Danida

"Monitoring Matters:
Comparative Analysis of Innovative Approaches" (MOMA)

Bhutan, Ghana, Namibia, Nicaragua, Tanzania and the Philippines

Proceedings from Kick-Off Workshop

Copenhagen, Denmark
3-6 April 2006

The Royal Agricultural
and Veterinary University
Denmark

NORDECO

Contents

List of Annexes:

1. Background

This report documents a workshop of the Danida-funded research project "Monitoring Matters: Comparative Analysis of Innovative Approaches" (MOMA). The workshop was convened from 3-6 April 2006 at the Royal Agricultural and Veterinary University in Copenhagen, Denmark. The purpose of this report is to summarize the discussions and conclusions of the workshop.

The workshop was organised with the objectives of developing a common understanding of locally-based and scientist-based approaches for monitoring biodiversity and resource use through exchanges of participants' experiences. In addition, the workshop was intended to contribute to obtain agreements on the methods and activities of the MOMA project.

The minutes of the workshop are provided in Annex 1 while the workshop programme and participants are listed in Annexes 2 and 3. Annex 4 outlines the preliminary sampling strategy of MOMA which was presented at the workshop.

This report contains the views of the workshop participants and does not necessarily reflect the views of the involved government authorities and other institutions in the project.

2. Summary and conclusions

1. The Royal Agricultural and Veterinary University (KVL) and Nordeco, Copenhagen, organized a workshop on the Danida-funded research project "Monitoring Matters: Comparative Analysis of Innovative Approaches" (MOMA). The workshop was held in Copenhagen, Denmark, on 3-6 April 2006, with participants from eight countries, which are involved in this project. The main objectives of the workshop were to: (i) develop a common understanding of locally- and scientist-based approaches for monitoring biodiversity and resource use through exchanges of participants' experiences; and (ii) to obtain agreements on the methods and activities of the MOMA research project.

2. The participants from Ghana, Namibia, Nicaragua, the Philippines and Tanzania presented the structure of the biodiversity monitoring schemes in their countries and the key lessons learnt. In all five countries except Nicaragua, there are already substantial experiences with biodiversity monitoring undertaken at a local scale and by local people who depends on the resources for their livelihoods.

3. Staff of Nordeco proposed a sampling strategy for the project with focus on two key questions: "Is locally-based monitoring able to detect changes in the abundance, distribution and utilization of resources?" and "Is locally-based monitoring an effective resource management tool - compared to conventional methods?" The proposed sampling units would be forest, savanna, and wetland sites. The methods would be: village patrol records; community assessments of presence of species; community assessments of trends for populations and extent of utilization of selected species; transects; simple presence-absence and encounter rate sampling.

4. The participants from University of Berkeley, California, presented an *a priori* power analysis which concluded that data from 50 sites would be needed equalling 9 sites per country, each site with 10 repeated measurements and 3-4 measurements per year. In the discussion, it was agreed that

there is a spectrum of approaches to biodiversity monitoring, not just locally-based and professional scientists' monitoring, and that this should be reflected more in the sampling strategy for the project.

5. Participants from the Royal Agricultural and Veterinary University discussed Memorandum of Agreements (MoAs) between KVL and the involved institutions and provided detailed guidance on reporting requirements, the use of CampusNet and various financial matters.

6. An overall MOMA Project Implementation Plan and countrywise plans were drafted for all five countries. In addition, the first Steering Committee meeting was convened. It was agreed to ask Danida for formal approval of adjustments to the staffing, institutional set-up and the associated sub-budgets for the project, so as to reflect the agreements reached during the workshop discussions.

7. Finally, the workshop participants agreed on key tasks ahead. These included: (a) signature of MoAs before July 1, 2006 if at all possible; (b) Revision of budgets, institutional set-up and staffing as soon as possible; (c) Finalization of Country Implementation Plans and development of a 2-page MOMA 'minimum activity' document; (d) Compilation/development of a manual to the MOMA methods; (e) Establishment of Bhutan as full project participant country; and (f) Organization of an International Workshop which was scheduled for October 2007.

Annex 1. Minutes of the workshop.

The minutes of the workshop comprise 20 sections:

BACKGROUND

1. Opening of the MOMA kick-off meeting

By Prof. Flemming Frandsen (The Royal Veterinary and Agricultural University, Denmark)

Flemming explained the background to the project and how it fits into other research and education activities of the The Royal Veterinary and Agricultural University (KVL). KVL is the Danish university with most direct linkages between research/education and practical natural resource management.

2. Introduction to the Kick-Off Meeting
By Assoc. Prof. Per Moestrup Jensen (The Royal Veterinary and Agricultural University)

Per described why the MOMA project is particularly exciting, and he outlined the general structure and agenda of the Kick-Off Meeting.

3. Overview of the MOMA project
By Finn Danielsen (Nordeco, Denmark)

Finn presented the background and objectives of the MOMA project and this Kick-Off Meeting. The MOMA project is a new, Danida-funded research initiative which was conceptualized on an international symposium on locally-based monitoring of biodiversity and resource use held in Denmark in 2004. The results of the symposium have been published as a special thematic issue of the journal *Biodiversity and Conservation* (www.monitoringmatters.org).

Monitoring of biodiversity and resource use is important, because monitoring can answer questions such as:

- Are there increased benefits to local people from sustainable natural resource use?
- Are habitats and ecosystems being degraded?
- Are the populations of threatened species of plants and animals declining?
- What are the causes?
- Has management intervention the intended impact on the ecosystem?

In other words, monitoring can answer whether the management interventions in an area are effective in addressing biodiversity conservation and sustainable development.

Most existing biodiversity monitoring efforts are carried out by professional scientists. These monitoring schemes are however often constrained by high running costs and, consequently, they have proven difficult to sustain over time. In addition, such schemes are sometimes perceived by managers to be irrelevant and seen by some as paying inadequate attention to other stakeholders than scientists.

A new generation of monitoring methods have emerged. These are carried out at a local scale and by individuals with limited formal training in science. The objectives of the MOMA project are to find out if these new approaches to monitoring can detect natural resource trends and address the shortfalls of conventional monitoring approaches.

Finn asked the participants: ”Can’t community and scientists’ monitoring work together?” He then explained that in his opinion they certainly can, and that communities and scientists are in fact working together in most of the locally-based schemes that he knows about. For the purpose of the present project, however, we are distinguishing between the two types of monitoring so as to enable a comparison of the two approaches.

He also asked: “Can’t community monitoring be scientific?” and said that in his opinion community monitoring could certainly be scientific but that it would be important to document this, and this is exactly what this project intends to do.

In addition, Finn asked: “Does scientists’ monitoring tell the truth?” He said that it would be impossible to say whether one approach tells the truth or not, but instead the project could compare the two approaches and tell whether they were in agreement in their findings or not.

Finn then described the expected outputs of MOMA, which would be improved understanding of the reliability and the management effectiveness of locally-based *vis-à-vis* professional scientists’ monitoring. He also presented the organisational structure of the project. This includes a Steering Committee, a Management Unit at KVL, case studies in Bhutan, Ghana, Namibia, Nicaragua, Philippines and Tanzania, and a Technical Support Group.

He then presented the main objectives of the kick-off workshop, which were: (i) to develop a common understanding of locally- and scientist-based approaches for monitoring biodiversity and resource use through exchanges of participants’ experiences; and (ii) to obtain agreements on the methods and activities of the MOMA research project.

EXISTING MONITORING ACTIVITIES

4. Existing locally-based monitoring activities in Ghana

By Moses Sam (Wildlife Division, Ghana) and Assoc. Prof. Justin Brashares (University of Berkeley, California)

Justin and Moses described the ranger-based monitoring by the Wildlife Division in Ghana. This scheme entails monthly, 10-15 km foot patrol records around ranger posts in 6 savanna reserves (see Biodiv. and Conserv. 14: 2709-2722). Data collection has been undertaken for more than 30 years. Unfortunately, it has provided limited input to management because no mechanism has been established for integrating the information into park management. The scheme has however been highly successful in documenting declines in and local extinctions of larger carnivores, and some of the results have been widely circulated through their publication in the journal Science.

5. Existing locally-based monitoring activities in Namibia

By Greg Stuart-Hill (LIFE Namibia Programme)

Greg described the Ranger Event Book System which was developed in Namibia (see Biodiv. and Conserv. 14: 2611-2631). This scheme includes village patrol records (e.g. the poaching module) and mapping of problem animal incidents etc. by community game guards. The villages decide on what they would like to monitor from a pre-determined selection of possible monitoring modules. The community game guards are funded by revenue from trophy hunting/tourism. The scheme is in operation in 30 of Namibia’s communal conservancies covering 7 million ha. The documents used in this scheme have different colors, yellow are for data collection, blue for seasonal and yearly trends, and red for long-term trends. Overall, the role of scientists in this scheme is mainly to ensure that data are efficient, defendable and comparable. Greg said that in general the data as such are only 50% of the value of this scheme, because it has so many add-on benefits in terms of building local constituencies.

6. Existing monitoring activities in Nicaragua
By Dr Mijail Perez and Dr Ricardo Rueda (University of Central America, Nicaragua)

Mijail and Ricardo introduced the existing biodiversity monitoring activities in Nicaragua which are largely undertaken by professional scientists but sometimes with the involvement of local community members.

7. Existing locally-based monitoring activities in Philippines
By Danny Balete (Laksambuhay Foundation, University of the Philippines, Philippines) and Marlynn Mendoza (Protected Area and Wildlife Bureau, Philippines)

Danny described the integrated ranger and village-based monitoring scheme in the Philippines. This scheme comprises four methods: (i) Focus group discussion with volunteer community monitoring groups, (ii) On-the ground fixed point photography of selected forest blocks in priority forest areas, (iii) Simple line transects; and (iv) Patrol records (see Biodiv. and Conserv. 14: 2633-2652). Elements of this scheme are in operation in around 25 protected areas (PAs) nationwide. It has led to 156 conservation management interventions in 8 PAs over 2 years. Examples of these management actions include:

- 'Obo Bagobo' indigenous people: the village chieftain issued an ordinance on seasonal closure for hunting of wild pig and deer, based on Community Monitoring Group and simple line transect results.

- Village in the mountains of Sierra Madre: the village head issued an ordinance banning the collecting of fresh Narra (Pterocarpus sp.) and the floating of all Narra on the river in order to protect the fish resources in the river, based on the results of Community Monitoring Group discussions.

- Municipality of Batan: fishermen decided to ban the use of fishing nets and compressors in a bay. Locals mainly use hook and line, while visitors from other areas were using nets and compressors. The abundance of fish and the catch of fish on hook reportedly improved after only 7 months. This management action was based on Community Monitoring Group discussions.

- Protected Area Management Board (PAMB) in Batanes: the issue of overgrazing of communal lands by goats was raised in the PAMB. The Board decided to organize a workshop with the local stakeholders to develop a management plan for the pastureland. This action was based on Community Monitoring Group discussions and fixed-point photography.

8. Existing locally-based monitoring activities in Tanzania
By John Massao (Forest and Beekeeping Division, Tanzania)

In southern Tanzania, a community-based monitoring scheme entails 2-4 village patrols per month in each forest, recording signs of resource use and selected species (see Biodiv. and Conserv. 14: 2653-2677). This scheme is in operation in 60 villages mainly in Iringa. Village patrol work is funded by revenue from harvested forest products. The scheme has led to 181 conservation management interventions in 20 villages in less than 2 years. Keeping track of the management

interventions that result from the monitoring has proven useful for indicating the possible management impact of the activities as well as for providing direction for the development of the scheme. The scheme is sustained even without government action and some elements of the scheme are now being scaled up to the forestry sector nationwide.

METHODS OF MOMA

9. Discussion of Methods

Finn Danielsen and Mikkel Funder (Nordeco, Denmark) presented a proposed sampling strategy which they asked the participants to discuss . The strategy was based on previous discussions among a number of the project participants.

They defined *locally-based monitoring* as "monitoring carried out at a local scale by individuals with limited formal training". In comparison, they defined *conventional monitoring* as "monitoring by professional scientists".

They proposed that the project should concentrate on answering two key questions, one question on accuracy and one on management effectiveness. They formulated the Accuracy Question like this: Is locally-based monitoring able to detect changes in the abundance, distribution and utilization of resources? Sub-questions would be: To what extent? … and under which conditions as compared to conventional methods? They proposed that sampling units should be forest, savanna, and wetland sites. Each site should have a size that makes it significant both in terms of biological resources and local utilization.

They suggested that the locally-based methods should be:
1) Village patrol records
2) Community assessments of presence of species
3) Community assessments of trends for populations and extent of utilization of selected species

These methods should be compared with conventional methods, which could be:

1) Transects
2) Simple presence-absence sampling
3) Encounter rate

For the Accuracy Question, the type of data on each site would then be:

- Overall habitat / land-use, latitude and longitude, size
- Distance to nearest other sampled site
- Basic environmental characteristics
- Socio-economic data
- Management set-up

Similarly, the data on each scheme would describe:

- Education of those who collect and analyze data
- Estimates of seasonal detection abilities
- Evaluation of species identification bias
- Assessment of other biases w/ scorecards

Data would be entried nationally on Excel spreadsheet and downloaded every three months on CampusNet to allow for back-up and access by all.

In the analysis of the Accuracy Question, it would be useful to look at how similar the results are between the schemes, and how the findings varies between habitat types, between countries, and between villages at different levels of wealth and education. To do this, the two data sets would be compared, and efforts would be made to seek correlation with the background data.

In practice, in each country, to obtain data for answering the Accuracy Question, there would be three main steps: Field survey (where all the locally-based and conventional methods are used in e.g. 10 forest sites, and each site is surveyed e.g. 10 times), registration of site data, and registration of data on each scheme.

Mikkel then explained that the second Key Question for the project to look at: Is locally-based monitoring an effective resource management tool - compared to conventional methods?

To answer this, one could compare inputs (human resources, time and cost), use of data (plans and management actions), stakeholder agreement with the data, and conservation/development links. The sampling units would be the same as for the Accuracy Question: forest, savanna and wetland sites, including the local communities living in or near these sites. It would be important to take a pragmatic approach. For instance, some issues might only be covered in some countries. The methods could comprise of a stakeholder survey (multiple choice questionnaire/scoring, interviews/PRA, one survey of 3-4 weeks in year 3 among communities, management staff, decision makers, and scientists) and own data registration of e.g. inputs.

Data on inputs could be divided into those dealing with human resources (educational level of collectors and analysts, duration and cost of training), time (person hours used incl. training, duration of monitoring, frequency of monitoring, time from data collection to practical use) and financial cost (operational expenses, equipment cost, and human resource salary cost).

Use of monitoring data could be assessed by looking at management planning (type of plans generated from monitoring, level of plans, stakeholder awareness of plans) and actions emanating from the monitoring (e.g., no. of management actions resulting from monitoring, type of management actions, stakeholder awareness of management actions). Stakeholder agreement with the monitoring data could be assessed by examining the number of stakeholders agreeing and the types of stakeholders agreeing to the monitoring data. Conservation and development linkages could be explored by asking stakeholders about the key impacts on local/national development of the various types of monitoring.

Analysis of the data on the second Key Question could be carried out at both site, “national” and international level (across the countries). Mikkel also mentioned the possibility of expanding the locally based monitoring methods to socioeconomic and institutional monitoring.

The participants were then asked to split into country-groups in order to discuss the proposed sampling strategy with point of departure in the following questions:

- What is your main comment to the key questions?
- What is your main comment to the methods for the Accuracy Question?
- What is your main comment to the methods for the Management Effectiveness Question?
- Are the proposed data collection steps possible to undertake?

10. Plenary presentation of group work and discussion (4 April 2006)

The response from each country to the proposed sampling strategy was presented. The Nicaragua group intended to use village patrol records and community presence/absence data as well as transects/point counts along current paths of park guards. Fires would be relevant to monitor for them as would forest gaps/fragmentation and river pollution. Monitoring of rivers/wetlands would be a particularly high priority, since many villages depend on river resources.

The Namibian group suggested an opinion survey in each country to identify what is really important to monitor and in which way. In addition, they proposed an assessment of what is actually being done in each country. Key topics in Namibia include poaching, habitat fragmentation, wildlife trends for key species, and utilization of resources. Monitoring of management actions would also be useful as well as monitoring of the sustainability of the various approaches (ownership, interest, continuation). They found a need to classify the various types of monitoring in each country. Jon Fjeldså added that it would also be important to find out what it is that local approaches is in fact monitoring (eg typically not butterflies)

The Ghana group gave high priority to the Accuracy Question. They stressed the need for clear and consistent definitions of 'local' and 'conventional' methods. They would consider their CREMA and RBM approaches to be locally-based as long as data interpretation and data processing were also undertaken locally. They found it unlikely to be able to detect temporal trends but better to expect to find trends over a gradient of land use/disturbance. They therefore found there is a need for more types of sites than simply 'forest' and 'savanna' sites (e.g. degraded forest and pristine forest). They expected a good overlap for some target resources (eg wildlife species and bushmeat) but a less clear relationship for other resources.

The Philippine group asked the workshop participants what would be achieved, if the same trends were not found by the two approaches. Per Moestrup responded that we can only see if the two approaches are consistent or inconsistent, nothing more than that. The group said that in practice no "conventional" method is in operation in Philippine terrestrial protected areas at the moment and getting this going would be difficult. Also, they asked how to decide on what to monitor. With regard to management effectiveness, they suggested that we all examine how the governments use conventional monitoring at present, for instance forest cover statistics or permanent plots. They found that during MOMA it would not be feasible to obtain reliable effectiveness data on the conventional methods. For instance, it would be too short time to expect much management decisions from the conventional approaches.

The Tanzanian group would like to use the following methods for the Accuracy question; locally-based methods: random walk (timed) and focus group discussion; conventional monitoring: transects, plots, and tree diversity assessment. For the Management Effectiveness question, number

of illegal activities, reduction in key threat, activity level of the local village committee. They would prefer to look at impact on overall biodiversity/natural resources, e.g. by checking forest cover change by asking locals and by checking with forest cover maps.

Discussion
A number of overall challenges were identified and discussed, facilitated by Associate Professor Brian Child, University of Florida:

- Is the locally-based monitoring providing the same or better data than official systems? Does this matter? Is the data that local people can collect reliable? Is it a political question more than a scientific question whether local approaches can produce useful data?
- Do the local people think the scientists are good or bad? Scientists are slow. Local people need answers. Both sides need to be combined to bring things together.
- Precision in terms of LBM and CM: what are we actually comparing? How do we avoid comparing apples and oranges?
- Are we actually testing the efficacy of CBNRM or of locally based approaches?
- How do we compare LBM with non-existing CM in some countries, e.g. the Philippines?
- LBM is trend-based – it is after all monitoring – how do we do this legitimately in three years? Would it suffice to substitute time for space?
- All our cases of LBM are quite 'scientific'. Are there perhaps better examples of less-scientific, locally-based methods available?
- LBM has some gaps. E.g. habitat type assessments. E.g. attitudes of key policy makers to local approaches. E.g. tracking flow of information can be difficult.
- Important donors for natural resource management initiatives such as the GEF/World Bank/UNDP want examples and want to know how well it works, what is best practice etc.
- There is a gap between between field people and the policy people.
- If the methods work, why do some people think that they do not work? Is this work we are doing just advocacy work?
- Are the methods accurate/useful to the community? Or to other levels? What is the community perspective on this issue?

11. Methods discussion continued: Conclusions on data collection strategy (4 April evening)

Neil Burgess presented his interpretation of the agreements reached during the evening discussion:

- All sites with operating locally-based monitoring schemes seem to have some relationship to community based natural resource management

- If sites have local schemes already, most likely the MOMA project will have to do the professional scientists' equivalent

- If sites have professional scientists' monitoring already, then the project will need to establish the locally-based equivalent (e.g. Nicaragua)

- Proposal: All we do with regard to the Accuracy question is simply a 'test' of local versus "scientific" protocol/results/impact. It is not really about monitoring over many years.

In terms of sampling, it was proposed:

- Need c. 50 sites in total across all countries, or c. 9 sites per country

- Sites can be villages or areas of habitats or reserves, but have to be realistic and further thoughts on this might be needed

- Need c. 10 repeated measurements per site i.e. about once per quarter over 2½ years

- Proposal: Work on land habitats only to simplify the conventional methods

12. Plenum discussion of the conclusions on data collection strategy (5 April 2006)

In plenum, there were many comments and suggestions to the data collection strategy, and these are summarized below:

- It was suggested that there is a need for further work on the definitions – in terms of there should not be too many different types of schemes/methods/approaches etc., otherwise comparisons would be hard.

- Some saw a problem when the test is looking at "scientific" vs. "scientific", because the local approach e.g. in Namibia is generally carried out on the basis of fundamental scientific principles. Perhaps some schemes should be called "local level scientific" schemes and these could then be compared to "conventional scientific schemes". Or perhaps the word "scientific" should be avoided.

- The project will try to see if 'hard line' scientific methods generate the same results as locally based methods. It will show if the trends identified are the same.

- In Namibia there was the general interest to have aerial surveys as the scientific method. Not ground based as these were perceived as 'the same' as the existing locally based methods.

- It is a problem that some scientists don't trust communities. Fundamentally this might be a political problem. Perhaps those scientists have not tried to work together with the communities.

- Some suggested that the project should audit the local schemes on the ground and that this could leverage credibility.

- The Nicaraguan group was concerned that wetland (river) habitats should be included in the project as these are very important habitats for many rural villages in their country.

- Every country can come up with its own system and approach to monitoring. But there is very little data and papers out there on these different types and approaches in the hard scientific literature. In the literature there are many negative papers telling that community-based approaches are not useful. If this is not true, it is really important to have some positive papers out there. Some studies have focused narrowly on the data level, but local schemes also deliver a lot of other benefits.

- Some participants suggested that the project should not test one thing against the other. They would rather like to see a triangulation/validation of the existing locally-based methods. For instance, they proposed there should be at least two methods showing the same thing.

- Tanzania is very keen on looking at how reliable their local data are. They suggested that scientists should try to look at impact on biodiversity/natural resources values in the Eastern Arc. And thus assess if the local methods are able to assess these trends, as well as trends related to local benefits.

- The way to do this might be for wildlife e.g. forest species (defined list) to use as locally based method random walk (timed) and as conventional method transects/point counts. Similarly, for habitat/threat/use, e.g. for Logging, Pole Cutting, Charcoal burning, Firewood collection, Poaching/snares, Medicinal plants, Poaching/Hunting, and Honey gathering, the methods Random Walk (timed), Focus Group Discussion and Transects/ Inventory Plots/Tree diversity.

- The Tanzanian group would like to address the Management Effectiveness Question by looking also at:
    - Number of illegal activities recorded
    - Activity level of village committees.
    - Reduction of key threats e.g. in number of snares.
    - Does the work have impact on overall biodiversity/natural resources.

Then the discussion focused at the earlier statement that "this is "a 'test' of local versus 'scientific' protocol/results/impact" which promoted a lot of discussion. After some time we took the discussion country by country.

PHILIPPINES: Statement is too loaded. What are we testing? Method or people? Prefer the word audit.

GHANA. Not about science vs non-science. Drop the word test and scientist. Strength and weaknesses is better. Reliability of data collected. May assess different things. Audit also has problems – implies looking for possible fraud.

NICARAGUA. Not met the local actors yet. 15-20 people in the country who work on biodiversity. 4-5 PhDs. Need alternatives. Want a model to replicate to other areas. Scientists should provide a framework not to 'test' differences.

TANZANIA. Fewer problems with this point. Change 'test' to strength and weakness. Should not use the word 'scientist' as that downplays local methods. Need these methods in developing countries as they may solve a shortfall in expertise and funding in developing countries. To try is a step forward.

NAMIBIA. Not happy with the point. Would split it into two.

A) Undertake, in each country, an independent monitoring system to triangulate with locally based methods.
B) Develop procedural review system to undertake:
    - An evaluation of local schemes.
    - An audit of how 'approved' local schemes are actually being applied.

It was then concluded:

- Approach - every country should have two methods. Looking at ability of these two to get consistent outputs. One is external and the other is one of the various types of local schemes. And to also look at strengths, weaknesses of the implemented approaches.
- There is a draft paper that defines the various Type 1-6 of local schemes. Maybe this should be opened up to the entire group to participate. This was agreed. This could potentially be the first major output of this project.
- Another idea was to undertake a principle components analysis (PCA) of all these schemes and seeing if they can cluster together.
- All agreed that we should recognize monitoring as a gradient of ownership from external to fully locally. Use the Type 1-6 scheme as potential schema for this.
- All agreed on substituting space for time, and this requires including sites with e.g. degraded and pristine habitats or other differences between them (e.g. cocoa agroforestry versus forest, etc.).
- The group discussed if the project document need revising. Maybe better to get a short revised set of outputs and methods for the project based on the 4-5th April meeting. This would be a 2 page document that would be sent around people for comment over the next couple of weeks. That would allow people to make their 7inputs.

Finally, a possible categorisation of 'monitoring schemes' was presented:

- Type-1 monitoring schemes (technical).
- Type-2 monitoring schemes (volunteer or employed).
- Type-3 locally-based monitoring schemes (external analysis).
- Type-4 locally based monitoring schemes (local data analysis).
- Type-5 locally based monitoring schemes (local methodological selection)
- Type-6 locally based monitoring schemes (fully local)

Table 1. Typical changes of eight characteristics across monitoring schemes, whether the general pattern is avoidable, and suggested question for user to answer in the design phase (from manuscript in preparation)

Characteristic	Type-1 scheme	Type-2 scheme	Type-3 scheme	Type-4 scheme	Type-5 scheme	Type-6 scheme	Exception / way of avoiding generality	Question for user to answer
Cost to local people	*	**	**	***	***	***	Careful design may reduce costs of types 4 and 5	How much do local people benefit from monitoring, are they aware of this benefit, is it sustained over time, etc.?
Cost to others	***	**	**	(a) *-***	(a) *-***	*	Careful design may reduce costs of types 1, 2, 3, 4 and 5	What external resources are available, and are they sustainable over time?
Requirement for local expertise	*	**	**	***	***	***	Unavoidable?	What is local capacity (or scope for training) like?
Requirement for external expertise	***	***	***	(b) **-***	(b) **-***	*	Careful design may reduce need in types 1, 2, 3	What is availability of external expertise?
Accuracy and precision	***	***	***	**	**	*	Careful design may improve accuracy or precision of types 1, 2, 3, 4 and 5	What is need for accuracy and precision?
Immediacy/ speed of decision-making	*	*	*	***	***	***	May require supportive environment to maximize benefits of types 3, 4, 5, 6	What is need for immediacy and speed of decision-making?
Potential for local empowerment	*	*	**	***	***	***	May require supportive environment to maximize benefits of types 4, 5 and 6	What is need for local empowerment?
Ease of feeding into national/global schemes	***	***	***	**	**	*	With appropriate design and support, type 4 and 5 schemes could still feed up	What is need for global data from this scheme?

* = low; ** = intermediate; *** = high; (a) = recurrent costs to non-locals low, set-up/training costs to non-locals high; (b) = recurrent requirement for non-local expertise intermediate, during set-up/training requirement for non-local expertise high.

13. Power analysis and data evaluation strategy
by Associate Professor Justin Brashares, University of Berkeley, California, USA

Justin mentioned recent references which were very critical towards local approaches, e.g. Pollock et al. *Envirometrics* 2002, 13, 105-119; and MacKenzie & Royle, *J Appl Ecology* 42, 1105-1114.

He then said that in his assessment there would be a need for at least 3 visits/samples per site per year (multiple, i.e. nested is ideal). In addition, 30 sightings of a species in a given areas is a minimum for abundance estimates (ideally direct sightings).

14. Sampling methodology, GIS and possible data analysis approaches
by Cole Burton (University of Berkeley, California, USA)

Cole briefly summarized the potentials and constraints of using GIS technology for analysis, based on examples from Ghana and the USA.

ADMINISTRATION

15. Financial monitoring, reporting and auditing
By Assoc. Prof. Per Moestrup Jensen (The Royal Veterinary and Agricultural University, Denmark)

Per discussed the need for Memorandum of Agreements (MoAs) between KVL and the involved institutions and provided guidance on financial and progress reporting requirements. The aim is to have all MoAs agreed and signed before July 1, 2006.

16. Why use KVL CampusNet?
By Nicolai Meyling (The Royal Veterinary and Agricultural University, Denmark)

Nicolai went briefly through the KVL CampusNet services and how to most easily make the best use of these. He said that all the presentations from the workshop would be made available for the public on the website.

IMPLEMENTATION PLANS

17. Presentation and discussion of overall Project Implementation Plan
by Finn Danielsen

Finn presented a draft overall Project Implementation Plan (PIP) and proposed each country should prepare draft country PIPs. The overall PIP draft is presented below.

MOMA Overall Project Implementation Plan

Activity	**Completion Date**	**Primary Responsible**	**Other involved**
Project mobilization		PMJ, FD	
Organization of Kick-Off Workshop and 1st Steering Committee meeting	April 2-5, 2006	PMJ, NW, FD	All
Overall sampling strategy developed and agreed upon (methods, areas, participants, procedures)			
Pilot study for feasibility check of sampling strategy in 1-2 countries			
Brief manual to the conventional methods developed and distributed (incl. scorecards)			
Organization of International project workshop and 2nd Steering Committee meeting (DK, yr 2)	2007		All
Organization of 3rd Steering Committee Meeting (in a developing country)	2008		
Data organization, analysis, interpretation and write-up			
Final overall project completion report	Dec 2008		

18. Country Meetings: Development of detailed implementation plans for each country

Participants were:
Tanzania: John Massao, Ngaga, Neil Burgess, Elmer Topp-Jørgensen, Michael K. Poulsen
Nicaragua: Mijail Perez, Ricardo Rueda, Sune Holt, Thomas Skielboe
Ghana: Moses Sam, Justin Brashares, Cole Burton, Hanne Hübertz, Casper Harboe
Namibia: Greg Stuart-Hill, Brian Child, Mikkel Funder
Philippines: Marlynn Mendoza, Danny Balete, Arne Jensen, Martin Enghoff
Per Moestrup Jensen, Finn Danielsen and Nicolai Meyling joined several groups.

Country implementation plans were drafted for all five countries following a pre-determined standard format.

19. Wrap-up and tasks ahead
By Finn Danielsen

Key tasks ahead were agreed. These included:

(a) Signature of MoAs before July 1, 2006;

(b) Revision of budgets, institutional set-up and staffing if required - as soon as possible;

(c) Finalization of Country PIPs and development of a 2-page MOMA 'minimum activity' document;

(d) Development/ compilation of a manual to the MOMA methods;

(e) Establishment of Bhutan as full project participant as soon as possible; and

(f) Organization of an International Project Workshop tentatively scheduled for October 2007.

20. Closing remarks
By Justin Brashares

Justin thanked everybody for their patience and active participation in the workshop.

Annex 2. Workshop programme

SUNDAY 2 APRIL 2006

Arrival of participants from Nicaragua

MONDAY 3 APRIL

9.30-16.00 Pre-Kick-Off Meeting with participants from Nicaragua (9-16.00); Ghana (13-14.00); and the Philippines (14-15.00).

Arrival of participants from other countries

TUESDAY 4 APRIL MORNING

9.00-9.15 Opening by Prof. Flemming Frandsen, The Royal Veterinary and Agricultural University, Denmark

9.15-9.25 Introduction to the Kick-Off Meeting by Associate Professor Per Moestrup Jensen, The Royal Veterinary and Agricultural University, Denmark

9.25-9.45 Overview of the Monitoring Matters: Comparative Analysis of Innovative Approaches (MOMA) research project by Mr Finn Danielsen, Nordeco, Denmark

9.45-12.15 **First Session. Introduction to Existing Locally-based Monitoring Schemes**
Chair: Assoc. Prof. Yonika Ngaga, Sokoine University, Tanzania

9.45-10.05 Existing locally-based monitoring activities in Ghana, structure of scheme and key lessons, by Mr Moses Sam, Wildlife Division, Ghana and Associate Professor Justin Brashares, University of Berkeley, California

10.05-10.25 Existing locally-based monitoring activities in Namibia, structure of scheme and key lessons, by Mr Greg Stuart-Hill, LIFE Namibia Programme

10.25- 10.55 Coffee/tea

10.55-11.15 Existing locally-based monitoring activities in Nicaragua, structure of scheme and key lessons, by Dr Mijail Perez and Dr Ricardo Rueda, University of Central America, Nicaragua

11.15-11.35 Existing locally-based monitoring activities in Philippines, structure of scheme and key lessons, by Ms Marlynn Mendoza, Protected Area and Wildlife Bureau, and Mr Danny Balete, Laksambuhay Foundation, University of the Philippines, Philippines

11.35-11.55 Existing locally-based monitoring activities in Tanzania, structure of scheme and key lessons, by Mr John Massao, Forest and Beekeeping Division, Tanzania

11.55-13.30 Lunch

TUESDAY 4 APRIL AFTERNOON

13.30-17.00 **Second Session. Discussion of Methods.**
Chair: Mr Moses Sam, Ghana Wildlife Division, Ghana, and Associate Professor Brian Child, University of Florida

13.30-14.15 Workshop introduction by Mr Finn Danielsen and Mr Mikkel Funder, Nordeco, Denmark

14.15-15.30 Workshop group session – working coffee/tea

15.30-17.30 Plenary presentation of group work. Discussion

19.30 Dinner (Methods Working Group Session)

WEDNESDAY 5 APRIL MORNING

7.30-9.00 Breakfast

9.00-10.00 **Third Session. Introduction to Project Management.**
Chair: Ms Marlynn Mendoza, Protected Area and Wildlife Bureau, the Philippines

9.00-9.15 Financial monitoring, reporting and auditing by Associate Professor Per Moestrup Jensen, The Royal Veterinary and Agricultural University, Denmark

9.15-9.30 Why use KVL CampusNet? by Dr Nicolai Meyling, The Royal Veterinary and Agricultural University, Denmark

9.30-10.00 Follow-up on the methods discussion: Presentation of the conclusions of data collection strategy from the Methods Working Group Session by Dr Neil Burgess, University of Cambridge

10.00-10.30 Coffee/tea

10.30-12.00 Plenum discussion of the conclusions on data collection strategy

12.00-13.30 Lunch

13.30-17.00 **Fourth Session. Expected Activities in Each Country.**
Chair: Finn Danielsen, Nordeco, Denmark.

13.30-14.00 Power analysis and data evaluation strategy by Associate Professor Justin Brashares, University of Berkeley, California, USA

14.00-14.30 Presentation and discussion of overall Project Implementation Plan and framework for national implementation plans by Finn Danielsen

WEDNESDAY 5 APRIL AFTERNOON

15.00-16.00 **Country Meetings to develop detailed implementation plans for each country**

Expected participants:

Tanzania:	Massao, Ngaga, Burgess, Topp-Jørgensen, Poulsen, (Funder)
Nicaragua:	Perez, Rueda, Holt, Skielboe, (Poulsen)
Ghana:	Sam, Brashares, Burton, Hübertz, Harboe
Namibia:	Stuart-Hill, Child, Funder
Philippines:	Mendoza, Balete, A. Jensen, Danielsen, Enghoff

16.30-16.45 Sampling methodology, GIS and possible data analysis approaches by Associate Professor Justin Brashares, University of Berkeley, California, USA

16.45 Wrap-up and tasks ahead by Finn Danielsen

16.45 Closing remarks by Justin Brashares

17.00-17.30 **Steering Committee Meeting**

19.00 Dinner

THURSDAY 6 APRIL

Excursion 7.00 – 16.00 to the island of Saltholm.

Follow-up meeting with the Namibian participants.

FRIDAY 7 APRIL

Follow-up meetings with the Nicaraguan participants

Annex 3. List of participants

Ghana:

Mr Moses Sam, Wildlife Division, Forestry Commission of Ghana, Accra, Ghana
c/o brashares@nature.berkeley.edu

USA:

Mr Justin Brashares, University of California Berkeley, Dep. of Environmental Science, Berkeley, California, USA brashares@nature.berkeley.edu

Mr Cole Burton, PhD student, University of California Berkeley, Dep. of Environmental Science, Berkeley, California, USA cburton@nature.berkeley.edu

Mr Brian Child, The Univ. of Florida, Center for African Studies and Dep. of Geography, Gainesville, Florida, USA bchild@africa.ufl.edu

Namibia:

Mr Greg Stuart-Hill, LIFE Programme, Namibia gstuart@wwflife.org

Nicaragua:

Mr Mijail Perez, Centre of Malacology and Animal Diversity, University of Central America, Managua, Nicaragua c/o pasmash@cablenet.com.ni

Mr Ricardo Rueda, Managua, Nicaragua c/o pasmash@cablenet.com.ni

Mr Sune Holt, Managua, Nicaragua pasmash@cablenet.com.ni

Tanzania:

Mr John Massao, Iringa Districts Lands, Natural Resources and Environment Office, MNRT, Tanzania c/o neil.burgess@wwfus.org

Mr Yonika Ngaga, Sokoine University of Agriculture, Fac. of Forestry and Nature Conservation, Morogoro, Tanzania c/o neil.burgess@wwfus.org and yngaga@yahoo.co.uk

Mr Neil Burgess, Morogoro, Tanzania neil.burgess@wwfus.org

Mr Elmer Topp-Jørgensen, Nuuk etj@nordeco.dk

Philippines:

Ms Marlynn Mendoza, Protected Area and Wildlife Bureau (PAWB), DENR, Philippines
mmendoza@i-manila.com.ph

Mr Danilo Balete, Los Banos, The Philippines
dsbalete@yahoo.com

Mr Arne Jensen, Manila, The Philippines
aej@pldtdsl.net

Denmark:

Mr Jon Fjeldså, ZMUC, Universitetsparken 15, 2100 Kbh. Ø
jfjeldsaa@zmuc.ku.dk

Per Moestrup Jensen pmj@kvl.dk

Flemming Frandsen ff@kvl.dk

Nicolai Meyling nvm@kvl.dk

Michael Køie Poulsen mkp@nordeco.dk

Mikkel Funder mf@nordeco.dk

Hanne Hübertz hh@nordeco.dk

Thomas Skielboe ts@nordeco.dk

Martin Enghoff me@nordeco.dk

Finn Danielsen fd@nordeco.dk

Annex 4.

Minutes

1st Steering Committee Meeting
Monitoring Matters: Comparative Analysis of Innovative Approaches (MOMA)
Wednesday 5 April 2006 17.00-17.30

Participants: Marlynn Mendoza, Protected Area and Wildlife Bureau (PAWB-DENR), Philippines; Greg Stuart-Hill, LIFE Programme, Namibia; Brian Child, Univ. of Florida, USA; John Massao, Iringa Districts Lands, Natural Resources and Environment Office, MNRT, Tanzania; Jon Fjeldså, ZMUC, Denmark; Mijail Perez, Centre of Malacology and Animal Diversity, University of Central America, Managua, Nicaragua; Moses Sam, Wildlife Division, Forestry Commission of Ghana, Accra, Ghana; Per Moestrup Jensen, The Royal Veterinary and Agricultural University (KVL), Denmark (Chair); Finn Danielsen, NORDECO, Copenhagen (rapporteur).

Agenda:

1. Welcome and introduction
2. Appointment of rapporteur
3. Agreement on the agenda of the meeting
4. Presentation of the responsibilities of the Steering Committee
5. Financial matters
6. Administrative and organizational matters
7. Technical issues

Ad. 1. Welcome and introduction
Per Moestrup Jensen welcomed the participants. All were very tired because the meeting was held at the end of the MOMA kick-off workshop so Per would try to keep it short.

Deki Yonten, Nature Conservation Division, Bhutan; and Henning Nøhr, Danida, were unable to participate. Both Deki and Henning participated in the Monitoring Matters workshop activities in Denmark in 2004 which led to the development of this project.

Since 2004, Deki has been enthusiastic about the development of the project, and her institution, the Nature Conservation Division, has recently appointed a staff member, Karma Thinley, to work with the project. At the moment, Karma is facilitating the official approval of the project by the Royal Government of Bhutan.

Ad. 2. Appointment of rapporteur
Finn Danielsen was appointed as rapporteur.

Ad. 3. Agreement on the agenda of the meeting
The proposed agenda of the meeting of the Steering Committee was approved.

Ad. 4. Presentation of the responsibilities of the Steering Committee
Per and Finn referred to the Project Document of 12 January 2006. They presented the responsibilities of the Steering Committee. The role of the Steering Committee is to supervise and guide the overall implementation of the project in line with the objectives specified in the project document.
The participants in the MOMA Kick Off Workshop had appointed one person from each case study country as members of the Steering Committee. Danida had appointed Henning Nøhr, who is the Head of Environment in Danida, to be their representative in the Committee.

The MOMA Steering Committee was then formally inaugurated. The members are:

- Per Moestrup Jensen, The Royal Veterinary and Agricultural University (Chairman)
- Henning Nøhr, Danida
- Marlynn Mendoza, Protected Area and Wildlife Bureau (PAWB-DENR), Philippines;
- Greg Stuart-Hill, LIFE Programme, Namibia
- John Massao, Iringa Districts Lands, Natural Resources and Environment Office, MNRT, Tanzania
- Mijail Perez, Centre of Malacology and Animal Diversity, University of Central America, Managua, Nicaragua
- Moses Sam, Wildlife Division, Forestry Commission of Ghana, Accra, Ghana
- Deki Yonten, Nature Conservation Division, Bhutan
- Jon Fjeldså, Zoological Museum, University of Copenhagen, and
- Finn Danielsen, NORDECO, Copenhagen

According to the Project Document, the Committee is expected to meet annually. In 2007, the meeting will be held simultaneously with the international workshop, where the leading researchers will be present (funded from budget lines of each case study country).

Ad. 5: Financial matters

Per informed that one of the original staff members of the project, Elmer Topp-Jørgensen, while waiting for project approval had taken up a full-time position abroad. Fortunately, a strong alternative person had been found to substitute Elmer in the project, Michael K. Poulsen.

Following strategic discussions before and during the Kick-Off Workshop, an agreement had been made to increase the focus on the management effectiveness aspects of the locally-based monitoring. Per concluded that there is a need to ensure a minimum level of socio-economic input into the work of each of the case study countries. In addition, in the Philippines and Nicaragua, there are now opportunities for benefiting from project supervision by permanently based Nordeco staff in these countries.

To obtain approval for these adjustments in project staffing, KVL and Nordeco will shortly submit to Danida a revised staffing list and budget for the KVL/Nordeco components of the project.

Ad. 6: Administrative and organizational matters

Per briefed the Steering Committee on the status of the Memorandum of Agreements (MoAs) between KVL and the involved institutions. It was agreed that every effort would be made to have the MoAs signed before July 1, 2006.

Some participants mentioned that they might like an adjustment in the institutional anchorage of their project activities. Per informed that such changes would have to be officially approved by Danida, and that written and well-argued explanations for this should be submitted to him as soon as possible.

Ad. 7: Technical issues

It was agreed that it would be valuable if the expertise of Brian Child, Neil Burgess and Justin Brashares could be used not only to contribute to the case studies in their respective countries but also for assisting in the development of the overall sampling strategy.

Annex 5. MOMA methods: Towards an overall sampling strategy

This Annex is a proposed short outline of the definitions, key questions and methods as they stand at the moment (work in progress; March 28, 2006).

DEFINITIONS

Locally-based methods	Monitoring carried out at a local spatial scale and by individuals with no or only limited formal training
Conventional methods	Monitoring by professional scientists

KEY QUESTIONS

Key question 1	**Are locally-based monitoring methods able to detect changes in the abundance, distribution and utilization of forest, savannah and aquatic products? (= the Accuracy Question)**

This question can be split into two sub-questions:

Sub-question 1.1	To what extent are the locally-based monitoring methods able to detect the *same trends* in the abundance, distribution and utilization of forest, savannah and aquatic products *as monitoring by professional scientists?*
Sub-question 1.2	*Under which conditions* are the locally-based monitoring methods able to detect the same trends in the abundance, distribution and utilization of forest, savannah and aquatic products as monitoring by professional scientists?
Key question 2	**To what extent are locally-based monitoring methods an effective resource management tool, compared to monitoring by professional scientists? (= the Management Effectiveness Question)**

This question can be split into four sub-questions:

Sub-question 2.1	To what extent do the required inputs differ in terms of time and cost within the two types of monitoring?
Sub-question 2.2	To what extent are the data produced by the two types of monitoring applied in practical management activities? (four old countries)
Sub-question 2.3	To what extent and on what scales (local to nation-wide) is there consensus between stakeholders on the accuracy of the two types of monitoring data? (four old countries)
Sub-question 2.4	To what extent, and on what scales (local to nation-wide) do the two types of monitoring contribute to furthering conservation and development linkages? (four old countries)

METHODS FOR ANSWERING THE ACCURACY QUESTION

Types of data	1) Presence/absence of forest, savannah and aquatic products 2) A measure of quantity (numerical values) or trend (increase/decrease/no change/no info)
Sampling unit	Specific areas of discernible habitat or land-use (of a size/value that make them significant both in terms of biological resources and importance for utilization by locals)
Habitats/land-uses	1) Forest[1] 2) Savanna[2] (grassland/woodland) 3) Wetland[3] (freshwater or marine)
Locally-based methods	1) Village patrol records (filling-out by villagers of routine patrol sheets on key species/habitats, or extent of species/habitat utilization) 2) Community assessments of presence/absence of species/resources 3) Community assessments of trends for populations/abundances and extent of utilization of different focal species Note: Possible to include fixed point photography?. Necessary to rule out recording of ecosystem service?
Conventional methods for comparison with the local methods	1) Distance sampling transects (abundance estimator) 2) Simple presence-absence sampling 3) Encounter rate (as comparative index of species presence, because of low sample sizes of many species)
Other data needed on each sampled site	1. Overall habitat/land-use, geographical coordinates, size of the site 2. Distance to nearest other sampled site (for spatial independency check) 3. Basic environmental characteristics (rainfall, temperature, soils, land cover type, level of deforestation), from existing data in government offices and the literature/the web 4. Socio-economic data (the dominant type of land/resource use by the locals; the importance of natural resources to local livelihoods; the existence of different services e.g. school, health post, etc.; the local human population density; the history of settlement, distance from village to forest, distance to urban market, distance to water), from scorecards, multiple choice surveys, interviews, and existing data in government offices and the literature/the web

[1] Bhutan, Ghana?, Namibia?, Nicaragua, Philippines, Tanzania,
[2] Bhutan (high-altitude), Ghana, Namibia, Tanzania,. Not meaningful in Nicaragua, Philippines
[3] Bhutan?, Ghana?, Namibia?, Nicaragua?, Philippines, Tanzania?

Other data needed on each scheme	1. Estimates of seasonal detection probabilities by re-sampling a proportion of transects (distance sampling transects) 2. Assessments of each potential bias to both types of methods (based on scorecards, plus test of local people's skills in species identification for spoor marks) 3. Education/ previous training of those who collect/analyze data (both for the locally-based and conventional methods), based on scorecard (how do we factor out the effects of education/wealth? We can assume that scientists are of similar education and relative wealth in different countries – but can we assume the same for the local people? If not, does this matter?)
Potential sources of bias	Other studies suggest the main biases (constraints to the accuracy) of all monitoring methods are: 1. Inconsistent use of methods, across time or observers 2. Conflict of interest 3. Unrepresentative spatial or temporal spread of sampling effort 4. Poor identification, field or language skills 5. Lack of measurement experience
No of sampling sites and sampling frequency	To be determined (the Ghana group will attempt an *a priori* power analysis before the kick-off workshop)
Data entry	Nationally, on Excel spreadsheet with downloading e.g. every 3-months on CampusNet, to allow for back-up and access by all participants
National analysis	Approach to be decided upon at the national level, depending on the needs of each country
Overall analysis	We want to see how similar the results are between the schemes. We want to see how the above varies between habitat types, and also between villages at different levels of wealth and education and between countries. Here are the proposed steps: 1) Test that each sampled area is spatially independent of others (e.g. by evaluating 'nested' subsets) 2) Comparison of the two data sets across space, not time, using e.g. Wilcoxon's non-parametric test for matched pairs (measure of the discrepancy between the methods) 3) Applying the test value as a measure of local monitoring accuracy, correlation is then sought with the background data on each sampled site, using a GIS database and Pearson's Correlation, multiple regression, and Principal Component Analysis
To be sorted out	Distance sampling transects are not suitable in some wetlands (rivers)

	Possible to avoid scale-dependency of the results of the comparison between locally-based and conventional methods?
Draw-back	No assessment of the impact on biodiversity itself - would require for instance remote image analysis (perhaps possible on a subset of sites, e.g. Ghana, Philippines)
	No assessment of the ability of locally-based methods to detect changes in the provision of ecosystem services; this was envisaged in the project document. Any suggestions?.
	No assessment of all of the most frequently used locally-based methods (only patrol records and village group discussions, not e.g. simple transects, species lists, or fixed point photography). Any suggestions?
Location of pilot study for feasibility check	To be determined. We need to check that our sampling strategy works before we begin in all six countries, and within each country we also need to check it in 1-2 areas before beginning in them all

METHODS FOR ANSWERING THE MANAGEMENT EFFECTIVENESS QUESTION

Types of data	1) Inputs (costs, no. of person hours, required staff skills) 2) Time (data processing time and required frequency of data collection) 3) Type and level of plans that apply monitoring data 4) Type and no. of management actions emanating from the monitoring data (local scale as well as actions by government bodies) 5) Extent of stakeholder agreement with data 6) Contribution to conservation/development linkages
Sampling unit	Specific villages (which should be located next to the sampling sites for the Accuracy Question)
Habitats/land-uses	1) Forest, 2) savanna, and 3) wetland
Methods	Scorecards, multiple choice surveys, qualitative interviews
Other data needed on each sampled site	As for Accuracy Question plus institutional management set-up and procedures, protected area management budgets, prior interventions
Potential sources of bias	Socio-cultural differences between sample sites, hidden agendas (e.g. corruption), "eager to please" responses, poor/untrained interview-techniques
No sampling sites and sampling frequency	To be determined

Data entry	Nationally, on Excel spreadsheet (scoring, multiple-choice) and interview summaries in Word, with downloading on CampusNet, to allow for back-up and access by all participants.
National analysis	Approach to be decided upon at the national level, depending on the needs of each country
Overall analysis	(1) Comparison of scorecard and multiple-choice results for the two data sets; (2) Qualitative analysis of semi-structured interviews (various methods)
Draw-back	Qualitative data analysis requires time.
Location of pilot study for feasibility check	To be determined.
To be sorted out	Need for socio-input to be clarified and planned.

Annex 6. A proposal to the analytical approach in MOMA

By Per M Jensen

I have been reading the manuscript provided by Neil, Finn et al. on: “Monitoring matters: towards a characterisation of monitoring approaches” and tried to analyse the components brought into play in the text. The following is a brief reflection on how the thoughts presented can be used to address the tasks ahead in the MOMA project.

In brief, the manuscript suggests that 6 types of monitoring schemes exist and that these can be defined by a limited number of attributes relating to the spatial resolution of the resources (= people) that provide the basis for monitoring. It is subsequently claimed that the locally based schemes are less expensive, leading to high cost effectiveness and sustainability. In the manuscript, ‘sustainability’ is simply defined as being able to continue. The main hypothesis of the MOMA project is however that LBM provides sound data on natural resources, which suggests that the priority of the project is testing the following hypotheses:

1. LBM provides sound data
2. LBM schemes can be defined based on attributes relating to funding, data collection etc.
3. LBM is less expensive
4. LBM is more sustainable

Ad 1. LBM provide sound data

In starting off from the discussion from the Kick-Off Meeting this project delivers pair-wise data from LBM and an external assessor on various resources and resource uses. Due to the limited time available there is going to be limited material on temporal variation in specific sites. Hence the introduction of substituting space for time.

The two set should be analysed against a measure of deterioration, which makes sense in the given context. Alternatively they could simply be analysed by rank as implied in **Figure 1**. As the order of the observation are of little consequence the correlations coefficient supply a unique characterisation of the correlation (which in this case is 0.57).

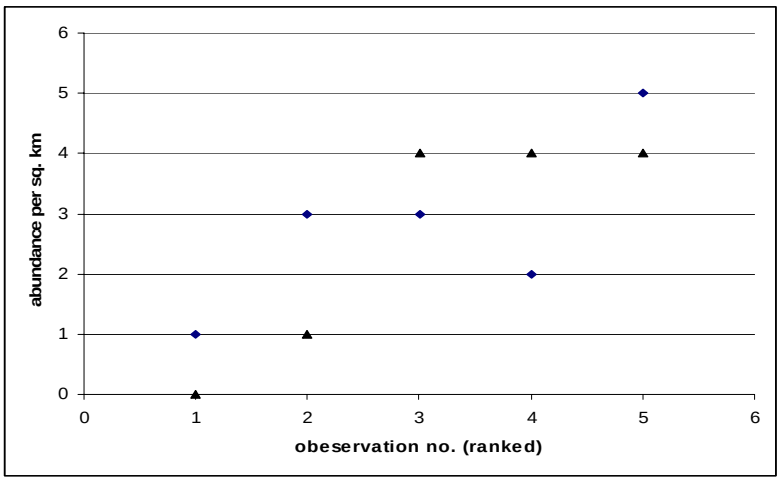

Figure 1: A plot of two independent set of observations (dots and triangles) ranked by observed abundances.

Although it might be perceived as in-transparent, what really happens is that the two sets are measured directly and pair-wise against each other, which normally would imply that the one is plotted against the other. The appropriate tool for evaluation would then be (linear) regression, **Figure 2**.

Although this change in procedure give a more precise measure of the relationship between the two it still means that the project include multiple pair-wise comparisons. Data from e.g. deforestation and elephant abundance cannot be analysed together unless the data are transformed to the same type of units. To do this the data should be transformed to relative data based on division with the maximum value in the individual dataset. For the data in Figure 1 and 2, this leads to the plot in **Figure 3**

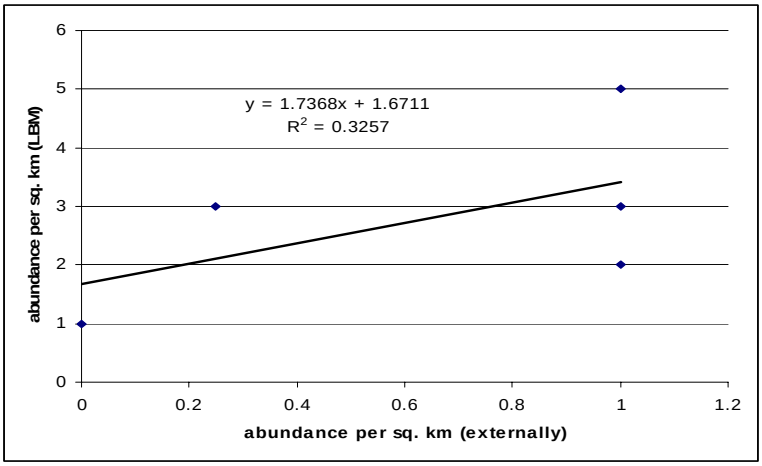

Figure 2. A plot of LBM and externally derived data on e.g. large mammals. The same data as in Figure 1.

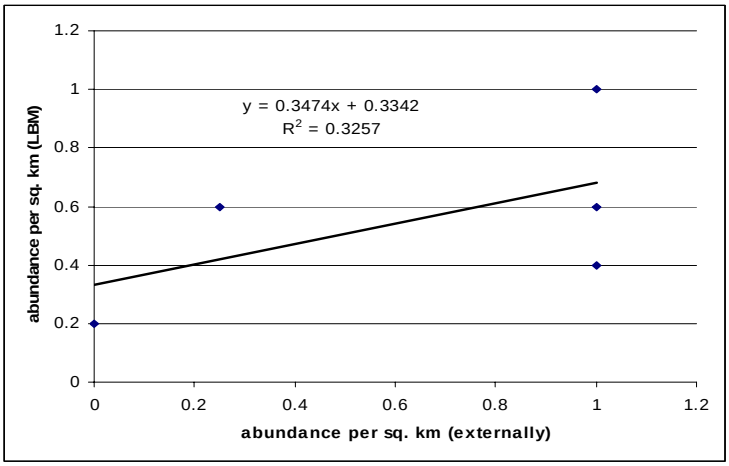

Figure 3. A plot of relative LBM and externally derived data on e.g. large mammals. The same base data as in Figure 1 and 2.

The transformation to relative numbers for a number of resources is listed in Table 1. Following this transformation the data can be inserted into a generalized linear model by analysing the relative data versus the matching externally derived data.

I have performed the analysis on the mock-data in Table 1. The result is that none of the pair-wise relationships are statistically significant on their own, but by pooling these they attained an almost statistically significant positive relationship (P =0.055; see the provided PDF filed on inputs and outputs from the statistical programme SAS.) The procedure identified in this case that “Forest

cover" deviated significantly from the other types of data, and in eliminating "Forest cover" data the relationship became statistically significant (P=0.04) i.e., LBM yields good data!

There are two types of relative data:

- A relative value based on division with the maximum value **within a subset of the dataset** e.g., obs. 1 to 5 and correspondingly 6-10 in Table 1 and
- A relative value based on division with the maximum value **within an entire dataset** e.g (obs 1 to 10 in Table 1)

The example given above is based on division within the subset, which allows for an analysis for precision in the data. Had the analysis been based on division with the overall maximum value within the dataset then the analysis would reflect both accuracy and precision (assuming that LBM or the external data represent the 'true' values).

I hope the above is seen as reasonably transparent and a procedure that can be performed on the data MOMA obtains. Please note that fairly few and "bad" data will allow us to answer the stated hypothesis.

Finn has suggested that it's more feasible that data types from a LBM perspective would be:
1. Presence/absence/no data
2. Abundance trend up/down/stable/no data.
3. Many/some/few and (ranking between site A, B and C in terms of the abundance of a species).
4. No of hunting days since last capture of a certain species

As for 1: there are methods for estimating species abundance from occurrence. But I'm not sure that they apply for the given setup. It usually requires that the area is divided into many squares of sorts. Someone with more insight into the actual monitoring (than I) should look into this.
No.2 is the least attractive because it does not include any quantitative information – it basically useless in this setup (the trend does not give any information on the size of the resource – both small and large population may increase or decline).
No. 3 is just surrogates of densities and applies on some level. The more level includes the better e.g., all over the place / abundant / many /common /rare /extremely rare/ not there.
No. 4 is a catch-effort relationship or sequential sampling which can be transformed to abundance of some sort.

NB: A number of issues in the above strategy are not described in full e.g., transformation of relative values for approximation to the normal distribution etc. this does not impose any restrictions at this point, but will be a challenge for the group analysing the results.

Ad 2. LBM schemes can be defined based on attributes relating to funding, data collection etc.

In the above analysis there is no detailed information on the LBM – it is assumed to constitute a single type of observation. As discussed during the Kick-Off Meeting this is not an attractive approach. There is however no specific reason to maintain this simplistic approach. The following paragraphs outline an idea on how to remedy this.

I have taken my starting point in what was labelled Table 1 in the manuscript by Neil and Finn et al. The manuscript addressed the attributes: recognition, design, data collection, interpretation and

decision making. These are claimed to be associated with other important variables e.g. funding, ownership etc. The tables given later in this text is an expansion of Table 1 in the manuscript with the proposal above on the statistical analysis.

The aim of these analyses has been to reduce the variables in the text to *unloaded measurable singular units* suitable for a statistical analysis.

- *Unloaded* meaning: there is an objective value of the variable (not exclusively subjective).
- *Measurable* meaning: the variable can be expressed in meters, kilograms or similar units
- *Singular* meaning: the variable is not confounded i.e., containing more than one meaning or measure.

To bring more clarity to the process the monitoring has been divided into spatial (Table 2A) and temporal topics (Table 3) and the spatial topics into three parts given by the sequence of events: *Before monitoring*, *Monitoring* and *After monitoring*. Sixteen attributes is listed in total where six belongs to "before monitoring", six during monitoring and four after monitoring. All 16 may affect the outcome of the monitoring scheme. Possibly more attributes could be mentioned depending on how detailed the information is desired. Perhaps it would be prudent to state whether the scheme is based on "simple samples" or scientifically advanced techniques like sight-resight, catch-effort etc.

No matter how this is perceived, this part is fairly straight forward and can be designed and redesigned even during MOMA.

In the original MOMA Project Document LBM and external monitoring is given as a dichotomy on the thesis-antithesis concept. While this may be valuable and meaningful in communicating the socio-economic implications it is not without consequences.
The distinction in two types may be too simplistic for analysis and I have therefore extended these into four groups: local, regional, national and external (external = other nationals) and provided an even more detailed description with 10 levels (Appendix 2). If it during the analysis is found that there is no difference between groups then they can easily be lumped into two groups with, for instance, the first three being considered as one.

A possible approach to the LBM spatial-topic-attributes given in Table 2A, which generate a total of 6*6*4 combination of attributes 144 combinations on 4 different scales leading to a grand total of 576 possible schemes. Within the core of MOMA: the monitoring process *per se* (shaded) there is only 24. More attributes may however be added to generate more possible schemes.
Temporally defined attributes can be added if desired to generate an almost indefinite number of schemes. No matter how many attributes or possible scales they may have they must be defined in clear terms as suggested in Table 2B for spatial attributes.

Having defined this number of schemes by spatial reference alone it should be possible to demonstrate that attributes are internally linked. Among the more obvious links there will be a linkage between management rights and implementation. The link between the processes leads to a result where only some are conceptually acceptable. The two extremes in this paradigm are: all local and all external as envisaged in the original schemes 1 to 6 (Appendix 1), but a more detailed review of a large number of schemes may show other common or logic links. It should be considered to carry out a principal component analysis (PCA) on e.g. 100 selected publications on monitoring schemes to identify the natural clustering of attributes in resource monitoring.

Such an analysis could identify the clustering of the attributes in monitoring schemes given by the "reality of the world". Out of the 576 it seems likely that we may only find examples representing 25 of these and that 90% of the examples represent the six types of schemes given by the original text. The logic dictates that there should be only a few types of schemes because of internal naturally given links in the processes driving monitoring. Such a study could define the premises for grouping of data in the comparative study of the quality of monitoring. Should there be previously published schemes then these will be included in what will be perceived as naturally existing schemes.

The quality of monitoring approaches could be defined by spatially referenced attributes. In assigning attributes it will be possible to do this for every type of LBM performed under the MOMA project. Fx. focus group discussions may not have identical attributes in all counties, which will allow for an analysis of the individual attributes to the total sum of variation. Still we may lump these together in an alternative analytical approach. None of this should be any problem analytically. It must also be noted that we should be able to analyse for any effect desired by any member of the project. In more technical terms the data will be added to Table 1 and included in the statistical analysis. This allows the analysis to show that e.g., the origin of the funding is not an important issue, but rather it's the data collection step.

The more detailed we can describe LBM the greater chance we have of avoiding unwanted confounders in the analysis. On a particular note it seems to me that scientific skills and spatial resolution is accepted as being confounded, in the original MOMA project document. The logic applied is that when the people selected to monitor is the most highly skilled among the people available then the level of scientific skills increase with the population size available. Broadly this seems acceptable but it is not flawless. On a personal note I live 10 minutes on bike from my place of work, and thus by this definition I am scientifically unskilled.

Ad 3 and 4: LBM are less expensive and LBM is more sustainable

With regard to the last two hypotheses I have no comments at this time. They are not entangled in the original concept and further discussion lies beyond the scope of these reflections. It should however be noted that since "sustainable" is defined mainly in temporal terms it will require (long) time series to evaluate this issue in full.
The alternative which was discussed during the Kick-off meeting is auditing. Auditing does not assess that the end results remain trustworthy but that the methodology remains intact over time. The argument following would be that:

1. when auditing proves that the methodology remains intact or untainted,
2. and - the methodology yields reliable data
3. then the data is sustainable

Hence auditing represents an acceptable evaluation of sustainability. Currently the aim is to engage MSc students in this, possibly in several countries. Both Greg and I have been approached on this from students – so all wee need is a plan how to actually audit an LBM scheme!

Criteria for data collection and characterisation of variables

The current country project implementation plans (PiPs) indicate that MOMA input will be generated from the following monitoring schemes, Table 4.
Each of the countries includes two measures of monitoring, which is sufficient to implement the above plan. If each measure includes e.g 10 species we will have a lot of data which will give the expected opportunity to assess LBM's.

It seems that Bhutan, Ghana, Nicaragua, Philippines and Tanzania can use "Transects by professional scientists" as externalized assessment, whereas Namibia will have to use "Aerial surveys". Each of the countries will include at least two LBM, with exception of Namibia. Since these may differ in their particular attributes there is a firm base for the evaluation of the hypothesis, providing that we give a precise characterisation of the LBM's.

Table 4. Overview of the input as result of the Kick-Off Meeting (country MOMA PIPs)

Field method	Bhutan	Ghana	Namibia	Nicaragua	Philip-pines	Tan-zania
Community assessment of presence/absence and trends with Focus Group Discussion	+	+		+	+	+
Patrol records by villagers/ rangers	+	+	+	+	+	+
Transects by professional scientists incl. presence/absence and encounter rate	+	+		+	+	+
Village counts		+				
Aerial survey			+			
Forest cover assessment by remote sensing (not in country PIPs)		?				?

At this time it would also be prudent to raise the awareness on some of the more obvious points of critique, we are likely to receive from reviewers.

A: *The temporal and spatial reference point was not matching and hence difference between LBM and externally derived data were predictable!* Such critique is a part of what we are trying to resolve but still it seems that we must in e.g., focus groups and Aerial surveys make great efforts to ensure that the area and time frame of LBM and Externalized is identical.

B: *When transforming the data to relative values we may accidentally improve accuracy of the data because poor external assessments are performed where poor LBM work is being performed!* The best solution to this problem is to ensure that all externalized method is identical for all countries involved.

C:…….I am sure that there are other points on this discussion but at this time the above is sufficient to point out that it is recommendable to include transects by professional scientists in a small number of areas in Namibia if at all possible and to be very careful in the focus group discussion, to ensure that the data represent a true part in the "pair" of data.

Appendix (not included)

1 The original schemes as given in Table 1 in Neil and Finn et al. on: Monitoring matters: towards a characterisation of monitoring approaches
2 An example of how attributes can be assigned to given schemes
3 SAS statistical input file for the data in Table 1 (Separate Pdf-file)
4 SAS statistical out-put file for the data in Table 1 (Separate Pdf-file)

Table 1. Mock-data for a number of imagined natural resource data collected in MOMA

OBS	data set	Method	Ressource	abundance	unit	Relative data	Matching Ext. Data
1	1	LBM	large mammal	1	per sq. Km	0.2	0
2	1	LBM	large mammal	3	per sq. Km	0.6	1
3	1	LBM	large mammal	2	per sq. Km	0.4	1
4	1	LBM	large mammal	5	per sq. Km	1	1
5	1	LBM	large mammal	3	per sq. Km	0.6	0.25
6	1	External	large mammal	0	per sq. Km	0	.
7	1	External	large mammal	4	per sq. Km	1	.
8	1	External	large mammal	4	per sq. Km	1	.
9	1	External	large mammal	4	per sq. Km	1	.
10	1	External	large mammal	1	per sq. Km	0.25	.
11	2	LBM	small mammal	25	per ha	0.5	0.666667
12	2	LBM	small mammal	2	per ha	0.04	0.222222
13	2	LBM	small mammal	50	per ha	1	1
14	2	LBM	small mammal	12	per ha	0.24	0.111111
15	2	LBM	small mammal	6	per ha	0.12	1
16	2	External	small mammal	30	per ha	0.666667	.
17	2	External	small mammal	10	per ha	0.222222	.
18	2	External	small mammal	45	per ha	1	.
19	2	External	small mammal	5	per ha	0.111111	.
20	2	External	small mammal	45	per ha	1	.
21	3	LBM	Forest cover	1	Deviation from 100%	1	1
22	3	LBM	Forest cover	1	Deviation from 100%	1	0.7
23	3	LBM	Forest cover	0.85	Deviation from 100%	0.85	0.8
24	3	LBM	Forest cover	1	Deviation from 100%	1	0.65
25	3	LBM	Forest cover	0.95	Deviation from 100%	0.95	0.5
26	3	External	Forest cover	1	Deviation from 100%	1	.
27	3	External	Forest cover	0.7	Deviation from 100%	0.7	.
28	3	External	Forest cover	0.8	Deviation from 100%	0.8	.
29	3	External	Forest cover	0.65	Deviation from 100%	0.65	.
30	3	External	Forest cover	0.5	Deviation from 100%	0.5	.
31	4	LBM	poaching incidences	2	Number per month	0.4	0.125
32	4	LBM	poaching incidences	4	Number per month	0.8	0.5
33	4	LBM	poaching incidences	1	Number per month	0.2	0.75
34	4	LBM	poaching incidences	5	Number per month	1	1
35	4	LBM	poaching incidences	3	Number per month	0.6	0.125
36	4	External	poaching incidences	1	Number per month	0.125	.
37	4	External	poaching incidences	4	Number per month	0.5	.
38	4	External	poaching incidences	6	Number per month	0.75	.
39	4	External	poaching incidences	8	Number per month	1	.
40	4	External	poaching incidences	1	Number per month	0.125	.

Tabel 2A Overview of selected processes in monitoring which may be assigned to geographical scale of the people involved and their monitoring skills. The list of the following16 topics can replace the phrase LBM in Table 1.

	Topic	Scale Monitoring Skills	Local low	Regional medium	National High	External Highest	Internally linked
	BEFORE THE MONITORING						
1	Recognition by cost prevention to						* *
2	Recognition by proposed gains to						* *
3	Value in terms of sustenance / money to						
4	Value in terms of non-monetary terms to						
5	Alienation rights by						*
6	Managements rights by						*
	MONITORING						
1	Funding by						
2	Design by						*
3	Data collection by						
4	Data processing by						
5	Interpretation by						*
6	Quality control – audit/review by						
	AFTER THE MONITORING						
1	Implementation by						*
2	Scale of management impact						*
3	Recognition of management impact						*
4	Policing						

Gray area reflects the working area of MOMA. Two '*' within a column indicate linked attributes.

Table 2B: Proposed definitions of spatial attributes that characterizes monitoring schemes.

1	Recognition of cost prevention by	Did the idea to monitor originate from an assumption that this would reduce costs (because an exhaustion of a given resource would lead to added use of another resource)
2	Recognition of proposed gains by	Did the idea to monitor originate from an assumption that this would increase the harvest, earning etc. of a given resource
3	Value in terms of sustenance / money to	Is monitoring a way to increase the welfare of the particular group in terms of food supply or other type of income. Perhaps better define as having current value
4	Value in terms of non-monetary value to	Is monitoring a way to increase the welfare of the particular group in terms of ethic, aesthetic aspect. Perhaps better define as having potential future but not current value
5	Alienation rights by	Can other people be excluded from accessing/using the resource being monitored
6	Managements rights by	Can the group define and execute management without interference from other groups

1	Funding by	Who paid for the monitoring
2	Design by	Who designed the monitoring
3	Data collection by	Who collected the data
4	Data processing by	Who organized and analuzed the collected data
5	Interpretation by	Who interpreted the results
6	Quality control – audit/review by	Who did – as independent of the monitoring- go though and checked the above 5 points before the material was put to use (if appropriate)

1	Implementation by	Who implemented decision emanating from the monitoring
2	Scale of management impact	On what scale does the management impact
3	Recognition of management impact	?
4	Policing	Who check that the regulations are being observed and who do they refer to.

Table 3 Overview of selected processes in monitoring which are defined by a temporal context

				Scale	days	months	years	decades
		Speed of management implementation						
		Speed of management impact						
		Periodicity of monitoring						
		?						