Monitoring of CWR diversity
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Why Monitor?

What is the Goal and objective?

Goal

- Global frameworks for monitoring biodiversity and countries have reporting obligations

- Project SADC CWR: aim is to develop a National Strategic Action Plan ; monitoring and evaluation needs to be an integral of it.

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Aims of monitoring

"You can't manage what you don't measure"
(Peter Drucker)

- Investigate trends in biodiversity → monitoring; challenge - biodiversity including CWR are being lost, threatened ;

- Determine how current conservation efforts are working or not working; evaluate progress and highlight where conservation efforts need to be focussed

- Produce data and information that we can report to decision makers and global reporting mechansim; for scientific publications

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Global Framework for monitoring Biodiversity

Sustainable Development Goals:

Goal 9: Secure Ecosystem Services and Biodiversity, and Ensure Good Management of Water, Oceans, Forests and Natural Resources

Replaces Millennium Development Goal 7: Ensure environmental sustainability.

FAO Global Plan of Action-

FAO publishes state of the world report and a rolling GPA for monitoring status of PGRFA, AnGR and FGR. National Reporting thru Country reports

Convention on Biological Diversity:

UN Strategic Plan for Biodiversity 2011-2020; Aichi Targets Identified 2010 as key date to achieve significant reduction in rate of loss of biological diversity; identified range of indicators for assessing progress towards 2010; GBO primary mechanism for delivery of indicators. National reporting thru NBSAP

Constraints in monitoring

- Difficult and Expensive to implement
- Inadequately funded and Inadequately implemented
- Lack of compatibility between data sets by different organizations and projects; insufficient integration at different scales
- bias towards species-poor temperate zone & charismatic vertebrate species → minimal services to human economy; lack of genetic data
- subject to *ad hoc* approaches that lack rigorous survey and sampling approaches
- do not systematically involve the participation of local-level actor
- usually based on collections instead of direct observations in the field

What to Monitor?

Indicators and Metrics

What do we want to monitor?

- What is the status and trend of biodiversity independent of our actions?

- Are our conservation actions achieving the desired results? Are your management intervention effective?

- At what scale? Local, community, national, regional or global?

CWR and monitoring: identification and selection of variables to be measured

- Key characteristics of a species and its habitat to ensure that management interventions and actions are in fact meeting their objectives; changes in:
  - Demographic parameters (population size, structure, etc.
  - Ecological factors (predation numbers, invasive species; soil runoff; Abiotic and biotic factors; Disturbance and control sites; Climate change; Socio economic factors
  - Genetic diversity - Fitness, genetic diversity. Gene frequencies, Effective population size; Minimum viable populations
  - Iriondo et al, 2008 (Chapter 4); Hunter and Heywood, 2011 (Chapter 11)

FAO Indicators – Monitoring progress of the GPA

- FAO indicators – monitoring progress of the implementation of second Global Plan of Action. 66 indicators covering 18 activities in 4 main areas viz.
  - *In situ* conservation and management (12 indicators)
  - *Ex situ* conservation (12 indicators)
  - Sustainable use (22 indicators)
  - Building institutional and human capacities (20 indicators)

Priority Activity 4: Promoting *in situ* conservation and management of crop wild relatives and wild food plants
- Number of crop wild relatives and wild food plants *in situ* conservation and management actions with institutional support
- Percentage of national *in situ* conservation sites with management plans addressing crop wild relatives and wild food plants
- Number of crop wild relatives and wild food plants species actively16 conserved *in situ*

PA 15- Information on PGRFA
- Number of crop wild relatives conserved *in situ* documented in a publicly available information system

Strategic Plan for Biodiversity 2011-2020
Aichi Target 12 & 13

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained;

Target 13: "By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity."

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How to Monitor?

Methodologies

Main steps involved in Monitoring

1. Complete background tasks - BASELINE.

2. Develop objectives.

3. Design and implement management.

4. Design monitoring methodology.

5. Implement monitoring as a pilot study.

6. Implement and complete monitoring.

7. Report and use results.

(*Source:* Elzinga et al, 1998)

Establishing a baseline

- Baseline from which to start and compare the data to in future;

- Compiling and reviewing existing information on the population, species, habitat or other element, process or action that is the target of monitoring;

- Ecogeographical surveys, discussed earlier by Nigel provide such baseline for monitoring;

Monitoring

- How to sample
  - Plot method (quadrats- shapes, sizes); line intercept method

- How much to sample?
  - Size & Numbers of quadrats

- How often to sample?
  - frequency of sampling
  - The initial monitoring frequency is likely to be high.

- Data Accumulation and analysis
  - record the actual management that is undertaken between sampling events, which may for practical reasons differ from prescription
  - standard statistical techniques require random, independent sampling
  - GIS tools

- Feedback to reserve management plan and prescription.

1975

1989

1996

2008

Monitoring regime:
How to sample?

Plot methods: take observations at the sampling point within areas of standard size, usually called <u>quadrats</u>.

Line-intercept methods: measuring tape is laid out in a random direction at the sampling point and observations taken on those individuals which intersect the tape.

Monitoring regime: Quadrats

- Usually **square** or **rectangular**, sometimes **circular**

- **Small**: portable wood or metal frames
  Large: demarcated by pacing out or measuring the sides using a tape measure, placing pegs or stakes in each corner, and running string or coloured tape around the perimeter.
  - may be subdivided

- **Temporary** or **permanent**:
  - new quadrat sites on each sampling occasion statistically better, though there are ways of analysing time-series data from a set of fixed sampling units
  - permanent quadrats easier if large and numerous and the terrain difficult
  - precise instructions on how to reach each permanent quadrat needed
  - permanent plots are often photographed
  - pegs or stakes used to mark permanent quadrats should be wooden or plastic rather than metal, easy to spot and firmly planted

- **Demographic studies**
  - individual plants labelled with a tag bearing a unique identifier
  - position within the quadrat accurately mapped, eg using a pantograph or GPS

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- **size and number of quadrats**

Quadrats should be:

- small enough to be searched easily and permit sufficient replicates in the time and with the resources available

- large enough to accommodate whole plants of the target species,

- quadrat size should be kept constant, in particular if frequency.

- Having begun monitoring measured, to permit comparison of data from subsequent surveys.

Monitoring regime: How much to sample?

Rules of thumb

- plotting number of species against quadrat area usually gives asymptotic relationship, which can be used to determine the quadrat size above which any further increase leads to the recording of few if any additional species

- Goldsmith (1991): most species in the vegetation should have a frequency of 20-70% in the quadrats sampled and if several are present in all quadrats, then quadrat size is probably too large.

- Clark (1986): recommended quadrat size/shape for different plant habits

Target species	Plot size (m²)	Ratio of sides
Herb	0.5-1.0	1:2
Shrub	50-100	1:5 or 1:10
Tree	200-1000	1:5 or 1:10

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Monitoring regime: How much to sample?

2. Number of quadrats

The greater the number the more reliable the result, but the extra information gained from an extra quadrat will diminish as the total number of quadrats rises.

- Plotting variance against number of quadrats often yields an oscillating relationship: a useful guide to the minimum number of quadrats is the point where the oscillations damp down (Goldsmith *et al.*, 1986).

- Poole (1974) suggests that variance (s^2), resolution (L) and number of samples (n) are related as follows:

$$n = 4s^2/L^2$$

If numbers of a target species are being monitored, L would refer to the maximum percentage difference (eg among sites) or change (eg between years at a given site) in the numbers of individuals of the target species which the project is willing to consider unimportant.

The size and number of samples taken from the reserve will often be a practical compromise between the number that are required to generate meaningful statistics and the resources available.

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Monitoring regime: How often to sample?

- Main determinant of the frequency of sampling will be the strength and nature of the perceived threat to the population(s).

- For rare and/or very threatened annuals, monitoring may occur as often as every week or fortnight during each of several growing seasons.

- For perennial species, the interval between observations of adult individuals may well be several years, though there may be frequent monitoring of seedlings and saplings during a growing season to assess recruitment.

- If the population is to be monitored once a year, it is important to sample at comparable stages in the life cycle of the target species.

- The initial monitoring frequency is likely to be high. However, as changes or adjustments to the management prescription become less necessary, so the interval between monitoring exercises may be extended.

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Data accumulation and analysis

- Standard hardcopy or softcopy forms should be used on each sampling occasion

- record the actual management that is undertaken between sampling events, which may for practical reasons differ from prescription

- standard statistical techniques require random, independent sampling

- it may be necessary to monitor both populations being subjected to management within the reserve and nearby conspecific populations not subjected to management
  - outside the reserve
  - within the reserve but excluded from human interventions by the management plan

Thank you

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Group Exercise

- Discuss the relevance and feasibility of the set of indicators for Monitoring of in situ conservation of CWR and monitoring of the implementation of NSAP in your countries?

- Score each indicators according their attributes (provided)

- Provide a core set of indicators that can be used for monitoring NSAP?

Attributes of the indicators

- Relevant;

- Unambiguously related to the assessment goal;

- Precisely defined;

- Diagnostically specific;

- Easy to detect, record and interpret;

- Reliable, as indicated by the replicability of results;

- Sensitive to stress on the management, ecological or social systems;

- Providing a measure over space/time;

- Appealing to users

Café style

- Divide yourselves in to 4 groups and nominate a rapporteur:
  - South Africa + 4 or 5 neighbouring countries
  - Zambia + 4or 5 neighbouring countries
  - Mauritius
  - Germination countries (3)+ 4 or 5 Mauritius
- 15 mins to complete the exercise
- Sharing/discussion – 5 mins sharing/discussion with other group: (rapporteur stays in his/her group)
  - SA group moves to ZAM group
  - ZAM group moves to MRU group
  - MRU move to GER group
  - GER group moves to SA group

After 5 mins move around, clockwise.

- Rapporteur writes a report and submit to organisers by end of workshop