Biodiversity Monitoring Switzerland

BDM-CH

The system and how it works

ISEBI, Moscow, 19 May 2009
Meinrad Küttel, meinrad.kuettel@bafu.admin.ch
Some facts about Switzerland

- 41,290 km$^2$
- from Lago Maggiore, 193 m a.s.l., up to Monte Rosa, 4,634 m a.s.l.
- part of the catchment areas of rivers Rhine, Rhone, Danube and Po.
- varying geology: from the Upper Rhine Rift or Oberrheingraben (Löss) across the Jura, the Molasse Basin, the Alps to the edge of the Northern Italian Plain.
- Several glaciations during the Pleistocene with regular eradication of a large proportion of the flora and fauna.
- Not an island, but an open system
- an estimated 70,000 plant and animal species, of which
  - 50,000 known species
  - 3,000 vascular plant species
Six main biogeographical regions

- Jura
- Western Central Alps
- Northern Alps
- Eastern Central Alps
- Southern Alps
- Central Plateau
Jungfrau
Habkern
Lavaux, Lake Geneva
Fribourg
Aims of the BDM

Mainly

- To replace assumptions or beliefs with facts
- To gain a better understanding of biodiversity
- To provide a basis for our nature conservation policy
- To test the efficacy of national policy
- To establish reliable indicators (i.e. as simple as possible in methodological terms, reproducible, convincing, cost-efficient and suitable for use on new issues etc.).
- To provide information on Switzerland as a whole and on the regions.
Swiss Monitoring Concept

- Environmental policy (objectives, regulatory framework)
- Integrated environmental reporting
- Monitoring (observation of the environment)
- Effectiveness monitoring of projects/programmes

Projects/programmes

Environments/programmes
Organisation

FOEN

Advisory board of experts

Coordination office

Subcontractors field work (Z7/Z9 etc.)

Data providers (Z3/Z4 etc.)

Various data providers Z- / E- / M-indicators
**History**

1995  Pilot study, working group
1996  Development of concept:
       Requirements of future recipients, discussion with experts
1997-98 Development of methods, comprehensive tests
1999  Invitation to tender for field work
2000  Training season for field survey
2001  Start of data collection on biodiversity state (core indicators Z7 and Z9. i.e. vascular plants, mosses, molluscs and breeding birds [butterflies 2003])
2006  Start of data collection on biodiversity change (core indicators Z7 and Z9; second survey)
A few keywords...

- National monitoring programme for biodiversity (data since 2001)
- Representative and highly standardised surveys (errors in data gathering known)
- Only a few indicators are surveyed directly by the BDM; most of the data are collected by other programmes
- Balanced list of indicators (e.g. common and rare species; avoiding bias)
- Additional surveys
- Open to finding answers to new questions that may arise
Selection criteria for taxonomic groups
Selection criteria for taxonomic groups

- Costs
- Human resources
- Charisma
- Number of species
- Sensitivity
- Ecological valence
- Precision of methods
- Validity
- Combination of groups
Data Quality: Focus of the BDM

- Representativeness: systematic sampling grid covering all of Switzerland
- Reproducibility: evaluation-independent surveying methods
- Systematic use of defined surveying methods

Data quality known thanks to
- duplicate surveys
- the use of advanced capture-recapture methods
- re-sampling and other analysis of the data
Survey Frequencies
Geographical Resolution

• Frequency (updating)
  • annual (e.g. Z1, Z7 [subset], Z9 [subset], M4, M5)
  • multi-annual (Z4)
  • irregular (dependent on third-party data, e.g. Z5 RL evaluation, Z11 quality of the valuable biotopes)

• Geographical resolution
  • Switzerland
  • Biogeographical regions
  • Cantons
  • Agricultural zones/regions
The 33 Indicators
grouped according the OECD System
Pressure (E Einfluss),
State (Z Zustand)
Response (M Massnahmen)

<table>
<thead>
<tr>
<th>Pressure</th>
<th>State</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valuable habitats</td>
<td>Genetic diversity</td>
<td>Protected areas</td>
</tr>
<tr>
<td>Landscape features</td>
<td>Species diversity</td>
<td>Contract areas</td>
</tr>
<tr>
<td>Use of natural areas</td>
<td>Habitat diversity</td>
<td>Agriculture</td>
</tr>
<tr>
<td>Use of woodland</td>
<td></td>
<td>Enforcement</td>
</tr>
<tr>
<td>Use of watercourses</td>
<td></td>
<td>Finance</td>
</tr>
<tr>
<td>Settlement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(15 indicators)</td>
<td>(12 indicators)</td>
<td>(7 indicators)</td>
</tr>
</tbody>
</table>
State Indicators: Methodical Principles

- Main emphasis on the level of species diversity
- Change in the number of species in the course of time
- Emphasis on widespread and common species
- Entire (taxonomical) species groups
- Systematic random sampling
State indicators

Genetic diversity
Z1 Number of livestock breeds and plant varieties
Z2 Proportion of livestock breeds and plant varieties

Species diversity
Z3 Species diversity at national and regional level
Z4 Number of species in Switzerland facing global extinction
Z5 Change in the endangerment status of species
Z6 Population size of endangered species
Z7 Species diversity in landscapes
Z8 Population size of common species
Z9 Species diversity in habitats

Habitat diversity
Z10 Size of valuable habitats
Z11 Quality of valuable habitats
Z12 Diversity of species communities

Core or Key indicators
All indicators operational
## Pressure Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Size of valuable habitats (=Z10)</td>
</tr>
<tr>
<td>E2</td>
<td>Size of areas of defined use</td>
</tr>
<tr>
<td>E3</td>
<td>Size of wilderness areas</td>
</tr>
<tr>
<td><strong>E4</strong></td>
<td><em>Length of linear landscape features</em></td>
</tr>
<tr>
<td>E5</td>
<td>Diversity of land use and land cover</td>
</tr>
<tr>
<td>E6</td>
<td>Nitrogen supply in the soil</td>
</tr>
<tr>
<td>E7</td>
<td>Intensity of agricultural land use</td>
</tr>
<tr>
<td>E8</td>
<td>Forest area dominated by non-indigenous trees</td>
</tr>
<tr>
<td>E9</td>
<td>Area of artificially regenerated young woodland</td>
</tr>
<tr>
<td>E10</td>
<td>Area of woodland with special use</td>
</tr>
<tr>
<td><strong>E11</strong></td>
<td><em>Volume of water extracted from watercourses</em></td>
</tr>
<tr>
<td><strong>E12</strong></td>
<td><em>Proportion of adversely affected watercourses</em></td>
</tr>
<tr>
<td><strong>E13</strong></td>
<td><em>Water quality of watercourses and captive water</em></td>
</tr>
<tr>
<td><strong>E14</strong></td>
<td><em>Proportion of polluted waterways</em></td>
</tr>
<tr>
<td>E15</td>
<td>Density of access options</td>
</tr>
</tbody>
</table>

*italic* still not operational (work in progress)
Response Indicators

M1  Size of protected areas
M2  Size of “secure” protected areas
M3  Endangered species living in protected areas
M4  Ecological Compensation Areas
M5  Areas farmed organically
M6  Implementation of environmental regulations
M7  Financial resources for nature and landscape conservation

italic  still not operational (work in progress)
Core indicators

• Z3 Species diversity at national and regional level

• Z7 Species diversity in landscapes

• Z9 Species diversity in habitats
Levels of Species Diversity

Country/biogeographical regions

Landscape

Habitat

Indicator Z3

Indicator Z7

Indicator Z9
Change in the number of species living in the wild in Switzerland which can be identified using standardised methods

Selected taxonomic groups
## Z3 Results 1997 - 2007

<table>
<thead>
<tr>
<th></th>
<th>1997</th>
<th>2007</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammals (excl. bats.)</td>
<td>57</td>
<td>59</td>
<td>2 newcomers</td>
</tr>
<tr>
<td>Breeeding birds</td>
<td>178</td>
<td>177</td>
<td>3 disappearances</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 newcomers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 unstable species</td>
</tr>
<tr>
<td>Reptiles</td>
<td>15</td>
<td>15</td>
<td>no change (n.c.)</td>
</tr>
<tr>
<td>Amphibians</td>
<td>18</td>
<td>18</td>
<td>1 unstable species</td>
</tr>
<tr>
<td>Fishes</td>
<td>52</td>
<td>54</td>
<td>2 newcomers</td>
</tr>
<tr>
<td>Cyclostomes</td>
<td>1</td>
<td>1</td>
<td>n.c.</td>
</tr>
<tr>
<td>Butterflies</td>
<td>189</td>
<td>189</td>
<td>n.c.</td>
</tr>
<tr>
<td>Grasshoppers</td>
<td>103</td>
<td>103</td>
<td>n.c.</td>
</tr>
<tr>
<td>Dragonflies</td>
<td>65</td>
<td>65</td>
<td>n.c.</td>
</tr>
<tr>
<td>Total</td>
<td>678</td>
<td>681</td>
<td>3 newcomers</td>
</tr>
</tbody>
</table>
1900 - 2007

- Losses (different causes)
- Newcomers: only established through active human assistance
- Newcomers: migrated independently to Switzerland from European regions

Number of Species

<table>
<thead>
<tr>
<th>Species</th>
<th>1900-2007</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Säugeltiere (+8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brutvögel (+14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reptilien (+1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amphibien (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fische (+1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rundmäuler (-1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tagfalter (-2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Libellen (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heuschrecken (-2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Levels of Species Diversity

Country/biogeographical regions

Landscape

Habitat

Indicator Z3

Indicator Z7

Indicator Z9
Change in the mean species diversity for selected species groups per 1-km$^2$-sampling grid unit.
Sampling grid

- 510 sampling grid units, each measuring 1 km²
- Systematic random sampling
- The sampling grid is denser for the Jura and Southern Switzerland.
- Sampling repeated every 5 years
Z7 Sampling Grid Unit/Transect

Surveyed taxa:
- Vascular plants
- Breeding birds
- Butterflies

Length of transect:
- 2.5 km
Z7 Sampling Grid Unit/Concrete Transect
Butterflies 2003 – 2007:
Mean for Switzerland: 32 species
All three groups show different pictures of biodiversity!
Levels of Species Diversity

Country/biogeographical regions

Landscape

Habitat

Indicator Z3

Indicator Z7

Indicator Z9
Z9 Species Diversity in Habitats: Definition

Change in the mean number of species belonging to a specific taxonomic category living in small areas of standardised size and of a specific type.

Source: Wildermuth (1978)
Z9 Sampling grid

- 1,600 sampling grid units, each measuring 10 m²
- Systematic random sampling
- No densification
- Sampling repeated every 5 years
Z9 Sampling Unit

Surveyed taxa
• Vascular plants
• Mosses
• Molluscs (snails)

Size of sampling grid unit
• 10 m²
Z9 Concrete Sampling Units
Numerous Evaluation Options, e.g.

- Climate change
- Quality of meadows and pastures (BDM)
- Model for plant species diversity in Switzerland (WSL)
- Contribution to the spread of plant species (CRSF/ZDSF)
- Confirmation/discovery of rarities

*Distichophyllum carinatum*

(globally endangered species, extinct in Switzerland, re-discovered by the BDM in October 2005)
### Genetic Diversity of Livestock Breeds and Plant Varieties

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Varieties</th>
</tr>
</thead>
</table>

#### Z2 Proportions

<table>
<thead>
<tr>
<th>Year</th>
<th>Reben weiss Anteil Sorten</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Diverse (49)</td>
</tr>
<tr>
<td>2004</td>
<td>Pinot blanc</td>
</tr>
<tr>
<td>2005</td>
<td>Sauvignon blanc</td>
</tr>
<tr>
<td>2006</td>
<td>Arvine (petite)</td>
</tr>
</tbody>
</table>

- **Diverse (49)**: Various types of varieties.
- **Pinot blanc**: Certain type of variety.
- **Sauvignon blanc**: Another type of variety.
- **Arvine (petite)**: A specific variety.

**Legend for Varieties:**
- Diverse (49)
- Pinot blanc
- Sauvignon blanc
- Arvine (petite)
- Pinot gris / Malvoisie
- Sylvaner / Rhin
- Chardonnay
- Müller-Thurgau
- Chasselas / Gutedel
The problem lies not in the change in the diversity of species and varieties but in the extreme asymmetry of distribution in cultivation and breeding practices (commercial agriculture is dominated by a few species/varieties).
Where Do We Stand Now?: Conclusion

- BDM is being carried out.
- The majority of the indicators are operationalised.
- BDM is internationally recognised.
- The data are high in quality.
- The data are sought after (universities, research institutes, regional nature research associations, data centres outside of BDM).
- Special evaluations have been and will be carried out.
- BDM can do a lot, but not everything.
Communicating the Results:
Visit www.biodiversitymonitoring.ch

- Basic data for the indicators (pdf-file)
- Website with the current data and additional information
- Report on the situation with regard to biological diversity (triannually; next report due on 22 May 2009)
- Two pages in the magazine «Hotspot» (biannual publication)
- Media conference (on demand)
- Publication in scientific journals
- Data transfer (international organisations)
High-Quality Results can only be achieved with a Committed Team of Professionals