An aerial photograph of a mountainous region. The foreground and middle ground show terraced agricultural fields, some of which are golden-brown, suggesting a dry season or specific crop. The surrounding hills and valleys are covered in dense, dark green forests. The background shows more distant, hazy mountain ranges under a clear sky.

Participatory science:
Community experiments as a reliable
information base for sustainable
harvesting

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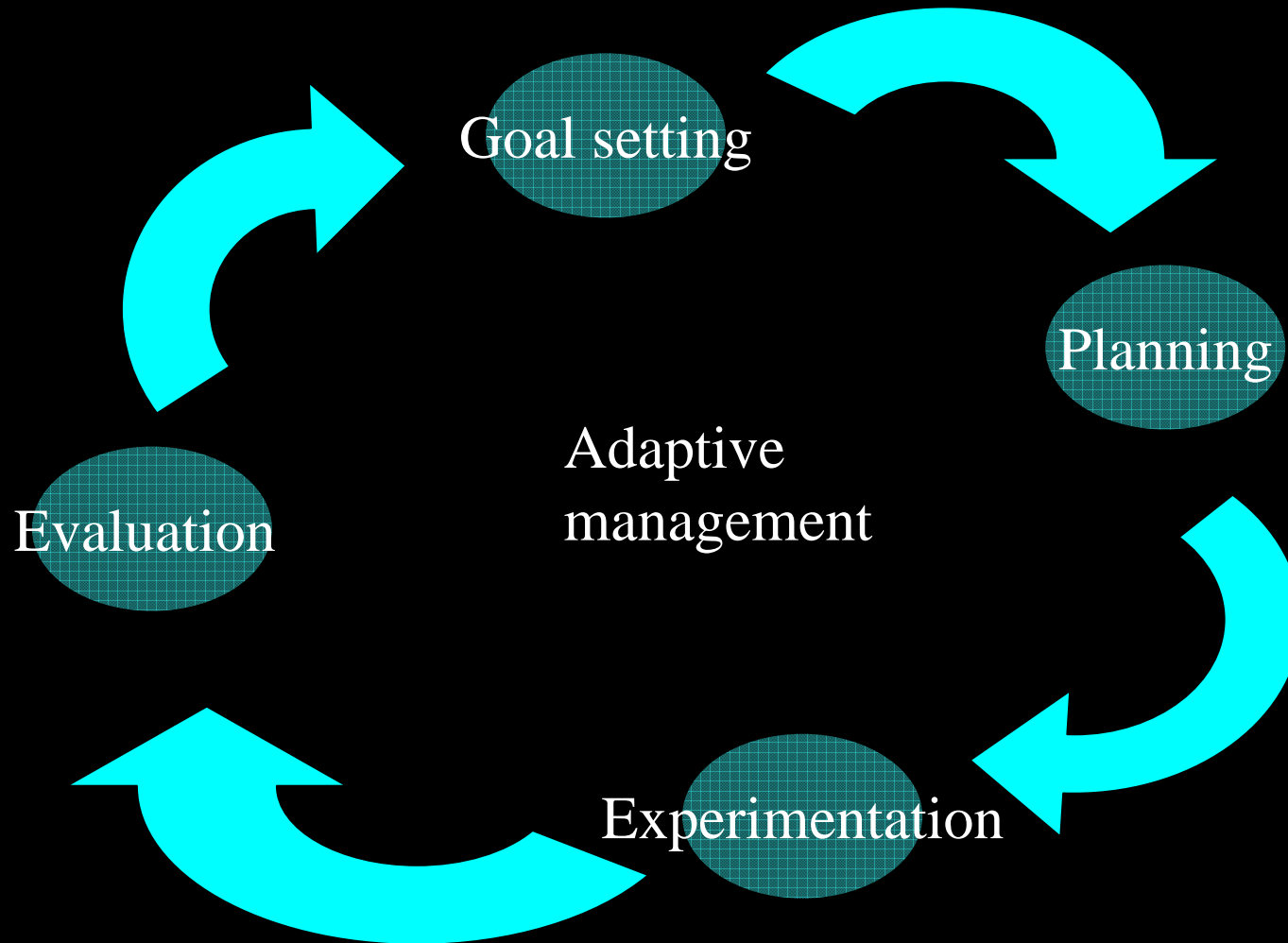
and funding from the UK's Dept
for International Development

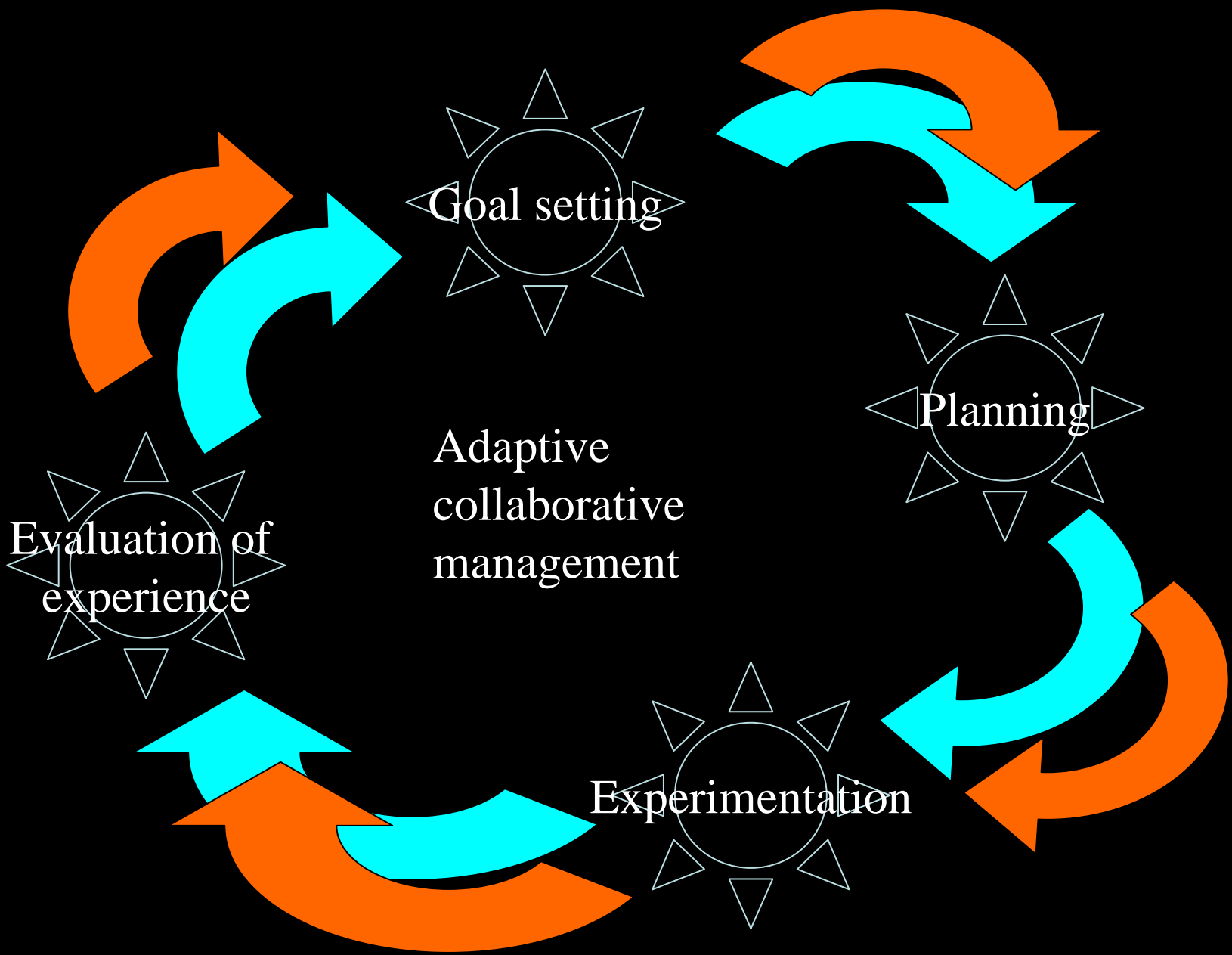


Key question linking forest science and governance

If collaborative NTFP management is to be adaptive:

- Where is the reliable and valid information going to come from to shape the adaptation?
- How can that information be incorporated into decision-making at different scales?
- [and therefore] How can foresters, NGOs and scientists most helpfully interact with these processes?





Caution!

- Cultural and psychological aspects include beliefs, desire for social coherence, emotions, 'sense-of-place', personal experience
- The models we are discussing (including mine) are cognitive rationalist
- i.e. they suggest that we do what is the most 'sensible' thing to do based on rational goals, the information available to us, and a belief in observable cause and effect
- Reality is more complex
- The human factors are often hidden, unconscious, profound and causal
- This approach is situated within local cultural (institutional) contexts leaving the interpretation and implementation to the resource users

Nightingale 2003

- *To account for ecological change in relation to equally dynamic social-political and cultural processes is difficult because it is not possible to simply ascribe all observable changes in forest structure and composition to human harvesting practices*

Klooster (2002)

Conventional scientific management fails:

- Limited and socially inappropriate goals
 - E.g. extreme control
 - E.g. focus on timber
- Does not address environmental complexity
- Lack of explicit attention to monitoring (in many countries)
- No culture of experimentation
- Institutional failures
 - Centrally imposed regulations do not take into account local conditions
 - Limited adaptability

(Klooster 2002)

Local knowledge fits with recent nonequilibrium understandings of nature.

But:

- Social conditions may override it (e.g. need to respect others' need for firewood)
- Can be inappropriate:
 - Time scale not conducive to learning about succession
 - Individuals' actions are spatially dispersed
 - Appropriate management unit (of forest) is bigger than woodlot

And I would add ...

Local knowledge:

- *Can be unconscious, dormant*
- *Events may have overtaken it*
 - *Population growth*
 - *Commercialisation*
 - *Wider environmental change*

Scientific knowledge:

Contributes particularly a methodology for
developing new knowledge

Currently lacks reflexivity

(Shindler and Cheek 1999)

- Currently, an institutional stability and organizational culture that enables experimentation and learning among our natural resource agencies do not exist. ..
- ... early research efforts [in citizen science] have been largely exploratory and primarily qualitative ..

Participatory forestry research

Scarce

Criticisms include:

- non-rigorous
- un-replicable
- unreliable
- tends to idealise local knowledge

Need a rigorous methodology that will

- Be relevant to rural communities in many settings
- Bring scientific rigour

Key features of our approach



- New knowledge (not just a ‘blend’ of local and scientific knowledge)
- Context specific
- Reliable, valid and credible – to all the stakeholders

Credibility and relevance come from:

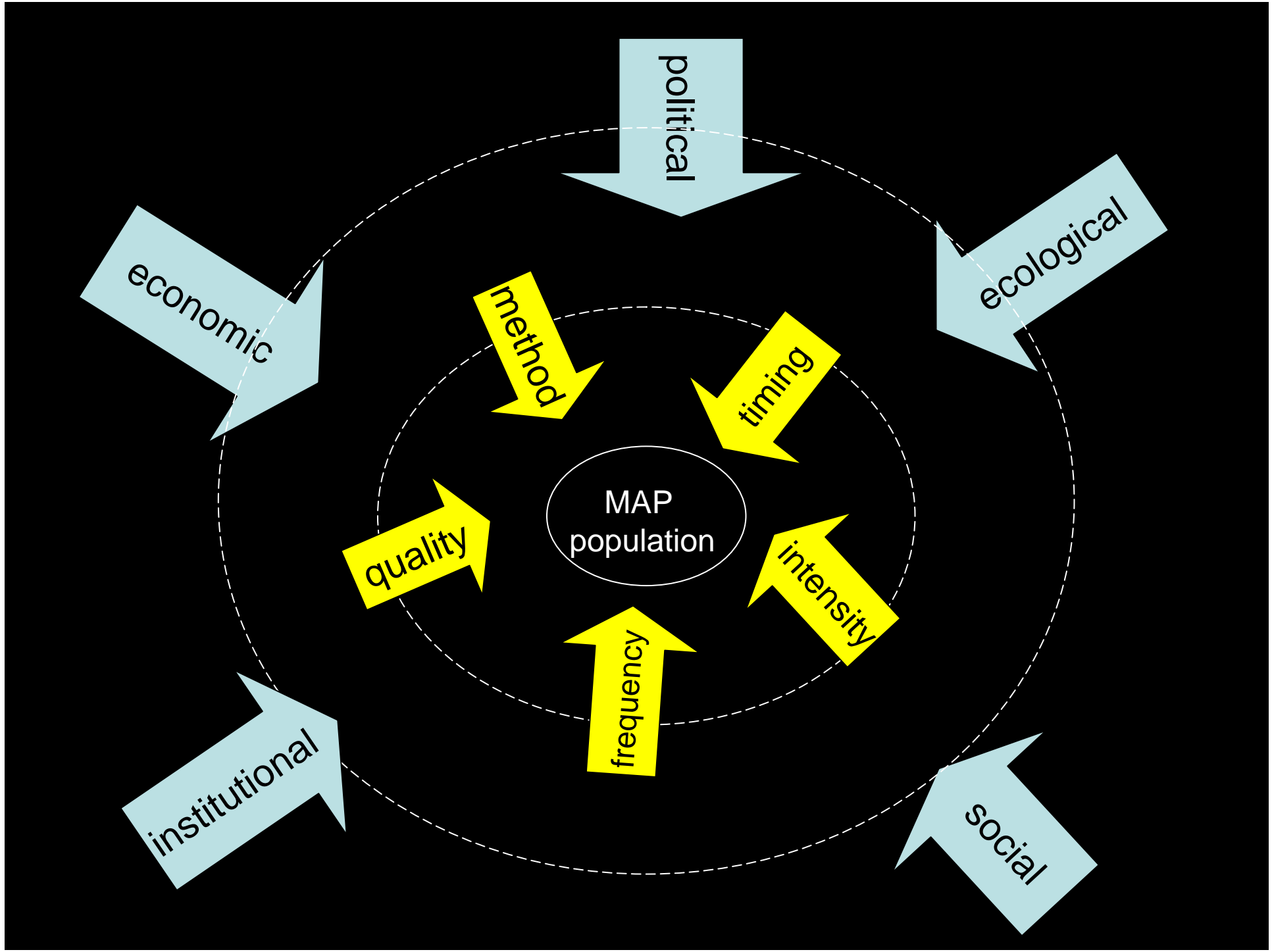
- **Validity:** results are really telling us what is true in the context in which we want to apply them. So if we want to generalise, we need to know how typical the social group is.
- **Reliability:** results will be the same every time we repeat the research.

The research process outlined here helps to ensure

- validity by thinking through alternatives and testing them,
- reliability by applying scientific principles to the design.

Which requires ...

- Institutional pre-conditions
- Foundation on local knowledge
- New ideas tested through scientific experimental methods
 - Formulating hypotheses about NTFP decline based on local knowledge
 - Rigorous sampling design
 - Rigorous data collection
 - Statistical methods applied and shared with the communities
- Facilitated adaptation of results into management plans



Design principles

- Goals
 - To gather reliable data on species
 - To evaluate different management practices (or “treatments”)
- Treatment hypotheses are developed with community input and tested by experimentation
- Principles of experimentation
 - Representation
 - Get a fair sample of the population
 - Randomization
 - To avoid systematic error
 - Replication
 - To increase confidence in results



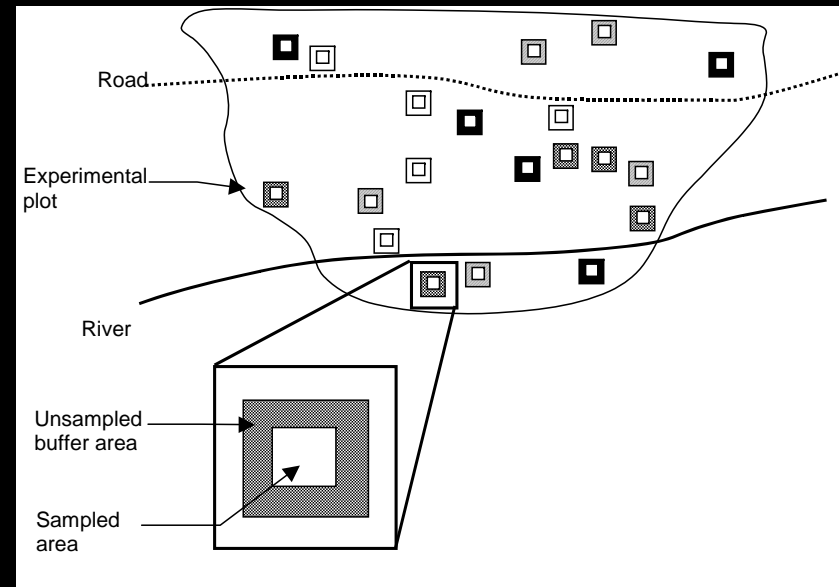
Example - creating a hypothesis

- Initial hypothesis:
 - “More mature fruits will be collected from *Garcinia* which might increase regeneration”
- Revised to:
 - “**If** we collect mature *Garcinia* fruits in a designated harvest season [i.e. to prevent green-apple picking] **then** more fruit will be available for natural regeneration **because** overall fewer fruit will be harvested.”
- Benefits
 - “If...then...because” shows logical thought process, e.g. why collecting mature fruit will increase regeneration
 - Definitive words make accepting or rejecting the hypothesis easier (e.g. not using “might”, “could” or “should”)
- An experiment can now be designed to reject or accept this hypothesis



Example – experimental design

- Stratification with community
- Random location of plots
- Random allocation of treatments
- Sampling to represent entire area
- Multiple replications of each treatment
- Deviations from protocol seen in practice
 - E.g. location of control plots, difficulties in accessing forest



Statistical analysis

- Once experimental design is complete, we can:
 - Establish plots in the field
 - Collect data (carefully keeping clear data records)
- Then perform analysis with Excel or other software
 - T-tests, ANOVA, regression
- Two common types of hypotheses to analyse
 - *Indicator and Management*
 - Looking for a “*significant*” (i.e. non-random) effect

Defining a hypothesis

- Through PRA and group discussion, define 'usual' harvesting practice ('Business as Usual' or BAU)
 - This in itself can be a challenging task and lead to much reflection among the group
- Propose alternative management regimes that might produce a more sustainable harvest (i.e. formulate a hypothesis) [= "jump-start"?)]

Turning a community hypothesis into a scientific hypothesis

For example,

Community Hypothesis: If 100% of Kurilo plants are harvested, the yield will be greater in the first year and less from 2nd year onward than if 75% of plants are harvested.

Statistical Hypothesis: There is no significant difference in the yield of the Kurilo tuber when harvested at rates of 100% or 75%

Testing the hypothesis

- **MONITORING:** Test the sustainability of ‘usual’ harvesting regimes
- **EXPERIMENTATION:** Rigorously design and set up experiments to test:
 - the effect of management on harvest quantity and quality, and on total yield, and on regeneration
 - the usefulness of proxy indicators which will be easier for communities to use in assessing yield, avoiding the need for harvest and measurement.



Some management hypotheses

Species *Feronia limonia*

Tree; fruit

BAU Collect all fruits in one harvest before 2nd week in March

Hypothesis Compared with BAU, collecting only mature and fallen fruits strictly between the last week of March and the second week of April will improve the quality of the harvest and regeneration



Some management hypotheses

Species *Cinnamomum macrocarpum*

Plant habit /

part used

BAU

Tree; leaves
Collect all leaves by cutting branches and twigs

Hypothesis is

Compared to BAU, collecting only mature leaves by plucking individual leaves will improve regeneration and yield



Some indicator hypotheses

For kurilo:

- Tuber weight is correlated to height of plant
- Tuber weight is correlated to the root collar diameter of the plant
- Tuber weight is correlated to the crown diameter of the plant



Analysis

- Explicit comparison of
 - Community hypothesis
 - Community impression of results
 - Statistical significance
 - ANOVA tests for differences between treatments
 - Correlations between indicators
 - Projected harvests in future under different treatments
 - Community's response to statistical significance

after two years, in Nepal:

- Approx. 40% community hypotheses are supported
- In such cases people feel that their knowledge has been validated
- Where hypotheses refuted, villagers often interested in revising the hypothesis (i.e. adaptive management)
- Communities are motivated
 - to observe more data where their hypotheses are not proven
 - to search for information on ecology, life cycle of spp.
- Communities have started to question and reflect on their hypotheses

Some challenges of scientific methods

- Temptation to
 - establish experimental plots in areas where the species is more abundant, and the land easier to visit and monitor;
 - locate control plots in protected area;
 - improve the treatment plots e.g. by seeding with the fruits collected.
- Bias towards harvesting the 'better' plants.
- Desire to test more than one variable in each experiment.



credibility

- Takes different forms for different stakeholders
 - Reflection and sharing of local knowledge
 - Logic of hypothesis formulation
 - Process of replication, randomisation
 - Quantitative data analysis
 - Direct observation and experience
 - Reflexive analysis of experience ('social learning')

What effect can this process have?

- Ecological
 - All four participating communities changed their management plans to include new NTFP harvesting regulations, or permanent sample plots
 - Protection and cultivation of NTFPs started
- Intellectual
 - The process of sharing local knowledge, developing the hypotheses and designing the experiments is often more convincing and leads to more action than the statistical results
 - Started experimenting with other species
- Economic
 - NTFP enterprises established
- Social
 - Land allocation for poor to cultivate NTFPs in CF
 - Increased employment opportunities for the poor
- Institutional
 - Increased participation in the CF processes
 - Inclusive decision making process institutionalized
 - State forestry service now providing training in the method, aim to develop yield tables for NTFPs

Is all of this too reductionist?

Must be facilitated as part of a process which

- Recognises that experiments are sub-sub-systems within subsystems within systems
- Supports learning within complexity
- Supports increased consciousness of nested systems
- Leads to adaptation (of behaviour and rules) as result of learning



“quantitative data not only informs but empowers”

“it’s putting the science back into forestry”