Long-term monitoring

Tim O'Connor
SAEON

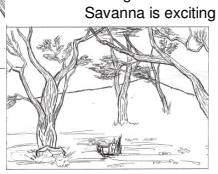
Why monitor ecosystem change?

Manager or scientist 1
For first decade
Woodland is enchanting

Why monitor ecosystem change?

Manager or scientist 1
Woodland is enchanting

Manager or scientist 2
Savanna is exciting

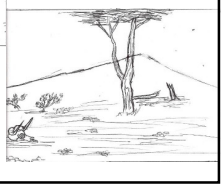


Why monitor ecosystem change?

Manager or scientist 1
Woodland is enchanting

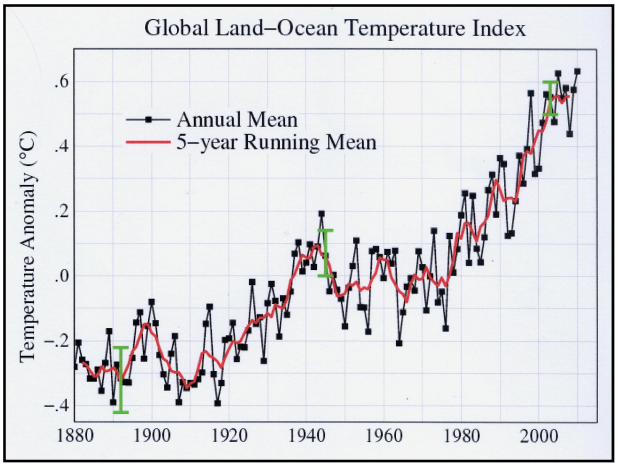
Manager or scientist 2
Savanna is exciting

Manager 3.
Shrub desert has a stark, ethereal beauty

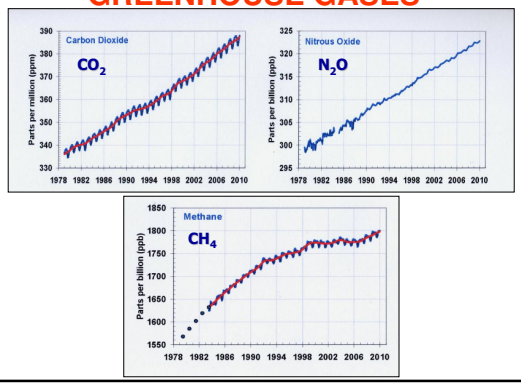


Our individual mandates are short in relation to ecological time frames

It takes time to reveal change



HISTORICAL TRENDS IN ATMOSPHERIC GREENHOUSE GASES



What is Monitoring?

Some people like to distinguish monitoring from surveillance

Monitoring

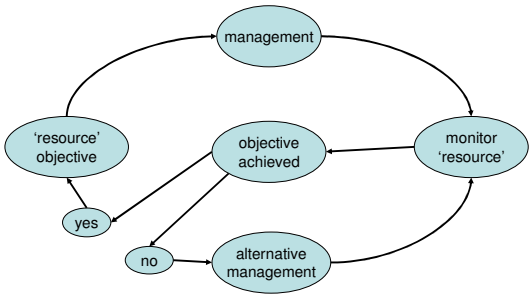
Collection and analysis of repeated observations to evaluate changes in a state variable(s) of interest in order to assess the ongoing influence of management/decision-making to achieve a stated management objective

NB adaptive management

Surveillance

Collection and analysis of single or repeated measurements in order to determine the state of a state variable at a point in time in the absence of a specific management context or objective

Monitoring in an Adaptive Management Context



Acknowledgments: EKZNW

Different forms of monitoring

- Monitoring for decision-making in a management context
- Monitoring for improving scientific understanding
- Long-term ecological research

All tend to fail or succeed for similar reasons

What is the usual outcome of monitoring?

Unfortunately most efforts fail

Some veld monitoring examples:

Veld monitoring in KZN reserves

Place	Duration	# surveys	# plots	Product
Coleford	75-85	5	36	No
E Shores	91-04	Annual	15	?
False Bay	87-04	Annual	11	Ann Rep (AR)
HiP	80-88	Annual	?	No
HiP	30-95	Every 4 yr	?	No
Mkuzi	79-04	Annual	32	No
Ncandu	87	2	~5	No
Ndumo	97-pre	Annual	19	AR
Sileza	94-pre	Annual	10	AR
Spioenkop	78-88+0x	1-4	88	Rep
Tembe	98-pre	Annual	28	AR
Wagendrift	80-?	3	8	No
Weenen	80-?	3	12	No

Why such poor success?

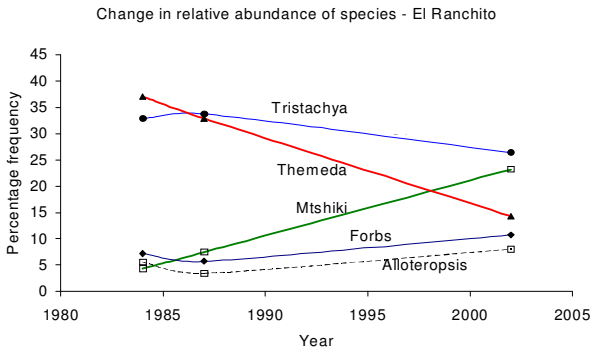
- Large data bases
- 50-50 flow to management
- Minimal scientific value extracted
- Collapse of monitoring common

WHY?

1. Question? – so what if veld changes?
2. Conceptual framework – agric patterns do not apply, so what is expected and why?
3. Sampling design – no controls, how are changes to be interpreted?
4. Minimal products by which to adapt approach

PROMISE

Not too late to extract scientific value from these – see what questions can or could be addressed



From: Short et al (2003) AJRFS 20,1-10.

Another example

Bergkamp is one of the longest running grazing trials in the world (mid 1930s).

Stunning effects of management over the long-term, but what has actually been documented?

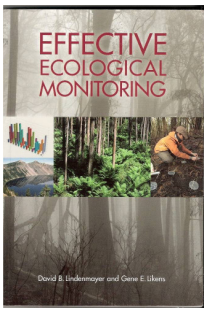
What is not monitoring

Retrospective studies (but they are an essential foundation)

Simply demonstrating change
- shown here from two points in time

Need to reveal in part the causes of change so that an action can be implemented

"Lessons" of talk



1. No grand design – no one-size fits all
2. Case-by-case basis
3. Question driven
4. Necessity of a conceptual framework
5. Sound sampling design, appropriate monitoring variables
6. Continually evaluate data
7. Change monitoring approach if need be

Why Monitoring fails

List from Lindenmayer and Likens (Chap 2)

1. Passive, mindless, and lacking questions
2. Poor experimental design
3. Snowed by a blizzard of ecological details
4. Squabbles about what to monitor
5. Assumption that 'one-size-fits-all'
6. Big machines that go 'bing'
7. Disengagement
8. Poor data management
9. Breaches of data integrity
10. Lack of funding – budget myopia
11. The loss of a champion
12. Out of nowhere
13. Excessive bureaucracy

What makes effective long-term monitoring?

1. Good questions and evolving questions
2. The use of a conceptual model
3. Selection of appropriate entities to measure
4. Good design
5. Well-developed partnerships
6. Strong and dedicated leadership
7. Ongoing funding
8. Frequent use of data
9. Scientific productivity
10. Maintenance of data integrity; calibration of field techniques
11. Little things: transport, staff, field access, field time

Case 1: Grassland diversity

General question:

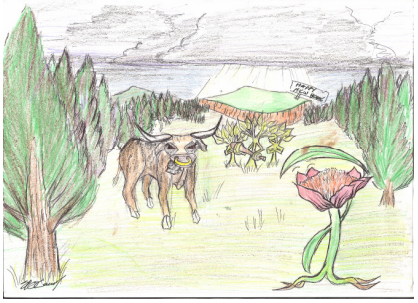
Can we maintain plant diversity of grasslands within a transforming landscape in the face of climate change?

Practical question:

How should monitoring be conducted in order to assess whether our conservation aim is being achieved?

The landscape in question

Preliminary conceptual model: adapting to climate change



Movement within altitudinal corridors

Potential Constraints
Inhospitable soils
Heavy grazing
Loss of pollinators
Aliens
Shading
Topographic barriers
Perturbed fire regime

Individual species Responses
- dispersal
- regeneration
- etc

So how to monitor response?

1. First, what are the potential management responses – if not defined can we anticipate what information is needed?
2. If a general approach of plots for botanical composition is used, will they effectively sample important individual species?
3. If you attempt to monitor a large set of individual species, will it be sustainable?
4. Are there likely to be indicator species? (NO)
5. What about monitoring the changing environment?

Case 2. Elephant impacts in small reserves

Case illustrates that a single method to meet two objectives can result in a compromise, and that monitoring must evolve.

Elephants were introduced into a semi-arid reserve supporting savanna in order to thin the dominant bush species and promote grass growth.

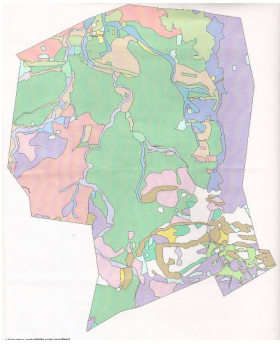
Question 1: Can elephants be sustained in a small reserve considering their known impacts on their food supply?

Approach: Monitor their impact on their food supply – 150 transects across the reserve.

Things done correctly and lessons learnt

Plus 1.

We had a basic knowledge of the vegetation of our ecosystem and could plan sampling accordingly



Things done correctly and lessons learnt

Plus 2.

We developed a conceptual model of the impact of elephants on plant diversity.

Also of the overall set of relationships

BIOLOGICAL CONSERVATION 136 (2007) 329–345

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/biocon

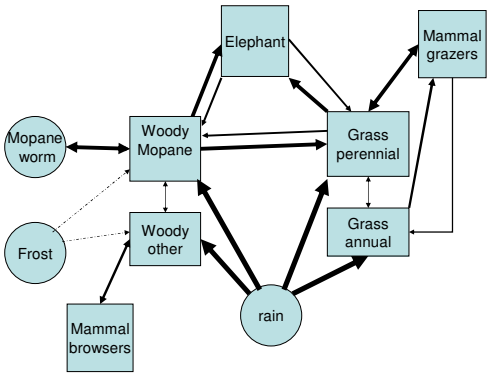
Review

A functional hypothesis of the threat of local extirpation of woody plant species by elephant in Africa

Timothy G. O'Connor[a,*], Peter S. Goodman[b], Bruce Clegg[b]

[a]Centre for African Ecology, School of A.P.E.S., University of the Witwatersrand, Private Bag 3011, P.O. WITS 2050, South Africa
[b]Ezemvelo KwaZulu-Natal Wildlife, P.O. Box 13053, Cascades, Pietermaritzburg 3202, South Africa

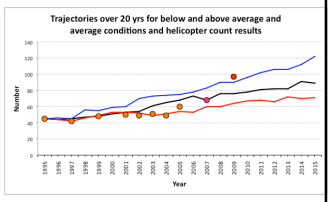
Woody-grass system: wildlife



Things done correctly and lessons learnt

Plus 3.

We made predictions about the main agent of change – the elephant population would grow



Things done correctly and lessons learnt

Plus 4.

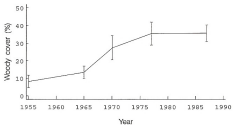
We recognised from the outset that agents other than elephants affected the abundance of woody plants

Journal of Applied Ecology 2001 38, 1314–1325

Effect of small catchment dams on downstream vegetatio of a seasonal river in semi-arid African savanna

T. G. O'CONNOR

Centre for Sustainable Savannas, University of Natal, Pietermaritzburg, Private Bag X01, Scottsville, 3209, South Africa

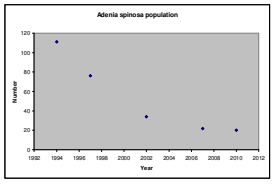


Increase in woody cover on hydromorphic grasslands (n=6)

Things done correctly and lessons learnt

Plus 5.

We adapted our monitoring early on when we realised some uncommon species were not present on transects but were being impacted.



Things done correctly and lessons learnt

Plus 6.

We intensified sampling where an important dynamics was unfolding, ie adaptive monitoring

Elephant-induced reversion of hydromorphic grassland 1996-2010

Response of *Acacia tortilis* to utilization by elephants in a semi-arid African savanna

Shaun D. MacGregor & Tim G. O'Connor*

South African Journal of Wildlife Research 34(1): 55-66.

2002

2010

Things done correctly and lessons learnt

Minus 1 to 5.

OVERKILL

12000 plants monitored

>6000 are dominant species (elephant staple)

(Cannot let go!!)

Things done correctly and lessons learnt

Minus 6.

Overkill compromises sustainability of monitoring

Each monitoring:

1 mo data prep

100 field days X 2

6 mo data entry

Consequently, monitoring frequency could not be maintained

Things done correctly and lessons learnt

Minus 7.

Elephants have impacted so many uncommon species severely that we cannot maintain sample size

Dead maroela-pollard

Dead maroela-ringbark

Uprooted *Lannea scweinfurthii*

Dead *Commiphora*-Partial uprooting

Partially pollarded *Sterculia rogersii*)

Dismemberment of *Adansonia digitata*

Things done correctly and lessons learnt

Minus 8.

Scale of operation makes it difficult to respond to events

Examples:

Mopane worm outbreaks (above)

Frost (< once a decade) (below)

Solution

Process data

See what has been learnt

Identify implications of any potential management decisions

Adapt monitoring approach accordingly

Conclusion

If anyone wants to discuss their monitoring design, perhaps we could find the time with others who might be interested.

The critique would be along the lines presented in this talk