

# WORKPLAN FOR DATA COLLECTION BY THE K2C ENVIRONMENTAL MONITORS

Version 1

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## 1. BACKGROUND

### **Purpose**

This plan is intended to guide the activities of Environmental Monitors (EMs) employed under the DEA “Environmental Monitors” programme, to be implemented in collaboration with SANParks. The goal is for EM to collect data for a core set of variables at each location where they are based. From March 2013, approximately 80 EMs will be deployed at about 21 locations within the Kruger-to-Canyons Biosphere Region. Data will be captured in a centralized database, allowing for analysis of trends for a wide range of environmental variables, for a variety of land use types throughout the Kruger-To-Canyons Biosphere Region. These analyses will allow for improved management of natural resources in these locations and others, and promote a sustainable supply of ecosystem services.

The various variables are clustered according to the following five themes:

1. Protected Areas Management (focused on data required to manage protected areas more efficiently)
2. Rangeland Monitoring (focused on the state of natural resources and biodiversity of terrestrial ecosystems)
3. Freshwater Monitoring (focused on the water quality and biodiversity of surface water resources)
4. Environmental Health (focused on disease and other factors affecting the health of people and animals)
5. Community Engagement (focused on socio-economic trends in rural communities)

The monitoring objectives for each of these themes are outlined in Section 2, below.

## Protocol

- EMs will be required to collect a variety of data, as required for each of the five themes that is relevant to the land use where they are based:

Land Use	Protected Areas Management	Rangeland Monitoring	Environmental Health	Freshwater Monitoring	Community Engagement
Private reserve	✓	✓	✓	✓	X
Rural village	X	✓	✓	✓	✓
Commercial farm	X	X	✓	✓	X

- Data collected for the above themes are **core data**, i.e. data that is required from each location where EMs are employed, and all host organizations will be encouraged to provide their EMs with the time and resources required to collect this data. It is expected the time required for collection of the **core data** will be 50% of EM working days per year.
- In addition to the collection of **core data**, EMs will collect more detailed data required by their host organization, called **host-specific data**. As far as possible, the **core data** should supplement the **host-specific data**, i.e. variables that form part of the **core datasets** should be a subset of the **host-specific dataset**.
- The frequency of data collection will vary according to the theme and species variables:
  - Some data will need to be collected regularly through the year, on a weekly or monthly basis (particularly for the Protected Areas Management, Rangeland Monitoring and Environmental Health themes). EMs will often collect data relevant to different themes on the same day, while on routine patrols.
  - Some data will be collected ad hoc, when and where sporadic events occur (particularly for the Protected Areas Management and Environmental Health themes)
  - Some data will be collected during specific campaigns, either once a year (such as the annual sampling of veld condition for the Rangeland Monitoring theme) or for once-off events (such as the assessment of an awareness campaign for the Community Engagement theme).
- EMs will generally work in pairs, although some may be required to work alone in some locations, while others may work in large groups for particular campaigns. When working in pairs or larger groups, there is scope for specialization by each group member, e.g. one EM would be trained in Veld Condition Assessment and will take the lead when the group collects these data, while another might be trained in conducting household interviews and will take the lead when the group collects those data.
- Most data will be captured in the field on a handheld GPS, using CyberTracker software. Other equipment required varies per theme as follows:

Equipment	Protected Areas Management	Rangeland Monitoring	Environmental Health	Freshwater Monitoring	Community Engagement
100m tape measure	✓	✓	X	X	X
Disk pasture meter	✓	✓	X	X	X
SASS net and trays	X	X	X	X	X

Notebook for recording narratives	X	X	X	X	✓
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- The exact variables to be collected will depend on the land use of their location. These are outlined in section 2 below.
- Data management
  - Data Collators (employed by SANParks specifically for this EM programme) will visit each EM once a month and download data from their handheld GPS units, and collect any data recorded on paper. These visits will also allow for any administrative paperwork to be completed by the EM's, under supervision from a Data Collator.
  - Each of the five Data Collators working under the programme will capture or download all data retrieved at the end of the month. They will then check for basic errors, and extract data relevant to each of the five programs, which can be emailed to anyone requiring the data.
  - Once appropriate funding can be sourced, a Data Manager will be employed to build and maintain an on-line spatial database to house all data collected, and make it publically available over the internet. The Data Manager would also be required to run queries to extract data relevant to theme objectives (see below) or in response to queries from host institutions and managers of land where data are collected.

## 2. THEME OBJECTIVES AND VARIABLES

### 1. Protected Area Management theme

#### 1.1. Overall Aim

To improve the management of protected areas, through improved monitoring of threats to biodiversity.

#### 1.2. Specific Objectives

To record incidents of, and establish monthly to annual trends in:

- 1.2.1. Fence breakages, including severity of breakages
- 1.2.2. Poaching of game
- 1.2.3. Poaching (and legal harvesting) of plants (harvesting of medicinal or ornamental plants, or cutting of fuelwood)
- 1.2.4. Incursion by domestic animals into protected areas
- 1.2.5. Availability of surface water, and condition of artificial water sources
- 1.2.6. Sickness and mortalities of game resulting from disease

Note that objectives relating to fires, alien plant cover and pollution, while also relevant to Protected Areas Management, are covered under other themes.

#### 1.3. Examples of management-related questions that might be answered using the data collected

- 1.3.1. How does the type and frequency of poaching vary for different protected areas, and how these are changing from year to year?
- 1.3.2. What parts of a particular protected area suffer more from poaching and intrusion by poachers?
- 1.3.3. Which protected areas, or parts of protected areas, are frequently visited by livestock? (relates to disease transmission)
- 1.3.4. How does the density of artificial water supply in protected areas compare to the density of natural water sources, in the wet versus dry season?
- 1.3.5. How frequently are repairs required to maintain an effective boundary fence, and is this frequency changing over time?
- 1.3.6. Are incursions by domestic animals increasing? (and hence, do we need to start taking new management actions to prevent these)
- 1.3.7. How many game died as a result of a drought, and was mortality greater in particular protected areas, or particular parts of any one protected area?

#### 1.4. Location of EMs involved:

- 1.4.1. Timbavati
- 1.4.2. Balule
- 1.4.3. Sabi Sands
- 1.4.4. Blyde Rivierspoort (both sides)
- 1.4.5. Andover
- 1.4.6. SANDF Hoedspruit
- 1.4.7. Kondowe
- 1.4.8. Wild Rivers

#### 1.5. Variables

Note: following each of the variables listed, the information in the square brackets indicates: 1) type of monitoring required for data collection [PATROL or CAMPAIGN] and 2) the frequency at which such monitoring would be conducted [DAILY, WEEKLY, MONTHLY or ANNUALLY]

- 1) Fence breakages [PATROLS / DAILY to WEEKLY]
  - a) Type
    - i) Standards bent / pulled out
    - ii) Droppers bent
    - iii) Digging under
    - iv) Wire strands cut / broken
    - v) Electric strands cut / broken
    - vi) Bobbin out
  - b) Cause
    - i) Floods
    - ii) Animals
      - (1) Species (select from predetermined list)
      - (2) How was presence of animal detected?
        - (a) Visual
        - (b) Tracks
        - (c) Other
    - iii) People
      - (1) How was presence of people detected?
        - (a) Tracks
        - (b) Other
    - iv) Other cause (describe)
  
- 2) Incursion by people [PATROLS / DAILY – WEEKLY]
  - a) How were people detected?
    - i) Tracks
    - ii) Visual
    - iii) Other (describe)
  - b) Number of people
  - c) Were they armed?
  - d) Evidence of poaching?
    - i) Snares
    - ii) Hunting dogs
      - (1) Number
    - iii) Animal remains
    - iv) Fishing rods or traps
  
- 3) Poaching incidents [PATROLS / DAILY to WEEKLY]
  - a) What was poached?
    - i) Animal
      - (1) For each animal poached:
        - (a) Species
        - (b) Gender
        - (c) Age class
          - (i) Juvenile
          - (ii) Sub-adult
          - (iii) Adult
      - (2) Method of poaching
        - (a) Snare
        - (b) Rifle
        - (c) Fishing
      - (3) Animal recovery
        - (a) Carcass taken
        - (b) Animal found but dead
        - (c) Animal found and ok

- (d) Animal found and treated
      - (e) Animal wounded and not treated
    - ii) Plant
      - (1) Species
      - (2) Number of individuals affected
      - (3) Method of poaching
        - (a) Cut stems or leaves
        - (b) Debarked
        - (c) Dug roots
        - (d) Removed entire plant
- 4) Incursions by domestic animals [PATROLS / DAILY to WEEKLY]
- a) Type of animal
    - i) Dog
    - ii) Cattle
    - iii) Goat
    - iv) Donkey
    - v) Cat
    - vi) Other (describe)
  - b) How was animal detected?
    - i) Tracks
    - ii) Visual
    - iii) Other (describe)
  - c) Follow up action
    - i) None
    - ii) Animals caught
    - iii) Animals shot
    - iv) Message to ranger
- 5) Water sources (excluding perennial rivers) [PATROLS / DAILY to WEEKLY]
- a) Type?
    - i) Pool in riverbed
    - ii) Pan (wetland)
    - iii) Wallow
    - iv) Trough
    - v) Dam
    - vi) Reservoir (no trough)
  - b) Water source?
    - i) Borehole
      - (1) Windmill
      - (2) Diesel pump
      - (3) Mains electric pump
      - (4) Solar electric pump
    - ii) River
      - (1) Ephemeral
      - (2) Seasonal
      - (3) Perennial
    - iii) Rainwater only
  - c) Status
    - i) Empty
    - ii) Less than half full
    - iii) More than half full
    - iv) Full
  - d) Water quality (covered by Freshwater Monitoring Theme)
  - e) Damage?

- i) Type
    - (1) Erosion of dam wall
    - (2) Valve broken
    - (3) Pipe broken
    - (4) Floor of trough cracked
    - (5) Reservoir leaking
  - ii) Cause of damage
    - (1) Elephant
    - (2) Other (describe)
    - (3) Unknown
- 6) Evidence of disease [PATROLS / DAILY to WEEKLY]
- a) Type of animal
    - i) Species
    - ii) Gender
    - iii) Age class
      - (1) Juvenile
      - (2) Sub-adult
      - (3) Adult
  - b) Vitality
    - i) Dead
      - (1) Cause of death?
        - (a) Disease
          - (i) Describe evidence
        - (b) Predation
        - (c) Starvation
        - (d) Unknown
    - ii) Alive, but appears sick
      - (1) Symptoms
        - (a) Salivation
        - (b) Unnaturally tame
        - (c) Disorientation
      - (2) Body condition (5 point scale of body condition)

## 2. Rangeland Monitoring theme

### 2.1. Overall Aim

To monitor the state of biodiversity of terrestrial ecosystems, within protected areas and communal rangelands. This includes aspects of biodiversity that are critical for sustaining the key ecosystem services in these areas (in other words, the natural resources that underpin local economic activities and livelihoods).

### 2.2. Specific Objectives

- 2.2.1. Determine annual trends in the quality and quantity of forage provided by herbaceous vegetation (this includes the measurement of the cover of herbaceous vegetation, as relevant to soil conservation and other sustainable land-use practises)
- 2.2.2. Determine trends in the cover and density of woody vegetation, by height class (relevant to browse production, bush encroachment, and the impacts of elephants or harvesting on biodiversity)
- 2.2.3. Identify and map isolated features that support high biodiversity (such as koppies)
- 2.2.4. Identify, map locations, and estimate population trends (where possible) of rare and threatened species
- 2.2.5. Monitor impacts to biodiversity and natural resources resulting from:
  - 2.2.5.1. Changes in rainfall patterns (incorporating annual rainfall, rainfall event sizes and the length of dry intervals between rainfall events).
  - 2.2.5.2. Herbivory
  - 2.2.5.3. Soil erosion
  - 2.2.5.4. Fire (or lack of fire)
  - 2.2.5.5. Clearing of fields for cultivation
  - 2.2.5.6. Clearing of land for housing or other buildings
  - 2.2.5.7. The spread of alien plants
  - 2.2.5.8. Small-scale mining
  - 2.2.5.9. Harvesting of wood
  - 2.2.5.10. Harvesting of medicinal and food plants
  - 2.2.5.11. Harvesting of Mopane worms (in relevant areas)

### 2.3. Examples of management-related questions that might be answered using the data collected

- 2.3.1. Is forage supply declining in rangelands with a particular land management strategy?
- 2.3.2. Is there a progressive loss of perennial grass species from rangelands with a particular management strategy, or is the abundance of these primarily determined by annual rainfall throughout?
- 2.3.3. Is there a decline in tall trees in protected areas with elephants, compared to those without elephants?
- 2.3.4. Is there currently an increase in small-scale mining in rural areas?
- 2.3.5. Is bush thickening still occurring, or has the density of shrubs and short trees stabilized?
- 2.3.6. Is the height structure of the woody layer stable or changing?
- 2.3.7. Does fire frequency and intensity differ between rangelands with different management strategies?
- 2.3.8. Does the effect of fire on woody plant cover differ for rangelands with different management strategies?
- 2.3.9. Are alien plants increasing in cover on rangelands of a particular management strategy?

### 2.4. Location of EMs involved:



#### 2.4.1. Protected areas

- 2.4.1.1. Timbavati
- 2.4.1.2. Balule
- 2.4.1.3. Sabi Sands
- 2.4.1.4. Blyde Rivierspoort (both sides)
- 2.4.1.5. Andover
- 2.4.1.6. SANDF Hoedspruit
- 2.4.1.7. Kondowe
- 2.4.1.8. Wild Rivers

#### 2.4.2. Communal rangelands

- 2.4.2.1. Mnisi Tribal Authority villages
- 2.4.2.2. Mametja Tribal Authority villages
- 2.4.2.3. Craigieburn
- 2.4.2.4. Makhushane area (Phalaborwa)
- 2.4.2.5. Giyani village (still to be selected)
- 2.4.2.6. Ha-Makuya

#### 2.5. Variables

Note: following each of the variables listed, the information in the square brackets indicates: 1) type of monitoring required for data collection [PATROL or CAMPAIGN] and 2) the frequency at which such monitoring would be conducted [DAILY, WEEKLY, MONTHLY or ANNUALLY]

##### 1) Herbaceous vegetation

- a) Cover and composition [CAMPAIGNS / ANNUALLY (summer)]
  - i) Line point transects, to record for nearest plant to each point:
    - (1) Species
      - (a) Grass species (selected from list)
      - (b) Forb (species not required)
    - (2) Distance to point
    - (3) Tuft diameter
    - (4) Utilization (yes or no)
    - (5) Photo (down length of transect)
  - b) Grass biomass [CAMPAIGNS / MONTHLY]
    - i) Disc pasture meter readings for 100 points at selected sites
      - (1) % greenness for each point

##### 2) Woody vegetation [CAMPAIGNS / ANNUALLY (summer)]

- a) Cover
  - i) Line point transects (same as used for herbaceous vegetation) to record at each point:
    - (1) Presence / absence of canopy above each point
      - (a) Height class
- b) Composition
  - i) Belt transects, to record:
    - (1) Species
    - (2) Number of stems per plant
    - (3) Damage
      - (a) Cause
        - (i) Elephant
        - (ii) Other herbivore
        - (iii) People
          - 1. Stems cut
            - a. Number of stems cut

- 3) Biodiversity features [PATROLS / DAILY to WEEKLY]
  - a) Koppies
    - i) Type of rock (if known)
    - b) Other feature - describe
  
- 4) Rare or threatened species [PATROLS / DAILY to WEEKLY]
  - a) Animal
    - i) Species (select from predetermined list of relevant species)
      - (1) Number of individuals
        - (a) By gender (if known)
        - (b) By age class (if known)
    - ii) How was presence of animal detected?
      - (1) Visual
      - (2) Tracks
      - (3) Dung
      - (4) Nest
      - (5) Other
  - b) Plant
    - i) Species (select from predetermined list of relevant species)
    - ii) Number of individuals (approximately)
  
- 5) Threats to biodiversity [CAMPAIGNS or PATROLS / WEEKLY or MONTHLY or ANNUALLY]
  - a) Rainfall changes
    - i) Record rainfall on a daily basis at home, using manual raingauge
  - b) Soil Erosion
    - i) Type
      - (1) Gully
      - (2) Sheet
      - (3) Rill
      - (4) Piping
    - ii) Map (length or perimeter, using track function on GPS)
  - c) Fires [CAMPAIGNS / ANNUALLY (winter to spring)]
    - Map perimeter of burnt area (using track function on GPS)
    - Source of fire
      - Protected areas
        - Lit by poachers, within protected area
        - Lit by poachers, outside of protected area
        - Planned burn
        - Accidental, within protected area
        - Accidental, entered from outside
        - Lightning
        - Unknown
      - Communal rangelands
        - Lit for clearing a field or debris
        - Lit for grazing
        - Accidental
        - Entered from outside study area
        - Lightning
        - Unknown
    - Intensity of fire
      - Patchiness (sample a 100 step points on transects located randomly through burnt area)

- Topkill: sample a 100 random trees and record topkill (sampled in spring following fire)
      - Full
      - Partial
- d) Fields
  - i) Status
    - (1) Active (planted this summer)
    - (2) Inactive
  - ii) Year cleared (if known)
  - iii) Crops planted
  - iv) Map perimeter
- e) Mining
  - i) Status
    - (1) Active
    - (2) Abandoned
  - ii) Type
    - (1) Pit for clay
    - (2) Sand mining
    - (3) Stone collection
    - (4) Other
- f) Alien plants
  - i) Species (select from list relevant to location)
  - ii) Density
    - (1) Adult (fruiting or flowering stage)
      - (a) Number of plants, or estimate of cover within specific area
    - (2) Juveniles
      - (a) Number of plants, or estimate of cover within specific area
  - iii) Flowers or fruit / pods present?
    - (1)
- g) Natural Resource Use
  - i) Fuelwood (covered by woody vegetation belt transects, above)
  - ii) Harvesting of plants for food or medicine [ad hoc observations?]
    - (1) Species
    - (2) Type of harvesting
      - (a) Cut stems or leaves
      - (b) Dug out entire plant
      - (c) Roots dug up
    - (3) Number of plants harvested
  - iii) Harvesting of Mopane worms [only for villages with Mopane trees; annual campaigns at end of December to assess amount of worms available, and amount harvested within predetermine areas / plots near village]

### 3. Freshwater Monitoring theme

#### 3.1. Overall Aim

To monitor the water quality and state of aquatic biodiversity of freshwater ecosystems in protected areas and communal rangelands. Rivers, dams, and wetlands are included, but not groundwater. The riparian vegetation of rivers is also included, as the state of this is closely linked to water quality. Particular stretches of rivers, or particular bodies of standing water, will be monitored intensively, to capture all factors affecting the freshwater resource.

#### 3.2. Specific Objectives

- 3.2.1. Determine seasonal trends in water quality, using appropriate indexes.
- 3.2.2. Identify and map isolated features that support high biodiversity (such as wetlands, riverine forests, river stretches with pools and rapids)
- 3.2.3. Identify, map locations, and estimate population trends (where possible) of rare and threatened species
- 3.2.4. Identify and monitor threats to water quality, aquatic biodiversity and riparian biodiversity, including:
  - 3.2.4.1. Pollution
  - 3.2.4.2. Alien plant invasions in riparian zones
  - 3.2.4.3. Loss of riparian vegetation, whether through clearing of fields, cutting of trees or reeds, sand-mining or flood damage.
  - 3.2.4.4. Alteration of hydrology through e.g. water abstraction, building of dams, or draining of wetlands.
  - 3.2.4.5. Fishing
- 3.2.5. Maintain “alien free” zones along particular stretches of river, in order to determine the effort and cost required to clear aliens over large areas, and to determine the effect of alien invasive species on biodiversity (aquatic and riparian).

#### 3.3. Examples of management-related questions that might be answered using the data collected

- 3.3.1. Is there a progressive decline in the water quality of a particular river?
- 3.3.2. Is there incidence of pollution increasing along a particular stretch of river?
- 3.3.3. What is the status of wetlands in communal areas?
- 3.3.4. Is there an increase in the area of wetlands and floodplains being used for cultivation?
- 3.3.5. Is the cover of alien plants increasing along a particular stretch of river?
- 3.3.6. What are the best methods to clear aliens along a particular river, and how frequently should it be applied.

#### 3.4. Location of EMs involved:

##### 3.4.1. Protected areas

- 3.4.1.1. Timbavati
- 3.4.1.2. Balule
- 3.4.1.3. Sabi Sands
- 3.4.1.4. Blyde Rivierspoort (both sides)
- 3.4.1.5. Andover
- 3.4.1.6. Kondowe
- 3.4.1.7. Wild Rivers

##### 3.4.2. Communal rangelands

- 3.4.2.1. Welverdiend
- 3.4.2.2. Mametja
- 3.4.2.3. Craigieburn
- 3.4.2.4. Makhushane area (Phalaborwa)
- 3.4.2.5. Giyani village (still to be selected)

- 3.4.2.6. Ha-Makuya
- 3.4.3. Commercial farms
- 3.4.3.1. New Dawn

### 3.5. Variables

Note: following each of the variables listed, the information in the square brackets indicates: 1) type of monitoring required for data collection [PATROL or CAMPAIGN] and 2) the frequency at which such monitoring would be conducted [DAILY, WEEKLY, MONTHLY or ANNUALLY]

- 1) Water Quality [CAMPAIGNS or PATROLS / WEEKLY or ANNUALLY]
  - a) SASS 5 sampling (provided adequate training can be provided, and that EMs can obtain proficiency with this method)
  - b) IHAS (an index of aquatic habitat condition)
  - c) Eutrophication
    - i) Algae
      - (1) Type
        - (a) Submerged
        - (b) Surface
      - (2) Colour
      - (3) If on pan or dam, % of area covered
  - d) Fish deaths
    - i) Species (select from predetermined list, customized for location)
    - ii) Number dead
  - e) For ephemeral streams, record when flowing
- 2) Biodiversity features [CAMPAIGNS / ANNUALLY]
  - a) Type
    - i) Riverine forest
      - (1) Dominant species (select from list of predetermined species, customized for location)
      - (2) Estimate width (from river bank to edge of forest)
    - iv) Wetland
      - (1) Type
        - (a) Valley bottom
        - (b) Seepage
        - (c) Pan
        - (d) Floodplain
      - ii) Pool and rapid system
  - b) Map perimeter or length (using track function on GPS)
- 3) Rare and threatened species [PATROLS / WEEKLY]
  - a) Trees (greater than predetermined size)
    - i) Species (select from list of predetermined species, customized for location)
    - ii) Approximate height
    - iii) Approximate stem diameter(s)
    - iv) Damage
      - (1) Pushed over and roots exposed
        - (a) Age
          - (i) Fresh (less than 1 year old)
          - (ii) Old (older than 1 year)
        - (b) Cause
          - (i) Elephant
          - (ii) Flood
          - (iii) Wind

- (iv) Unknown
    - (2) Main stems broken or cut
      - (a) Age
        - (i) Fresh (less than 1 year old)
        - (ii) Old (older than 1 year)
      - (b) Cause
        - (i) Human
        - (ii) Elephant
        - (iii) Flood
        - (iv) Wind
        - (v) Unknown
    - (3) Debarking
      - (a) % of circumference debarked
      - (b) % of stem height debarked
      - (c) Age
        - (i) Fresh (less than 1 year old)
        - (ii) Old (older than 1 year)
      - (d) Cause
        - (i) Human
        - (ii) Elephant
    - (4) Climbers in canopy
      - (a) % of canopy affected
    - (5) Other damage (describe, e.g. “burnt by fire last month”)
  - b) Animals
    - i) Type
      - (1) Hippo
      - (2) Crocodile
      - (3) Bird (only if EMs can obtain proficiency to identify important birds, such as the Pel’s Fishing Owl)
        - (a) Species
      - (4) Fish (only if EMs can obtain proficiency to identify fish species visually)
      - (5) Other
    - ii) How was presence of animal detected?
      - (1) Visual
      - (2) Tracks
      - (3) Dung
      - (4) Nest
        - (a) With animal present
        - (b) Animal absent
      - (5) Other
    - iii) Number
      - (1) Adults
      - (2) Juveniles
- 4) Pollution [PATROLS / WEEKLY]
  - a) Type of pollution
    - i) Physical litter
      - (1) Plastic
      - (2) Nappies
      - (3) Other
    - ii) Chemical
      - (1) Oil
      - (2) Other
    - iii) Sewerage
      - (1) Flowing or stagnant?

- (2) GPS location of overflow pipe, if present
  - iv) Sediment inflow
    - (1) Describe...
- 5) Alien plants [CAMPAIGNS / ANNUALLY]
  - a) Cover
    - i) Species (select from list relevant to location)
    - ii) Number of plants, or estimate of cover within specific area
    - iii) Flowers or fruit / pods present?
  - b) “Alien free” zones (predefined areas which will be kept clear of all aliens)
    - i) Prior to clearing, sampling cover as above
    - ii) Clearing effort
      - (1) Clearing method
      - (2) Number of people
      - (3) Number of days
    - iii) List of all alien plant species removed
- 6) Damage to riparian vegetation [PATROLS / WEEKLY]
  - a) Type of vegetation in which damage was observed
    - i) Riverine forest or bush
    - ii) Reeds
    - iii) Grazing lawn
    - iv) Other (describe)
  - b) Type of damage
    - i) Cutting live trees
      - (1) Primary stems or branches
      - (2) Maximum diameter cut
    - ii) Cutting of reeds
      - (1) Approximate size of area cut
    - iii) Fire
      - (1) Map perimeter of mined area (using track function on GPS)
    - iv) Flood damage
      - (1) GPS each tree pushed over (only for trees with diameter greater than ? cm)
    - v) Clearing for fields
      - (1) Year cleared (if known)
      - (2) Status of cleared area
        - (a) Cleared, but not planted yet
        - (b) Active (planted this summer)
          - (i) Crops planted
          - (c) Inactive
      - (3) Map perimeter of field (using track function on GPS)
    - vi) Mining
      - (1) Material mined
        - (a) Sand
        - (b) Clay
      - (2) Status
        - (a) Active
        - (b) Abandoned
      - (3) Method
        - (a) By hand and wheelbarrow
        - (b) By hand and bakkie / tractor
        - (c) Grader or TLB
        - (d) Not clear
      - (4) Map perimeter of mined area (using track function on GPS)

7) Alteration of hydrology [PATROLS / WEEKLY]

a) Type

i) Dam

(1) Type

(a) Earth

(b) Concrete

(2) Year constructed (if known)

ii) Bridge or crossing

(1) Bridge

(2) Crossing

(a) Cement

(b) Directly on river-bed

iii) Abstraction

(1) Type of abstraction

(a) Pump

(i) Pump station

(ii) Temporary pump

(iii) Status

1. Pump running

2. Off

(b) Canal

(i) Flowing

(ii) Closed

(c) Other (describe)

iv) Draining of wetland

(1) Type

(a) Hand-dug canals

(b) Concrete canals

(c) Erosion (gullies)

(2) Map length of each canal or erosion gully (using track function on GPS)

8) Fishing

a) Type

i) Line

ii) Nets

iii) Traps

b) Number of people fishing

c) Fish species caught (select from predetermined list, customized for each location)



## 4. Environmental Health theme

### 4.1. Overall Aim

To identify and monitor outbreaks of livestock diseases and associated human diseases, as well as the factors that promote the spread of these diseases.

### 4.2. Specific Objectives

- 4.2.1. Monitor the health of wildlife populations, and record disease outbreaks and any associated diseases in humans.
- 4.2.2. Identify and map all sources that may promote the transmission of disease, to livestock or humans, including
  - 4.2.2.1. Water points
  - 4.2.2.2. Slaughtering practises
  - 4.2.2.3. Transport of livestock
  - 4.2.2.4. Incursion by wildlife from protected areas in rangelands

### 4.3. Examples of management-related questions that might be answered using the data collected

- 4.3.1. Is the frequency of livestock disease declining in rural areas (over-time or in response to some intervention)?
- 4.3.2. Do incursions of indigenous wildlife ever lead to disease outbreaks in livestock populations?

### 4.4. Location of EMs involved:

- 4.4.1. Communal rangelands
  - 4.4.1.1. Mnisi Tribal Authority villages
  - 4.4.1.2. Mametja Tribal Authority villages
  - 4.4.1.3. Craigieburn
  - 4.4.1.4. Makhushane area (Phalaborwa)
  - 4.4.1.5. Giyani village (still to be selected)
  - 4.4.1.6. Ha-Makuya

### 4.5. Variables

Note: following each of the variables listed, the information in the square brackets indicates: 1) type of monitoring required for data collection [PATROL or CAMPAIGN] and 2) the frequency at which such monitoring would be conducted [DAILY, WEEKLY, MONTHLY or ANNUALLY]

- 1) Livestock health [PATROLS / WEEKLY or MONTHLY]
  - a) Dip-tank monitoring
    - i) Number of animals dipped per owner
    - ii) If no animals dipped, then why?
      - (1) No water
      - (2) No official present
  - b) Evidence of disease
    - i) Type of animal
      - (1) Species
      - (2) Gender
      - (3) Age class
        - (a) Juvenile
        - (b) Sub-adult
        - (c) Adult
    - ii) Vitality
      - (1) Dead
        - (a) Cause of death?

- (i) Disease
      - (ii) Predation
      - (iii) Starvation
      - (iv) Unknown
    - (2) Alive, but appears sick
      - (a) Symptoms
        - (i) Salivation
        - (ii) Unnaturally tame
        - (iii) Disorientation
      - (b) Body condition (5 point scale of body condition)
- 2) Water points [PATROLS / DAILY to WEEKLY]
- a) Water source type
    - i) River
    - ii) Dam
    - iii) Trough
  - b) Livestock use
    - i) Animal species
      - (1) Cattle
      - (2) Goats
      - (3) Donkeys
    - ii) Frequency of use
      - (1) Year-round
      - (2) Only in winter
      - (3) ...
  - c) Human use
    - i) Washing
    - ii) Drinking
    - iii) Frequency of use
      - (1) Year-round
      - (2) Only in winter
  - d) Pollution (covered under Freshwater Monitoring theme)
- 3) Slaughtering and trading [PATROLS / DAILY to WEEKLY]
- a) Animals involved
    - i) Species
      - (1) Cattle
      - (2) Goats
      - (3) Donkeys
      - (4) Chicken
    - ii) Number of animals involved
  - b) Slaughtering
    - i) Method...
  - c) Transport
    - i) Method
    - ii) Destination
- 4) Incursions by wildlife from neighbouring protected area [PATROLS / DAILY to WEEKLY]
- a) Type of animal
    - iii) Buffalo
    - iv) Elephant
    - v) Lion
    - vi) Other (describe)
  - c) How was animal detected?

- i) Tracks
- ii) Visual
- iii) Other (describe)
- d) Damage caused by animals
  - i) None
  - ii) Ate crops
    - (1) Number of fields affected
  - iii) Killed livestock
    - (1) Species killed
      - (a) Cattle
        - (i) Bull
        - (ii) Cow
      - (b) Goat
      - (c) Donkey
      - (d) Other
    - (2) Number killed
- e) Use GPS track function to track animals route (where possible)

## 5. Community Engagement theme

### 5.1. Overall Aim

To estimate and monitor the reliance of rural communities on natural resources, and to determine the impact of interventions (such as awareness campaigns) on the use or misuse of natural resource, and on perceptions of the status and value of natural resources.

### 5.2. Specific Objectives

- 5.2.1. Monitor the use of natural resources by rural people, as well as the importance of natural resources for sustaining their livelihoods.
- 5.2.2. Monitor socio-economic factors that may alter the use and reliance on natural resources, by rural people. Such factors would include e.g. income, household demographics, availability and price of food commodities, proximity of water sources, governance of communal lands, etc...
- 5.2.3. Estimate the financial value of natural resources used by rural people, and monitor changes in these values over time (other economic values have not been included, due to the difficult of using EMs to estimate such values).
- 5.2.4. Estimate the time and, where applicable, financial costs of utilizing natural resources.
- 5.2.5. Determine the impact of outside interventions, such as restoration projects or awareness campaigns, on the way in which rural people perceive and utilize natural resources. Note that some of the data relevant to this objective are covered by the Rangeland Monitoring and Freshwater Monitoring themes (such as occurrences of littering, rates of harvesting, clearing of fields).
- 5.2.6. To generate baseline social and economic data that can be used to design appropriate rural development interventions.

### 5.3. Examples of management-related questions that might be answered using the data collected

- 5.3.1. Which natural resources are the most important for sustaining rural livelihoods, and do these differ in different parts of the Biosphere?
- 5.3.2. What is the financial value of all natural resources utilized by a particular village?
- 5.3.3. Is the utilization of a particular natural resource changing (over a time-scale of years) and is this linked to changes in the supply of the resource and / or social or economic changes within rural households.
- 5.3.4. Did a particular awareness campaign lead to the desired change in behaviour amongst the rural people involved?

### 5.4. Location of EMs involved:

- 5.4.1. Communal rangelands
  - 5.4.1.1. Mnisi Tribal Authority villages
  - 5.4.1.2. Mametja Tribal Authority villages
  - 5.4.1.3. Craigieburn
  - 5.4.1.4. Makhushane area (Phalaborwa)
  - 5.4.1.5. Giyani village (still to be selected)

### 5.5. Variables

Note: following each of the variables listed, the information in the square brackets indicates: 1) method of data collection [VILLAGE SURVEY or HOUSEHOLD SURVEY or PATROL (interviewing of people located randomly whilst patrolling communal areas for tasks associated with other themes)] 2) the frequency at which such monitoring would be conducted [ANNUALLY or CAMPAIGN (i.e. following a specific intervention) or AD HOC]

- 1) Services [VILLAGE SURVEY / ANNUALLY]

- a) Shops
    - i) Goods sold (select from list of specific food items)
    - ii) Price for selected goods
  - b) Schools
    - i) Grade
    - ii) Number of learners enrolled
  - c) Water supply
    - i) Communal taps
    - ii) Number of houses with piped water (within a particular section of village)
  - d) Sanitation
    - i) Number of houses with sewerage service (within a particular section of village)
  - e) Roads
    - i) Map tarred or paved roads (within a particular section of village)
    - ii) Map new gravel roads (within a particular section of village)
  - f) Health Services
    - i) Clinic – number of staff
    - ii) Number of clients on ARVs
    - iii) Average number of clients visiting the Clinic on a monthly basis
    - iv) Number of Traditional Health Practitioners (THP) practising
    - v) Average number of clients seen by THPs on monthly basis
  - g) Social Grant Pay Out/Registration Points
  - h) Department of Home Affairs Mobile Unit visits p.a.
  - i) Nearest Police Station (Kms)
- 2) Community-based Institutions [VILLAGE SURVEY / ANNUALLY]
- a) Headmen and Council
    - i) Number serving on Committee
    - ii) Frequency of Meetings
  - b) Ward committee
    - i) Number serving on Committee
    - ii) Frequency of meetings
  - c) Community Development Forum
    - i) Number serving on Forum
    - ii) Frequency of Meetings
  - d) Water Committee
    - i) Number serving on Committee
    - ii) Frequency of Meetings
  - e) Clinic Committee
    - i) Number serving on Committee
    - ii) Frequency of meetings
  - f) List other (internal) Community-based Structures:
  - g) List other regional structures where some community members represent the community
    - i)
- 3) Household profiles [HOUSEHOLD SURVEY / ANNUALLY (specific household will be re-interviewed once each year)]
- a) Infrastructure
    - i) Type of house
    - ii) Use of garden for food production
      - (1) Fruit trees present
        - (a) Type (select from predetermined list, customized for each village)
      - (2) Crops planted
        - (a) Type (select from predetermined list, customized for each village)
  - b) Household residents

- i) Gender
  - ii) Age
  - iii) Education
  - iv) Employment
    - (1) Select from list?
  - v) Monthly income
  - c) Livestock owned by household
    - i) Type
    - ii) Number
    - iii) Management of livestock
      - (1) Which areas do livestock utilize?
        - (a) By season
      - (2) Are livestock dipped?
      - (3) Are livestock fed?
        - (a) Type of feed
        - (b) Amount spent on feed per year
      - (4) Village rules that pertain to livestock
        - (a) None
        - (b) If yes, describe
  - d) Natural resources collected by members of household
    - (1) Type (select from predetermined list)
      - (a) Water
        - (i) Source
          - 1. Communal tap
          - 2. Natural source
            - a. Type
              - i. River
              - ii. Dam
            - b. Frequency of collection from natural source
    - (b) Fuelwood
    - (c) Food plants
      - (i) Type
    - (d) Mopane worms
      - (i) Quantity collected this year
    - (e) Other resources...
  - (2) Quantity used per week (will have to develop appropriate indexes for each resources, e.g. wheelbarrow loads for fuelwood)
  - (3) Time required for collection, per week (estimate of person-hours)
  - (4) Perceptions of supply
    - (a) Is it becoming more difficult to harvest enough of this resource?
- e) Natural resources purchased by members of household
  - (1) Type (select from predetermined list)
    - (a) Water
    - (b) Fuelwood
    - (c) Mopane worms
    - (d) Other...
  - (2) Quantity and cost purchased, per week / month, per resource
- f) Natural resources sold by members of household
  - (1) Type (select from predetermined list)
    - (a) Water
    - (b) Fuelwood
    - (c) Mopane worms
    - (d) Other...
  - (2) Quantity and income generated per week / month, per resource

- 4) Harvester profiles [PATROLS / AD HOC (interviews with people actively harvesting resources, to determine spatial harvesting patterns)]
  - a) Harvesting location
    - i) At site of interview
    - ii) Another location (i.e. harvesters in transit to or from harvest site)
  - b) Type of resource harvested
    - i) Water
      - (1) Source type
        - (a) Dam
        - (b) River
    - ii) Fuelwood
    - iii) Medicinal plants
    - iv) Mopane worms
    - v) Other
  - c) Type of transport
    - i) Bakkie
    - ii) Wheelbarrow
    - iii) Carrying by hand / bag / bucket
    - iv) Other
  - d) Harvester profile (s)
    - i) Gender
    - ii) Age
    - iii) Household address (section of village)
- 5) Intervention effectiveness [HOUSEHOLD SURVEYS / AD HOC]
  - a) Customized interviews designed to assess the effectiveness and responses to specific interventions