



Why does biodiversity decline ?

Anne Teyssèdre for the European Environment Agency, February 2006

- **A biosphere dominated and overexploited by humans**

6,5 billion people endowed with high energetic and spatial requirements exploiting a relatively small and vulnerable biosphere : the causal link between the spectacular expansion of humanity and the current biodiversity crisis is not a matter of asking anymore. By its widely extended and poorly organised consuming activities, our species is currently degrading most terrestrial and aquatic ecosystems, and hence strongly reducing the diversity of populations and species.

- ➔ **An increasing ecological human footprint on Earth** (see next page)
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- **Europe shares a responsibility in the current world biodiversity crisis**

As in many other countries, agricultural intensification, increased urbanisation and CO₂ emissions are the main current drivers of biodiversity loss in Europe. The huge pressure of European activities on Earth's ecosystems and species may be assessed by measuring its ecological footprint on Earth, i.e. the total area required to produce the food and fibres Europeans consume, absorb their waste and provide space for infrastructure.

In 2001, while Europe's biocapacity was estimated at 2.2 global hectares available per person, each European required in mean 4.9 hectares to provide for his lifestyle, among which about 1.9 ha necessary to produce the biological resources (food, fiber, timber..) he consumes, and

3 ha to absorb the waste of his energy consumption. This human pressure on earth's ecosystems, which extend far beyond Europe's shores, is clearly unsustainable.

More on these data :

- Global Footprint Network, 2005 : "Europe 2005 : The ecological footprint" :
http://www.footprintnetwork.org/gfn_sub.php?content=europe2005
- EEA, 2005 : State of the Environment Report 2005 :
http://reports.eea.eu.int/state_of_environment_report_2005_1/en/tab_content_RLR

➔ An increasing ecological human footprint on Earth

At the end of the 1990s, UNEP-WCMC and the WWF have developed a measure of the impact of human activities on our biosphere, called the human "ecological footprint". A country's ecological footprint is "the total area required to produce the food and fiber it consumes, absorb the waste from its energy consumption, and provide space for its infrastructure". This footprint is expressed in "global hectares", *i.e.* in hectares of land or sea which biological productivity equals the global average.

Unequally distributed among countries, the human ecological footprint has globally increased by 160% between 1961 and 2001. Due to the increasing global consumption of not renewable fossil energetic resources, it has upset the Earth's biocapacity, *i.e.* Earth's total biologically productive areas, since the end of the 1980s. Today, the mean ecological footprint per person reaches more than 2.2 ha, while Earth's present biocapacity is less than 1.8 ha/person. Such an excess is clearly not sustainable : humanity is currently depleting the resources of the planet.

To know more on these researches and data, consult the global footprint network at
<http://www.footprintnetwork.org>

➔ The main contemporary drivers of biodiversity decline

Scientists have identified five major drivers of biodiversity decline, all linked to human activities :

- **Land use changes :**

Habitat reduction and degradation are the main drivers of biodiversity loss. The conversion of many forests and other rich habitats into cultivated - and aquacultivated – lands, characterized by a far lower biotic capacity, has strongly reduced biodiversity on Earth since the beginning of Agriculture, some 9000 years ago.

Present deforestation in many tropical countries is still reducing it at a high rate. It is worth noting that European and other Northern developed countries, although not reducing their own forests anymore, contribute to this world deforestation by their high demands of tropical “crops” such as coffee, tea, soybean oil and meal or shrimps.

In Europe and North America, mainly since the 1950s, the intensification of agriculture have changed relatively biodiversity rich extensive farmland and other semi-natural habitats like wetlands into monotonous crop and pasture lands. Moreover, due to increasing urbanisation, a growing fraction of (abandoned) extensive farmland and semi-natural areas are currently converted into biodiversity poor artificial and suburban zones.

- **Chemical pollution of terrestrial and aquatic habitats :**

The increasing use of fertilizer and pesticide since fifty years, linked to the intensification of agriculture, causes the degradation or/and eutrophication of many terrestrial, freshwater and near-shore marine ecosystems in developed and developing countries. The forecast 50% increase of the world human population by 2050 is expected to be accompanied by a 150% increase of pesticides and organic fertilizers, without a drastic change of the agricultural policies.

- **Overexploitation of species**

Above all, overfishing at the world scale is now leading to the generalized impoverishing of marine ecosystems.

- **Massive CO₂ emissions**

The current massive emission of CO₂ and other green house gazes by human societies, mainly due to the massive combustion of fossil fuels, is expected to drive a 2° to 4°C

world warming for 2100, as well as contrasted regional and subregional climate changes. These climatic changes will imply a wide modification of most habitats, to which many species will probably not be able to adapt. It is worth noting that habitat fragmentation, another big driver of the current biodiversity erosion, increases the impact of climate changes on populations' survival through reducing their success of dispersion.

- **Biological invasions**

The strong intensification of transports and trade linked to the current globalization leads to numerous introductions of species or subspecies, intentional or not, increasing the risk of biological invasions potentially detrimental to the ecosystems (but see Didham et al., 2005).

➔ **Selected bibliography on the current main causes of biodiversity decline :**

- Benton et al., 2003 : "Farmland biodiversity : is habitat heterogeneity the key ?" *Trends in Ecology and Evolution* 18, pp. 182-188.
- Didham R.K. et al., 2005 : "Are invasive species the drivers of ecological change ?" *Trends in Ecology and Evolution* 20, pp. 470-474.
- Donald P.F. et al., 2001. Agriculture and the collapse of Europe's farmland bird populations. *Proc. Royal Soc. London* 268, pp. 25-29.
- EEA, 2005 : State of the Environment Report 2005. Weblink : http://reports.eea.eu.int/state_of_environment_report_2005_1/en/ab_content_RLR
- Gaston K.J. et al., 2003. "Habitat conversion and global avian biodiversity loss." *Proc. R. Soc. Lond. B* 270, pp. 1293-2000.
- (Gurevitch J. & D.K. Padilla, 2004 : Are invasive species a major cause of extinctions ? *Trends. Ecol. Evol.* 19, pp. 470-474.)
- Harrison P. and F. Pearce, 2001 : AAAS Atlas of Population and Environment. University of California Press, Berkeley. Published on Internet at : <http://atlas.aaas.org>
- Julliard et al., 2004. "Common birds facing global changes : what makes a species at risk?" *Global Change Biology* 10, pp. 148-154.
- Millennium Ecosystem Assessment, 2005 : "Ecosystems and human well-being : synthesis". Island Press, Washington D.C. Published on Internet at : <http://www.millenniumassessment.org/en/index.aspx>

- 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. <http://www.pnas.org/cgi/content/full/98/10/5404>
- Sala O.E. et al., 2000. “Global diversity scenarios for the year 2100”. *Science* 287, pp.1770-1774. <http://www.sciencemag.org/cgi/content/abstract/287/5459/1770>
- Teysse re A. et Couvet D., *in prep.* Expected impact of agriculture expansion on the world avifauna, in abundance and species richness.
- Thomas C.D. & al., 2004. “Extinction risks from climate change”. *Nature* 427, pp. 135-148. <http://www.nature.com/nature/journal/v427/n6970/abs/nature02121.html>
- Tilman, D., 2000. Global environmental impacts of agricultural expansion : the need for sustainable practices. *Proc. Nat. Acad. USA* 96, pp. 5995-6000.
- Tilman D. et al., 2001. “Forecasting agriculturally driven global environmental change”. *Science* 292, pp.281-284. <http://www.sciencemag.org/cgi/content/abstract/292/5515/281>
- Vitousek P.M. et al., 1997. “Human domination of earth’s ecosystems”. *Science* 277, pp. 494-499. <http://www.sciencemag.org/cgi/content/full/277/5325/494>