What is the state of biodiversity ?

Anne Teyssèdre for the European Environment Agency, February 2006

- **A world biodiversity crisis**

Although yet limited, the data on the current dynamics of species, subspecies and populations consistently indicates a net trend towards biodiversity loss at the world level, which goes with the reduction or/and degradation of many or most habitats. The current degradation of terrestrial and aquatic ecosystems is such that without wide conservative measures, we can fear a mass extinction crisis comparable to those which signed the end of previous geological periods (http://www.well.com/user/davidu/extinction.html).

- **Species erosion : Inferring information from necessarily partial data** -> See the text on next page
- **Measuring the current biodiversity crisis** -> See the text and bibliography on next page
- **The Millennium Ecosystem Assessment** -> Link to subsection L3, first page
- **Why does biodiversity decline ?** -> link towards subsection L3
- **Why matter about biodiversity loss ?** -> Link towards subsection L2

- **State of biodiversity in Europe**

From Neolithic to Middle age, Europeans have converted more than two third of their biodiversity rich forests in biodiversity poorer farmlands, necessary to nourish their growing populations. Since then, the intensification of human activities, and mainly the intensification of agriculture during the last 50 years, have led to the degradation of many terrestrial, freshwater and coastal ecosystems. As a result, many species specialised to their habitat have been shown to decline between 1970 and 2000. More recently, the expansion of suburban and artificial areas at the expanse of farmland and semi-natural habitats has become a further driver of biodiversity loss. Moreover, northern, mountain and Mediterranean ecosystems, particularly rich in endemic species, are threaten by the current climate warming.

- **The changing face of European countryside** : *-> link to text below*
- **Selected references about European biodiversity state and trends** : *-> Link to the list on next page*
- **Monitoring and exploring land use changes in Europe** : *-> Link to text on next page*

- **Detailed information for Europe** : -> http://biodiversity-chm.eea.europa.eu/information

➔ The changing face of European countryside

Europe is unique in global terms because the diversity of its species is part of landscapes largely modeled by human activities. Europe's biodiversity has been shaped by agriculture since the last glaciation more than on any other continent. From the Mediterranean woodland and olive groves to the reindeer pastures of Scandinavia, remarkably few areas of even the highest conservation value are truly natural. Thus the continuation of traditional methods seems essential to species survival in many areas. Yet intensive agriculture, farmland abandonment and urbanisation are currently degrading habitats and threatening species in whole Europe.

➔ Species erosion : Inferring information from necessarily partial data

Our biosphere presently wears dozens of million species, each composed by one or several distinct subspecies, the huge majority of those being wild – *i.e* not intentionally raised and domesticated by human. Each subspecies itself is a web of interconnected populations dispersed on a more or less wide terrestrial or aquatic habitat. Obviously, it is impossible to monitor the dynamics of each of these million (sub)species. Only a small fraction of them can be, and are in fact, monitored. However, it is important to understand that:

1/ well designed sampling of populations, or of "sorting of populations" (for example: the British avifauna), combined to their monitoring in space and time, allows to identify the ecological factors determining their variations in number, *i.e.* the causes of the decline or expansion;

2/ such analyses allow to infer the present dynamics, not only of the considered populations and species, but also of other species or communities sharing the same habitats and facing the same or induced ecological pressures ;

3/ on another hand, the monitoring of the extent and quality of defined habitats - *i.e.* for most of them the monitoring of their current reduction and/or degradation - may be used to roughly estimate the variation in abundance of species or communities.

In other words, the monitoring in time and space of well sampled populations or of defined habitats may be used as indicators of biodiversity.

- To know more on indicators : -> http://biodiversity-chm.eea.europa.eu/information/indicator

➔ Measuring the current biodiversity crisis

Scientists have explored different approaches to measure and forecast the current biodiversity crisis. One can :

- Evaluate the present increase of the extinction rates, compared to a "quiet" geological period ;
- Evaluate the present increase of the extinction risks, compared to that of a quiet geological period ;
- Follow the dynamics of different populations and/or communities, representing different systematic groups, by sampling and monitoring them in space and time, and used them as "biodiversity indicators";
- Estimate and monitor the reduction in area of the main habitats and ecosystems ;
- Estimate and monitor the complexity of the main ecosystems, for example by the mean of a "trophic index" measuring the number of trophic levels;
- Identify the main causes of biodiversity erosion and analyze their dynamics to forecast their impact on biodiversity at mid term (*i.e.* 2050).

To know more on these different methods and on the main related data : -> *Link to the* **selected bibliography** *below* :

➔ Selected bibliography on the evaluation of the current biodiversity crisis :

- Balmford A. et al., 2003 : «Measuring the changing state of nature». *Trends in Ecology and Evolution*, 18, pp. 326-330.
- BirdLife International, 2004 : State of the world' birds 2004 : Indicators for our changing planet. Cambridge, 73 p.. Web link : http://www.birdlife.org/action/science/sowb/
- Butchart S.H.M. & al., 2004. "Measuring global trends in the status of biodiversity : Red List Indices for Birds". *Plos Biology* 2, December 2004. Web link : http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371/journal.pbio.0020383
- Gaston J. et al., 2003: "Habitat conversion and global avian biodiversity loss". *Proc. R. Soc. Lond.* B 270, 1293-1300.
- Jenkins M. et al., 2003: The challenge of measuring global change in wild nature: are things getting better or worse?" *Conservation biology* 17, pp. 20-23.
- Millenium Ecosystems Assessment, 2005 : "Ecosystems and human well being". Synthesis. Island Press, Washington D.C, USA.
- Pauly D. et al., 1998 : "Fishing down marine food webs". *Science* 279, pp. 860-863. Web link : http://www.fisheries.ubc.ca/publications/news/fishdown6feb1998.pdf
- Pauly D. & R. Watson, 2005. "Background and interpretation of the Marine Trophic Index as a measure of biodiversity. *Phil. Trans. R. Soc. B*, 360, pp. 415-423.
- Rosenzweig, M.L. 2001. "Loss of speciation rate will impoverish future biodiversity". *P.N.A.S.* 98, pp. 5404-5410. Web link : http://www.pnas.org/cgi/content/full/98/10/5404
- Teyssèdre A., 2004 : "Towards a 6th extinction crisis?" *in* "Biodiversity and global changes", R. Barbault & B. Chevassus-aux-Louis eds, ADPF, December 2004. Web link : http://www.adpf.asso.fr/adpf-publi/folio/biodiversite/pdf/en/chap2.pdf

- Thomas C.D. & al., 2004. "Extinction risks from climate change". *Nature* 427, pp. 135-148. Web link : http://www.nature.com/nature/journal/v427/n6970/abs/nature02121.html

➔ **Selected references about European biodiversity state and trends :**

- Birdlife International, 2004 : "Birds in the European Union : a status assessment". Published online at : http://www.birdlife.org/action/science/species/birds_in_europe/birds_in_the_eu.pdf
- De Heer M., Kapos V. & B.J.E. ten Brink, 2005 : "Biodiversity trends in Europe : development and testing of a species trend indicator for evaluating progress towards the 2010 target. *Phil. Trans. Roy. Soc.* B, pp.297-308.
- Gaston J. et al., 2003: "Habitat conversion and global avian biodiversity loss". *Proc. R. Soc. Lond.* B 270, 1293-1300.
- Thomas J.A. et al., 2004 : "Comparative losses of British butterflies, birds and plants and the global extinction crisis. *Science* 303, pp. 1879-1881.
- Thuillier W. et al., 2005 : "Climate change threats to plant diversity in Europe". *P.N.A.S.* 102, pp.8245-8250. Published online at : http://www.pnas.org/cgi/reprint/102/23/8245

- EEA, 2005 : State of the Environment Report 2005 : http://reports.eea.eu.int/state_of_environment_report_2005_1/en/tab_content_RLR
- Previous EEA reports : http://reports.eea.eu.int/92-9157-202-0/en/page311.html http://reports.eea.eu.int/report_2002_0524_154909/en http://reports.eea.eu.int/environmental_assessment_report_2003_10/Chapter11

➔ **Monitoring and exploring land use changes in Europe :**

Land use by human societies is a major driver of biodiversity changes. In order to help researchers to monitor, analyse and forecast the impact of land use change on biodiversity, and to help policy makers to understand and eventually alleviate this impact, the EEA is developing three related projects which first data are already or will soon be available for local, national or regional use on Internet :

1. Corine Land Cover :

Launched in 1990, Corine Land Cover allows to generate European land cover maps using ground-validated satellite images, and to monitor land use changes by comparison of successive maps. Based on Landsat ETM+ satellite maps, this program maps the cover in 44 habitat classes with a resolution of 25 hectares. Land cover changes are detected at a resolution of 5 ha. The updating frequency is currently every ten years.

More on Corine Land Cover and related data : -> *link to paragraph below :*

More on Corine Land Cover and related data :
- Video on Corine Land Cover : http://org.eea.eu.int/news/Ann1102683276
- Corine Land Cover web pages : http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=571

- Corine Land cover brochure (2000)
  http://org.eea.eu.int/documents/brochure/CLC2000brochure
- Main land use changes in Europe for 1990-2000 : Chapter 2 in EEA State of the Environment Report 2005 (“The changing face of Europe”) :
  http://reports.eea.eu.int/state_of_environment_report_2005_1/en/SOER2005_Part_A.pdf
- EEA analytical maps and graphs : http://dataservice.eea.eu.int/atlas/

2. IRENA project :

The IRENA project, for Indicator Reporting on the integration of ENvironmental concerns into Agricultural policy, aims to analyse land use change in a policy context. More explicitly, it
aims to analyse the environmental impact of agricultural policies by the means of a set of interrelated agri-environment indicators introduced by the European Commission, and to produce a policy assessment report on the integration of environmental concerns into agricultural policy.

- More on IRENA : http://webpubs.eea.eu.int/content/irena/index.htm

3. PRELUDE scenarios :

PRELUDE, or Prospective Environmental analysis of Land Use Developments in Europe, is a pilot project which trys out a new method to address future environmental issues and actively influence the policy agenda in a early stage of policy lifecycle. It presents a set of five different land use scenarios for Europe, based on different assumptions about drivers of land use change.

Web site : http://scenarios.ewindows.eu.org/reports/fol077184