

# Stratified Monitoring

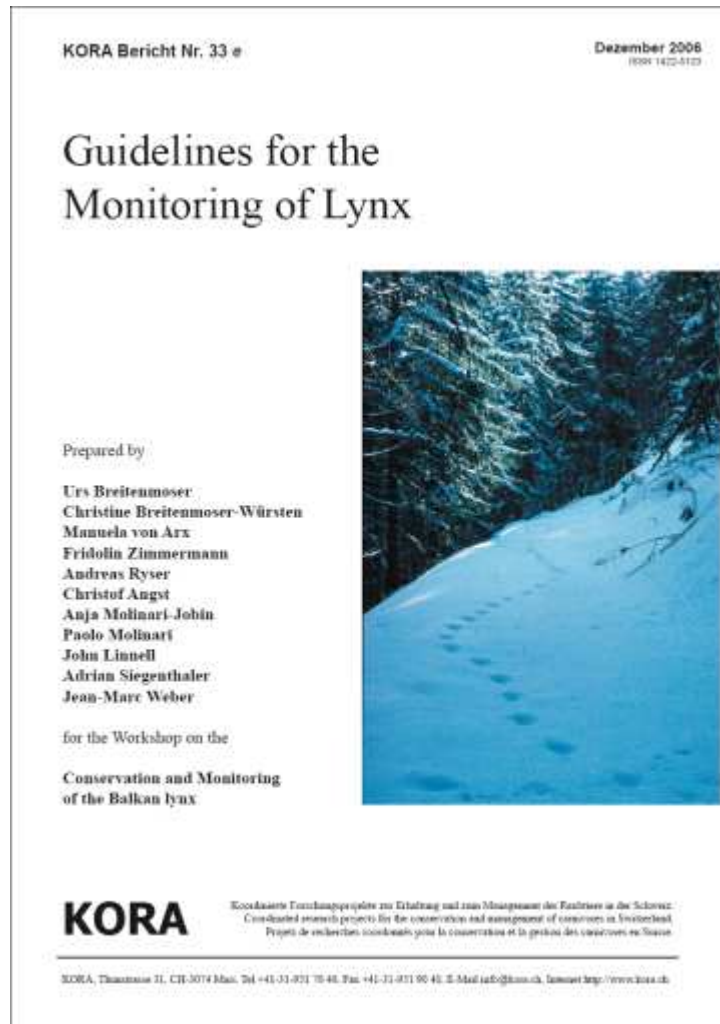
## Aims, Concept and Principles of Stratified Monitoring

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1. **WHY “stratified monitor”?** – the rational
2. **WHAT is “stratified monitoring”?** – the concept
3. **HOW to carry out “stratified monitoring”** – the principles
4. **WHO is involved in “stratified monitoring” ?** – the network





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## Definitions:

**Survey:** Compilation of qualitative or quantitative information through standardized procedures to define status. (e.g. baseline survey)

**Surveillance:** Series of surveys to reveal a dynamic process (e.g. surveillance of epidemics).

**Monitoring:** Regular and structured surveillance to assess the effect of a (conservation) measure in respect to a goal to be reached (e.g. recovery of an endangered species).

→ *Often used for “continuous observation of a population”*

→ *Can also be a “baseline survey”*



# 1. Why “stratified monitoring”? – the rational

How can we know...

... what the status, distribution and trend of a population is?

... what threats, conflicts and attitudes of people are?

... what we have to do to conserve or sustainably manage it?

... that the conservation or management measures are effective?

→ monitoring, monitoring, monitoring...!



## 1. Why “stratified monitoring”? – the rational

What do we need to know for a comprehensive conservation programme?

- **Status:** distribution, abundance, and trend of the population
- **Ecological conditions:** prey (status), habitat, critical resources
- **Problems:** threats, conflicts, attitudes of people
- **Performance:** efficiency of conservation or management measures
- **Monitoring at different levels and scales, using a variety of methods, with a limited budget**
- **We cannot monitor everything everywhere continually with a high precision**
- **Combine large scale/vague/cheap with small scale/precise/expensive methods and different time scales (repeat frequency) to develop comprehensive picture**
- **Stratified monitoring**



## 2. What is stratified monitoring? – the concept

### Concept of stratified monitoring:

1. Large carnivore populations often distributed over several countries.
2. Many administrative units, GOs, NGOs and scientists involved (difficult communication).
3. Means (funding) are too limited to survey whole area with the same intensity.
4. The status of a population can vary between regions.
5. Time scale is unpredictable. Recovery and expansion of a population may take a long time.



## 2. What is stratified monitoring? – the concept

Stratified monitoring combines several monitoring methods at different geographic scales and administrative levels with different resolutions in order to optimise the information gain compared to the effort and the (financial) investment.



## 2. What can be monitored?

Scale/level

### Distribution:

- Occupied area, e.g. outline polygon or point distribution
- Presence/absence (e.g. raster distribution)
- Areas of permanent/sporadic presence; reproduction/no reproduction
- Areas of confirmed/unconfirmed presence

Entire range

### Abundance:

- Relative abundance (source/sink; high, medium, low)
- Absolute density (total count; capture-recapture methods)
- Frequency of selected parameter (standardised sampling method)

Entire range,  
reference area

### Population trend:

- Changes in distribution area: changes in outline polygon, # occupied raster cells
- Relative or absolute changes of population (total population, density)
- Changes of frequency of observations/parameters over years

Entire range,  
reference area

### Health and genetics:

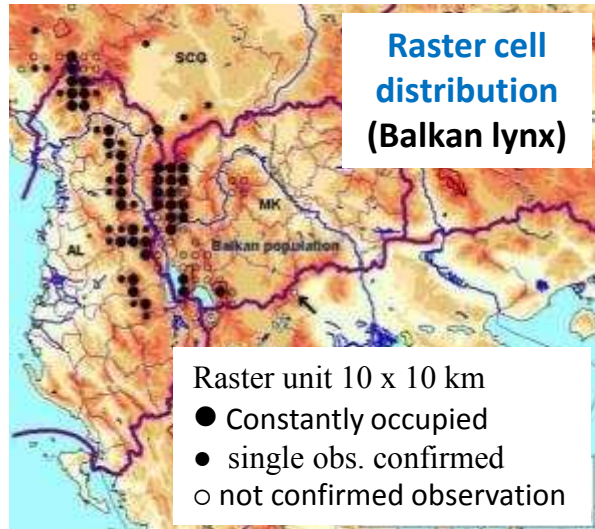
- Presence/absence or incidence of pathogens
- Spread and dynamics of epidemics
- Genetic variability, genetic drift

Opportunistic,  
study area

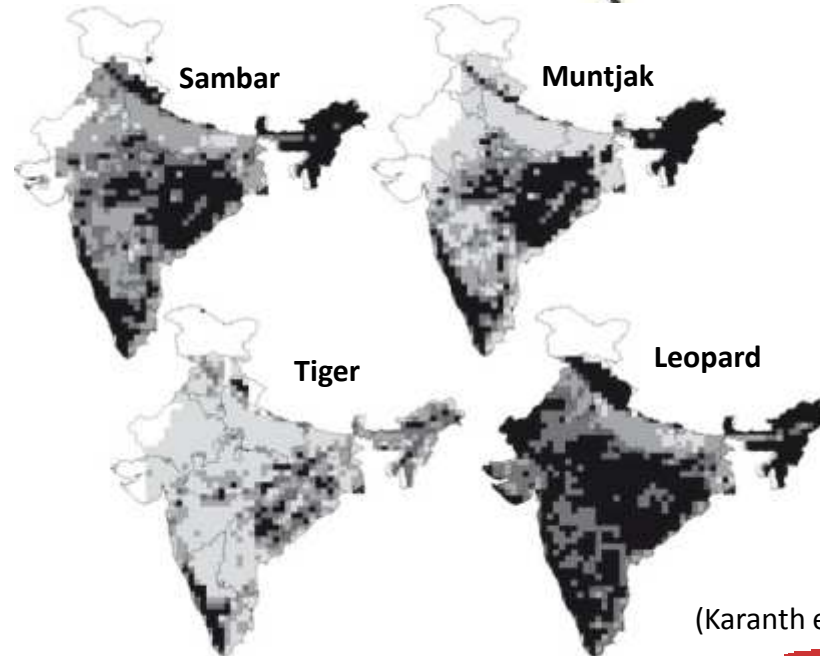
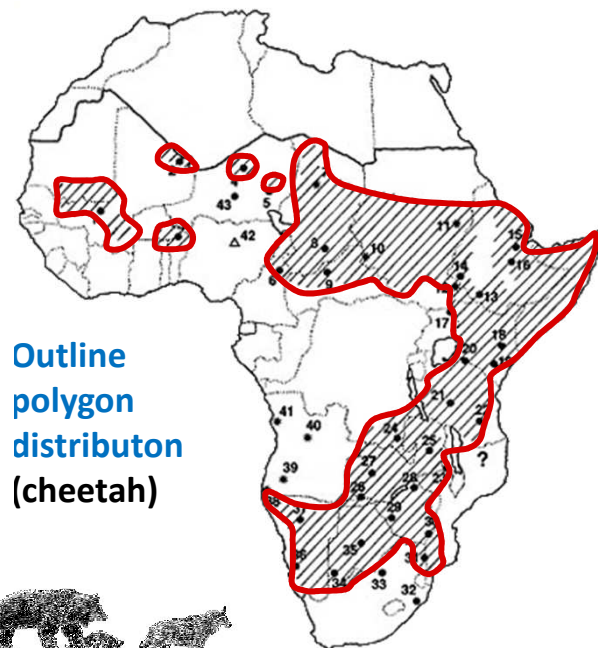
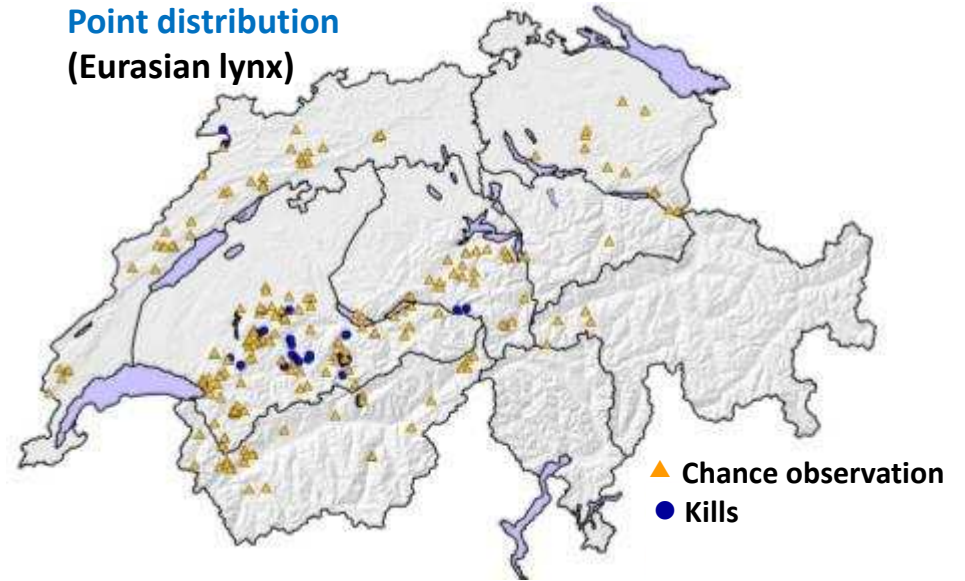




# Distribution



**Point distribution (Eurasian lynx)**

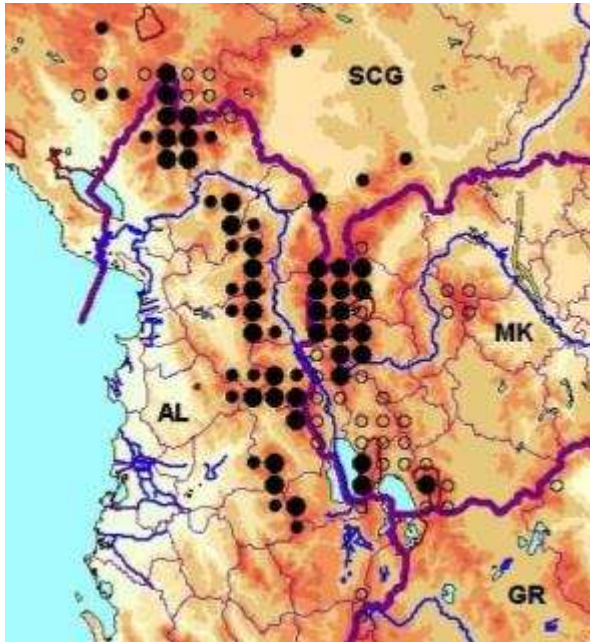


(Karanth et al. 2009)

**Distribution probability (Occupancy)**



# Abundance



## Relative abundance

(Eurasian lynx)

Expert opinion

- Permanent
- Sporadic
- Unconfirmed

## Absolute abundance

(Eurasian lynx)

Radio-telemetry, camera tapping



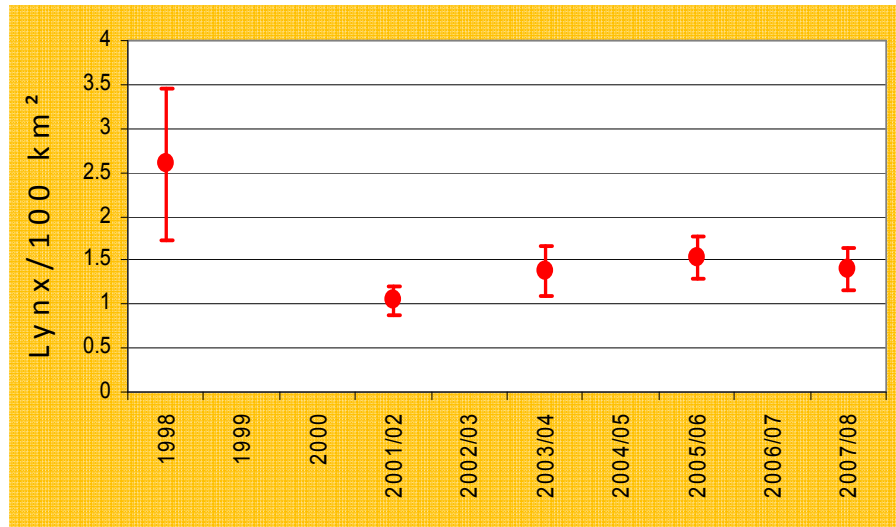
Polygons: Home ranges resident **males**, **females**

Lynx symbols: Resident **males**, **females** camera trapping

Footprints: **Males**, **females** from indirect observations



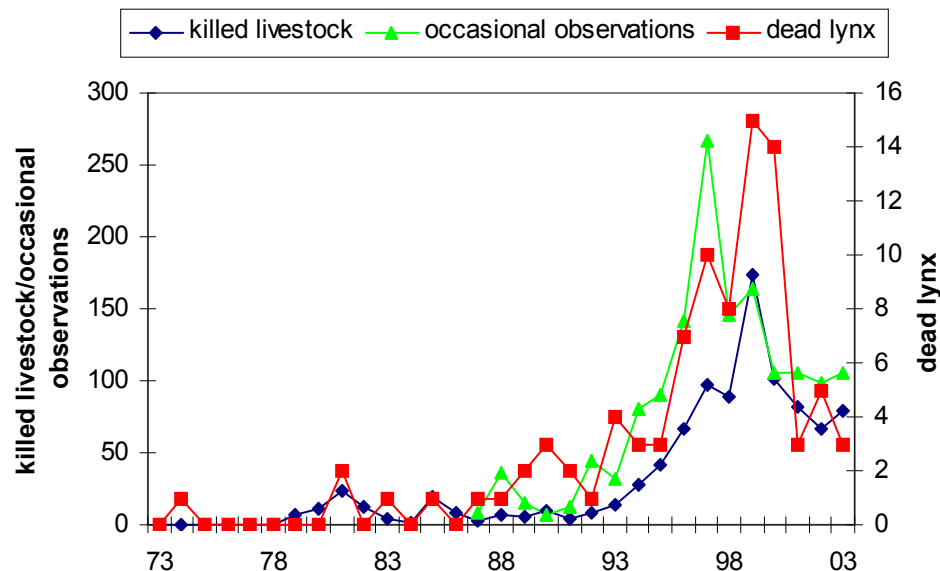
## Population trend



### Absolute density

#### (Eurasian lynx)

Density of lynx (ind./100 km<sup>2</sup>) based on number of lynx in reference area, confidence interval



### Trends of parameters

#### (Eurasian lynx)

Observations consistently collected over years in entire study area



## Health and genetics



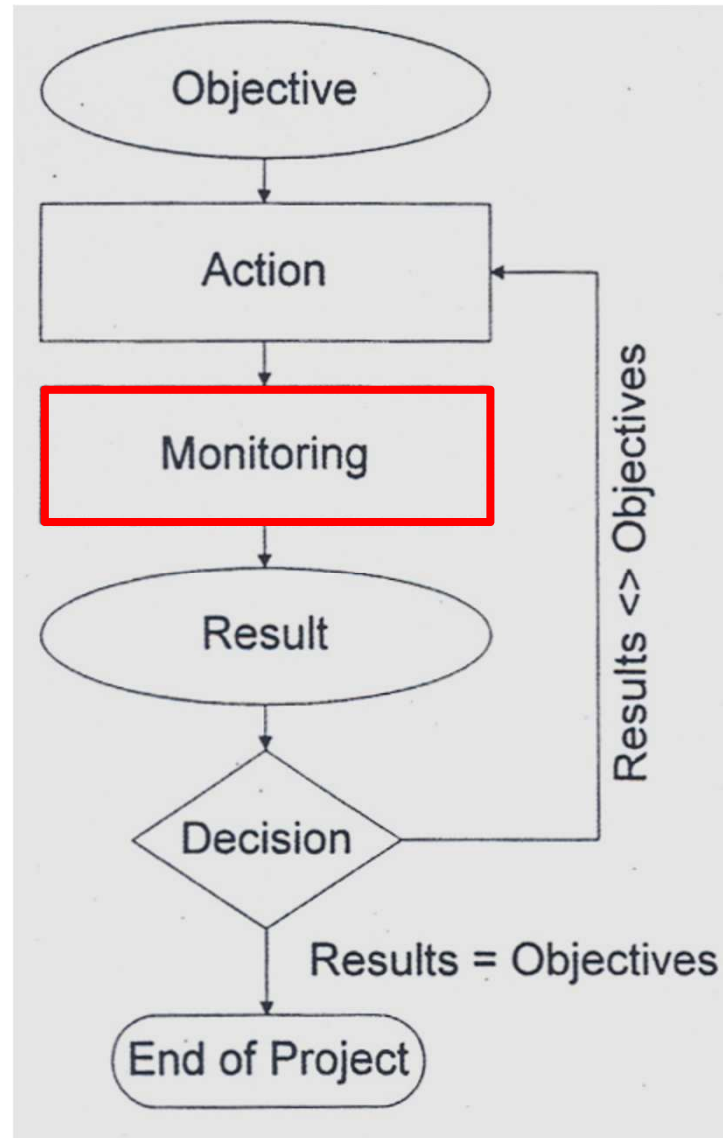
- Defined protocols for dead and captured cats!
- Consistent collection, storage and analyses of samples
- Apply the same protocols, analyses and interpretation over the entire area of the species



### 3. How to carry out stratified monitoring? – the principles

#### Principles of (stratified) monitoring:

1. Define the goals and objectives to be reached.
2. Measure (repeatedly) control parameters to describe the dynamics of the process being monitored.
3. Evaluate of the outcome of the measuring against the goals and decide on
  - (a) the adjustment of the actions and/or
  - (b) continuation of monitoring.



## Principles of (stratified) monitoring:

**Purpose.** What are the **aims** of the (stratified) monitoring project? What **questions** need to be answered?

**Method:** Which **parameters** do we need to measure to answer these question? Which **methods** can be used to collect the data needed?

**Precision/resolution:** Which **accuracy** and **resolution in time/space** do we need to draw the correct conclusions from the results?

**Level/scale:** At what **level/scale** do we need to measure the parameters allowing to answer these questions?

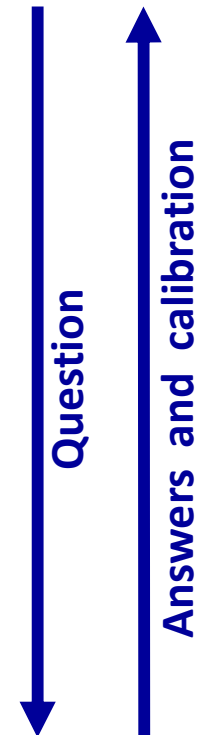
**Analysis and interpretation:** What **analyses** and statistical tests will be used? What sample size, quality/accuracy of data is needed, and what is the best repeat frequency? What will be the interpretation of the results?

→ Answering these questions allows developing a stratified monitoring approach for a species/metapopulation.

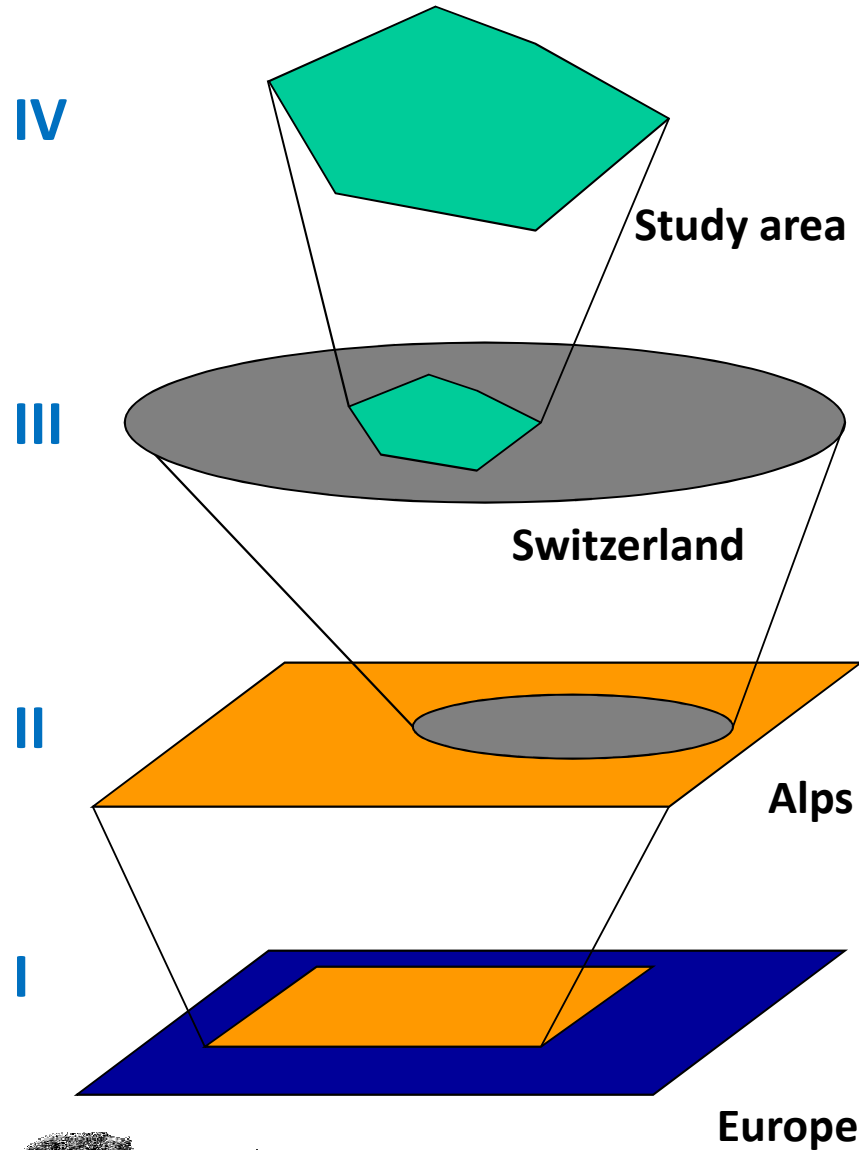


## Possible level of stratified monitoring (Eurasian lynx):

<i>Level</i>	<i>Range</i>	<i>Questions</i>
I	Species range, area Europe	Distribution, range, taxonomy
II	Population, metapopulation Alps, Carpathians	Distribution, dynamics, status, fragmentation, conservation
III	(Sub-)Population country, „compartment“	Dynamics, abundance, status, conflicts, conservation
IV	Part of a population, study area	Ecology, land-tenure system, density, diet, conflicts



### Concept of stratified monitoring:



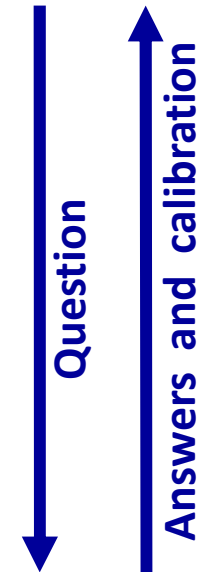
Calibration  
Calibration  
Calibration





## Possible level of stratified monitoring (Balkan lynx):

<i>Level</i>	<i>Range</i>	<i>Questions</i>
I	All range states (Albania, Kosovo, Macedonia, Montenegro)	Distribution (P/A), range dynamics, taxonomy
II	(Sub-)Population, country	Dynamics, rel. abundance, mortality, status, conflicts, attitudes, conservation
III	Reference area, study area	Ecology, abs. abundance (CMR), demography, land tenure system, etc.



## 4. Who is involved in stratified monitoring? – the network

### The monitoring-partnership



- GOs, NGOs, and scientists must **work together**.
- A **network** of observers and reporters needs to be established.
- Interest groups (hunters, foresters, veterinarians, etc.) and the public must **be informed**.

*Crucial to raise awareness and build trust between interest groups!*

### The monitoring-network

- Professionals and volunteers must be **trained** in identifying field signs, methods and reporting.
- Member of the network must get **a feedback!**
- Co-ordinators are responsible for the **group identity** and need to communicate on a regular basis or to organise reunions.

*E.g. CD with pictures from lynx camera trapping*



## 4. Who is involved in stratified monitoring? – the network

### Levels and responsibilities for a stratified monitoring (Balkan lynx):

<i>Level</i>	<i>Range</i>	<i>Responsibilities</i>
I	All range states (Albania, Kosovo, Macedonia, Montenegro)	Entire BLRP team (national teams, international experts, scientists)
II	(Sub-)Population, country	National Balkan lynx monitoring networks
III	Reference area, study area	National BLRP teams, research groups

### Analyses, interpretation and reporting:

- I Every 2-3 years, entire BLRP team, in English and national languages.
- II Every year, national teams, (English and) national languages, feedback to network!
- III As needed (e.g. after camera trapping), scientific reporting, summarised in national annual reports.

