



Monitoring for adaptation corridor sites

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Introduction

The benefits derived from conserving biodiversity and ecosystems extends beyond the protection of our natural heritage, those habitats and species in the environment, to securing significant value in terms of the maintenance and improvement of ecosystem services. These are the critical natural elements for human survival and sustaining livelihoods. Long-term maintenance of these ecosystem services must take future climate change scenarios and the possible impacts of these into consideration.

Early impacts of climate change are already being observed and scientists believe that further impacts are inevitable, regardless of efforts to reduce future global greenhouse gas emissions. The decisions we make today regarding our behaviour and interaction with the environment will have additional lasting consequences. It is therefore extremely important to start now with planning for and monitoring the impacts of climate change in the future, particularly when it comes to our sustained use of the environment.

As the threat of climate change looms, the task of protecting and restoring South Africa's biodiversity hotspots increasingly means preparing the way for species and ecosystems to adapt to changing conditions. Such conditions include the higher temperatures, drier (in the West) or wetter (in the East) conditions, and more variable weather events that are predicted for our country. It is, however, unclear just what it will take to reduce the vulnerability of our ecosystems and species to climate change. One of the key recommendations coming out of scientific research into climate change is to enhance the ability of ecosystems and species to adapt to change in the long-term. The creation of a system of viable biodiversity corridors, networked through the landscape and linking protected areas, should improve the ability of species and systems to persist and adapt. Connectivity can be achieved through the application of appropriate land uses and management actions that increase the likelihood of species survival. These corridors also allow for long-term mitigation measures to take effect and for people to be more resilient to change. In order to successfully implement these landscape corridors, it is essential to involve private and communal landowners. With appropriate management, landowners can become stewards of their land and, together with their neighbours, play a vital role in enabling species and people to adapt to climate change. A key mechanism to be used in securing these sites and corridors is, therefore, biodiversity stewardship.

Biodiversity Stewardship is an innovative conservation approach used to include landowners who own or utilise land that is of critical importance for conservation. For years conservationists have struggled to find a balance between protecting threatened habitats/species and not negatively affecting landowners' ability to derive an income from their

land. Stewardship is conservation's win-win solution that satisfies both the landowners' needs and those of the environment – maintaining ownership of the land, providing landowners with assistance in managing their land and creating sustainable livelihoods, while also protecting the country's unique biodiversity. Better management can result from improved extension services, production standards, financial incentives, market signals and increased compliance and enforcement. Spatial systematic biodiversity plans and focused plans for stewardship have been developed for both the Eastern Cape and Kwazulu Natal provinces.

The Biodiversity Stewardship programme provides a framework for enabling the environment to adapt to climate change. These adaptation options for biodiversity include:

1. Reducing existing threats to biodiversity to build resilience into natural systems and species,
2. Incorporating climate change information into management tools for biodiversity managers and also assisting people to adapt to change,
3. Assisting the natural adaptation of species and ecosystems through improved on-reserve and off-reserve management of areas of high conservation value,
4. Continual development of a comprehensive, adequate and representative protected area system which incorporates adaptation to the impacts of climate change
5. *The creation of corridors and a network of linked protected areas* which can lead to a landscape scale approach to conservation, and a method of securing conservation corridors that can reduce the vulnerability of biodiversity to climate change and conserve the critical ecosystem services on which we depend.

Although corridors are often described as the most obvious means to allow for the adaptation of conservation-worthy biota to climate change, little research has been conducted to verify that this is the case. Furthermore, although many biodiversity plans have incorporated notional corridors, these are often at inappropriate scales for action or not explicitly designed with climate change in mind. Methods for monitoring these corridors are of critical importance in order to track changes, improvements and adaptive capacity in the long term. When monitoring, one needs to define the goals as well as what makes up adaptation in this context. Adaptation is defined here as building resilience and increasing the ability to cope with change, thereby reducing the vulnerability of both people and biodiversity.

The aims of CAP research into monitoring criteria for corridors

This research aims to assess the suitability of current CAP adaptation corridor sites in relation to current provincial biodiversity corridor maps and climate change information and to identify ideal adaptation sites using conservation priority plans and climate change models and local knowledge. In addition the research aims to *design* broad criteria with which to monitor the effectiveness of corridors and adaptation projects for both biodiversity and people.

Assessment criteria for an adaptation “corridor”

In order to delineate a corridor and determine its functionality, various criteria should be considered. These include:

- The level of fragmentation as a result of transformation¹ associated with agriculture, urban development, plantations and so on.

¹ Transformation in this context means that the environment has been altered or destroyed and is not suitable for maintaining the historic biodiversity found there.

- The level of degradation due to poor management, including poor fire regimes and overgrazing.
- The level of conservation significance - the priority and status of the ecosystem and its supporting services.
- How vulnerable the area is to climate change, the likelihood of climate change, and what the current and future scenarios of climate change are.
- The restoration potential of the area and its ability to connect restored areas with intact biodiversity.
- Current and predicted competing land uses - what the likely future scenarios of land use are. These could include:
 - Commercial agriculture, incl. plantation forestry
 - Subsistence agriculture

GOOD corridor features

- Avoid crossing the borders of major bio-geographic zones.
 - Geological groups (and major soil families).
 - Major valley systems.
 - Climatic anomalies such as rain-shadows.
- Develop along macro-climatic gradients
 - Topographic (upland-lowland gradients)
 - Coastal – Inland gradients
- Are of a sufficiently large area to allow ecological processes to function.
- Include both North and South facing slopes.
- Include areas that are largely free of alien plants or, if infested, those which have a targeted restoration plan.
- Determine where people are likely to be responsive and willing to be stewards to assist in developing, maintaining and monitoring the corridors.

Monitoring for climate change

An effective monitoring programme needs robust criteria and indicators that are captured in a coherent monitoring plan that defines methodology, responsibilities, frequency and budget. Assessing the effectiveness of our adaptation corridors can be monitored quantitatively by looking at the current and future value of a target indicator as a % of change or by using indicators with metrics for biodiversity and communities such as the number of fires in a given period, or the number of hectares of improved vegetation cover. These quantitative measures should indicate the sources of data such as a thermometer, weir, or land SAT image. There are also social monitoring frameworks that

can be used to determine more qualitative outcomes. These include outlining the goals and objectives of lines of enquiry; the exact survey questions used, and the methods for monitoring and applying the framework approach.

General criteria for adaptation assessment of corridors

After extensive discussion in expert workshops held in the Eastern Cape, Western Cape and Kwazulu-Natal, four groups of criteria were identified for monitoring climate change adaptation: Climate, Biological, Ecological, and Socio-economic. Indicators that should be monitored were identified within each of these groups. These are summarised in the table below.

| Climate | Biological | Ecological | Socio - economic |
|---------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Rainfall (amount and intensity) | Presence / absence of indicator species | Vegetation changes e.g. shifts from C3 to C4 species | Land owner willingness to participate in conservation and stewardship programmes |
| Temperature regimes | Populations of key species | Taxa changes- and their fire association | Improved land management |
| Wind speeds | Vegetation boundaries (where definable, e.g. forest) | Corridors with intact vegetation vs. areas in need of restoration and the linkages between them. | Changes in land use- e.g. ploughing up fields or leaving natural vegetation, abandonment of fields |
| Extreme weather events, such as intense storms, dry spells or heat waves. | Vegetation cover – linked with soil moisture | Alien plant indicators | Reduced ecological services such as water yields, crop yields. |
| Fire (frequency, intensity, seasonality) | Soil erosion | Water availability, regulation, quality monitoring, and ground water. | Changes in livestock and rangeland management: livestock types, numbers and burning practices, use of water etc. |
| | Carbon sequestration (where relevant) ² | Photo monitoring of corridor linkages between restored and intact areas. | Improvement seen by stakeholders through involvement in the projects and perceived value of the projects. |
| | | Long-term observation sites (SAEON) | |

² Although these are adaptation corridors they may be part of a mitigation project and carbon will be monitored, such as soil C and above ground biomass- will also show changes in veg cover, ground litter (possibly) and biodiversity from this monitoring.

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| | | | <p>Any incentives to encourage new approaches. Effectiveness of these</p> <p>Management effectiveness (METS tool)</p> <p>Employment -man days, skills changes through skills audits, gender differentiation, number of the people employed (temporary vs. long term); the number of the people that return to work repeatedly.</p> <p>Quality of life index, e.g. improved access to water.</p> |
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Key guiding principles for monitoring

What to include

Corridors can include areas that are currently intact and/or protected as well as areas in need of restoration that provide important linkages. River systems and escarpment lines stand out as natural corridors systems that should be prioritised.

The monitoring criteria provided under climate, biological, ecological and social indicators represent an ideal toolbox. The collection of climatic data is primarily a governmental responsibility and should be done as part of a broader climatic analysis by the relevant meteorological departments. Projects should partner with these departments - the monitoring equipment and the long-term data sets are often provided by them - and integrate data into their projects. However climatic data is often poor and equipment to do comprehensive and accurate measurement is expensive. Climatic data should, therefore, also be collected by communities and landowners using very simple metrics and basic equipment (such as max-min thermometers and plastic rain gauges). This data collection raises awareness on a community level as to the climatic changes affecting the area and the community. This information can lead to changes in management practices that promote local community empowerment.

At the scale of adaptation corridors the focus should be more on the ecological and social changes and how these link to management practices that enable landowners and biodiversity to be more resilient to climate change. Again, community members should be encouraged to collect basic data. This is because either the practices adopted by the

landowner has been seen to effect change and provide better resilience or information collected by the community have been able to effect a better practice and an ability to cope better. An example would be showing improved water quality/quantity flowing into a town following alien clearing or re-vegetation along a river bank in the corridor leading to the town.

The process of monitoring is not purely about measurement and data gathering to build an argument about climate change adaptation. It is useful to initiate changes in the way people living in the landscape think about climate change and the way in which they are managing or using the land-based resources. This is why it is important to involve communities and landowners in the process and to promote partnerships with existing community groups, such as schools. Examples would be linking in schools with environmental awareness and monitoring of indicator species changes, alien invasive changes, or river quality changes.

Ongoing resources for monitoring and extension assistance also need to be considered. Creating incentives for landowners could be increasingly developed as an integral part of the stewardship approach. A payment for ecosystem services model should be considered to ensure ongoing resources and support so that the landscape and the services it provides are protected into the future.

There is no “one size fits all” approach to monitoring, and the criteria to be assessed must be determined on a site specific level using the above principles and criteria as a guideline. The frequency of monitoring is also site specific and should be applied to each criterion individually and linked directly to who responsible for the task.

Who to include

In the past monitoring has been largely extractive research, where there is a knowledge in the system that we trying to get out. On the other hand, reflexive research is an attempt to fix a situation. For example, the monitoring of alien tree species as they are removed demonstrates an improvement and actually affects a change in management practice. Another example is river quality monitoring, which is starting to be done in a way that is reshaping municipalities. Monitoring directly links communities to their municipalities through reporting practices such as using cellphones to notify the municipality of a breakage in water pipe. Action orientated or reflexive monitoring looks for new information, collected by those most affected, and feeds this information back into the management practice. A core goal is to include as much community participation as possible. Reflexive research examines behaviour that is moving from a current action to a better action. The behaviour change is what indicates the adaptation and this, in turn, can improve resilience. Extractive monitoring is also needed as part of the framework and involves robust science, either using already existing data sets or requiring further in depth study.

Over and above following the guiding principles and adapting the criteria to suit a reserve or corridor area, it is critical to consider the future of monitoring into the long term, identify who will be responsible, and record whether or not you having the desired effect?

Stakeholder participation should take place during initial planning in order to identify risks and threats and to encourage involvement early on. It can be helpful to use tools such as an artist impression of the landscape to create a map of how the people view their own landscape which then also provides more information on the history behind the hazard or risk or opportunity. This mapping process can include recent news from the area and as well as the relevant legislation that links to that particular risk, threat, or opportunity. Community involvement in designing the monitoring process provides opportunity for including local knowledge in determining the corridors. Local residents

can assist in identifying creative ways to represent these corridors to decision makers such as ward councilors and policy makers at the local and national level. The design and implementation of adaptation corridors can provide a creative method for promoting community understanding of climate change and other environmental issues.

Training for government officials, particularly in local municipalities, is mandatory. Citizen monitoring can also assist municipalities. Municipalities and or landowners should also develop databases into which all data is captured and into which citizen monitoring information can also be stored. This will assist with integrating adaptive management information into data bases which will also hopefully aide behaviour change and can help inform future policy changes and guide incentives mechanisms and funding schemes.

The concept of adaptation corridors can be made more accessible and relevant by “branding” the corridors and linking them to a historical event, significance or cultural experience. Examples include the Sani-to-Sea cycle ride, the Duzi canoe marathon; the Eden to Addo Hike, the Uhambo hike, and Johnny Clegg and the Thukela river system. These initiatives help people identify with the area, making management easier by encouraging a sense of ownership of the landscape and a desire to protect it.

Partnerships between local government, parastatals and conservation authorities, who are implementing protected areas expansion and supporting the stewardship model alongside NGOs and conservation partners, are critical to corridor monitoring due to the scale of the task. Focal issues such as catchment-to-sea water management can provide more of a focus to these partnerships.

In summary an overarching principle for monitoring is to include local community and landowners as much as possible, draw on existing data sets, and feed all of this back into the design of appropriate and effective management practices as an exercise in building adaptive capacity. Defining roles and responsibilities from the onset is critical.

Matrix for monitoring

The following matrix provides a guide to feasible monitoring criteria and the relevant metrics or indicators to be applied, as well as suggesting appropriate roles and responsibilities. Also noted are opportunities for community involvement, indicating a reflexive as well as extractive research approach.

Climate

Approach and responsibility

As mentioned before, climatic data capture is primarily the role of government. Partnerships can be created to enhance this process and contribute to climatic data collection. Communities can be encouraged to monitor weather changes, temperature changes, storm events and where possible, as an educational and adaptive capacity building exercise. Landowners can also track events and processes, such as fires, storms, or temperature increases and link these, where possible, to management practices and the effectiveness of these.

Indicators and metrics

Weather stations (Government, SAEON) to capture data on:

- Rainfall- rain gauge
- Temperature – min/max thermometer

- Wind speed
- Storm events- intensity of rainfall (where possible)
- Fire – government data sets and international satellite monitoring (SAEON) ,

Biological

Approach and responsibility

These factors could be measured at the landscape scale using governmental data and extractive research (scientific studies where needed). Use existing data, like photos and landSAT images, as much as possible. Communities and landowners can be engaged and the project scale communities can be used to monitor indicator species. Schools, civil society partnerships, CREW, and NGO's like BirdLife are appropriate entities for community level monitoring. Social media can be used for data collection and reporting (SMS to report changes and photographs). Individual farmers may also be able to provide information on species changes and so on, and provide the relevant context.

Indicator and Metric

Species: Studies or community monitoring of key and indicator species and species changes of trees, alien species, grasses, visible invertebrates, birds, algae's in river systems etc

Vegetation changes: noted by landowner/community or via photographs.

Soil erosion: changes can be noted by photographic images and also by communities and landowners and be linked with a storm/flood event.

Carbon sequestration: studies may be relevant where mitigation is also the purpose of the study and these studies are funded. The information can contribute into the monitoring process.

Ecological

Approach and responsibility

All these categories mentioned in the above table are valid here and what is to be monitored depends on the context of the particular reserve and corridor to be monitored. Community, landowner, and reserve manager monitoring is to be used as much as possible. Use existing government/research data as well. All of these data sets can be fed back into management practices. Where there are resources, scientific researchers can be used for further studies to enhance better practice.

Indicator and Metric

Taxa changes: landowner and research studies to monitor

Water flow and quality changes: government datasets and studies used where possible

Species shifts, connectivity and reduced fragmentation: A lot can be noted by the landowner and on satellite images and photographs as well as using social questionnaires and qualitative feedback from communities; landowners and reserve managers, which will be discussed more below.

Socio-economic

Approach and responsibility

Socio-economic monitoring studies current action as it moves towards a future action. Questions asked are designed to enhance understanding from landowners and reserve managers regarding their land under better management, whether or not there has been a perceived benefit from these practices, and what these benefits are. This information

on better practice can be linked back to the biological and ecological information gathered to note any further biological and/or ecological adaptation. Community monitoring for information with observed outcomes, on indicator species changes for example, can be tracked and linked with the management practices that have been implemented.

Questions around changes in management practice, benefits and incentives to landowners should be included as reference in management plans and then linked back to a specific climatic event or perceived changes in climate where relevant.

The adapted management practice is, however, what provides the resilience building and adaptation benefit, and educating people on how to monitor and then adapt these practices is very important. Social surveys, if used, should be targeted for specific outcomes.

Indicator and Metric

Criteria are listed above and again are context specific – social surveys need to be developed with specific objectives and questions around what you want to achieve.

Some examples of possible survey questions include:

- Has you access to water improved- and link to quality of life index?
- What have your changes in land use been in last year/months?
- What changes in management around livestock and fire have you implemented?
- What major climate events have occurred over the last year?
- Did any changes in management help you cope better with the climate event?
- What value have you seen in applying a conservation/better practice to the land?
- Have there been any incentives to help you change your practice and have these worked?

Other social indices which can be applied include:

- Management effectiveness (METS tool): changes in management practice can be noted and improvements in management indices.
- Employment criteria: Noted man days, skills changes through skills audits, gender differentiation, number of the people employed (temporary vs. long term); the number of the people that return to work repeatedly.
- Quality of life index – used in questionnaires

This matrix along with criteria and principles can provide a guideline for monitoring management changes and adaptation benefits of corridors over the long term.

Thank you

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