital Budget as well as its evaluation of development applications. These five Growth Management Areas cover the full extent of the City and indicate the priority the City has prescribed in terms of short, medium and longer term public investment per area.

The Growth Management Strategy defines where and under what conditions growth can be accommodated. Right bonuses are commonly used to promote conservation or improvement of natural resources and open space. City of Johannesburg may allow a developer to increase permitted land use rights in an area in exchange for permanently protecting open spaces or by making environmental improvements such as with landscaping or developing a

nature trail in a project area. This technique can be used to protect land on the property being developed or another property.

Integrated Development Plan

According to the City of Johannesburg Draft 2009/10 Integrated Development Plan (IDP) Revision, the Environmental Management Portfolio has been in existence since the new Mayoral term started in March 2006. This establishment was in recognition of ensuring that environmental sustainability issues are high on the City's agenda in line with international trends in other cities elsewhere.

One of the Environmental Management Sector Plan within the City is Biodiversity protection programme whereby:

- Preliminary zoning baseline data and zoning for priority conservation areas completed
- Compiled and submitted a consolidated list of potential areas for proclamation, which included approximately 67 Recreational parks, and 41 Nature areas
- 5 Ecological Management Plans were developed for the following areas Kloofendal Nature Reserve, Kloofendal, Cosmo City, Melville Koppies, Rietfontein and The Wilds for implementation according to
- Development and implementation of ecological management and development master plans for selected conservation areas
- Continue with protection of sensitive habitats diversity – capacity building and training legislation
- Biodiversity Assessment completed
- 1 519 ha cleared of alien vegetation through Working for Water and JCP
- Biodiversity and Conservation Environmental Education Programme reached approximately 23 772 during the 2006/7 and 19 684 beneficiaries during 2007/8 fiscal years (A total of 43 456 beneficiaries to date)
- Approximately 173 units of wild life game have been accounted for in all reserves that have capacity
- Develop and implement a long-term local biodiversity strategy for CoJ
- Development and implementation of Ecotourism Business case for selected conservation areas

National level policies, guidelines and legislation

National Environmental Management Act - NEMA (1998)

NEMA is a pivotal piece of environmental legislation in South Africa on which subsequent environmental legislation in South Africa is built. The main objective of this Act is to provide for cooperative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

City of Johannesburg should comply with this act in the matters affecting the environment, such as protection of biodiversity in the city.

National Water Act (1998)

The NWA gives effect to the constitutional right of access to water. The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors such as protecting aquatic and associated ecosystems and their biological diversity.

National Water Resource Strategy (2004)

The aim of National Water Resource Strategy is to encourage and promotes actions that ensure long term sustainable and beneficial utilization of the country's water resources. The strategy sets out how integrated catchment management will happen in South Africa.

The strategy must among other things:

- Contain estimates of present and future water requirements
- Set out principles relating to water conservation and water demand management
- State the objectives in respect of water quality to be achieved through the classification system for water resources provided for in this Act
- Determine the inter-relationship between institutions involved in water resource management
- Promote the management of catchment within a water management area in a holistic and integrated manner
- In establishing water management areas the watercourse catchment boundaries, social and economic development patterns, efficiency considerations and communal interests within the area in question must be taken into account.

Municipal Systems Act (2000)

According to the Municipal System Act (Act No. 32 of 2000), all municipalities have to undertake an integrated development planning process to produce integrated development plans (IDPS). Integrated development planning is a process by which municipalities prepare 5 year strategic plans that are review annually in consultation with communities and stakeholders.

City of Johannesburg's IDP should promote integration by balancing social, economic and ecological pillars of sustainability and by coordination actions across sectors and spheres of government as per Municipal System Act (Act No. 32 of 2000)

National Environmental Management: Protected Areas Act – NEM:PA (2003)

Protected areas are seen as an extremely important tool for achieving biodiversity objectives, since these often provide greater security for conservation- worthy land than the agreements or land use limitations provided for in the National Environmental Management: Biodiversity Act (Roux et al, 2006). The Act creates a framework and management system for all protected areas in South Africa as well as establishing the South African National Parks as a statutory board.

National Environmental Management: Biodiversity Act – NEM:BA (2004)

The city of Johannesburg needs to comply with the Biodiversity Act in providing the cooperative governance in biodiversity management and conservation. Biodiversity Act provides for the Minister to publish a notice in the Government Gazette that issues norms and standards, and indicators for monitoring progress for the achievement of any of the objectives of the Act. The Act provides for the development of a National Biodiversity Framework to guide all strategic development planning process regarding the integration of biodiversity planning and monitoring in South Africa and these binds all organs of the state, at national, provincials and local levels. (DJ Roux, JL Nel, HM Mackay & P Ashton, 2006)

National Spatial Biodiversity Assessment (2004)

This informs the policies, plans and day to day activities of a wide range of sectors both public and private. A spatial biodiversity assessment can take place at different spatial scales, from global to local.

It involves mapping information about biodiversity features such as species, habitats and ecological processes, protected areas and current and future patterns of land and resource use. It provides a national context for assessments at the sub national scale and points to broad priority areas where further investigation, planning and action are warranted.

It identifies three keys strategies for conserving South Africa's biodiversity existence from the assessment, namely

- Pursuing opportunities to link biodiversity and socio-economic development in priority geographic areas
- Focusing on emergency action on threaten ecosystem, to prevent further loss of ecosystem functioning.
- Expanding of the protected area network

The GDACE CPlan provides a finer scale biodiversity assessment at a provincial level. Any biodiversity prioritisation or projects should take account of the provincial plan and the guidance it provides.

National Biodiversity Strategy and Action Plans (2005)

The National Biodiversity Strategy and Action Plans (NSBAP) aims to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of South Africa, now and in the future.

In South Africa, terrestrial, inland water, coastal and marine ecosystems and their associated species are widely used for commercial, semi-commercial and subsistence purposes through both formal and informal markets. While some of this use is well managed and/or is at levels within the capacity of the resource for renewal, much is thought to be unsustainable. "Use" in this case refers to direct use, such as collecting, harvesting, hunting, fishing, etc. for human consumption and production, as well as more indirect use such as ecotourism.

All sectors that impact on biodiversity need to factor biodiversity considerations into their policies, plans and programmes, especially agriculture and urban planning. Mainstreaming implies that the full value of biodiversity should be recognized, so that activities that conserve biodiversity or use it sustainably should be rewarded economically and/or in other ways, while activities that destroy biodiversity should bear the associated cost. Critical for mainstreaming is an integrated planning framework that integrates and aligns biodiversity and development planning. It is especially important that spatial planning at national, provincial and local levels takes note of biodiversity priority areas.

It is critical that the value and importance of biodiversity to people's livelihoods is recognized and biodiversity management (including conservation, access, use and rehabilitation) must be integrated with poverty alleviation strategies and local economic development. Management of terrestrial and aquatic ecosystems needs to be integrated, through effective catchment management that mitigates the impacts of land degradation, invasive alien species, pollution and other threatening processes on our land, rivers, wetlands, estuaries and coastal and marine ecosystems, in order to ensure the continued provision of ecosystem services and enhance social and economic security.

Five key Strategic Objectives have been identified, each with a number of Outcomes and Activities to achieve the desired outcomes.

- Strategic Objective 1: An enabling policy and legislative framework integrates biodiversity management objectives into the economy.
- Strategic Objective 2: Enhanced institutional effectiveness and efficiency ensures good governance in the biodiversity sector.
- Strategic Objective 3: Integrated terrestrial and aquatic management across the country minimizes the impacts of threatening processes on biodiversity, enhances ecosystem services and improves social and economic security.
- Strategic Objective 4: Human development and well-being is enhanced through sustainable use of biological resources and equitable sharing of the benefits.
- Strategic Objective 5: A network of protected areas conserves a representative sample of biodiversity and maintains key ecological processes across the landscape and seascape.

International obligations and agreements

Ramsar Convention (1971)

The mission of the Ramsar Convention is “The conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world". The Convention provides a framework for international cooperation and was established following concern in the 1960s about the serious decline in populations of waterfowl.

It came into force in 1975 and currently has 100 contracting parties, which are obliged to undertake the following four main activities:

- To designate wetlands for inclusion in the "List of Wetlands of International Importance" and to maintain their ecological character.
- To develop national wetland policies, to include wetland conservation considerations within their national land use planning, to develop integrated catchment management plans and, in particular, to adopt and apply the guidelines for implementation of the "wise use concept". This concept advocates the sustainable utilization of wetlands for the benefit of mankind in a way that is compatible with the maintenance of the natural properties of the ecosystem.
- To promote the conservation of wetlands in their territory through establishment of nature reserves and to promote training in wetland research, management and wardening.
- To consult with other contracting parties about transfrontier wetlands, shared water systems, shared species and development aid for wetland projects.

In this way the Convention plays an important role in helping to prevent detrimental changes to wetland sites in states that are party to the Convention. Technical support on wetland conservation is provided to the Convention from organisations such as the IUCN (The World Conservation Union) and Wetlands International (a new body formed from the International Waterfowl and Wetland Research Bureau, the Asian Wetland Bureau and Wetlands for the Americas).

Bruntland Report (1987)

In 1987 the Brundtland Report, also known as *Our Common Future*, alerted the world to the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment. The report provided a key statement on sustainable development, defining it as: development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The Brundtland Report was primarily concerned with securing a global equity, redistributing resources towards poorer nations whilst encouraging their economic growth. The report also suggested that equity, growth and environmental maintenance are simultaneously possible and that each country is capable of achieving its full economic potential whilst at the same time enhancing its resource base. The report also recognised that achieving this equity and sustainable growth would require technological and social change.

The report highlighted three fundamental components to sustainable development: environmental protection, economic growth and social equity. The environment should be conserved and our resource base enhanced, by gradually changing the ways in which we develop and use technologies.

Biodiversity has been defined by as "the total variety of life on Earth." This term can also be used to reflect the range of species at a site, the size of the gene pool, or even the number of different ecosystems on the planet. Biodiversity is important for sustainable development because it represents the wealth of biological resources available to us and future generations for food, clothing, medicine and housing. Currently biodiversity is being reduced by habitat destruction, air and water pollution and the introduction of foreign plants and animals.

Reducing natural habitat destruction and promoting co-operation between countries are good ways of safeguarding the biodiversity that remains.

Earth Summit and Agenda 21 (1992)

Agenda 21, established at the 1992 United Nations Conference on Environment and Development, or "Earth Summit", in Rio de Janeiro, Brazil, is the blueprint for sustainability in the 21st century. Agenda 21 is a commitment to sustainable development, which was agreed by many of the world's governments. Nations that have pledged to take part in Agenda 21 are monitored by the International Commission on Sustainable Development, and are encouraged to promote Agenda 21 at the local and regional levels within their own countries. Agenda 21 addresses the development of societies and economies by focusing on the conservation and preservation of our environments and natural resources.

Agenda 21 is a blueprint on how to make development socially, economically and environmentally sustainable in the 21st century. Governments, non-governmental organisations (NGOs), industry and the general public are all encouraged to become involved. Agenda 21 provides a framework for tackling today's social and environmental problems, including air pollution, deforestation, biodiversity loss, health, overpopulation, poverty, energy consumption, waste production and transport issues.

Convention on Biological Diversity (1994)

The aim of the CBD is to effect international cooperation in the conservation of biological diversity and to promote the sustainable use of living natural resources worldwide. It also aims to bring about the sharing of the benefits arising from the utilisation of natural resources. Several nations have signed the Convention on Biological Diversity, which forms an international effort to conserve plant and animal species

The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:

1. To conserve biological diversity
2. The use biological diversity in a sustainable fashion
3. To share the benefits of biological diversity fairly and equitably

Millennium Summit and Development Goals (2000)

City of Johannesburg should integrate the principles of sustainable development into their policies and programmes and reverse the loss of environmental resources .The target is to reduce biodiversity loss, achieving by 2010, and a significant reduction in the rate of loss. In response to the loss of global biodiversity, the international community has encouraged land and marine protection. Protection alone is insufficient: all protected areas must also be managed effectively for conservation.

World Summit on Sustainable Development (2002)

During the World Summit on Sustainable development that was held in Johannesburg from 26 August to 4 September 2002, the ex officio Vice-President of the Summit opened the 3rd plenary meeting on 26 August 2002, on the theme of biodiversity and ecosystem management. At the meeting, statements were made by the High-level Adviser for the United Nations Environment Programme and the Executive Secretary of the Convention on Biodiversity, acting as presenters, and by the Special Envoy of the Secretary-General, acting as moderator.

Biodiversity and the ecosystems they support are the living basis of sustainable development. They generate a wide range of goods and services on which the world economy depends. About 40 per cent of the global economy is based on biological products and processes. The economic value of biodiversity is estimated to be $2.9 trillion per year, whereas that of ecosystem services is $33 trillion per year. Activities that reduce biodiversity jeopardize economic development and often the survival of many who depend on biodiversity for their livelihood, such as the poor in the rural areas of developing countries. The strong links that exist between biodiversity conservation and poverty alleviation are not always recognized or understood.

Human-imposed threats to biodiversity demand immediate attention. The ecosystem approach, as laid out in the decisions under the Biodiversity Convention, should be implemented for progress to be achieved in conservation and sustainable use of biodiversity. The links between poverty and biodiversity need to be paid greater attention, as they are intimately related. Many of the poor in rural sectors of developing countries depend on biodiversity for their survival.

Many instruments are in place and many important decisions have been taken on biodiversity. But the many agreements and conventions are not consistent with the lack of action and implementation. Much of the discussion focused on the obstacles to implementation and the need not for more agreements, but for concrete action at the national and local levels. Although there is a need for more knowledge on biodiversity and its role in the functioning of ecosystems, there is enough knowledge to justify action.

This knowledge is, however, often not provided to decision makers. Scientists must put the issues of biodiversity into understandable language for politicians to act on. There is an urgent need to mainstream biodiversity into overall development and sectoral strategies, but in order to do so, the closing of the feedback loop between science and policy makers must be better addressed.

The lack of knowledge also applies to the public at large. There is not always recognition of the values of biodiversity and its links to other sectors. Strengthening intersectoral links is an essential prerequisite for tackling biodiversity concerns around the world.

Challenges to biodiversity include:

- Ensuring equitable benefits arising from the use of biodiversity
- Empowering people and communities that are dependent on biodiversity and ecosystem functioning for their livelihoods, and supporting those that are affected by loss of biodiversity or negative changes in ecosystems
- Protecting and using indigenous knowledge and recognizing and compensating its benefits
- Integrating biodiversity concerns and the importance of biodiversity into all economic activity, including agriculture, forestry, land use, water resources management and infrastructure development
- Recognizing not only the economic value but also the cultural and spiritual value of biodiversity
- Shifting the focus from addressing the proximate causes of biodiversity loss to a strategy that addresses the underlying causes (treating the disease rather than the symptoms)
- Addressing the need for paradigm shifts (production and consumption patterns are at the root of biodiversity degradation and loss)
- Improving public knowledge and recognition of the importance of biodiversity for basic and daily needs for the public in general, which in turn could lead to a growing demand for more determined action on biodiversity by policy makers
- Improving knowledge on the links between production and consumption patterns and biodiversity
- Addressing the special conservation needs of important biodiversity areas and fragile ecosystems, such as those in many small island developing States.

Among the many actions required to address the challenges, the participants noted the following:

- Developing better processes and mechanisms for concrete action and implementation
- Introducing and using economic instruments more widely in relation to biodiversity (economic incentives and a closer look at the relation between perverse subsidies and biodiversity loss and degradation)
- Sharing more openly global and regional research results on ecosystem functioning and establishing ecological networks, particularly those that lead to more sustainable ecological mosaics for better land use and ecosystem management
- Building capacities, sharing technology and scaling up outstanding examples of best practices of rural communities throughout the developing world
- Building better synergies among the various biodiversity-related conventions
- Better recognition of linkages between trade and environment, particularly trade and biodiversity, and of the need to establish cooperation to achieve synergies and mutual supportiveness between multilateral environmental agreements and WTO

- Addressing the challenges of poverty and the need to eradicate it, as a major impediment to biodiversity conservation and sustainable use, particularly rural poverty, and developing new, sustainable options for employment
- Building capacities at the local level and empowering local communities to take action, as it is at the local level where stress on biodiversity occurs
- Building partnerships among Governments, business, farmers and local communities, which is the best way to mainstream biodiversity concerns into economic and social activity
- Addressing the issues of intellectual property rights in support of equitable benefits and use through capacity-building and proper legislation.

The World Summit addresses problems of extinction of species by bringing an end to illegal and unsustainable fishing and logging and to help people currently depending on these activities to find other, more sustainable ways of earning a living.

Cartagena Protocol on Biosafety (2003)

On 11 September 2003, the Cartagena Protocol on Biosafety (the "Protocol") entered into force - the first legally binding international agreement governing the movement of living modified organisms (LMOs) across national borders. Following entry into force, those countries that ratified the Protocol became Parties to the Protocol and are required to comply with and implement all of its provisions.

This Protocol was negotiated under the auspices of the Convention on Biological Diversity, and entered into force on 11 September 2003. South Africa had participated in the negotiations and ratified it last year. The overall purpose of the Protocol was to ensure that Genetically Modified Organisms do not cause destruction to the environment thereby altering biodiversity. States agreed that there should be a designation of focal points as well as designation of competent Authorities or Departments that would deal with issues relating to the Protocol.

South Africa already had legislation dealing with the regulation of genetically modified organisms (GMOs) as far back as 1997 facilitated by the Department of Agriculture (DoA). The Department of Environmental Affairs (DEAT) gave the Department of Agriculture the mandate to negotiate and deal with the day to day running of the Protocol. DEAT and the Departments of Health, Labour, Science and Technology and Trade and Industry sit on the joint executive council set up by the GMO Act. The DoA was responsible for the running of the Bio-Safety Clearing House (BCH) where the information on approvals on GMOs is held. DEAT was responsible for monitoring the process of implementation.

Rio Declaration on Biodiversity (2005)

The International Conference "Biodiversity: Science and Governance" (Paris Conference) met from 24-28 January 2005 at the headquarters of the United Nations Educational, Scientific and Cultural Organization (UNESCO), in Paris, France.

The Conference, organized by the French Government and sponsored by UNESCO, was attended by over 1000 participants representing governments, inter-governmental organizations and non-governmental organizations, as well as academia and the private sector.

The Conference, held independently from any intergovernmental negotiations, was part of the ongoing global effort to reverse the current rate of biodiversity loss by 2010, and ensure the long-term conservation and sustainable use of biodiversity, as well as the fair and equitable sharing of the benefits arising from genetic resources. The Conference was convened to assess the current knowledge in, and needs for, research and scientific expertise in biodiversity, as well as examine public and private approaches to biodiversity conservation and management, and the interactions between science and governance.

The Conference produced two documents: the Paris Declaration on Biodiversity, an appeal by scientists on biodiversity; and a Conference Statement, which recalls governments' commitments to the 2010 target and supports the launch of an international multi-stakeholder consultative process to assess scientific information and policy options for decision making.

Durban Agreement

The representatives of local, national and international non-governmental organisations (NGOs) and other civil society groups from around the world gathered in Durban/South Africa during the week of 28 August – 3 September 2001 for the World Conference against Racism, Racial Discrimination, Xenophobia and Related Intolerance (WCAR), guided by their commitment in the struggle against racism and racial discrimination and inspired by the recommendations of the NGO Forums held in Strasbourg/France, Santiago de Chile/Chile, Dakar/Senegal and Tehran/Iran and the related sub-regional NGO meetings held in Warsaw/Poland, Kathmandu/Nepal, Cairo/Egypt and Quito/Ecuador, in preparation for the World Conference, made declaration in terms of the environment that:

Recognizing environmental racism as a form of racial discrimination which refers to exploitation and depletion of natural resources and any environmental policy, practice, action or inaction that intentionally or unintentionally, disproportionately harms the health, eco systems, and livelihood of nations, communities, groups, or individuals, and in particular the poor.

Part 3: Vision and guiding principles for the CoJ LBSAP

This section will contain the overarching vision, where the City envisions biodiversity going and its role within the City, as well as guiding principles and objectives to achieve the vision.

The City of Joburg envisages "*An environmentally sustainable city, that anticipates, manages and reduces its vulnerability to potential global and local environmental shocks, and works consistently to reduce the impact of its own built environment and urban processes on the broader envelope of natural resources*."

Overall vision for the city

Conserve and manage biodiversity and the city's environmental heritage to ensure the delivery of sustainable and equitable ecological goods and services to the citizens of Johannesburg, now and in the future.

Strategic Objectives

1. An enabling policy and governance structure that integrates biodiversity management objectives into development planning
2. Citizens of Joburg are aware of environmental issues and contribute the sustainable use and protection of Biodiversity
3. Integrated terrestrial and aquatic management across the city minimizes the impacts of threatening processes on biodiversity, enhances ecosystem services and improves social and economic security
4. Human development and well-being is enhanced through sustainable use of biological resources and equitable sharing of the benefits
5. A network of open space areas conserves a representative sample of biodiversity and maintains key ecological processes across the landscape, and where possible is connected to social spaces

Guiding Principles

1. The remaining natural ecological spaces should be kept in their natural condition, remain intact and functioning optimally. These spaces provide valuable ecological goods and services to the City and intervention can reduce their value.
2. Build institutional capacity and develop partnerships with society (community structures, CBOs and NGOs). Develop and encourage networks and learning within the city departments. All departments and entities can play a role in enhancing and maintaining biodiversity, no matter how small or seemingly unrelated (e.g. Pickitup, JRA, JPC). Partnerships are essential to successfully implement conservation goals.
3. Biodiversity is a common, shared good (or *public asset*) and the City should take collective responsibility for the ecological goods and services provided by biodiversity.
4. Engage local communities for the conservation and management of the remaining natural areas in order to harness existing local knowledge and raise awareness of biodiversity issues.
5. Think globally and act locally. Ecological processes are not confined to city administrative boundaries and wards and are connected throughout the city (for example, rivers systems and ridges). Various policies and strategies support this interconnected and integrative approach such as the Open Space System, C-Plan, Catchment Management Policy, Wetlands audit, ridges policy and so forth.
6. Align with other plans and initiatives being undertaken by the city, NGOs or communities. It is better to contribute to and complement other policies and plans, add to existing initiatives and recognize existing projects, rather than creating new initiatives. (for example, owl boxes, bat boxes at schools)
7. Use best available science and knowledge. Biodiversity science is a relatively new science that is continually developing and evolving, use the best available knowledge for urban biodiversity and principles of sustainable development.
8. Balance public interest and private interests of property owners. Successful biodiversity management and use requires a balance between the public interest and the rights and responsibilities of individual property owners.
9. Promote the city's open space framework (OSS) and ecological network (including ecosystem goods and services) as the context to which urban development must be tailored.
10. Use innovative approaches to protecting and integrating biodiversity into city management.

Part 4: The Action Plans

This section provides details of the various action plans required to meet the vision and strategic objectives set out in Part 3. There are seven subsections each addressing a different suite of problems. These include the broader strategic issues of the urban ecological framework that essentially sets the scene for biodiversity protection and integration into the City of Joburg. Second, issues of governance and institutional arrangements that would enable the biodiversity strategy and action plans. Third, action plans related to environmental education and awareness to raise the profile and understanding of the role of urban biodiversity within the City. Forth, specific issues around biodiversity within Joburg. This subsection is divided into the features associated with watercourses, ridges and species and ecosystems of special concern. Fifth, a subsection dealing with action plans to address the social open space system in Joburg and the biodiversity contribution that it can make. Sixth, action plans relevant to the services and utilities Joburg provides its citizens and what they can do to contribute to the biodiversity values. Finally, there are a specific set of actions that relate to the control and removal of invasive alien plants within the city.

Each action plan is set out within a template that:

- describes the action plan,
- what objectives it would satisfy,
- what problems it aims to address,
- what the possible constraints to implementation are and how they might be overcome,
- lists the existing relevant policies and legislation that deal with the action, and
- lists other linked action plans.

The prioritisation of the action plans scores the action on a scale of 1 to 3 where:

1 = Action required immediately, essential to success of plan

2 = Action definitely required but not urgent, important to the success of plan

3 = Action would be useful to the success of the plan

At the end of the action plan section a summary table provides an overview of all the action plans as well as providing an indication of the time frame for implementation and the responsible department or entity for that action.

Action Area 1: Urban Ecological Network

Minimising species or specimen losses would be possible if enough is known about the sensitivity, distribution and rate of extinction of indicator species. This would go hand-in-hand with arresting the speed of local extinctions through strategic interventions, even to the point where the conservation strategy is slowly improving the current situation.

However, in the absence of clear information or sufficient resources, short-term gains might be the only viable option. This would focus on securing as much of the ecological resources as possible, in the hope that immediate conservation goals may later be converted into longer term strategies.

In order to derive a comprehensive an integrated urban ecological network, the following process is must be followed:

- Define conservation objectives
- Describe the likely urban development scenarios
- Conduct a strategic environmental assessment of the impacts of each scenario on the objectives
- Classify and spatially locate the various elements that comprise an ecological network

The implementation of the framework must be uniform throughout the municipality, with all sector departments and entities taking the responsibility for application of the guidelines in their particular field. By implication, the guideline(s) need to be generally accessible and specific in their allocation of responsibilities and determination of thresholds and spatial guidance.

Conservation objectives

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Network analysis and patch identification

Only 1.8% of the city is formally conserved with the greatest percentage of the regional open space located on the periphery of the city. Areas in the south notably Regions D and F have the potential to provide additional

conservation areas. Due to rampant private and public developments among others there is an uneven distribution of open spaces and recreational parks consisting of 17 nature reserves and 12 river systems.

The design of the conservation network will need to consider best practice ecological science; however, this is very limited for urban ecological contexts. Some concepts that will need to be applied include:

- A network will consist of a mother node and supportive satellite nodes. The mother node will be instrumental in repopulating the satellite nodes.
- Connectivity implies movement corridors for day-to-day activities as well as long-term patterns required for healthy population dynamics.
- Connectivity is influenced by barriers, type of habitat, stepping stones, and relative location (i.e. a small dysfunctional patch within a much larger unfragmented area might overcome thresholds and add value).
- Minimum patch size is based on the minimum area required for the maintenance of biodiversity levels and ecological functioning. This is relative to the artefact being targeted – either specific species, or habitats. The minimum functional size may consist of several connected smaller patches as long as the connectivity is supportive of the ecological functioning of the overall patch.
- A reference patch size: for habitat specific birds 5ha worth of habitat is required, with a maximum fragment separation of 50m.
- Ecological processes are vulnerable to fragmentation and edge effects primarily where they relate to vegetation (i.e. decomposition, foraging).
- Conservation of absolutely relevant fragments, based on fine-scale investigation, is more effective than broad application of buffers.
- Small animals use corridors, invertebrates and plants don't. Their dispersal is more dependant on proximity of suitably sized patches.

Action Plan 1.1 Define the conservation objectives for the City of Joburg

The first step in compiling an urban conservation framework is to define clear conservation objectives. It is not enough to conserve open space for the sake of it; rather, there needs to be clear purpose and definition behind actions and decisions. Conservation objectives will guide decision-making in terms of species, areas and networks of concern, and determine whether there is a focus on specific indicators or rather a general attempt at conserving as much as possible.

Aligning biodiversity plans and governance issues: Informing why and where ecological spaces should be

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- Clear conservation objectives aimed at improving the sustainability of the urban environment
- A quality urban environment
- A comprehensive conservation network

Main problems this action will address

- Uncertainty about:
    - how much conservation area is required
    - where the conservation areas must be
    - what the minimum size for conservation areas is

    - which species indicate whether the conservation actions are effective
    - what corridors between the open spaces must look like
    - where conservation corridors must be
- Loss of ecosystem services related to microclimatic control, groundwater recharge, invertebrates, small mammals and birds.
- Degradation of the subjective urban environment through development encroachment onto open space areas
- Uncoordinated conservation efforts
- Uninformed open space management

Constraints

Constraint	How will it be addressed in the activities?
1. Conservation objectives can be disputed	Best practice science must be applied to determine the conservation objectives.
2. Indicator species is an inherently uncertain concept	Objectives and methods must be chosen, and the decision implemented without uncertainty.
3. Knowledge about urban ecological management is exceedingly limited	Ongoing research and external involvement must inform a constantly evolving strategy.

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF

Related actions

- Governance action plans

Action Plan 1.2: Defining Strategic environmental assessment that compares conservation objectives with development scenarios

By comparing urban conservation objectives to development scenarios, the strategic environmental impact of the various development patterns can be assessed. This will indicate how and where development will have the greatest impact on the identified conservation objectives, and consequently also where amendment of the various planning frameworks is required. For example, if the objective is to provide all citizens with access to natural open spaces, but the development scenario describes major densification, it means that spatial planning needs to identify and protect areas of natural open space in-between the densification.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- Clear conservation objectives aimed at improving the sustainability of the urban environment
- A quality urban environment
- A comprehensive conservation network

Main problems this action will address

- Uncertainty about how conservation and development interacts on a global scale
- Retroactive planning that leaves environmental objectives and concerns as a nice-to-have element of spatial planning.

Constraints

Constraint	How will it be addressed in the activities?
1. Development scenarios may not provide enough detail	An interdisciplinary team must be assembled, consisting of city planning, environmental management, JCP and other identified stakeholders.
2. Knowledge about urban ecological management is exceedingly limited	A structured process of scenario building and assessment must be followed, and it must be accessible and transparent for all participants
3. Gathering the right expertise and stakeholders together is difficult	The strategic assessment may be outsourced to independent parties

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF
- CoJ GMS, GDS, SDF, IDP etc

Related actions

- Social open space action plans
- Governance related action plans

Action Plan 1.3: Identify indicator species and reference sites for biodiversity in Joburg

Progress made towards achieving the urban conservation objectives must be monitored through means of reference sites or indicator species. The indicators will be:

- directly linked to the selected objectives
- representative of the urban conservation targets
- sufficiently known as to allow for the monitoring of long-term changes to population dynamics

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- Integrated biodiversity management
- A quality urban environment
- A comprehensive conservation network

Main problems this action will address

- The need to have a baseline monitoring reference, and ongoing monitoring programme for biodiversity conservation
- Lack of a clear urban conservation objective.

Constraints

Constraint	How will it be addressed in the activities?
1. In-depth knowledge of indicator species and reference sites may be difficult to find.	Best practice biodiversity science must be used to inform all decisions and actions
2. Monitoring is often the last priority in any work programme	Monitoring responsibilities must be shared where possible, and allocated to parties with the highest vested interest in the collection of quality information
3. The strategy might differ from provincial or national programmes and targets	

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF

Related actions

- Species of special concern action plans
- Biodiversity audit action plans

Action Plan 1.4: Determine and express the value of corridors in biodiversity policies and guidelines

Connectivity between islands of biodiversity in the urban landscape is potentially critical for the survival of species of particular concern. There is, however, some uncertainty about what these connections should look like, consist of, and function as. For example, different species classes will derive different values from ecological corridors. A determination is therefore necessary that details conservation thresholds in consideration of the following:

- ecological processes that are directly related to vegetation (e.g. decomposition, species-specific association) do not find value in corridors
- Connectivity is less important for invertebrates, small animals with low dispersal ability and plants
- Different species will have different requirements for ecological corridors
- Corridors will be relative to both the day-to-day movement patterns and long-term population dynamics of particular species

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- Integrated biodiversity management
- A quality urban environment
- A comprehensive conservation network

Main problems this action will address

- Uncertainty exists with regards to the provision and maintenance of ecological corridors.
- The needs of specific indicator species are not taken into account in a blanket approach to ecological networks.
- No sound argument has been compiled for the provision of ecological corridors of specific sizes and nature. This leads to motivations in favour of encroachment onto the corridors.

Constraints

Constraint	How will it be addressed in the activities?
1. In-depth knowledge of indicator species and reference sites may be difficult to find.	Best practice biodiversity science must be used to inform all decisions and actions.
2. Conventional conservation practice ascribes a universal importance and value to corridors, and this thinking might be difficult to change.	Priority must be given to the design and structuring of an urban ecological network, specifically with regards to an overall conservation objective.
3. No clear objectives or species of specific concern have been identified, and therefore only generic corridors can be identified.	

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF

- SDF

Related actions

- Governance related action plans
- Social open space action plans

Action Plan 1.5: Classify ecological open spaces into a system of core and satellite nodes

A conservation network will consist of the following elements:

- Large open spaces (Subclasses of untransformed and transformed)
- Small open spaces (Subclasses of untransformed and transformed)
- 'natural' connectivity elements
- Non-ecological connective elements
- Other open space elements

The threshold sizes for the open space areas are determined by the conservation objectives, but core areas will be in the range of 5ha for common urban birds and 20ha for invertebrates. The largest open space areas will function as 'mother' nodes in the network from where satellite nodes are repopulated or restocked from time to time.

It is therefore necessary to design the urban conservation network in a manner that creates core nodes throughout the critical habitat areas, and satellite nodes with the required connectivity to the core areas.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- Integrated biodiversity management
- A quality urban environment
- A comprehensive conservation network

Main problems this action will address

1. Uncertainty exists with regards to the provision and maintenance of ecological corridors.
2. The needs of specific indicator species are not taken into account in a blanket approach to ecological networks.
3. There is no priority scale for open spaces, and no size thresholds. As a consequence, no strong arguments exist to counter development encroachment onto the open spaces.

Constraints

Constraint	How will it be addressed in the activities?
1. Research on threshold sizes is extremely limited.	Best practice biodiversity science must be used to inform all decisions and actions.
2. Comprehensive ecological information on the life histories of species is not always available.	As long as a well-informed system is conceived, based on a structured compilation process, there should be consensus and support from all related open space

3. Optimally sized and located open space areas will not be available in reality.	conservation stakeholders.
4. A definitive classification of 'transformed/untransformed' etc. is not necessarily possible	

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF
- SDF

Related actions

- Species and ecosystems of special concern
- Social open space action plans

Action Plan 1.6: Application of the conservation plan in spatial planning processes

Spatial Development Frameworks (SDFs) are important landuse planning and decision-making tools, and are required for all municipalities. Threatened ecosystems, ecological corridors and other special biodiversity features should be taken into account in a meaningful way in the planning categories and land management guidelines set out in SDFs.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- A quality urban environment
- Wide awareness of the conservation programme
- A comprehensive conservation network

Main problems this action will address

- Inaccessibility of environmental information due to uncertain scientific language or vague, non-quantified recommendations
- Lack of integration between the spatial planning and environmental management programmes of the city

Constraints

Constraint	How will it be addressed in the activities?
1. Spatial planning cannot apply biodiversity principles exactly as prescribed by ecologists in urban environments	Detailed conservation planning needs to take place, with specific spatially referenced guidance.

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF
- SDF, IDP, GDS, GMS etc.

Related actions

- Governance related action plans
- Social open space action plans

Action Plan 1.7: Identify specific conservation roles and related management plans for individual protected areas

The management of the various protected areas in the municipality should be informed by the specific conservation value of each site. For example, a wetland that is isolated within an otherwise developed area will function primarily as a rest stop for migratory birds, with a limited number or aquatic fauna and flora species that can survive in situ. Its management should therefore be focussed on optimising the value of the wetland for avian species, as opposed to public recreation or stormwater management.

A similar characterisation must be undertaken for each protected area, based on the following determinants:

- Size
- Connectivity (distance to adjacent open spaces as well as the state of actual ecological corridors)
- Known or expected species of special concern that may be present
- Social use and well-being value

Priority 3 Action

This action will contribute to the following objectives of the BSAP

- Integrated decision-making and planning that mainstreams biodiversity conservation
- Clear conservation objectives aimed at improving the sustainability of the urban environment
- A quality urban environment
- A comprehensive conservation network

Main problems this action will address

- Loss of ecosystem services related to microclimatic control, groundwater recharge, invertebrates, small mammals and birds.
- Degradation of the subjective urban environment through development encroachment onto open space areas
- Uncoordinated conservation efforts
- Uninformed or ad hoc open space management

Constraints

Constraint	How will it be addressed in the activities?
1. Knowledge about the sensitive features present in the protected areas.	The conservation objectives for the city must be clearly defined
2. Understanding the global role of individual the protected areas	Coordination between conservation entities must pool resources and knowledge on sensitive features

Existing relevant plans, programmes and legislation

- GDACE C-Plan and Biodiversity Gap Analysis Project
- JMOSS & OSF

Related actions

- The identification of conservation planning objectives is a critical precursor

Action Area 2: Governance

Adaptive management

Mainstreaming biodiversity conservation in the City of Johannesburg will necessarily rely greatly on the effectiveness of the governance systems that are in place. Governance systems consist of all the structures and processes through which power and activities are shared and regulated within society. It includes regulatory controls, negotiation forums and processes for the appointment of public officials. In a democratic context, governance results from the interaction between government, the private sector, stakeholder organizations and the general public.

The most effective means of integrating biodiversity concerns into governance structures would therefore be a strategy that targets all the different components of the governance system. The BSAP has to identify the opportunities and responsibilities that are present in organizational structures, planning frameworks, development and sectoral strategies as well as in institutional mechanisms and stakeholder partnerships. All of this need to take place within a management environment that can adapt to a constantly evolving context, in order to strive for continuous improvement.

The general approach that needs to inform governance for biodiversity is one of adaptive management. Adaptive management designs and implements management actions as continuously improving 'experiments', as opposed to closed-ended and final. This approach emphasizes monitoring of the effectiveness of the actions, and encourages learning and novelty, thus increasing resilience in governance systems.

Ideally, adaptive management should be paired with an approach that draws on collaborative action and responsibilities, rather than an isolated centralized governance structure. According to the Stockholm Resilience Centre[1], 'adaptive co-management' will -

> *"…promote an evolving, place-specific governance approach in which strategies are sensitive to feedback (both social and ecological) and oriented towards system resilience and sustainability. Such strategies include dialogue among interested groups and actors (local-national), the development of complex, redundant and layered institutions, and a combination of institutional types, designs and strategies that facilitate experimentation and learning through change…"*

Three principles will therefore underlie governance for biodiversity in the CoJ:

- Participation
- Defined and transparent governance structure
- Accountability

Participation ensures that consultation form part of the governance process, in order to build trust and understanding, and to facilitate the identification of impending problems or innovative solutions. This needs to be matched with a governance structure that clearly defines the roles and responsibilities of the various organisational centres. Each functional entity in the City must be able to define its role with respect to biodiversity mainstreaming, its monitoring and improvement process, as well as its relationships with other entities, whether these are on the same institutional level or not. Lastly, the authorities must be held accountable for their decisions and actions, and in particular with regards to the equitable inclusion of the concerns of, and risks faced by minority groupings.

[1] Stockholm Resilience Centre, www.stockholmresilience.org

Action Plan 2.1: Develop an Environmental Information Management system

Biodiversity management is highly dependent on quality spatial and ecological information. By implication, Johannesburg needs to centralize, standardize and improve the quality of its environmental management information base, in order to equally inform all stakeholders and improve the access to relevant biodiversity information.

The quality of information depends on the manner in which it is collected, reported and maintained. Standards for the documentation and storage of information must therefore be set, along with protocols for the continued maintenance and updating of the information.

Specific subtasks are:

- Sorting, cleaning, documenting and structured storage of all relevant environmental management and biodiversity information in the City
- Electronic capturing of paper-based records such as maps and older policy documents
- Sourcing of updated biodiversity information from stakeholders such as SANBI, GDACE, DEA (DEAT), etc.
- Identification of information gaps and compilation of strategies to address the gaps
- Development of strategies for the ongoing improvement of information sets, including long-term data acquisition forecasts.
- Uploading of relevant information layers to the Corporate GIS system

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integration of biodiversity management into the governance structure, and improved governance through informed decision-making
- Improving awareness of biodiversity issues and information
- Integration of biodiversity management with other programmes

Main problems this action will address

- Uncertainty with regards to the completeness and accuracy of biodiversity information
- Uninformed decision-making outside of the environmental management department
- Inaccessibility of information
- Lack of information sharing between institutions
- Inappropriate use of purpose-specific information sets

Constraints

Constraint	How will it be addressed in the activities?
1. Time and cost implications	Information sharing between institutions must be actively pursued.
2. Understanding of biodiversity data on the part of GIS or information professionals	Information standards must be rigorously applied in order to avoid the wasting of resources for data cleanup. Data usage instructions and descriptions of the limitations of the data must be provided to information professionals

Existing relevant plans, programmes and legislation

- CoJ Corporate GIS standards
- Biodiversity information programmes at associated institutions

Related actions

- Urban ecological network action plans
- Invasive alien species action plans
- Species of special concern actions

Action Plan 2.2: Undertake Strategic Environmental Spatial Planning

Integrated environmental management in the CoJ must be based on the premise that Environmental Impact Assessments (EIAs) should feature as the last piece of information that informs decision-making. The EIA process, along with all other planning and design practices must be informed by strategic understanding of the project area and environmental issues relevant to the specific project. In this respect, pro-active Environmental Management Frameworks and Strategic Environmental Assessments should be conducted.

Strategic environmental decision-support tools such as EMFs and SEAs generate up-to-date biodiversity information and targets, which can inform spatial planning, structure biodiversity management plans, and align conservation efforts with other planning processes. Decisions regarding development that may result in loss of biodiversity can therefore be made with a full understanding of the trade-offs.

It is therefore necessary to identify priority areas where strategic assessments and frameworks are required, as a complementary process to the formulation of an overall ecological management framework.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integration of biodiversity management into the governance structure, and improved governance through informed decision-making
- Improving awareness of biodiversity issues and information

- Integration of biodiversity management with other programmes
- Integrated biodiversity management

Main problems this action will address

- Lack of understanding with regards to cumulative, regional and off-site impacts of development.
- Absence of city-wide implementation of environmental programmes and policies.
- Strategic development programmes lacking environmental understanding.

Constraints

Constraint	How will it be addressed in the activities?
1. Time and cost implications	Environmental awareness and education must be performed within council structures
2. Environmental awareness in governance structures	The benefits of pro-active environmental planning must be clearly identified, described and communicated.
3. Lack of legislative incentives for strategic environmental planning	Strategic environmental planning must be granted a prominent place in environmental regulatory services planning and operations.

Existing relevant plans, programmes and legislation

- Existing environmental spatial plans
- Biodiversity information programmes at associated institutions

Related actions

- Urban ecological network action plans
- Social open space action plans
- Linkages to spatial planning actions

Action Plan 2.3: Integrate biodiversity considerations into the planning and budgeting processes of the City of Joburg

It is necessary to integrate biodiversity considerations into the planning and budgeting processes of the City of Joburg. Ideally, budget allocations and spending patterns of organs of state should reflect the full costs and benefits of ecosystem service provision. However, simple measures such as green procurement standards can be implemented without significant changes to the fiscal policy.

The City of Johannesburg therefore needs to investigate ways in which green budgeting can be implemented. Subtasks would include:

- Identify opportunities within the current budgetary processes
- Identify best practice examples of incentive and disincentive schemes such as
    - Tax rebates
    - Penalties
    - Higher budget/Funding allocation for green projects
- Identify replacement or improvement options for large-scale schemes such as waste collection
- Formulate an incentive scheme for non –governmental conservation schemes that contribute to financial savings through ecosystem service restoration

Priority 3 Action

This action will contribute to the following objectives of the BSAP

- Integration of biodiversity management into the governance structure
- Improving awareness of biodiversity issues and information
- Integration of biodiversity management with other programmes
- Improvement in human well-being

Main problems this action will address

- Biodiversity conservation is implemented as an ex post facto project, and is not integrated into the day-to-day planning and activities of all the implementing agencies in Joburg
- Greater savings can be generated if large-scale green projects are undertaken, and this would need to be stimulated through upfront funding requirements/forcing
- Medium and micro-scale public-private-partnership conservation projects rely on public contributions, yet contribute to the overall ecological functioning of the city. They should therefore be assisted by central funding, as well as streamlined processes and procedures especially where they protect and utilize public open space effectively.
- Demand-side management allows for the exploration of opportunities for innovative service provision that can lead to long-term savings, and should therefore be part of the budget considerations

Constraints

Constraint	How will it be addressed in the activities?
1. Challenging convention	Best practice examples that demonstrate the value of green budgeting can be used as motivation
2. Costing ecosystem services	The knowledge base of organizations such as the Cities Network must be tapped as well as looking towards international best practice for Payments for Ecological Services
3. Demonstrating the benefits of biodiversity conservation to an unreceptive audience	Education and awareness training in the city must be continued

Existing relevant plans, programmes and legislation

- Joburg IDP
- GDACE C-Plan
- SANBI Stewardship programme

Related actions

- Governance related action plans

Action Plan 2.4: Align land use planning with ecological principles for open space planning

Priority biodiversity areas and ecological open spaces should be part of spatial plans for the city. Spatial plans and prioritization of biodiversity and biodiversity goods and services should be included in spatial frameworks (SDFs, GMS) to ensure adequate space for biodiversity and the protection of important features. Similarly, the provision for biodiversity conservation should be present in non-spatial planning such as the IDP.

It is therefore necessary to find opportunities for the exchange of information between the environmental management and, for example, spatial planning departments. The biodiversity information must be offered in a format that is accessible to non-environmental officials.

The formation of an open space forum will allow for the exchange of information, planning priorities and activities between the departments of Environmental Management, and Development Planning and City Parks as well as MOEs where needed. This forum should be chaired by the Environmental Management department and meet on a bimonthly basis.

The same approach will be taken with regards to departments and MOEs that own and control land which may harbour valuable biodiversity resources. These entities must be informed of the value of biodiversity conservation and supported in ways that will preserve the sustainability of biodiversity goods and services associated with their land.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integration of biodiversity management into the governance structure
- Improving awareness of biodiversity issues and information

- Integration of biodiversity management with other programmes
- Improvement in human well-being
- Developing an open forum to discuss issues between relevant city departments

Main problems this action will address

- Biodiversity conservation is implemented as an ex post facto project, and is not integrated into the day-to-day planning and activities of all the implementing agencies in Joburg
- Spatial planning customarily relies on very limited spatial environmental mapping, without the accompanying explanations and motivations. Informed trade-offs between environmental requirements and land use planning are therefore absent.
- Environmental management principles in high-level planning seldom gets translated into instructions in detailed planning guidelines.
- Poor communication on the possible conflicts between environmentally sensitive sites and development planning priorities (particularly for development applications).

Constraints

Constraint	**How will it be addressed in the activities?**
1. Ignorance of the fact that the implementation of environmental management is the responsibility of sector departments rather than the environmental management department.	Education and awareness strategies and action plans.
2. Specific mandates of MOEs that act as disincentives for conservation (e.g. JPC mandated to develop land, not conserve it)	The mandates of sector departments and MOEs must be reconsidered and amended accordingly, with environmental indicators added to scoresheets. An environmental forum, whether formal or informal, should be set up for interdepartmental consultation on environmental management issues

Existing relevant plans, programmes and legislation

- GMS, Land Strategy, etc.
- SDFs, IDP etc.

Related actions

- Awareness raising and education
- Governance related action plans

Action Plan 2.5: Develop a monitoring and evaluation programme for biodiversity management

It is necessary for the biodiversity management strategy to be continuously monitored and evaluated, in order to confirm the effectiveness of the programme in conserving biodiversity as well as to improve management actions as new information and strategies become available. The city therefore needs to formulate and implement a monitoring and evaluation framework. As with the National BSAP (DEAT, 2005: 48) –

> *"[this] may require developing a set of high-level biodiversity indicators and thresholds, based on existing sets of indicators for example in State of Environment Reports, Environmental Management Plans and Environmental Implementation Plans, biodiversity assessments and other research programmes that use indicators. It will also require guidelines for applying the indicators and thresholds, that can be used by all departments, MOEs, environmental assessment practitioners, researchers and academics, so that assessment, monitoring and reporting is streamlined and efficient. The monitoring and evaluation framework should build on current initiatives, such as various programmes run by NGOs and research institutes, the River Health Programme. This framework could also act as an early warning system and to prevent further species or ecosystems becoming threatened. This framework should assist in monitoring and reporting on the achievement of conservation and sustainability targets for biodiversity."*

The information reported on by the M&E framework must be used to adapt and improve the various control instruments, management strategies and implementation tools of the BSAP.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integration of biodiversity management into the governance structure
- Integration of biodiversity management with other programmes
- Improvement in human well-being
- Improvement in urban ecosystem well-being

Main problems this action will address

- A consistent process of monitoring biodiversity loss or gain is absent, which makes it difficult to argue in favour of specific interventions.
- Without any biodiversity monitoring, the implementation and adaptation of conservation programmes become intuitive rather than scientific

Constraints

Constraint	How will it be addressed in the activities?
1. Consistent monitoring will require dedicated resources	The identification of clear conservation objectives must be given priority.
2. Differences in opinion are possible with regards to the selection of indicators	Integration of the M&E framework with similar programmes by associated organizations such as GDACE will ease the burden.

Existing relevant plans, programmes and legislation

- GDACE Biodiversity Gap Analysis Programme
- SANBI Grasslands Project
- National Spatial Biodiversity Assessment

Related actions

- Governance plans

Action Area 3: Education and awareness

Over the past decade there has been much talk, and some lively debate, over the terms 'sustainable development' and 'sustainability'. This includes a Canada-hosted on-line colloquium on the future of environmental education with a selection of papers published in Volume 4 of the Canadian Journal of Environmental Education (1999). Within the picture, we find outreach programs inevitable to accomplish outcomes that are key and instrumental to the concepts in review.

More recently, another internet debate on education for sustainable development was initiated by the Dutch Inter-Departmental Steering Group on Environmental Education (1999). Nevertheless, those seeking to care for the environment and human-environment relationships have often sought goals and rallying concepts around which to organize their efforts. Beginning with the report of the World Commission on Environment and Development (1987) and followed by *Agenda 21* (1992), which was signed by 179 nations in Rio de Janeiro, adherents of sustainable development and sustainability have gained much momentum in their efforts to establish environmental guidelines and goal statements.

Sustainable development and sustainability are key elements to an environment friendly approach in developing the country. On the other hand, the concepts are far beyond understanding to many in the country and this includes both literate and illiterate members of the larger part of the community. In many planning sessions, be it in conferences or workshops held by those who seem to have a better understanding of their fundamental obligations towards sustaining and improving the human-environment relationship, recommendations devoted to education, public awareness, training becomes key issues. In the midst of these many to mention great ideas comes the responsibility to implement and very little is achievable. These creative possibilities can arise when exploration, evaluation and critique of emerging ideas are embraced.

In the light of the above milieu, great ideas have been explored in identifying most challenges the world is facing. The vigour of research and critical stance taken by many participants who are convinced that what ever is being tabled as a milestone could be achieved is impressive. It is in the interest of the City of Johannesburg however, that a strategy to pursue education and awareness focused agenda to make sure that many ecological processes are sustained despite population and development pressure experienced within her jurisdiction. The co-existence of both bio-diversity and human development can be realized only if education and awareness becomes an element in the planning and development trends pursued by authorities.

Education and Awareness within the City

Much has being made in an endeavour to facilitate human development through environmental education and awareness programs within the City. The current mechanisms in place aimed at improving on these valuable exercises seem to be dependant on the attitudes of the masses and the contribution made by authorities to sustain the success of the effort made.

The Joburg City Parks' Environmental Education Unit is running Environmental Education programs through offering free environmental education lessons to school groups. It might be perceived that environmental education and awareness is all about going on excursions to larger nature areas and publicizing manuals that could be accessed by those that are exposed, but the effort made by City Parks is tailor-made to address both schools and communities in its nature so that environmental sustainability is realized in-house. There are but a few nature areas within the City which in a sense portray what a nature lover might look for if one really wants to interact with nature for the purpose of edutainment and related experiences. City Parks utilizes these facilities to a rather limited extent given the nature of their standard and limited resources required to gain full utilization to serve their intended purpose. However, a big challenge remains as to how these efforts are being sustained and whether there are sufficient mechanisms in place to measure the impacts thereof.

On the other hand, Pikitup, a Municipal owned Entity (MoE) whose core business is Waste Management, plays a role in education and awareness that is more related to its operations. With the little resources available, education and awareness initiatives are facilitated through initiation of clean-up campaigns and competitions that are aimed encouraging communities and schools alike to adhere to the objectives of the campaigns and competitions rolled out. These activities have very little impact on the state of the City's waste management efforts. Again the question is whether long term plans are in place to sustain the efforts.

The above MoEs commit themselves on annual basis to roll out programs in education and awareness to the greater communities of the City of Johannesburg.

Key challenges

The City of Johannesburg is one of the densely populated Metropolitan areas in the world. The city's development was influenced by mining and industry which led to escalating population figures and attracted more people from neighbouring countries migrating for job opportunities. The impacts became prevalent in many scenarios where the impact of education and awareness programs could not be realized. The following situations prevail:

- Lack of sense of ownership
- Project sustainability
- Unstable citizenship
- Unstable funding
- Poor networking with NGOs and CBOs
- Lack of interdepartmental relationship
- Lack of resources (human)

The above issues are not given enough attention especially at management level of the City which would be in a position to proactively address same.

Education and Awareness are concepts that can not be presented separately. The two concepts are related in that; Awareness itself is a product of Education and one of the objectives in environmental education. According to UNESCO, environmental education objectives are categorized as follows:

- Awareness
  To help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.
- Knowledge
  To help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.
- Attitudes
  To help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
- Skills
  To help social groups and individuals acquire the skills for identifying and solving environmental problems.
- Active participation
  To provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.
- Evaluation ability
  Evaluate all existing programmes as well as all future programs

Action Plan 3.1: Awareness and advocacy campaign to reach key-decision makers and top level Management of the City.

For management to be able to address some of the issues listed as challenges, effective communication is desired. Effective communication meant for management level should be formalized and create room for commitment on feedback desired from the recipient. Communication should carry elements that will inform management of what the lower level committed itself to in terms of service delivery or prescribed score card. A simple methodology can be applied and formalized to draw enough attention from the higher level of management. A platform should be created to enable the following actions:

- Presentation of Progress Reports (quarterly) on education and awareness achievements to top level management
- Motivation for budget to roll out education and awareness programs with clearly defined milestones and set deadlines for reporting to authorities
- Escalation of issues should easily follow the reporting patterns as stipulated in the management systems in place
- From lower management level, the Project Steering Committee should be alerted of a project in progress and forward its status to the Executive Committee which will assess and forward to the BOARD for recommendations to the MMC
- Highlights on both gains and losses in education and awareness sectors of MoEs and the City should be clearly defined to enable the development of uniform delivery mechanisms based on scorecards (specific outcomes/milestones set)
- Interdepartmental co-ordination of education and awareness programs within the top level management should be implemented to avoid duplication of functions and strengthen the impact of programs in place (entities should include among others; Gauteng Department of Education, Department of Agriculture, Conservation & Environment, City of Johannesburg and all the MoEs)

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Building up a well informed and up-to-date management structure in terms of departmental service lines performance
- A delivery orientated share in budget allocation to MoEs
- Creation of an open-door policy between lower level management top management
- An integrated service delivery model and networking within and outside the City

Main problems this action will address

- Backlog of programs due to lack of funding or inadequate budget allocation
- Duplication of services rendered to the same clients/communities resulting in indirect misappropriation of state funds contradictory to the requirements of both the MFMA and PFMA
- Indiscriminate service delivery within the Civil Service

Constraints

Constraint	How will it be addressed in the activities?
1. Inadequate allocation of funds for the implementation of education and awareness programs	Streamlining of budget with planned activities for the entire financial year. Program Managers should be requested to develop budget proposals for their service lines projected for the financial year
2. Top level management is not well informed of challenges that hamper good service delivery and completion of programs	Each service line should be afforded an opportunity to present reports on projects done and in progress to pro-actively react to prevailing challenges through direct interaction with decision makers if required
3. Duplication of services within the City's Service lines	An integrated approach on planning for annual programs will be implemented in a collaborative manner as all MoEs have similar Units/service lines

Existing relevant plans, programmes and legislation

- Individual Directorates decide upon programs to be implemented with guidance from the Environmental Calendar Days Themes bullets
- Annual plans are informed by the IDP Score Card

Related actions

- Allocation of funds for the implementation of theme based programs in relation to Environmental Calendar Days bullets
- Schools, community and work force awareness programs are rolled out by the MoEs with allocated annual targets per client sector

Action Plan 3.2: Design and implement a creative and innovative Advocacy and Communication Strategy to make biodiversity concern relevant to communities.

Education and awareness, whether formal, non formal or informal, should be grounded in critical and innovative thinking in any place or time, promoting the transformation and construction of society. There must be stimulation of solidarity, equality, and respect for human rights involving democratic strategies and open climate of cultural interchange. Democratization of the mass media and its commitment to the interests of all sectors of society is required in education and awareness. It should be noted that communication is an inalienable right and the mass media must be transformed into one of the main channels of education, not only by disseminating information on an egalitarian basis, but also through the exchange of means, values and experience. The following steps can be taken to achieve communal interest in biodiversity issues:

- Conduct research on the intensity of natural resources utilization within the City e.g. muti, artefacts etc. and develop a data base to highlight the intensity or balance in such utilization for publication to stakeholders
- Mitigate on corrective measures where a threat is eminent
- Intensify energy efficiency campaigns and water-wise gardening and promote the “Bontle ke Botho” campaign
- Explore the use of media in intensifying campaigns
- Make available up to date information regarding the state of the environment report to communities through a media device that will be understood by all levels of community (the use of local languages and individual community structures is of vital importance)

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Awareness of and a sensitivity to the total environment
- Capacity to move from environmental awareness to knowledge and action
- A set of values and feelings of concern for the environment, the motivation for actively participating in environmental improvement and protection
- Understanding of the partly natural, partly arbitrary borders of the system, i.e. the geographical compartmentalizing of the biosphere
- Understanding the system-part-relationships of an ecosystem (producers, consumers, decomposers, soil, water, etc.) being parts of the system; the ecosystem in turn being part of a super system, e.g. the biosphere.
- Build up an inquisitive community towards the dynamics of thee environment

Main problems this action will address

- The environmental illiteracy challenge within the City of Joburg community
- Lack of community stewardship towards the environment and biodiversity

Constraints

Constraint	How will it be addressed in the activities?
1. Lack of resources to develop models to serve all sectors of community	Involvement of institutions of higher learning to conduct research on best methodologies that will create the best clearly defined links between man and biodiversity
2. Lack of capacity and human resources	Capacity building among the available staff and recruitment of qualified personnel
3. Lack of communal buy-in to available programs	A participatory approach during planning sessions of programs will be implemented – involvement of both youth environmental groups and the environmental desk of the Wards Committees
4. Lack of knowledge of the biodiversity components and their ecological niche	School learners will be involved in research activities to familiarize themselves with components of the biodiversity

Existing relevant plans, programmes and legislation

- Environmental Education Programs run by Johannesburg City Parks' Environmental Education Unit

Related actions

- Nature parallels (walks in nature areas to get glues natural creatures, identify them and explore their role in the ecosystem) conducted with school groups guided walks in the City's nature areas by City Parks Environmental Education Unit. This is however done at limited scale as knowledge of the ecosystem is required.

Action Plan 3.3: Develop and implement focused awareness campaigns on threatening processes, including invasive alien species, GMOs and climate change, that aim to change behaviour in public and private sectors

Biophysical problems such as pollution, loss of biodiversity, degradation of life support systems, global climate change and ozone destruction are just some of the many environmental problems which become visible in the biophysical realm. Even if these problems can be scientifically proven to exist, they might be beyond many peoples' understanding meaningless to a large extent. Programs in place should be able to deal with a way of creating awareness to communities in highlighting their impacts to draw attention even from the most illiterate member of society. This can be achieved through information campaigns through methodologies that are available and accessible to the greater community, and in simplified/local languages.

- Intensify the Working for Water Program within the Municipal boundaries especially in open spaces, wetlands and conservation areas
- Intensify the "Basa njengo Magogo" program to reach all communities within the City of Johannesburg
- Participate in the Gauteng Province's Bontle ke Botho Clean and Green Campaign by encouraging schools and wards to focus on biodiversity matters
- Popularize statistics on negative health incidents stemming from environment related issues

- Conduct Energy Efficiency lessons to CBOs and schools and develop an evaluation tool on rolled out programs
- Encourage compliance with environment related by-laws through awareness campaigns in the industrial sector especially developers and manufactures

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Community participation in environmental programs
- Improve the quality of the environment and all life forms including the community
- Better understanding of environmental legislation
- Job creation in the environmental field

Main problems this action will address

- Water quality (ground)
- Alien and invasive species
- Air quality
- Disposed species diversity

Constraints

Constraint	How will it be addressed in the activities?
1. Limited alien invasive plants control programs	Involvement of DWAF in alien invasive plants control programs
2. Poor water quality management	Involvement of community and other structures in issues related to water quality management
3. Lack of compliance with environmental legislation	Create awareness in human rights and the environment

Existing relevant plans, programmes and legislation

- Eradication of alien and invasive plants in City Parks' nature reserves
- Air quality monitoring in communities

Related actions

- The "Basa njengo Magogo" project being implemented in the Greater Soweto for Air Quality monitoring

Action Plan 3.4: Design and implement biodiversity education programs.

Education and awareness entities have been established in all MoEs within the City. Perhaps the way to go in achieving ultimate goals would be the implementation of participatory resource development. Teacher/educator participation is key in resource development in that programs could be aligned with school curricula resulting in creation of relevance of programs to lessons. This will stimulate interest in both learner and educator milieu.

- Develop school and outdoor education and awareness programs in collaboration with the Gauteng Department of Education's Natural Sciences subject Advisers and other relevant personnel (this should include educators in the field)
- Conduct research programs with institutions of higher learning and incorporate the research material into school programs e.g. biodiversity in local wetlands, conservation areas etc.
- Establish school working groups on environment related projects in collaboration with locally available NGOs that are working on related programs e.g. EWT, WESSA etc.
- Encourage schools participation in wetlands cleanup campaigns
- Implementation of water quality monitoring by schools working groups on wetlands and other water bodies up-stream and downstream
- Conduct annual environmental summit for schools working groups to report on progress and discoveries encountered during research programs and campaigns
- Encourage celebrations of Environmental Theme Days through media campaigns.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- An integrated approach towards environmental education program development
- Enhance biodiversity knowledge in learners through hands-on participation
- Create stewardship amongst the learners and better networking with other environmental organizations
- Creation of the feeling of ownership towards the water bodies among young people
- Mobilization of the youth and learners to bee more actively involved in environmental activities and creation of a platform to raise their concerns and experiences

Main problems this action will address

- Lack of networking during education and awareness program development
- Poor knowledge of biodiversity among the learners, youth and community
- Lack of stewardship for the environment
- Poor participation in celebration of environment theme days or attendance without good reason

Constraints

Constraint	How will it be addressed in the activities?
1. Poor/lack of communication among environmental sectors in government and private sector	An environmental communication desk will be initiated to facilitate communication
2. Availability of learners to participate in programs	An annual program will be developed with nominated schools and learners notified in advance
3. Budget constraints	Available budget should effectively utilized with plans to seek funding from available funders of environmental programs

Existing relevant plans, programmes and legislation

- There are currently no active programs

Related actions

- Celebration of environmental them days as and when they come

Action Area 4: Biodiversity features

Watercourses

The natural aesthetic appeal of surface waters also makes it an important resource for recreational use and suburban development is very often centred on rivers or dams - this being a major marketable aspect to housing estate developments. Wetland and the associate riparian zones are habitat types that support a relatively high diversity of faunal and floral species (many of which are especially adapted to or dependent on aquatic and riparian habitats, sensitive or Red Data Listed (RDL) species). The natural connectivity of all the watercourse networks form important "green corridors" throughout the City of Joburg and therefore form important habitats for biodiversity conservation within the urban environment as well.

The cumulative pressure of all these aspects means that unpolluted water is becoming an increasingly rare resource worldwide. The highly urbanized nature of the City of Joburg means that this phenomenon will form an increasingly pertinent aspect, governing the management and conservation strategies of the surface water resources found throughout the City of Joburg.

A further large concern is the risk to biodiversity from failing or overloaded infrastructure. For example, where there is inadequate or non existing sewage infrastructure, the sewage outflows may run into river systems causing severe water quality and river health problems.

Wetlands

Prominent wetlands that are included within the City of Joburg boundary include the vast reed bed formations of the Klipspruit/Klip River floodplain complex that run along the western and southern boundaries, respectively, where they remain closely associated with areas characterised by mining activity, and informal and semiformal settlements within highly-populated suburbia. These riparian land uses have impinged on the riparian habitat. Soil erosion from the surrounding catchments (especially the mining sector) has lead to siltation of the aquatic and riparian habitats, which have facilitated the encroachment of these reed beds to within the active channel. These wetlands therefore serve a water purification and filtration role as well as providing for important habitat for supporting biodiversity (including some RDL butterfly species).

Ephemeral pans located within the north-eastern areas of the City of Joburg boundary, especially Glen Austin Pan provide for important habitat that is known to support various RDL fauna species. This pan provides for one of the most prominent breeding areas for the Giant Bullfrog Pyxicephalus adspersus and is also known to support viable breeding populations of African Grass-owls Tyto capensis.

In the southern part of Joburg, in the Klipspruit / Klip River catchment, a number of large wetlands occur within the drainage systems to the south of the Klipriviersberg and Roodepoort ridge systems. Some of the least disturbed wetlands, containing high levels of biodiversity occur in the Kibler Park / Meredale area.

The upstream parts of the north-draining streams feeding into the Jukskei River have been largely transformed by urbanisation, with the likely resultant loss of wetland habitat. However certain wetlands still exist in parts of the catchment such as in Montgomery Park. Wetland systems are to be found in the northern parts of the city such as parts of Midrand, smallholding areas to the north of Fourways and in the north-eastern parts of the City in the Modderfontein area. These wetlands, especially those in areas of agricultural landuse are still largely intact and provide important habitats for biodiversity, while providing movement corridors for biota. Most of these wetlands are valley bottom wetland systems, but in some areas hillslope seepage wetlands are to be found.

Ephemeral pans located within the north-eastern areas of the CoJ boundary, especially Glen Austin Pan provide for important habitat that is known to support various RDL fauna species. This pan provides for one of the most prominent breeding areas for the Giant Bullfrog Pyxicephalus adspersus and is also known to support viable breeding populations of African Grass-owls Tyto capensis.

Examples of successful projects:

Jukskei Capital River Rehabilitation projects

This project entailed rehabilitation and stormwater management measures that comprised of environmentally friendly engineering works to the streambed and banks. This was intended to return the river to a more natural flow state, thereby reducing the risk of further erosion to the stream banks and improving the water quality through a series of natural weirs. A complimentary project involved the construction of a litter trap to aid in reducing the high volume of litter and waste emanating from the city centre that has had an effect on the entire system downstream that has lead to a decrease in water quality, river health and the aesthetic value of the river itself.

Klip/Klipspruit 2010 Legacy project

The aim of the project is to achieve the 2010 City's vision, which has the following objectives: Clean, healthy rivers, free of pollution, odours; Safe and beautiful parks for enjoyable recreation alongside the rivers – including cycle paths, picnic areas, etc.; Well managed conservation areas within river corridors, free of alien vegetation and supporting enhanced biodiversity; Well-managed reed beds; and, Social and economic opportunities and associated activities.

These projects are all currently underway with the basic common aim of improving the aquatic ecosystem health of both the Jukskei and Klip River catchment areas.

Action Plan 4.1 Raise awareness regarding wetland values, protection, rehabilitation, policies and regulations and encourage involvement by individuals, groups, corporations and industries in all aspects of wetlands protection and rehabilitation (Action in JMOSS)

The JMOSS outlines 3 keys steps that would be necessary to achieve this action:

- Evaluate and catalogue existing wetlands information from Desired Primary Open Space Assessment Reports, identify gaps and potential audience.
- Formalize a distribution network and provide existing centres with a catalogue of available wetlands information.
- Produce communication packages targeted for corporations/ industry/ developers and include information on opportunities for involvement in wetlands conservation

Priority 3 Action

This action will contribute to the following objectives of the BSAP

- A quality urban environment
- A comprehensive conservation network
- Mainstreaming biodiversity concerns into other sectors
- Protection and care of watercourses in Joburg

Main problems this action will address

- Continued building within riparian areas and destruction of wetlands
- lack of awareness on the role of wetlands and services they provide for this city

Constraints

Constraint	How will it be addressed in the activities?
1. Development pressures to build over wetlands and land use changes	Not allowing any development within riparian buffers and in wetland areas An opportunity exists to upgrade of infrastructure, road, storm water and recreation facilities in a manner so as to protect and enhance the functionality of wetlands and rivers
2. Many wetlands are already severely damaged and have lost some or all of their ecosystem functions	Rehabilitation of wetlands to restore their ecosystem functioning. Detailed rehabilitation plans for priority areas. Rehabilitation designs should include detailed engineering designs and should consider the socio-economic impacts of rehabilitation efforts that may result in alterations to the current hydrological regime

Existing relevant plans, programmes and legislation

- JMOSS II
- OSS
- Wetland Audit
- Catchment Management Framework

Related actions

- Other awareness raising action plans
- Other watercourse related action plans

Action Plan 4.2: Develop an accessible, computerized database for wetlands and use this information to produce a readable report for the public outlining wetland targets and trends. (Action in JMOSS)

The Joburg Wetland Audit begins to provide a good baseline data set on wetlands within the City. The next step in the development of this audit is to use this information to understand the values associated with particular wetlands and regions, as well as prioritisation in terms of wetlands needing rehabilitation, protection or conservation. This information could feed into the State of Environment Reporting process as well as other environmental reporting and target setting in the city.

The JMOSS highlights 5 steps necessary to achieve this action:

- Establish a data management group.
- Prepare a catalogue of existing wetland databases.
- Prepare and distribute to the public information concerning local wetland targets and a regular, standardized, readable report on wetland trends.

- Create and maintain an integrated computerized database for the wetlands.
- Establish community - based, volunteer monitoring stations (for birds and amphibians) at project sites in areas of concern and other wetlands.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- A quality urban environment
- A comprehensive conservation network
- Mainstreaming biodiversity concerns into other sectors
- Protection and care of watercourses in Joburg

Main problems this action will address

- Destruction and damage to wetlands
- Encroachment onto wetlands and in riparian areas
- Loss of ecosystem services associated with particular wetlands
- Poor decision making regarding wetland priorities within the City.

Constraints

Constraint	How will it be addressed in the activities?
1. Insufficient data for ecosystem services provided by wetland systems	Furthering work done on the Joburg Wetland audit to identify wetland prioritization and associated ecosystem services provided by the wetlands
2. Many wetlands are already severely damaged and have lost some or all of their ecosystem functions	Rehabilitation of wetlands to restore their ecosystem functioning. Detailed rehabilitation plans for priority areas. Rehabilitation designs should include detailed engineering designs and should consider the socio-economic impacts of rehabilitation efforts that may result in alterations to the current hydrological regime
3. Different approaches to prioritisation of wetlands are available (e.g. social vs. ecological values of wetlands)	Multi-stakeholder involvement in compiling the modelling approach and conservation objectives.
4. Many wetlands are on private land areas are privately owned	Interim decision-making guidelines must be compiled, that will limit the encroachment until such time as a comprehensive policy is available.

Existing relevant plans, programmes and legislation

- JMOSS II
- OSS
- Wetland Audit

- Catchment Management Framework

Related actions

- Other awareness raising action plans
- Ridges and ecological features audit action plans

Action Plan 4.3: Identify and Protect key priority wetland areas (Action in JMOSS)

Prominent wetlands that are included within the City of Joburg boundary include the vast reed bed formations of the Klipspruit/Klip River floodplain complex that run along the western and southern boundaries, respectively, where they remain closely associated with areas characterised by mining activity, and informal and semiformal settlements within highly-populated suburbia. These riparian land uses have impinged on the riparian habitat. Soil erosion from the surrounding catchments (especially the mining sector) has lead to siltation of the aquatic and riparian habitats, which have facilitated the encroachment of these reed beds to within the active channel. These wetlands therefore serve a water purification and filtration role as well as providing for important habitat for supporting biodiversity (including some RDL butterfly species). (COJ SoER, 2009)

Ephemeral pans located within the north-eastern areas of the City of Joburg boundary, especially Glen Austin Pan provide for important habitat that is known to support various RDL fauna species. This pan provides for one of the most prominent breeding areas for the Giant Bullfrog Pyxicephalus adspersus and is also known to support viable breeding populations of African Grass-owls Tyto capensis.

It is essential for biodiversity management within the City that no development within wetlands be allowed and that the wetland buffers be enforced. Current policy calls for a minimum of a 30m buffer surrounding the wetland, however larger buffers may be necessary depending on the size and importance of a particular wetland.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- A quality urban environment
- A comprehensive conservation network
- Mainstreaming biodiversity concerns into other sectors
- Protection and care of watercourses in Joburg

Main problems this action will address

- Understanding the value of particular wetlands and the services they provide to the city (e.g. flood attenuation and water quality improvement)
- Destruction and damage to wetlands
- Encroachment onto wetlands and in riparian areas
- Loss of ecosystem services associated with particular wetlands
- Poor decision making regarding wetland priorities within the City

Constraints

Constraint	How will it be addressed in the activities?
1. There are no incentive schemes currently available for wetlands protection and restoration	Develop Payments for Ecosystem Services models for wetlands that rewards best practices

Existing relevant plans, programmes and legislation

- JMOSS II
- OSS
- Wetland Audit
- Catchment Management Framework
- C-Plan (GDACE)

Related actions

- Actions relating to social open space
- Awareness raising for wetlands

Action Plan 4.4: Implement 'environment friendly' stormwater management policies that reduces the impact on aquatic ecosystems

Stormwater management is another aspect of water management that remains one of the key environmental issues facing local governments in relation to the impact of stormwater on aquatic ecosystems and in terms of human safety. Stormwater, for the most part throughout the City of Joburg, is merely directed into the nearest watercourse. The increase in paved and impermeable surfaces that is in direct relation to the increased residential, commercial and industrial development within the city has lead to increased frequencies of greater volumes of runoff surface waters into the watercourses throughout the City of Joburg. This has lead to stream bed modifications, riverbank erosion and degradation and riparian vegetation destruction.

The flooding waters have an associated increased velocity and turbulence that often washes aquatic organisms downstream, with many organisms being unable to recolonise these upstream areas. Increased flooding, especially within urban stormwater canals poses a serious human health risk – especially to children that are often found to be playing within these canals. Increased flooding levels and frequencies of urban-managed rivers within informal settlement areas where infrastructure development tends to encroach to within riparian zones, often also leads to the washing away of informal housing units, with the associated human health risks and loss of property. The Department of Water Affairs and Forestry, Provincial and Municipal authorities are all beginning to realize the dire implications of the increased hard and impermeable surfaces is having on the catchment management of an area. The City of Joburg has placed management strategies, such as the Catchment Management Plan and Stormwater Bylaws into practice to potentially curb the effects of poor historical stormwater management.

The loss of overall aquatic and wetland ecosystem health and the important role that the proper functioning of these systems plays in facilitating stormwater attenuation and management is also beginning to be understood. Wetlands are being regarded as ecologically sensitive ecosystems worthy of formal conservation more than ever before. Urban-managed streams and rivers have riparian zones that are protected to a large degree from degradation through construction and development activities. These riparian areas, with their associated riparian vegetation, form "green corridors" within an otherwise urban environment that is not only important for facilitating migratory movements of various species, but also enhances the flood attenuation capacity of a stretch of river.

These riparian areas are also very often managed as open park areas. The retention of these areas as open spaces is therefore viewed as being important to maintaining this flood attenuation capacity.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- To reduce the safety hazard of flash flooding – particularly in rural areas;
- To enhance the overall ecological integrity of the surface waters throughout the City of Joburg;
- It will allow for appropriate rehabilitation of riparian zones to take place;
- Allow for the enhanced functionality and therefore aid in flood attenuation and filtration of surface water runoff. This has great economic implications;
- To enhance the aesthetic appeal of aquatic habitats for both recreational purposes and land value.

Main problems this action will address

- Flash flooding during the wet season which can result in the loss of human life and infrastructure
- Loss of aquatic habitat integrity and the reduction of riparian habitat
- Improvement of water quality in watercourses in Joburg

Constraints

Constraint	How will it be addressed in the activities?
1. Large scale infrastructure; re-planning and construction is extremely costly	Prioritisation of resources at a metropolitan level to address areas according to areas of need
2. Wastewater treatment works that already run at capacity would need to be upgraded	Prioritising City resources to develop an integrated approach to flood management and river and wetland integrity

Existing relevant plans, programmes and legislation

- Stormwater management plans
- City bylaws for water resources management
- DWAF water quality guidelines
- River Health Programme
- CoJ Catchment Management Policy

Related actions

- Other watercourse action plans
- Urban Ecological Network action plans
- Social open space action plans

Action Plan 4.5: Prioritise the rehabilitation and conservation of wetlands, particularly upstream from settlements and townships

Rehabilitation of wetland systems provide an opportunity to greatly enhance the ecosystem services provided by these wetlands. Wetland areas characterised by severe degradation of wetland habitat by erosion, nutrient and sediment input, vegetation and soil disturbance are more likely to be subject to flooding and cause damage to infrastructure, buildings and cause harm to people. Focus on flood attenuation and improvement of water quality will decrease the risk of flooding and health problems related to poor water quality. Channelled wetlands are most effective at attenuating floods early in the wet season.

In areas affected by water quality challenges presented by mining or other anthropogenic activities, wetlands provide a very important opportunity to reduce the effect of acid mine drainage on the environment and other related problems. Microbes naturally present in wetland systems have the ability to convert sulphates into sulphides. Neutralization of acidic water within wetlands results from biological production of bicarbonate. As water moves through vegetated wetland systems, the velocity of the water slows down, allowing suspended particles, and therefore toxins, to settle out

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- A quality urban environment
- A comprehensive conservation network
- Mainstreaming biodiversity concerns into other sectors

Main problems this action will address

- Damage to buildings and structures caused by peak floods can be mitigated by proper care and protection of wetland areas
- Risks to human life by flooding
- Health problems caused by poor water quality; wetlands act as a filter and can improve the quality of water

Constraints

Constraint	How will it be addressed in the activities?
1. Development pressures to build over wetlands and land use changes	Not allowing any development within riparian buffers and in wetland areas An opportunity exists to upgrade of infrastructure, road, storm water and recreation facilities in a manner so as to protect and enhance the functionality of wetlands and rivers
2. Insufficient data for ecosystem services provided by wetland systems	Furthering work done on the Joburg Wetland audit to identify wetland prioritisation and associated ecosystem services provided by the wetlands
3. Many wetlands are already severely damaged and have lost some or all of their ecosystem functions	Rehabilitation of wetlands to restore their ecosystem functioning. Detailed rehabilitation plans for priority areas. Rehabilitation designs should include detailed

Constraint	How will it be addressed in the activities?
	engineering designs and should consider the socio-economic impacts of rehabilitation efforts that may result in alterations to the current hydrological regime

Existing relevant plans, programmes and legislation

- Wetland Audit, provides details specific actions required for the Joburg administrative regions
- City of Joburg Catchment Management Policy
- Working for Wetlands/ Working for Water

Related actions

- Development of an Ecological network
- Clearing of alien invasive species
- Maintenance of riparian areas
- Linkages to Wetland rehabilitation projects conducted by Working for Water

Action Plan 4.6: Develop a plan to manage the impacts of urban development on water resource quality

Poorly controlled urban development is causing encroachment into floodplains, loss of natural drainage areas, canalisation of water courses and increased hard surfacing. It is also resulting in an increase in the frequency and total volumes of runoff, increased peak discharges of water and major changes in stream morphology as channels widen and deepen (causing erosion and sediment deposition). Further problems include an increase in sediment runoff and deposition, deterioration of biological, chemical and aesthetic water quality, increased debris load in runoff water and reduced groundwater recharge. All of this has a negative impact on biodiversity and creates a safety issue for humans by increasing the flood risk, a loss of function or stability of hydraulic structures, the failure of stormwater systems, loss of habitat diversity and loss of ecological function of watercourses as critical links between conservation areas.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Ensure protection of watercourses at outset of development process in line with International Best Practice
- Environmental, social and economic considerations
- Minimize subjectivity and ad-hoc decision making
- Reduce future costs to CoJ in respect of damage to infrastructure etc

Main problems this action will address

- An increase in the frequency and intensity of flooding creating serious threats to human lives
- Loss of riparian habitat
- Inadequate stormwater management system

Constraints

Constraint	How will it be addressed in the activities?
1. Ad-hoc decision making	Develop an integrated catchment approach to water resource management in the City Develop remediation strategies for highly impacted systems
2. Decision making for water resources lies across city departments (e.g. wetlands, stormwater lie in different departments)	Align departmental structures to ensure integrated decision making
3. Encroachment of urban development into riparian areas and wetlands	Enforce and maintain rules and regulations for floodplains, riparian buffers and the protection of wetlands Including: no development within the 1:100 floodline, 30m buffer and a 50m buffer outside of the urban edge
4. Developers who flout building restrictions and management guidelines	Enforce development guidelines and environmental requirements for land development
5. Polluters of watercourses are not held fully accountable for damages caused	Enforce the principle of polluter pays

Existing relevant plans, programmes and legislation

- CoJ Catchment Management Policy
- CoJ Wetlands Audit
- CoJ buffers Policy
- National Water Act
- CoJ Stormwater Management bylaws
- Management of Water Quality
- Groundwater management
- Requirements for boreholes
- Dam Safety
- Solid Waste Management
- Mine Waste Management
- Management of Riparian Vegetation

Related actions

- Watercourse related action plans
- Governance and institutional development action plans

Ridges

Jointly, watercourses and ridges represent the most important structural features of urban biodiversity conservation. Ridges, in particular, are typically present in the urban environment either in the form of islands of biodiversity or as corridors for species movement. They can therefore function both as nodal and connectivity elements in the overall open space network. In addition, due to their topographical diversity, they are critical to ecosystem processes and the life histories of many fauna species.

At the same time, however, property values clearly show that elevated areas in the urban fabric are sought-after locations for development. Many of the ridge systems in Johannesburg have already been completely transformed, or are under constant threat from development encroachment. A strategy for the incorporation of conserved untransformed ridge environments is therefore an inescapable component of the overall Biodiversity Strategy and Action Plan.

The conservation of biodiversity will contribute significantly by the protection of the ridges in Gauteng as the ridges were found to be important predictors of biodiversity (GDACE Ridges Policy, 2001; CoJ Biodiversity Audit, 2009). The ridges of Gauteng form vital habitat for many threatened or Red Data plant species and the conservation of ridges in Gauteng will provide habitat for significantly high number of species allowing for their continued survival in a rapidly urbanizing province, a desirable long term conservation plan.

Description of the problem

Popular recreational areas that represent untransformed grassland habitats found in the City of Johannesburg include Kloofendal, Klipriviersberg, Rietfontein and Melville Koppies Nature Reserves. Melville Koppies Nature Reserve, for example, hosts over 200 birds and a range of small mammals with 50 varieties of grass which makes it great area for nature walks. There are, however, also significant areas of biodiverse grassland areas that remain as undeveloped public or private properties with no form of conservation status whatsoever.

The ridges in Johannesburg are not uniform in terms of orientation and size. A few large ridge systems running roughly east-west characterize the southern and central part of the municipal area, whereas a fine-grain system of north-south orientated ridges is typical of the land surface in the northern parts. This is an important differentiation, since it introduces inconsistencies in the mapping of ridges. This is especially evident in the provincial scale mapping conducted for the Gauteng Conservation Plan. The GDACE modelling does not have a fine enough scale to accurately map the ridges in the northern parts of Johannesburg, which leads to an inaccurate delineation of ridges. At the moment, however, the GDACE delineation remains as the only comprehensive attempt at demarcating ridges[2].

Ridges contain very complex ecological systems due to their topographical, geological, hydrological and microclimatic diversity. Such complexity is hard to fully detail and understand, especially in an urban context where fragmentation and encroachment further complicates the open space network. It implies that the preservation, conservation and management of ridges in Joburg need to be an integration of ecological requirements and urban management constraints. The control of development and social needs therefore needs to be balanced with aspects of ridge ecology such as:

- Fragmentation and island biogeography, including connectivity indices, barriers to movement and open space network analyses, as well as considerations around minimum viable patch sizes
- Species life history requirements, including habitat requirements, daily movement limits, seasonal foraging and breeding habits
- Population dynamics, including genetic diversity, migratory requirements and recolonisation ability
- Habitat dynamics such as species succession and disturbance regimes (burning, grazing, seed dispersal)
- Conservation indicators and references such as indicator or umbrella species

[2] In the City of Johannesburg, only the Roodepoort (Protea) Ridge in the west has been accurately mapped. The information has however disappeared from common use.

Action Plan 4.7: Complete a Ridges Audit

It is necessary to conduct a ridges audit to determine where all the major ridge systems in Johannesburg are and what their level of transformation is. The ridges audit may form part of a more involved land cover mapping and classification programme, but is critical for an understanding of the role that ridges play in the overall open space framework of the City and how they are being impacted by development within the city.

The audit must be conducted at a scale that is more refined than the provincial modelling performed by GDACE, and must result in a single GIS layer of the ridges that can be used within all spatial planning processes. It should map and classify the following attributes:

- Overall extent of ridges
- Transformed (developed) areas vs. untransformed areas
- Vegetation type
- Habitat quality

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Incomplete knowledge of where open space on ridge systems remain
- Loss of ecosystem services related to microclimatic control, groundwater recharge, invertebrates, small mammals and birds.
- Degradation of the subjective urban environment through development encroachment onto topographically diverse open space areas

Constraints

Constraint	How will it be addressed in the activities?
1. Different approaches to scientific modelling are available	Multi-stakeholder involvement in compiling the modelling approach and conservation objectives.
2. Conservation objectives can be disputed	Clear conservation objectives will determine the modelling, and decisions taken based on the modelling.
3. Landcover data is required, but expensive	Funding must be found for a detailed landcover data set.
4. Development pressure is relentless	Interim decision-making guidelines must be compiled, that will limit the encroachment until such time as a comprehensive policy is available.
5. Many ridge areas are privately owned	

Existing relevant plans, programmes and legislation

- WMLC ridges policy
- GDACE development guideline for ridges
- GDACE C-Plan
- JMOSS & OSF

Related actions

- Ground truthing and sensitivity mapping – will follow the audit, but can be done at the same time
- Action plans related to the management of the remaining green-and brownfield sites (untransformed, expansion and peri-urban areas)
- Action plans related to the management of protected areas

Action Plan 4.8: Undertake Ground Truthing and Sensitivity Mapping of ridges

In order to confirm and detail the relative contribution of the various remaining ridge areas to biodiversity conservation in the City, ground truthing and surveys of actual onsite biodiversity is required. Three aspects will be focused on, namely intactness of the catena (slope profile), vegetation quality and the presence of rare and/or endangered species. The information will supplement the initial ridges audit, especially with regards to the classification of habitat quality.

Existing information that is in possession of the City of Johannesburg and other environmental or conservation agencies (GDACE, SANBI, etc.) should be used as a foundation, but field surveys and ground truthing have to identify changes in status and local characteristics such as accessibility and connectivity with adjacent open spaces or migratory corridors. Having a comprehensive biodiversity database and landcover information as a reference will offer the possibility to monitor trends and biodiversity losses as time goes by.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Incomplete knowledge of where open space on ridge systems remain
- Incomplete knowledge of which ecological sensitivities remain on ridges
- Fragmentation of, and loss of connectivity between, open spaces

Constraints

Constraint	How will it be addressed in the activities?
1. Time and resource intensive	Funding and load sharing opportunities must be explored
2. Conservation objectives can be disputed	A central data collection point must be established or allocated, and protocols for information collection and sharing specified.
3. Data needs to be captured electronically, which is costly and process sensitive (i.e. needs a consistent approach in capturing and recording information)	Clear conservation objectives will determine what needs to be verified
4. Development pressure is relentless	Interim decision-making guidelines must be compiled, that will limit the encroachment until such time as a comprehensive policy is available.
5. Many ridge areas are privately owned	Private land owners must be included as fully acknowledged stakeholders

Existing relevant plans, programmes and legislation

- WMLC ridges policy
- GDACE development guideline for ridges
- GDACE C-Plan
- JMOSS & OSF

Related actions

- Ridges audit
- Action plans related to the management of the remaining green-and brownfield sites (untransformed, expansion and peri-urban areas)
- Action plans related to the management of protected areas

Action Plan 4.9: Position Ridges within the Larger Open Space Framework

Since ridges may act as both biodiversity 'stores' (local concentrations of biodiversity) and distribution channels (migratory corridors), they need to be properly included into an overall open space network. The importance and function of individual ridge systems or fragments will be dependent on the following considerations:

- Patch size
- Connectivity with migratory corridors and other open spaces
- Proximity to other open spaces
- Habitat requirements (minimum viable habitat fragment size, movement requirements) of indicator species

A ridge fragment may, for example, be required as an in situ habitat conservation area for an indicator invertebrate with low dispersal ability or simply function as a migratory corridor for small mammals. In the case of the former, maintenance of the habitat quality becomes crucial, whereas the latter would require appropriate shelter and connectivity through barriers around the ridge area.

Ridge systems will become increasingly important during times of climatic flux when species will utilise the microclimatic variance offered by topographical diversity in order to overcome pressures of shifting weather and climate patterns. New areas will be colonised by both migratory and immobile species slowly driven from their current locations, whilst migratory species will require the opportunities for movement both along ridges and up and down the slopes

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- There is a limited understanding of how ridges function within a larger ecological network.
- There are no clear objectives set for biodiversity conservation in the COJ

Constraints

Constraint	How will it be addressed in the activities?
1. Conservation objectives and buffer sizes can be disputed	Uncertainty is inevitable, but an approach that is defendable as best practice and best available information can be supported by stakeholders
2. Detailed, species-level and landscape-level ecological information is required.	Best-practice information on species and landscape interaction must be used as part of the ongoing monitoring and improvement process
3. Assumptions and guesswork will be inevitable	

Existing relevant plans, programmes and legislation

- NEMA:BA

- JMOSS & OSF

Related actions

- Other Ridges action plans
- Other conservation planning action plans

Action Plan 4.10: Development Boundaries and Management Actions

Encroachment boundaries and management requirements need to be defined for the ridges in Johannesburg. Both are however dependent on the outcome of the ridges audit and sensitivity classification.

It is therefore suggested that for the time being, a guideline be compiled that demarcates ridges where possible, and specify interim management actions for the ridge areas that can be applied ad hoc. A final guideline can be compiled once the necessary audit and sensitivity classification is completed.

The GDACE Development Guideline for Ridges can be used to demarcate the ridges south of, and including, the Roodepoort (Protea) Ridge and Linksfield Ridge. To the north of these ridge systems, the ridge environments are less prominent, and may safely be considered simply as open space areas.

The remaining open spaces that are found on ridges must be considered and managed in accordance with general conservation practices in the City, but must make provision for the ecological processes associated with the topographical dynamics. This includes the preservation of migratory corridors and habitat that form links both along the ridge system as well as across the contours (i.e. up and down the slope).

Of particular consideration should be the provision for a conservation buffer zone allocation in order to mitigate edge effects. In order to maintain the viability of ecosystem processes taking place in the core habitat areas on ridges, a buffer strip of 200 metres is required outside of the core areas. The size of the core areas will be determined by the sensitivity and function of the individual ridge patches, and be based on the minimum area required for the functioning of ecosystem processes such as 'hilltopping' by invertebrates. Buffer zones must be taken into consideration during the planning phases of developments and these areas should not only remain undeveloped, but remain as far as possible, unimpacted by the development activities.

Priority 2 Action (3 if you have a good sensitivity layer, but failing that, in the meantime you can come up with some interim management actions)

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- There is a limited understanding of how ridges function within a larger ecological network.
- Decision-making on ridges currently fails to take into account ecological issues on scale that is relevant to the COJ municipal level.
- A universal and detailed guideline that is accessible to all municipal decision-makers will simplify coordination

Constraints

Constraint	How will it be addressed in the activities?
1. Conservation objectives and buffer sizes can be disputed	Uncertainty is inevitable, but an approach that is defendable as best practice and best available information can be supported by stakeholders
2. The ridges audit could take a long time to complete	Best-practice information on species and landscape interaction must be used as part of the ongoing monitoring and improvement process

Existing relevant plans, programmes and legislation

- GDACE Development Guideline for Ridges
- WMLC ridges policy
- Biodiversity Act
- JMOSS & OSF

Related actions

- Other Ridges action plans
- Other conservation planning action plans

Species and ecosystems of special concern

Situated in the transitional zone between grasslands and savanna, the Witwatersrand exhibits a high biodiversity, especially with regards to vegetation. Many of the species found in Gauteng are endemic to the region and South Africa, and various unique grassland types are found in the Johannesburg area. As a consequence, a need exists to provide some form of management and protection to species or ecosystems that are particularly vulnerable, of special concern, or of importance to conservation ideals.

The conservation of special ecosystems or individual species will ensure that the ecological functioning of the natural systems is not lost. It may very well be the case that an endangered insect represents the best suitable pollinator of unique grassland plant species, and should the insect disappear, so could the plant. Applying this reasoning to the urban ecosystem in general, leads to the concern that those vital elements of the grasslands ecosystem might be lost, leading to a complete collapse and transformation of the remaining natural systems. All associated ecosystem services would then need to be substituted.

The maintenance of a quality environment in Johannesburg further relies, in part, on the protection of some of the original grassland habitat and typical Highveld grassland fauna species. Some iconic species are found in Johannesburg, such as the Giant Bullfrog and Black Eagle. These species are popularly perceived as indicators of the health of the natural system, and therefore also of the perceived quality of the environment. Some effort therefore needs to be expended to preserve viable habitat for such 'indicator' species.

Another consideration with regards to ecosystems and species of particular concern is that there are legislated responsibilities with regards to rare and/or endangered species that need to be upheld. This is specifically relevant in protected areas, where endangered grassland species are likely to be found, and where the responsibility for their conservation lies with the City as management authority or land owner.

In principle, the protection and conservation of species require that sufficient suitable habitat be conserved for the species to complete their life history processes. The determination of what constitutes 'sufficient habitat' will differ between species, but ultimately needs to identify enough space to offer the species shelter, foraging and migratory opportunities (short term individual movement and long term population migration). Where individual populations of species are identified as worthy of conservation, the application of three different conservation zones around the population is required – firstly, a delineation of the population that allows for a slight overestimation (in the order of 30m beyond the definite population edge), secondly, a habitat area that is calculated according to the species' life history requirements, and thirdly, a buffer on the outside of the habitat area that will mitigate detrimental impacts on the species and its habitat (at least 200 meters).

A recent, and additional, concern is the effect that climate change might have on sensitive species. The climate in Johannesburg will likely become generally drier, with more concentrated and severe rainfall events, as a result of global warming. By implication, sufficient buffering or migratory opportunities must be allocated to species and systems of concern, in order to not confine them to locations and habitats that might become uninhabitable over time.

Action plans for species and ecosystems of concern therefore are:

- Identifying specific species or ecosystems of concern
- Determining what the conservation requirements for these species or ecosystems are
- Identifying the locations where these species or ecosystems persist
- Drawing up management plans for the identified locations, or incorporating the conservation requirements into existing management plans

Action Plan 4.11: Identifying specific species or ecosystems of concern

Identifying specific species or ecosystems of concern is the first step towards an informed and structured conservation strategy for such features. Although a general approach of identifying 'threatened species, grasslands, ridges, dolomite and watercourses' as ecosystems of special concern (as per the biodiversity assessment) can be applied on an advocacy basis, it does not guide decision making at a site and project specific level. It is necessary to use the most current information on species and ecosystem occurrence and value to decide on a list of such features that are considered worthy of special attention in Johannesburg. It will also determine how the City responds to the conservation needs of these features.

The valuation of species and ecosystems must be based on the following criteria:

- Ecosystem Services
- Threatened status
- High use value (direct use and subjective 'presence' value)
- Endemism

The information used in this determination must include up to date databases of sensitive species, especially Red List species, as compiled by SANBI, GDACE and the COJ (or its entities such as JCP)

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Integrating biodiversity concerns into development planning
- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- 1. Uncertain land use decision-making due to vague conservation objectives
- 2. Generalised open space management practices that fail to specifically provide for habitat and species of concern

Constraints

Constraint	How will it be addressed in the activities?
1. Subjective perspectives will be involved in identifying species of concern, and ecosystems of social value	The process of compiling the list must prepare for, and manage, a multi-stakeholder environment. Working relationships must be established and maintained with relevant information custodians
2. Up to date information on specific species or ecosystems might be hard to obtain	The sensitivity of species can be described according to the criteria provided in the Threatened or Protected Species Regulations, 2007 (specifically Regulation 15 on conducting risk assessments)

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF
- COJ Biodiversity Assessment

Related actions

- Action plan relating to the Setting conservation objectives

Action Plan 4.12: Determining conservation requirements

Following the identification of species or ecosystems of special concern, it must be determined what the conservation requirements for these species or ecosystems are. This can be done in conjunction with the general conservation strategy of the City, but in some cases, the 'special concern' requirements will differ from the overall conservation strategy due to subjective valuations being allowed.

Conservation requirements include:

- Specific life history requirements for individual species of concern, or system interrelationships for ecosystems
- Requirements for ecological linkages or connectivity
- Specific conservation targets for species population dynamics or ecosystem function
- Scope for adaptation to climate change (both as spatial buffers and policy approaches)

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Integrating biodiversity concerns into development planning
- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Minimising the impacts of threatening processes on biodiversity, enhancing ecosystem services and improving social and economic security

Main problems this action will address

- Generalised open space management practices that fail to specifically provide for habitat and species of concern
- Climate change pressures will force sensitive or habitat specific species into new areas, therefore rendering additional buffering vital

Constraints

Constraint	How will it be addressed in the activities?
1. Up to date information on specific species or ecosystems might be hard to obtain	Working relationships must be established and maintained with relevant information custodians
2. Conservation and management requirements may be disputed	'Popular' species or ecosystems are often part of larger ecological systems that offer ecosystem services, and these could be used to motivate for conservation action
3. Popular conservation features may not warrant special conservation measures, yet garner enough subjective support to merit special attention	

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF
- COJ Biodiversity Assessment

Related actions

- Setting conservation objectives
- Climate change adaptation strategy

Action Plan 4.13: Identifying the locations where species or ecosystems of special concern persist

Part of the overall conservation strategy for the City will be a land cover assessment, which identifies the remaining untransformed or natural areas that remain in the municipal area. This assessment must be used to inform a spatial representation of where special concern biodiversity elements are found. A spatial overview will focus conservation efforts and inform land use decision making.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integrating biodiversity concerns into development planning
- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Minimising the impacts of threatening processes on biodiversity, enhancing ecosystem services and improving social and economic security

Main problems this action will address

- Generalised open space management practices that fail to specifically provide for habitat and species of concern
- Uncertainty with regards to the presence and location of sensitive biodiversity features

Constraints

Constraint	How will it be addressed in the activities?
1. Up to date information on specific species or ecosystems might be hard to obtain	Working relationships must be established and maintained with relevant information custodians
2. Land cover assessments are costly	Set aside funding to develop the landcover layer as a priority activity

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- JMOSS & OSF
- COJ Biodiversity Assessment

Related actions

- Setting conservation objectives
- A land cover assessment for the City

Action Plan 4.14: Management plans for species and ecosystems of special concern

The interplay between the different conservation requirements for the different species or ecosystems, and the spatial or developmental contexts where these features occur, will require customised conservation management plans. New management plans for the identified locations might be required, or the conservation requirements may be incorporated into existing management plans. Management plans must however make provision for:

- Species or ecosystem specific conservation requirements
- Access and usage needs or rights
- Ongoing monitoring and status reporting

In addition, a pro-active approach by the City would be to set up specific monitoring programmes and rapid response systems to respond to illegal activities impacting on listed Threatened or Protected Species (TOPS). This would target wildlife and natural product traders such as nurseries, private zoos, pet stores, cycad collectors, etc. and ensure compliance with permitting requirements and conditions. The response actions need to include a rapid information dissemination system and close cooperation with "Issuing Authorities" designated by the TOPS Regulations and "Green Scorpion" units.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Integrating biodiversity concerns into development planning
- Creating a quality living environment
- Minimising the impacts of threatening processes on biodiversity, enhancing ecosystem services and improving social and economic security

Main problems this action will address

- Generalised open space management practices that fail to specifically provide for habitat and species of concern
- Delayed responses to illegal activities relating to threatened species

Constraints

Constraint	How will it be addressed in the activities?
1. Up to date information on specific species or ecosystems might be hard to obtain	Working relationships must be established and maintained with relevant information custodians The implementing agency, whether public, private or in combination, must be made aware of the motivations behind the specific management actions.
2. Proper implementation of management plans is always problematic.	The application of conservation objectives must be used as reference when making management decisions during day-to-day activities

Existing relevant plans, programmes and legislation

- JMOSS & OSF
- COJ Biodiversity Assessment

- JCP operational processes

Related actions

- Action plan for the identification of conservation requirements

Action Plan 4.15: Determine the values and uses of biodiversity to local communities and households and identify opportunities for sustainable management of biological resources

In order make more appropriate decisions on the way biodiversity and land are managed it is necessary to know who is making use of biodiversity resources and for what purposes (e.g. food or medicinal). This activity acknowledges the role that biodiversity plays in people's livelihoods and should attempt to find means to increase the benefits derived from biodiversity while at the same time developing better management tools to ensure the long term sustainability of those biodiversity resources.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Ensuring the sustainable protection and use of biodiversity
- Acknowledging the value of the ecosystem goods and services in Joburg
- Sustainable development

Main problems this action will address

- Unsustainable harvesting of biodiversity
- A lack of understanding of the social and economic values of biodiversity

Constraints

Constraint	How will it be addressed in the activities?
1. A lack of a holistic understanding of the valuable species occurring within the city and their contribution to livelihoods	Development of a database of useful and valuable species within the city
2. Overexploitation or loss of species	Specific protection plans for valuable species
3. A poor understanding of the important ecological spaces within the city	An audit of biodiversity and ecosystem spaces within the city

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- GDACE Red list plant species

Related actions

- Action plan to develop an audit of ecological spaces within the city
- Action plans relating to invasive species
- Action plans relating to education and awareness raising

Action Plan 4.16: Protect and conserve Red Data fauna and flora species

According to the Biodiversity Assessment (Ref), the following areas within the COJ have high value for the conservation of biodiversity, specifically with reference to vegetation and plant species:

1. Location and potential habitats for Red / Orange List plant species,
2. Remaining areas of Egoli Granite Grassland,
3. Dolomite areas, especially where there are chert outcrops,
4. Ridges and koppies

Currently within the City there are 26 red data flora species, 51 mammal species and 37 invertebrate species (Draft State of Environment Report, 2009)

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Reduction in filtration efficiency of wetlands

Main problems this action will address

- Loss of indigenous species and their natural habitat though urbanisation and degradation of land
- The spread of invasive plant species,
- Overgrazing and overexploitation of biodiversity
- The deterioration of ecosystem goods and services

Constraints

Constraint	How will it be addressed in the activities?
1. Not having a good understanding of the status and location of the important and red list species in Joburg	An audit of biodiversity and natural habitat in Joburg
2. Decreasing habitat availability for Red Data species	Protection of the remaining intact sites of natural habitats, particularly those areas known to have resident red data species
3. Loss of indigenous vegetation	

Existing relevant plans, programmes and legislation

- GDACE Red list plants policy
- GDACE Ridges Policy
- National Biodiversity Strategy and Action Plans – specific plans for red list species
- NEMA
- Convention on Biological Diversity

Related actions

- Ridges Audit action plan
- Watercourses action plans
- Classify ecological open spaces into a system of core and satellite nodes

- Other urban ecological network action plans

Action Plan 4.17: Protect and conserve the remaining intact habitat patches of the Grassland biome within the City of Joburg

The NSBA (Driver et al, 2005) and the GDACE C-Plan identify Grasslands as the important biome within Joburg that has largely been transformed due to urban development. As a result the remaining portions of intact habitat are often the last remaining examples of that ecosystem type and thus should be afforded a high level of protection (e.g. the Egoli Granite, Rand Highveld, Soweto Highveld and Tsakane Clay Grassland types).

The Egoli Granite Grassland makes up the largest vegetation type in the CoJ covering 42.9% of the Municipality and is endemic to the Gauteng Province (CoJ Biodiversity Assessment). It is thus the most sensitive vegetation type to urbanisation and transformation of the vegetation type and is a priority for biodiversity protection.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Protection of important biodiversity habitat
- Protection of ecosystem goods and services
- Protection of species endemic in Joburg

Main problems this action will address

- Loss of primary grassland habitat
- Fragmentation of natural habitat

Constraints

Constraint	How will it be addressed in the activities?
1. Grasslands are under high pressure from developers and are often lost	Identify important grassland sites and ensure their protection as core ecological spaces Set quantitative targets for the conservation of grassland habitat (linked to NSBA habitat targets)
2. Uncertainty as to where the remaining intact pristine areas of grasslands are	Complete an audit of ecological resources and habitats within the city and include this as part of the city wide environmental policies
3. Ad hoc decision making	Ensure that all sites of pristine habitats are declared no-go zones and that no developments are allowed there. Ensure that all city departments are aware of the no-go sites
4. Ongoing encroachment of urban development into pristine habitat areas	
5. Uncertainty on the extent of the remaining Habitat of Egoli Granite Grassland	Prioritise the conservation effort of Egoli Granite Grassland

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- National Biodiversity Strategy and Action Plan
- NEMA: Biodiversity Act
- Joburg Open space Framework

Related actions

- Audit of ecological features and sensitive areas within the CoJ
- Actions relating to institutional development to protect biodiversity

Action Plan 4.18: Develop and maintain a database of all red data species within the city

Red Data species locations must be documented and no development or access should be permitted within the Red Data habitats, potential habitats or buffer zones as per the GDACE Red Data Plants Policy (GDACE, 2001 b).

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Developing an understanding of the ecological features and sensitive areas within Joburg
- Protection of ecological goods and services

Main problems this action will address

- Loss of endemic species
- Poor information on biodiversity values of land during develop decision making

Constraints

Constraint	How will it be addressed in the activities?
1. Uncertainty of what red data species occur where in the city	Audit of sensitive areas and important species in the city
2. Habitat fragmentation through urban expansion	Enforcement of the urban edge
3. Uncontrolled development of ridges	Enforcement of the ridges policy
4. Alien invasive species pushing out endemic species	Better control of invasive species
5. lack of awareness of the importance of red data species	Education on the role and value of red data species in Joburg

Existing relevant plans, programmes and legislation

- GDACE Red list plant policy
- NEMA, particularly the EIA regulations for development applications
- NEMA: Biodiversity Act

Related actions

- Action plans for the control and eradication of alien invasive species
- Audit of ecological features and sensitive sites in Joburg
- Actions for environmental education and awareness

Action Area 5: Social Open Spaces

Within this biodiversity strategy it is important to make a distinction between spaces designated primarily for biodiversity (and the ecological goods and services they provide) and social spaces (and the associated social services they provide. While the focus of this BSAP is on biodiversity and spaces for biodiversity, social spaces (e.g. parks, recreational facilities) can play a vital supportive role within a large urban environment like Joburg.

Resilience in built-up areas

The sustainability of urban environments is closely related to the resilience of the urban ecological system, or differently put, the ability of the urban ecology to withstand and adapt to changes and shocks. If it is considered that the urban ecology provides important services that cannot adequately replaced by engineering interventions, and that the social and natural environments are no longer differentiable, then it stands to reason that the resilience of the ecosystem will be wound tightly within the social (developed) spaces of the city.

Natural systems are inherently resilient but just as their capacity to cope with disturbance can be degraded, so can it be enhanced. The key to resilience in social-ecological systems is diversity. Biodiversity plays a crucial role by providing functional redundancy. For example, in a grassland ecosystem, several different species will commonly perform nitrogen fixation, but each species may respond differently to climatic events, thus ensuring that even though some species may be lost, the process of nitrogen fixation within the grassland ecosystem will continue. Similarly, when the management of a resource is shared by a diverse group of stakeholders (e.g. local resource users, research scientists, community members with traditional knowledge, government representatives, etc.), decision-making is better informed and more options exist for testing policies[3].

Built-up and landscaped areas represent spaces that demonstrate the integration between the natural and social realms most clearly. Despite being completely 'artificial', in the sense that they are anthropogenic in origin and likely to not resemble natural untransformed open spaces, landscaping and built-up areas may contain various elements of the natural environment such as water features and vegetation thickets. Since these two land uses constitute the majority of the urban surface area, they have significant influence on to the biodiversity and ecological systems of cities, and therefore also the general resilience of the urban environment.

The influence of the artificial spaces is generally assumed to be detrimental to biodiversity and conservation purposes. However, the impact can be mitigated by designing these spaces in a manner that will mimic ecosystem functions as far as possible. Elements to consider include:

Water bodies & watercourses

Many urban parks are landscaped around impoundments, or are adjacent to linear water features. In addition, micro-containment can be present in parking areas or within walled gardens. Such spaces should be designed in a manner that can mimic the function of wetlands, in order to retain water for a period of time whilst groundwater recharge and the removal of pollutants or sediment can take place. Naturally, waterbodies and wetlands also become havens for various fauna species, especially birds, irrespective of their origin.

Engineered stormwater management networks should not be neglected though. Per definition, these systems offer a city-wide interconnected network of pipes and retention structures that potentially offer migratory routes to small fauna species. Stormwater channels and pipes may therefore be designed in a manner that allows small animals to enter and escape from the system, especially where sections of the structures link through underneath environmental barriers such as roads or between open space areas.

[3] The Stockholm Resilience Centre, www.stockholmresilience.org

Vegetation cover

Johannesburg is popularly referred to as the 'largest man-made urban forest' on account of the number of trees distributed throughout the built-up spaces of the city[4]. On the one hand, this appears to be a positive feature of the city, but several arguments to the contrary can be made. The main counter argument relate to the fact that Johannesburg falls within a grasslands biome, which negates the contribution that the trees make to regional and national conservation efforts. The wide distribution of trees in the city is also indicative of the relatively poor utilization of space since the trees occur mainly in sprawling suburban areas. Within a transformed natural system, however, it may be accepted that alternative vegetation categories will occur. Ideally, the afforestation should function in a supportive capacity for the remaining endemic grasslands in order to improve the resilience of the natural patches. This can be achieved through the exclusive cultivation of endemic or indigenous species, the co-location of trees and other natural elements, and the active removal of weeds and invasive species. Private space in the form of private open space or 'eco-friendly' developments that incorporate open space and biodiversity into urban functions can be important contributors as they often incorporate large land portions. Even artificial green space such as green (planted) roofs will contribute to the overall network.

A large component of the artificial natural surface of urban areas consists of grassed lawns and landscaping. These grassed areas are limited in their contribution to the urban biodiversity as a result of the ubiquitous monocropping. Nevertheless, they do present opportunities and support for certain species that have adapted to urban contexts. Many birds will use manicured lawns to forage for insects, whilst more natural landscaping with longer grasses offer seeds as food source. Longer grasses also function as shelter to small animals, even if the grass is mowed from time to time.

In terms of social resilience, the tree cover of Johannesburg contributes to a general improvement of the quality of life of residents. The larger the city, the more value is ascribed to open space and the biodiversity contained therein. 'Forests' can therefore become a reconstruction of the countryside in the city or important facilities for open air recreation.

Shelter

Generally speaking, fauna species require three things for survival – living space, food and shelter. More often than not, shelter in urban contexts will not resemble the types of shelter found in untransformed environments, yet fauna species will exploit many of the opportunities presented by the man-made environment. Bats and birds roost under roofs, insects find crevasses in walls, and many small mammals will find shelter in engineering structures such as stormwater drains. Environmental quality will, however, be increased if the shelter found in parks and other natural open spaces can be retained, preserved or restored. Appropriate shelter such as grass thickets, reedbeds, mature trees, rocky outcrops and islands in dams will attract many indigenous species whilst improving the social perception of the urban environment.

The security offered to animals by appropriate shelter will be diminished by pollution, especially 'nuisance' impacts such as noise, light and litter. It is therefore necessary to limit the amount of light spilling into natural open spaces, and the establishment of buffer zones between polluting activities and core shelter areas.

The development and protection of green spaces within the city also has a number of socio-economic benefits for local communities and inhabitants. These may include:

1. Enhanced the ecotourism potential
2. Job Creation throughout the various processes in the project programme plans
3. Enhancement of property value of adjoining residential areas.

[4] The definition of 'man-made urban forest' is, in fact, pushed to the limit by this description. More correctly, the term 'urban forest' would refer to a contiguous wooded area within an urban context that allows for ecosystem functions typically associated with forests. A better example of a 'man-made urban forest' is Tijuca National Park that was created within the city limits of Rio de Janeiro, following the large-scale rehabilitation of agricultural lands.

Action Plan 5.1: Include biodiversity considerations in property development and real estate guidelines and best practice codes to mitigate negative impacts on biodiversity

While ridges, wetlands are extremely important, each open space should be assessed for its value toward biodiversity and ecological processes. This includes privately own properties. Any open space has diversity or the potential for diversity and can contribute to the sustaining of ecosystem processes. What plant/animal/habitat may not be threatened now may be threatened in a few years time.

All new developments have potential to add valuable open space for the people of the City. Where trade offs for parcels of land are made the city should accept as much land as possible, and not payment in kind. These spaces should then be managed appropriately for their individual contribution to biodiversity protection.

Expansion of housing estates and resort development is a substantial contributor to habitat loss and degradation in many biodiversity important areas, particularly near ridges and water courses. Much of the impact can be minimised through careful planning and avoidance of sensitive areas. Ironically, it is scenic beauty and biodiversity that is driving the development process and the industry would benefit from integration of biodiversity management objectives into plans and operations.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Maintaining ecological goods and services
- Ensuring the integrity of ecosystem processes
- Achieving and overall biodiversity protection target.

Main problems this action will address

- Increase of invasive species on private property
- Loss of valuable intact habitat sold to private developers
- Maintenance of important ecological features on private land

Constraints

Constraint	How will it be addressed in the activities?
1. Many private developers develop regardless of environmental legislation or rules	Stronger enforcement and monitoring of development activities
2. The 30m riparian buffer is not always observed and valuable riparian areas are degraded or lost on private properties	
3. It is difficult to control or monitor what happens on private properties	
4. Alien invasive plants are used for landscaping, and destroy local vegetation and reduce the habitat for local species	Awareness raising of the value of indigenous species
5. Lack of awareness of local buyers and community members of what environmental best practice would entail	Develop and communicate best practice guidelines for estate development and residential development in line with biodiversity needs

Existing relevant plans, programmes and legislation

- GDACE C-Plan
- GDACE red list and ridges policies
- NEMA (particularly EIA guidelines for developments)
- CoJ Catchment Management Policy
- CoJ Wetlands Audit
- CoJ buffers policies
- CoJ Open Space Framework

Related actions

- Action plans related to maintaining riparian buffers
- Awareness raising action plans
- Watercourse action plans
- Alien invasive species action plans

Action Plan 5.2: Ensure the allocation for socio-economic space of 2.4ha per 1000 people is implemented (from the OSF)

The Open Space Framework (2008) for Joburg sets a standard of 2.4ha/1000 people for social open space. This value excludes provision for ecological space, but does include floodplains only where they can be used for recreational purposes. According to the City's GMS many areas within the city do not have enough social open space, and this is a priority to ensure adequate open space. These open spaces are varied and can include parks, sports fields, play areas and hard open spaces. When developing this social open space an opportunity exists to ensure that this social space network is aligned with the Ecological network.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Ensuring an adequate level of social open space to the citizens of Joburg
- Ensuring a network of open space that are connected to each other
- Where possible and feasible linking social to ecological spaces to provide increased benefits and linkages

Main problems this action will address

- A shortage of open spaces in some areas of Joburg
- Poorly connected open spaces
- Increased amount of open space in areas where densification or a high level of urban development is being experienced.

Constraints

Constraint	How will it be addressed in the activities?
1. Pressures to develop open land rather than provide open space	Reserve open space requirements into all spatial planning activities (e.g. SDF and GMS) Enforce the allocation of social open space in all development projects
2. Poor provision of linking spaces in Joburg	Provide some linear connected spaces like pedestrian and bicycle paths. These should be prerequisite guidelines for all urban development. Develop a spatial plan of all social spaces in Joburg and analysis the extent of linear connections and the potential for further connections.
3. Social spaces are often not accessible or unsafe to use	Ensure that spaces are centrally located, easily accessed by different means of transport, visible, have safe pedestrian crossings, and that entrances are easily identifiable The design of parks should discourage anti social behaviour Adequate lighting of parks is necessary, and landscaping should not allow hiding places for criminals

Existing relevant plans, programmes and legislation

- JMOSS
- OSF

Related actions

- Development of the urban ecological framework for Joburg
- Provision of adequate ecological spaces

Action Plan 5.3: Social open spaces should be landscaped with indigenous species

Social open spaces should be landscaped in a manner that minimizes maintenance costs and water and resource use. The spaces should be landscaped with indigenous species that use less water than invasive species and may provide micro habitats for species (e.g. birds). Fruit bearing and pollen bearing flora species will encourage birds and invertebrates in the areas.

Where lawn areas are necessary (e.g. sports facilities) only grass species that require less water and are not invasive should be used. By following a water wise planting scheme irrigation can be zoned to minimize the use and loss of water.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Ensuring the protection of indigenous species
- Providing habitat for migratory species
- Limiting the use of natural resources and water in public spaces

Main problems this action will address

- The spread of invasive alien species
- Reduced water availability by the water use of invasive plants
- loss of indigenous species that are out competed by invasive plants

Constraints

Constraint	How will it be addressed in the activities?
1. Many parks, particularly in northern Joburg are extensively covered with invasive species	Systematically replace high water using invasive plants with indigenous plants and trees
2. A lack of knowledge of the value of indigenous species	Environmental awareness of the role of indigenous biodiversity within the city and the options available.
3. Large tracts of invasive lawn species cover many city parks	Systematic replacement of invasive grasses with indigenous species

Existing relevant plans, programmes and legislation

- NEMA: Biodiversity Act
- Regulations and bylaws for the removal of invasive plant species

Related actions

- Action plans relating to species of special concern
- Action plans relating to invasive alien species

Action Area 6: Services and utilities (servitudes)

Infrastructural services and urban utilities are primarily concerned with the provision of water, sanitation, electrical, waste management, transport and gas within the City of Joburg. These services and utilities occupy certain premises, facilities and servitudes that provide such services such as landfill sites, cemeteries, reservoirs, water pipelines, depots, and sub-stations. Servitudes are linear tracts of land that are set aside or reserved for planned or existing services such as power lines, road reserves, water pipelines, etc.

The primary functioning of these is for service delivery within the urban context, but there is potential to supplement ecological and recreational functioning of the city as well. Services and utilities can contribute to ecological functioning by providing habitat enclaves once the facility has been closed, rehabilitated and developed as such (e.g. landfill sites and cemeteries); providing ecological goods and services (e.g. reduce urban heat islands by vegetating and landscaping depots); or ecological movement corridors and linkages (e.g. electrical servitudes and railway lines).

The difficulty in achieving these goals is compounded by the fact that these services and utilities are owned and managed by a multitude of CoJ Departments and Municipal Owned Entities, including Pikitup, City Power, JRA, Joburg Water, City Parks, Egoli Gas, etc. Efforts to improve the biodiversity of these areas and therefore improved ecological functioning of the city would have to address a wide range of stakeholders and deal with specific circumstances and objectives of these departments and MOEs in order to be effective.

The CoJ Open Space Framework acknowledges that these (cemeteries, landfill sites, road reserves, etc) are “potential open spaces and forms part of the bigger green network” yet “no specific strategies or policies are developed for these areas” (CoJ OSF, Policies, pg 9). Therefore no policy framework or strategy exists to assist in decision making and the allocation of resources to areas used for services and utilities.

An example of how areas used for services and utilities can enhance biodiversity with the CoJ is the issue of waste management and its associated infrastructure. Joburg is experiencing high levels of investment into infrastructure development and the expansion of the built environment. The opportunity exists to reduce the City’s ecological footprint by recycling and reusing as much of the waste materials possible (as opposed to illegal dumping or expanding landfill sites). This will also contribute to a cleaner and greener city which will promote the positive use and add value to existing open spaces as opposed to being derelict, polluted and unsafe spaces. In addition, existing landfill sites can be managed in such a way as to promote biodiversity. This can be achieved through vegetation and landscaping of the site; protection of certain areas in their natural state; and ongoing rehabilitation initiatives to ensure enhanced biodiversity once the facility has been closed. Ultimately this will have benefit to the ecological functioning of the city and enhanced biodiversity.

In addition, there are other related services and utilities that are not under the control of the City of Joburg (such as education facilities, cultural historic places, tourism sites, airports, health care facilities, and other private institutions) that could contribute to improved ecological functioning of the city. Partnerships to encourage sound ecological management of these areas should be encouraged, and successes celebrated and widely publicised.

Action Plan 6.1: Appropriate planning, design and management of services and utilities to enhance biodiversity

In order to promote enhanced biodiversity in the City of Joburg any interventions should ensure that such facilities and services are planned, designed and developed in such a way as to enhance their potential to function optimally ecologically. Interventions should include the following:

- Supplement the CoJ Open Space Framework by undertaking an assessment of these services and utilities to determine location and ownership, and to propose management interventions to improve the ecological functioning of these;
- Provide input regarding the appropriate siting and location of services and utilities to minimise negative impacts on sensitive environments;
- Ensure compliance to legislated processes (i.e. Environmental Impact Assessment) from all CoJ departments and MOEs relating to the upgrading, expansion and development of services and utilities;
- Assist with the formulation of Environmental Management Plans to assist CoJ departments and MOEs regarding the daily operations of these services and utilities to minimise negative impacts on the environment and enhance positive outcomes;
- Planned in such a way as to enhance the connectivity and linkages to other natural areas or open spaces and designed to allow for the movement of small mammals, reptiles and birds;
- Designed to allow for public access as areas to walk along bearing in mind design, use and public safety aspects thereby promoting the positive use and value attached to these areas (as opposed to being derelict and unsafe spaces).

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- A quality urban environment
- Mainstreaming biodiversity concerns into other sectors and programmes
- Integration of biodiversity management into the governance structure
- Improvement in human well-being
- Improvement in urban ecosystem well-being
- A comprehensive conservation network

Main problems this action will address

- Lack of awareness of the role of biodiversity management and the ecological goods and services the environment provides for the city;
- Improved city image and quality urban environment if these areas are rehabilitated and maintained so as not to be derelict, polluted and unsafe spaces; and
- Contribute to improved connectivity/ linkages and creation of habitat thereby enhancing biodiversity in the city.

Constraints

Constraint	How will it be addressed in the activities?
1. Limited information as to the location and ownership of the areas used for services and utilities (including servitudes)	Comprehensive assessment and audit of these areas as part of the annual Spatial Development Framework review process on a regional basis

Existing relevant plans, programmes and legislation

- JMOSS and Open Space Framework
- GMS
- IDP and SDFs

Related actions

- Awareness raising and education
- Development of an Ecological network
- Clearing of alien invasive species
- Governance

Action Plan 6.2: Use indigenous species for landscaping and rehabilitation of areas used for services and utilities

In order to promote enhanced biodiversity in the City of Joburg any facilities and services should be:

- vegetated with indigenous vegetation to provide suitable habitat for a variety of species as these services and utilities are usually significantly transformed or degraded;
- maintained in such a way as to enhance natural vegetation and the provision of habitat (e.g. grass should not be cut to horticultural standards but rather to encourage a more natural state thereby enhancing its ecological functioning);
- rehabilitated or regenerated to a natural state through the removal of alien vegetation (e.g. Working for Water/ Wetlands Programme).

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- A quality urban environment
- Mainstreaming biodiversity concerns into other sectors and programmes
- Integration of biodiversity management into the governance structure
- Improvement in human well-being
- Improvement in urban ecosystem well-being
- A comprehensive conservation network

Main problems this action will address

- Lack of awareness of the role of biodiversity management and the ecological goods and services the environment provides for the city;
- Improved city image and quality urban environment if these areas are rehabilitated and maintained so as not to be derelict, polluted and unsafe spaces; and
- Contribute to improved connectivity/ linkages and creation of habitat thereby enhancing biodiversity in the city.

Constraints

Constraint	How will it be addressed in the activities?
1. Limited funding for the rehabilitation and maintenance of these areas	Enhanced Open Space network and Biodiversity management, and ecological goods and services that these areas provide as a motivation for operational funding Motivate for the implementation of the Working for Water/ Wetlands programmes specifically focusing on premises, facilities and servitudes for services and utilities Arrange council work parties in partnership with the community (schools, NGOs, etc) to clean-up these areas and raise awareness regarding the ecological value of areas used for services and utilities
2. Limited knowledge and capacity to maintain these areas appropriately (in a more natural state)	Formulation of Environmental Management Plans to assist other departments and Municipal Owned Entities in the daily management and operation of these premises, facilities and servitudes
3. Limited resources and knowledge of private landowners and other government departments/ institutions that own and manage areas used for services and utilities (e.g. education facilities, cultural historic places, tourism sites, airports, health care facilities, and other private institutions)	Partner with private landowners and other government departments/ institutions by encouraging sound ecological management of these areas; and provide administrative and financial support to existing appropriate community conservation initiatives; celebrate successes and publicise these widely

Existing relevant plans, programmes and legislation

- JMOSS and Open Space Framework
- GMS
- IDP and SDFs

Related actions

- Awareness raising and education
- Development of an Ecological network
- Clearing of alien invasive species
- Governance

Action Area 7: Invasive Alien Species

Invasive alien plant species (IAPs) are plant species that have been introduced into South Africa from other parts of the world, either intentionally or unintentionally, and have become naturalized *i.e.* are capable of reproducing and spreading without the direct assistance of humans. Introduced plants benefit greatly from being freed from the herbivores, seed-feeders and diseases prevalent in their native ecosystems. Their increased vigor enables them to suppress and physically displace indigenous plants. Most of our worst invaders also take advantage of periodic fires. Although they can sometimes spread slowly in mature veld, their tough, long-lived seeds are stimulated to germinate by fire, and their numbers/densities typically expand with every fire. Sensibly, the worst invaders have been declared weeds and landowners are required to remove them. Even severely invaded natural ecosystems can be cleared provided there is sound planning and implementation of a structured control programme. Effective IAS management is an essential part of the sustainable management of natural resources.

Description of the problem

Invasive alien plants have major economic, environmental and social impacts. In South Africa, invasive alien plants are the greatest threat to biodiversity after habitat destruction. Once invasive species dominate an area, most natural vegetation is displaced or out-shaded. Remaining soil-stored seed banks decline to the point where areas invaded for a decade or longer must be actively reseeded or replanted with indigenous material if rehabilitation is to be successful. Invaded sites have a much greater biomass and total leaf area than un-invaded sites. This results in reduced river and stream runoff from invaded catchments through increased evapo-transpiration and interception. Other more insidious impacts are less well known, but no less profound. In the last few years government-funded programmes like the Working for Water Programme have generated awareness of the ecological, economic and human costs of invasive plants.

The priority areas for alien plant control in Johannesburg are:

- Areas listed, or are in the vicinity of listed areas, in GDACE's C-Plan.
    - The ridges, streams and valleys in south east Joburg in the Mondeor/Glen Vista/Mulbarton area (south of the N12 and east of R28). The problem species here are predominantly black wattle trees but also bugweed, privet, syringe etc.
    - Moffat Park area, north of the N12 and east of N1 is invaded by black wattle and blue gum trees.
- Rietfontein Nature Reserve is infested with Lantana (which Working for Water is struggling to control).
- Klipriviersberg Nature Reserve is infested with black wattle, and Pom-pom weed has established on the reserve outskirts.
- Kloofendal Nature Reserve is infested with Pom-pom weed.
- Pom-pom weed has established in the Ruimsig Butterfly Reserve. Work is currently being done to control the infestation, but requires monitoring.
- Pom-pom weed has become well established on the boundary of the Glen Austin Bullfrog Pan and about 10 plants have recently been removed from within the pan area. This site is a priority for action.
- The Bushbaby Park has a variety of problem plants especially creepers (morning glory) in the bank vegetation.
- Langermanskop, Linksfield and Observatory ridges are invaded by a variety of plants and are GDACE listed ridge areas.
- Cumberland Bird Sanctuary is invaded by a variety of alien plants, particularly black wattle and Eucalyptus trees.
- Beaulieu Bird Sanctuary has been invaded by stands of Pom-pom weed.
- Alberts Farm is infested with giant Spanish reed.
- Florida Lake Park has dense stands of giant Spanish reed.
- Enoch Sontonga Hill (behind Vista University) and Pimville Koppie are invested with a variety of species that are threatening the natural landscapes.

- Cosmo City conservation area, where a variety of alien plants occurs along the streams and there is an area of relatively unspoilt grassland that requires protection

Infested water bodies:

- The Klipriver/Klipspruit wetland system (including Soweto and north-west Joburg) has a variety of alien plants growing there.
- Blue Dam is covered by water hyacinth and duckweed.
- Florida Lake is coved by an unidentified species of water lily
- Witkoppen Dam is infested with Kariba weed.
- Westdene Dam is infested with duckweed and Kariba Weed.
- Zoo Lake is infested with duckweed.
- Kingfisher bird sanctuary dam is infested with duckweed and giant Spanish reed.
- Florence Bloom bird sanctuary (Delta Park) is infested with water hyacinth
- In the Roodepoort area (mainly Constantia Kloof/Wilro Park area) the streams and ridges are quite badly infested with black wattle and Eucalyptus that is threatening the natural vegetation.

Action Plan 7.1: Manage invasive alien plants in the City of Johannesburg within the appropriate policy and legislative frameworks

Ensure that the management of IAPs in the City of Johannesburg is consistent with the relevant legislation to meet the legal mandates and commitments, and to assist landowners to become legally compliant.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Unclear legislation;
- The outstanding NEM:BA regulations;
- Legal mandates not assigned or delegated.

Constraints

Constraint	How will it be addressed in the activities?
1. Outstanding NEMBA regulations	• Identify and address the legal and policy constraints to effective IAP management in the City of Johannesburg;
2. Poor understanding of the legal and policy constraints to IAP management	
3. No assignment and/or delegation of legal mandates for different groups of IAP under NEMBA.	Recommend assignment and/or delegation of legal mandates for different groups of IAP under NEMBA
4. Currently no structured system of incentives and disincentives to help encourage compliance.	Implement incentives and disincentives to encourage compliance;
5. No concerted and structured advocacy efforts to obtain political support for the implementation of IAP management	Muster political support for the implementation of the IAP strategy.

Existing relevant plans, programmes and legislation

- Conservation of Agricultural Resources Act No 43 of 1983
- Section 151(1) of the National Water Act 36 of 1998
- Section 28 of the National Environmental Management Act, 107 of 1998;
- Section 31A of the Environment Conservation Act, 73 of 1989;
- National Veld and Forest Fire Act 101 of 1989
- Municipal by-laws and common law relating to neighbours and nuisance

Related actions

- Governance related action plans

Action Plan 7.2: Harmonize the actions of all role-players through strategic planning

Provide a framework for all the role-players in the City Of Johannesburg to harmonize their activities through strategic planning. This involves strategic alignment with other programmes, *viz* Stewardship and landscape initiatives, ensuring efficient IAP management.

Prioritization should be based on sound scientific principles and on assessments that include factors such as evaluation of the threat, the costs and benefits of different approaches, and an evaluation of the probability of success of the intervention. Initial interventions should not be undertaken if insufficient resources are available to complete follow-up actions at a later stage. An incomplete clearing program often leads to even worse infestations.

Planning should be undertaken on a regional scale, involving all relevant role-players, to ensure a consistent, coherent and effective approach to IAP Management. Role-players are to ensure that the allocation of resources for IAS management takes restoration and / or rehabilitation into account where necessary.

A flexible planning tool for prioritization of IAP interventions must be implemented by all role players to ensure well-informed decision-making. Resource economic cases for the management of IAP need to be built up to ensure adequate and sustained resource allocations are made by the relevant decision makers.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Prioritization is not scientifically based and does not include cost and benefit assessments of interventions.
- Planning and prioritization of IAPS management in the region is fragmented and lacks coordination and alignment amongst key role-players and stakeholders, as well as with relevant strategies such as Global Climate Change and Fire.
- Resource allocation is not informed systematically by priorities at appropriate scales, resulting in uncoordinated and haphazard management interventions.
- Lack of coordinated management interventions such as prevention, early detection and rapid response results in new invasions going unattended and often becoming established problems with detrimental effects in terms of biodiversity and other costs.
- A flexible decision-making tool does not exist and role players mostly decide in isolation where and what interventions are implemented.
- The overall allocation of resources to IAPS management is not based on objective measures, and as such is often subject to the whims of individual decision makers.
- Long term control strategies cannot be successful unless assured funding at appropriate levels is made available.

Constraints

Constraint	How will it be addressed in the activities?
1. No existing centralized data base with all available IAP information pertaining to distribution, densities and control efforts.	Collate and capture all existing spatial and non-spatial data in terms of where the various role players are currently controlling IAPs; Prioritize land units for control in terms of biodiversity, catchment values, wildfire risk and security issues
2. Available data not all spatially-explicit	Collate spatial data pertaining to critical biodiversity network and units, open areas and other state owned-properties;
3. No generic prioritization system in place in terms of focusing and scheduling of IAP control operations to inform planning and decision-making;	Capture species information, *i.e.* species suites, densities, age classes
4. Different priorities between role players, *e.g.* obligations in terms of biodiversity, water catchment values, community safety, and wild fire management, and subsequent resistance to a generic prioritization system;	Develop a spatial decision support tool for prioritization and scheduling of IAP control;
5. No resource economic cases for the scale and duration of funding required for the major components of the IAP Strategy	Develop long term control plans which provide budgetary estimates and predict time periods required to bring infestations down to maintenance level

Existing relevant plans, programmes and legislation

- Conservation of Agricultural Resources Act No 43 of 1983
- Section 151(1) of the National Water Act 36 of 1998
- Section 28 of the National Environmental Management Act, 107 of 1998;
- Section 31A of the Environment Conservation Act, 73 of 1989;
- National Veld and Forest Fire Act 101 of 1989
- Municipal by-laws and common law relating to neighbours and nuisance

Related actions

- Governance related action plans

Action Plan 7.3: Appropriate awareness-raising, institutional arrangements and capacity-building implemented

IAP management is a shared responsibility that requires all role-players to have a clear understanding of their roles. All sectors of society need to improve their understanding of the potential risks and impacts of invasive alien species on the economy, society and the environment. Effective IAP management requires a coordinated approach to management supported by appropriate institutional arrangements. Capacity building across government, industry, land and water managers and the community is fundamental to effective IAP management. Capacity building should be undertaken in a strategic and catalytic manner, focusing on providing maximum support for the key actions required to implement the IAP strategy.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Both the public and decision-makers often have limited awareness and understanding of potential threats posed by IAPs and appropriate responses. This makes it difficult to mobilize relevant agencies and other stakeholders in controlling IAP.
- Lack of capacity within provincial departments and other agencies hampers effective IAPS management.

Constraints

Constraint	How will it be addressed in the activities?
1. A generally poor understanding and appreciation of the impacts of IAP at the economic, social and environmental levels;	Identify all stakeholders and target audiences; Develop appropriate and harmonized messages
2. Ignorance in terms of responsibilities;	Work with key stakeholders to disseminate information on IAP control; Develop and promote improved IAP control among public agencies and communities;
3. Poor political buy in;	Obtain high level buy-in and commitment from all relevant institutions and role-players to implement the IAP strategy;
4. Lack of capacity in terms trained and dedicated staff;	Investigate the feasibility of the establishment of representative coordinating body for IAP management in the City of Johannesburg, define roles, responsibilities and capacity requirements;
5. Uncoordinated efforts between various role players;	Establish the most appropriate representative and mandated coordinating structure in the City of

Constraint	How will it be addressed in the activities?
	Johannesburg to pursue the objectives of the strategy; Identify the areas where management capacity and training need to be improved and build capacity accordingly;
6. No dedicated budget for IAP management *per se*	Ring-fence funding for capacity building for IAP management; Encourage interventions that facilitate job creation to increase capacity in the field of IAP management, whilst contributing to the economy and improvement of human livelihoods; Create economic opportunities linked to the control of IAPs.

Existing relevant plans, programmes and legislation

- Conservation of Agricultural Resources Act No 43 of 1983
- Section 151(1) of the National Water Act 36 of 1998
- Section 28 of the National Environmental Management Act, 107 of 1998;
- Section 31A of the Environment Conservation Act, 73 of 1989;
- National Veld and Forest Fire Act 101 of 1989
- Municipal by-laws and common law relating to neighbours and nuisance

Related actions

- Awareness raising action plans

Action Plan 7.4: Control the introduction and establishment of new IAPs prevented through early detection and rapid response

Prevention is the most cost effective action possible. The goal is to intervene in the early stages of the process by preventing the introduction and early spread of new species that could become invasive. When new IAS are detected, rapid response is required to prevent them becoming too well established.

Both intentional and unintentional introductions of IAP should be prevented as far as possible. In the absence of any supporting information, the precautionary approach will be invoked. It is more cost effective to eliminate a problem early as opposed to dealing with a population that is already well established; therefore prevention, early detection and rapid response should be given priority in terms of resource allocation.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Management and policy responses to prevent intentional or unintentional IAPS introductions are not in place.
- Lack of early detection and rapid response strategies results in IAPS becoming established in new areas.
- Strategies to address sleeper weeds are not in place, resulting in lost opportunities for early detection of such species and rapid response to eliminate them.

Constraints

Constraint	How will it be addressed in the activities?
1. Lack of knowledge in terms which species should be classified as emerging species;	Implement protocols to prevent the introduction of new IAPs into the City of Johannesburg;
2. Lack of knowledge in terms of what the entry pathways for emerging IAPs are;	Facilitate the development of a strategy to address introductions by specific sectors, such as the nursery and pet trade
3. Ignorance on the side of nurseries and other entry points in terms of the threat posed by emerging species	Facilitate the development of a emerging species response plan for eradication or containment of emerging species before they establish
4. Responsibility and capacity in terms of detection and response, not defined.	Incorporate the identification and management of sleeper weeds and emerging species into strategies and plans

Existing relevant plans, programmes and legislation

- Conservation of Agricultural Resources Act No 43 of 1983
- Section 151(1) of the National Water Act 36 of 1998

- Section 28 of the National Environmental Management Act, 107 of 1998;
- Section 31A of the Environment Conservation Act, 73 of 1989;
- National Veld and Forest Fire Act 101 of 1989
- Municipal by-laws and common law relating to neighbours and nuisance

Related actions

- Governance related action plans
- Ridges action plans
- Species specific action plans

Action Plan 7.5: Impact of existing IAPS reduced through the implementation of integrated control measures

An integrated approach is more effective than using a single method of intervention A range of methods are implemented to eradicate and control already established IAPs. These methods can be applied individually or in various combinations. Given the complexity of IAP management, control measures must be scientifically based as far as possible. Cost-benefit considerations must inform the choice of the control methods.

Bio-control is, in the long term, the only known sustainable approach to the control of widely established IAPs and should be used to its full extent wherever possible. Role-players need to align their IAS plans and programmes and to accommodate long-term bio-control of IAPs.

Fire and IAP management strategies should be strongly aligned and should complement one another.

Priority 1 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Absence of an integrated approach impedes effectiveness resulting in costly operations.
- Bio-control is not adequately integrated into long-term IAPS management strategies.
- Fire and IAP management strategies are not integrated.

Constraints

Constraint	How will it be addressed in the activities?
1. Poor understanding of the availability of different control methods and the need for integration thereof, particularly in the use of fire and biological control agents;	Develop Best Practice guidelines for control methods based on lessons learnt and scientific research;
2. Resistance to the use of fire in terms of the risk involved	Facilitate the development of integrated control strategies including the use of fire and bio-control as management tools;
3. Unavailability of bio-control agents for all species	Incorporate restoration into IAP control operations;
4. Resistance to the introduction of bio-control agents;	

- Existing relevant plans, programmes and legislation
- Conservation of Agricultural Resources Act No 43 of 1983
- Section 151(1) of the National Water Act 36 of 1998
- Section 28 of the National Environmental Management Act, 107 of 1998;
- Section 31A of the Environment Conservation Act, 73 of 1989;
- National Veld and Forest Fire Act 101 of 1989

Related actions

- Governance related action plans

Action Plan 7.6: Adaptive management informed by Research, Monitoring and Evaluation

Ongoing monitoring, evaluation and research ensure increased proficiency in the campaign against IAP in the City of Johannesburg. Through systematic monitoring, the ecology, distribution, patterns of spread and response of IAP to management actions and/or events such as fire, will be better understood. Research will ensure improved management through increased knowledge of IAP and must always be aimed at improving practical management. Quality assurance is directly related to the success of IAP management actions and should be applied rigorously.

Priority 2 Action

This action will contribute to the following objectives of the BSAP

- Formulation of an urban conservation plan, based on an interconnected network of open spaces
- Creating a quality living environment
- Sustaining ecosystem services
- Good governance through informed decision-making

Main problems this action will address

- Quality assurance of interventions is often neglected, resulting in inappropriate utilization of limited financial resources.
- Invasive Alien Plants (IAPs) are successful at spreading and establishing in new areas because, by their very nature, they respond to changes such as fires and floods more quickly and effectively than other species.
- IAPs are successful at spreading and establishing in new areas due to land-use (e.g. plantations), land degradation or unnatural disturbance. The absence of pro-active strategic responses to potential invasion as a result of land use patterns reduces the overall success of IAPS management interventions.
- Insufficient information, understanding and monitoring of IAPS dynamics, such as how they respond to stimuli, how they spread and their invasion pathways, often leads to inadequate and inappropriate responses.

Constraints

Constraint	How will it be addressed in the activities?
1. No centralized data base available at present;	Consolidate and regularly update IAP control data into a spatially-explicit, centralized database to inform decision-making within the municipal boundaries;
2. Current lack of capacity in terms of ownership and responsibility for collecting, collating and analyzing data;	Establish an IAP Monitoring and Evaluation Framework for the City of Johannesburg
3. No overall strategy for the control of IAPs across the City of Johannesburg in place yet	Monitor the effectiveness, efficiency and appropriateness of all control efforts; Monitor the alignment of the IAP control efforts of all role-players; Prioritize IAP research needs;

Existing relevant plans, programmes and legislation

- Conservation of Agricultural Resources Act No 43 of 1983

- Section 151(1) of the National Water Act 36 of 1998
- Section 28 of the National Environmental Management Act, 107 of 1998;
- Section 31A of the Environment Conservation Act, 73 of 1989;
- National Veld and Forest Fire Act 101 of 1989

Related actions

- Governance related action plans

Summary table of action plans

Table 1: Summary Table of Action Plans with Priorities, timeframes and responsible departments, where the time frame reflects short term (less than 2 years), medium term (3-5 years) and long term (more than 5 years)

Strategic Objective	*Action Area*	*Action Plan*	*Priority*	*Time frame*	*Responsible department*
URBAN ECOLOGICAL NETWORK	1.1	Define the conservation objectives for the City of Joburg	1	Short term	Environmental Management
	1.2	Defining Strategic environmental assessment that compares conservation objectives with development scenarios	1	Short term	Environmental Management and Development Planning
	1.3	Identify indicator species and reference sites for biodiversity in Joburg	1	Short term	Environmental Management
	1.4	Determine and express the value of corridors in biodiversity policies and guidelines	1	Short term	Environmental Management and City Parks
	1.5	Classify ecological open spaces into a system of core and satellite nodes	2	Medium Term	Environmental Management and City Parks
	1.6	Application of the conservation plan in spatial planning processes	2	Medium Term	Environmental Management and Development Planning
	1.7	Identify specific conservation roles and related management plans for individual protected areas	3	Medium to long term	City Parks
GOVERNANCE	2.1	Develop an Environmental Information Management system	2	Medium Term	Environmental Management and Corporate GIS
	2.2	Undertake Strategic Environmental Spatial Planning	2	Medium to long term	Environmental Management
	2.3	Integrate biodiversity considerations into the planning and budgeting processes of the City of Joburg	3	Short term	Environmental Management to lead, but requires the buy in and commitment of all city departments and MOEs

Strategic Objective	*Action Area*	*Action Plan*	*Priority*	*Time frame*	*Responsible department*
	2.4	Align land use planning with ecological principles for open space planning	2	Medium Term	Environmental Management, City Parks and Development Planning
	2.5	Develop a monitoring and evaluation programme for biodiversity management	2	Short term	Environmental Management
EDUCATION AND AWARENESS	3.1	Awareness and advocacy campaign to reach key-decision makers and top level Management of the City	2	Medium Term	City parks and Environmental Management
	3.2	Design and implement a Creative and innovative advocacy and communication strategy to make biodiversity concern relevant to communities	1	Short term	City Parks
	3.3	Develop and implement focused awareness campaigns on threatening processes, including invasive alien species, GMOs and climate change, that aim to change behaviour in public and private sectors	2	Medium to long term	City parks and Environmental Management
	3.4	Design and implement biodiversity education programs	2	Medium to long term	City parks and Environmental Management
	BIODIVERSITY FEATURES				
BIODIVERSITY FEATURES : WATERCOURSES	4.1	Raise awareness regarding wetland values, protection, rehabilitation, policies and regulations and encourage involvement by individuals, groups, corporations and industries in all aspects of wetlands protection and rehabilitation	3	Short term	City parks and Environmental Management, JRA, Joburg Water
	4.2	Develop an accessible, computerized database for wetlands and use this information to produce a readable report for the public outlining wetland targets and trends	2	Short term	Environmental Management
	4.3	Identify and Protect key priority wetland areas	2	Short term	Environmental Management and City Parks
	4.4	Implement 'environment friendly' stormwater management policies that reduces the impact on aquatic ecosystems	1	Short term	Environmental Management and JRA
	4.5	Prioritise the rehabilitation and conservation of wetlands, particularly upstream from settlements and townships	1	Medium Term	Environmental Management, Development Planning, City Parks, JDA, JPA

Strategic Objective	Action Area	Action Plan	Priority	Time frame	Responsible department
	4.6	Develop a plan to manage the impacts of urban development on water resource quality	2	Medium to long term	JRA, Environmental Management and Joburg Water
BIODIVERSITY FEATURES: RIDGES	4.7	Complete a Ridges Audit	2	Short term	Environmental Management
	4.8	Undertake Ground Truthing and Sensitivity Mapping of ridges	2	Short term	Environmental Management
	4.9	Position Ridges within the Larger Open Space Framework	2	Medium Term	Environmental Management and City Parks
	4.10	Development Boundaries and Management Actions	2	Short term	Environmental Management
BIODIVERSITY FEATURES: SPECIES AND ECOSYSTEMS OF SPECIAL CONCERN	4.11	Identifying specific species or ecosystems of concern	1	Short term	Environmental Management and GDACE
	4.12	Determining conservation requirements	1	Short term	Environmental Management and GDACE
	4.13	Identifying the locations where species or ecosystems of special concern persist	2	Short to medium term	Environmental Management, GDACE and City Parks
	4.14	Management plans for species and ecosystems of special concern	2	Medium Term	Environmental Management and GDACE
	4.15	Determine the values and uses of biodiversity to local communities and households and identify opportunities for sustainable management of biological resources	2	Medium Term	Environmental Management and City Parks
	4.16	Protect and conserve Red Data fauna and flora species	2	Short term	Environmental Management, City Parks and GDACE
	4.17	Protect and conserve the remaining intact habitat patches of the Grassland biome within the City of Joburg	2	Short term	Environmental Management, City Parks and GDACE

Strategic Objective	*Action Area*	*Action Plan*	*Priority*	*Time frame*	*Responsible department*
	4.18	Develop and maintain a database of all red data species within the city	2	Short term	Environmental Management, City Parks and GDACE
SOCIAL OPEN SPACES	5.1	Include biodiversity considerations in property development and real estate guidelines and best practice codes to mitigate negative impacts on biodiversity	2	Medium Term	Environmental Management, City Parks, JPC, Housing department and GDACE
	5.2	Ensure the allocation for socio-economic space of 2.4ha per 1000 people is implemented	2	Long Term	Environmental Management, City Parks and Development Planning
	5.3	Social open spaces should be landscaped with indigenous species	2	Medium to long term	City Parks
SERVICES AND UTILITIES (SERVITUDES)	6.1	Appropriate planning, design and management of services and utilities to enhance biodiversity	2	Short term	All MOEs, Environmental management and planning
	6.2	Use indigenous species for landscaping and rehabilitation of areas used for services and utilities	2	Short term	All MOEs, Environmental management and City Parks

Strategic Objective	*Action Area*	*Action Plan*	*Priority*	*Time frame*	*Responsible department*
ALIEN VEGETATION CONTROL AND REMOVAL	7.1	Manage invasive alien plants in the City of Johannesburg within the appropriate policy and legislative frameworks	1	Medium to long term	Environmental Management, City Parks, MOEs, Working for Water, GDACE
	7.2	Harmonize the actions of all role-players through strategic planning	1	Medium Term	Environmental Management, City Parks, MOEs, Working for Water, GDACE
	7.3	Appropriate awareness-raising, institutional arrangements and capacity-building implemented	1	Short term	City Parks and Environmental Management
	7.4	Control the introduction and establishment of new IAPs prevented through early detection and rapid response	1	Short term	Environmental Management, City Parks, MOEs, Working for Water, GDACE, SANBI
	7.5	Impact of existing IAPS reduced through the implementation of integrated control measures	2	Long Term	Environmental Management, City Parks, MOEs, Working for Water, GDACE
	7.6	Adaptive management informed by Research, Monitoring and Evaluation	2	Long Term	City Parks, Environmental Management, Working for Water, GDACE

Part 5: Monitoring and Evaluation Framework

The next step in the implementation of the Joburg Biodiversity Assessment and the Joburg BSAP is to develop an effective monitoring and evaluation framework. The monitoring and evaluation (M&E) framework will ensure that implementation of the BSAP is aligned to the vision and objectives and is adapted according to changing circumstances within the city.

Tools for the monitoring and evaluation system must be linked to quantitative outputs from the biodiversity assessment and the BSAP to ensure an ongoing M&E system that can be continually updated according to progress. To ensure the relevance of these tools it is proposed that the biodiversity assessment (and its linked BSAP) be reviewed and updated every 5 years. The review should focus on changes to biodiversity values that occurred during that period and how projects and implementation should be adapted to cope with those changes. A further consideration is that as legislation changes or is reviewed; the BSAP should monitor its ability to respond to any new requirements or rules. This adaptive management cycle will allow the City to respond timeously to changes in the environment.

The Department of Environmental Management should take overall responsibility for the Joburg BSAP and it should be reflected within its line functions, business planning processes and the budgets of relevant role players. This will ensure that the conservation of biodiversity receives due attention and acknowledgement of its importance. However, to ensure the overall implementation of the BSAP all line departments that have a role to play in the implementation of this plan should have the outputs included in their business planning and performance management processes.

Conservation planning and biodiversity management occurs in a complex environment where the levels of uncertainty are often high and decision making is often characterised by disagreement (Roux et al, 2006). Having a robust biodiversity assessment, and clear set of goals and a vision for biodiversity can go a long way to reducing some of this uncertainty.

Specific recommendations for a monitoring and evaluation system:

- The Biodiversity Assessment and subsequently the BSAP should be reviewed on a 5 yearly basis (in line with the national review process)
- Clear responsibilities and time frames should be set for the implementation of the action plans
- Responsible line departments and MOEs should ensure that the action plans are reflected in their business plans, performance management systems and have the budget allocated to achieve the goals
- Gaps in the biodiversity assessment and BSAP should be identified and appropriate interventions developed
- A detailed monitoring and evaluation framework needs to be developed that this linked to quantitative and qualitative aspects of biodiversity values. The State of Environment reporting process can provide guidance on nationally acceptable indicators to monitor progress.

Conclusion and way forward

Managing and protecting biodiversity within an urban area is an issue that requires a collaborative and integrative approach. It requires acknowledging the particular value associated with urban biodiversity features, many of which may man made and part of the built environment.

The next step to implement the BSAP is to identify the key projects and activities that need to be implemented immediately. This section provides a shortlist of 6 possible programmes necessary for effective biodiversity management in Joburg. It draws actions from across the objectives and focus areas into 6 cross cutting programmes for implementation and gives a short description of the 6 programmes.

Priority Projects

Priority projects are identified as a means of taking the most important biodiversity priorities forward. Figure 2 provides an illustration of how these programmes are compiled across the objectives of the BSAP.

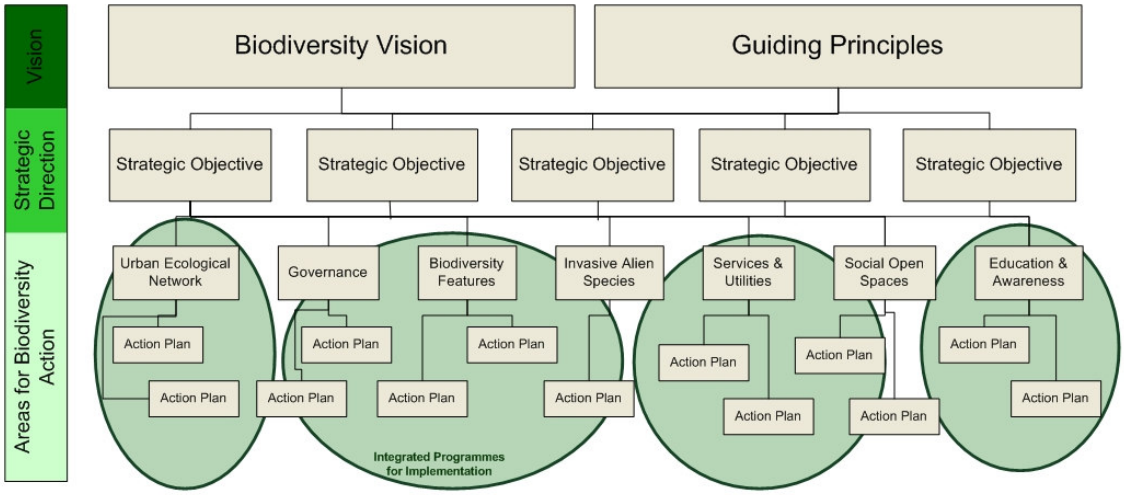

Figure 2: Framework for structuring priority biodiversity programmes

1. Set biodiversity objectives

Transformation of the natural environment in Johannesburg has progressed to the point where urban encroachment, non-endemic natural elements and developmental controls play much greater parts in biodiversity conservation than purist ecological ideals. As a consequence, biodiversity management has to confront a reality where general and conventional conservation principles no longer offer practical answers, and where critical strategic conservation decisions have to be made. The most important conservation decision facing the City, and one that will radically (re)determine the biodiversity management strategy, is a determination of a set of conservation objectives. Traditional generalist approaches that attempt to conserve biodiversity elements in the city using broad principles (typically through statements such as 'All remaining untransformed grassland areas must be conserved'), must be replaced with specific decisions on which species or habitats are considered to be of value to the City, along with conservation strategies that create the enabling frameworks for these features to persist in the urban landscape.

Conservation agencies in the municipality need to decide what strategic goal for biodiversity management in the City will be pursued – whether to preserve ecosystem services, or retain a representative sample of the original grasslands biodiversity, or even to protect specific popular indicator species – and then adjust both the biodiversity management and city development strategies accordingly. If, for example, the decision is made to conserve a functional ecological network throughout the city, then all efforts should be focussed on identifying and securing the necessary island nodes and ecological corridors whilst at the same time changing the developmental planning strategies to eliminate the fragmentation of the network.

Due to the level of transformation and pressure for further development of the cityscape, the strategic conservation decisions will result in specific biodiversity elements being sacrificed for the good of the overall system. However, the strategic objectives need not be of a 'one size fits all' nature. Different strategies may be relevant for different parts of the City, thereby limiting the overall sacrifice, but care must be taken not to allow a myopic or shortsighted (i.e. 'not seeing the wood for the trees') approach compromise the conservation of biodiversity in Johannesburg.

2. Develop an understanding of the biodiversity resources in the city (a comprehensive biodiversity audit, integrated database and field monitoring programme)

A tool or protocol for the systematic collection, recording and dissemination of biodiversity data is critical to ensure informed decision making. The high levels of uncertainty on biodiversity values and contributions to development, along with conflicting decision making for biodiversity and development priorities can be reduced by having a systematic and scientifically robust database of the biological resources within the city. This database must be spatial in nature and easily integrated into other strategic planning processes. This also implies that the biodiversity management should be communicated in a manner that other decision makers within the city can understand the implications of their decisions for biodiversity, thus making trade offs more transparent. Ultimately this would allow better pinpointing of sensitive and important features within the city that can then be afforded appropriate protection and management status.

This programme would tie up action plans for watercourses, ridges, species, the urban ecological framework and governance. It is an urgent priority to develop a good understanding of the biodiversity features within the city, linked to the ecological goods and services they provide. The Open Space Framework and Wetland Audit for the city provide a good base from where to develop a more detailed approach to a systematic recording of actual biodiversity values in the city. It is important that this information is informed by a programme that allows field data collection for improved ground truthing of sensitive areas and refinement of existing conservation plans.

This database should be linked to other existing inventory activities, for example at GDACE, the SANBI Red Data Lists for Species and the Global Biodiversity Information Framework.

3. Set up an institutional system that aligns planning and biodiversity.

For effective biodiversity management it is extremely important to ensure that the different sets of management tools and policies within Joburg are aligned with one another. If these policies are not coherent and provide a level of overlap and congruence then confusion can result that may give conflicting objectives or contradictory approaches to city management. The implications for biodiversity are further degradation, habitat and species loss, ultimately resulting in a loss of ecosystem goods and services.

Many of the actions plans have policy and institutional implications. In essence, effective biodiversity management and ensuring long term provision of ecological goods and services in Joburg is dependant on an institutional system that acknowledges and enables the valuable role of biodiversity within the city. The overall responsibility for ensuring alignment in biodiversity planning lies with the Department of Environmental Management with strong support from City Parks.

4. Ecosystem services for water

One of the most critical, and urgent, biodiversity needs within the City is the development of a programme to understand, plan and manage for the ecosystem services provided by water. People within Joburg are heavily dependant on the services that the environment provides to us for our survival, and in water scarce areas water services are of even more importance. Many of these goods and services are overlooked in development and spatial planning processes.

Wetlands have been significantly affected by transformation associated with urban development, with many wetlands in the City having been destroyed (especially in the case of hillslope seepage wetlands) or significantly transformed to the degree that they are no longer effective-functioning wetlands. The majority the rivers within Joburg are in a poor to critical condition and have had extensive losses to critical ecosystem functionality.

Loss of these ecosystem services has widespread impacts on this city; stormwater management, infrastructure development and maintenance, water quality, water availability and supply, groundwater management, human health and the ability to respond to climate change are all negatively affected by poor management of these services. A programme that deals holistically with water resources management and water services is urgently needed within the City.

5. Awareness and education on the value of urban biodiversity

It is in the interest of the City of Johannesburg however, that a strategy to pursue education and awareness focused agenda to make sure that many ecological processes are sustained despite population and development pressure experienced within her jurisdiction. The co-existence of both bio-diversity and human development can be realized only if education and awareness becomes an element in the planning and development trends pursued by authorities.

Issues of environmental awareness and a community that responds responsibly to biodiversity concerns is a central theme to all the action plans within the strategy. It is clear that an awareness and education campaign that runs across city departments and MOEs is necessary.

6. Conservation of grassland habitat

Although Johannesburg is located in the grasslands biome, most of its surface area has been transformed into urban gardens with woody elements predominating. A key question for urban biodiversity conservation is therefore why efforts should be made to conserve the remaining grassland fragments in the city.

The answer lies in the overlap between the grassland fragments and other sensitive biophysical elements that have also been identified for prioritisation in urban conservation actions. Ridges, watercourses and rare/endangered species in the CoJ require a functioning grassland ecosystem context in order to exist as functional entities in themselves. In other words, the extent of ecosystem services (pollination, water purification, stormwater management etc.) associated with sensitive biophysical elements will be directly proportional to the amount of intact grassland habitat that is conserved.

The only way for the City of Johannesburg to demonstrate its commitment to biodiversity conservation is by acknowledging the inherent merits of its endemic grassland vegetation types. Priority actions should therefore be directed towards identifying and protecting the significance of grassland types such as the endangered Egoli Granite Grassland within the city limits.

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