



LIFE08 ENV/IT/436

PROJECT ACT

ADAPTING TO CLIMATE CHANGE IN TIME

*Assessment of climate change impacts and local
vulnerabilities*

Biodiversity

Claudio Piccini

Rome, 19 July 2010

ISPRA Institute for Environmental Protection and Research

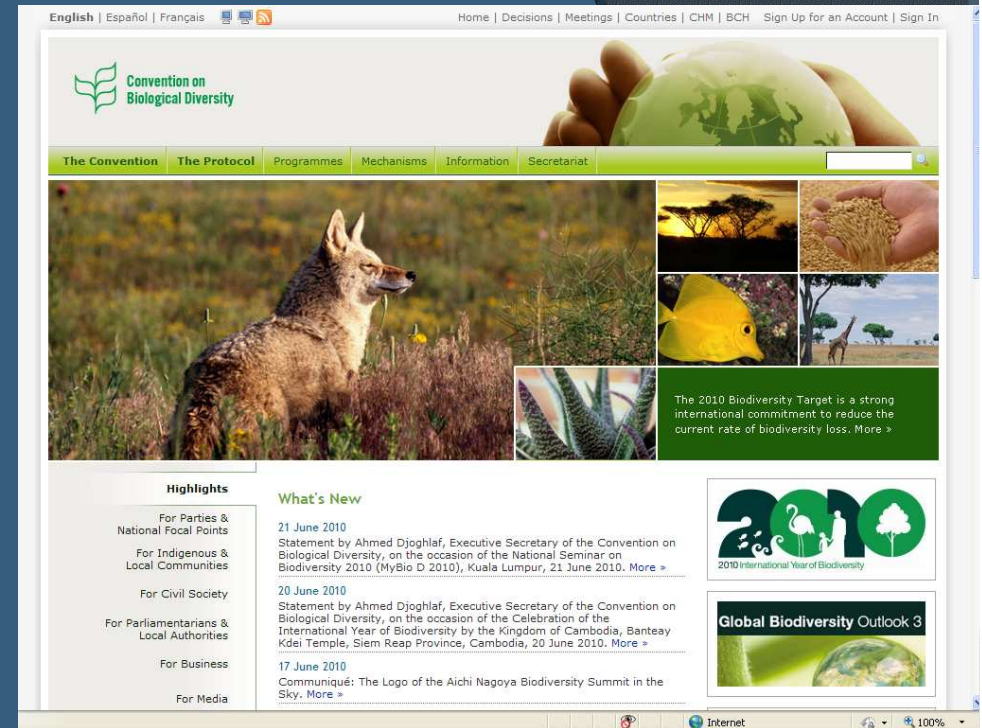


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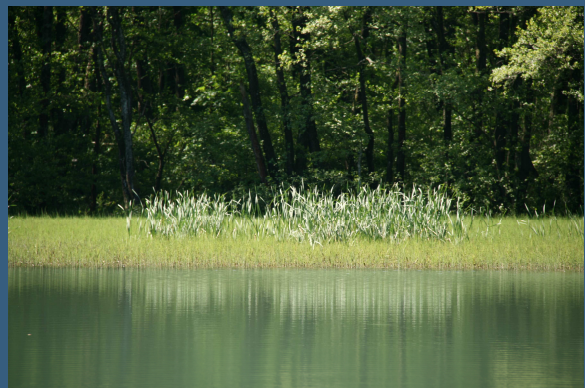
Introduction

"Biological diversity" or "Biodiversity" means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD, art.2)



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Biodiversity, apart from its intrinsic value, is a source of goods, resources and services (ecosystems services) that are indispensable to man's survival.

These services (*provisioning, regulating, cultural and supporting*) provide both direct and indirect benefits to all the planet's human, animal and plant communities



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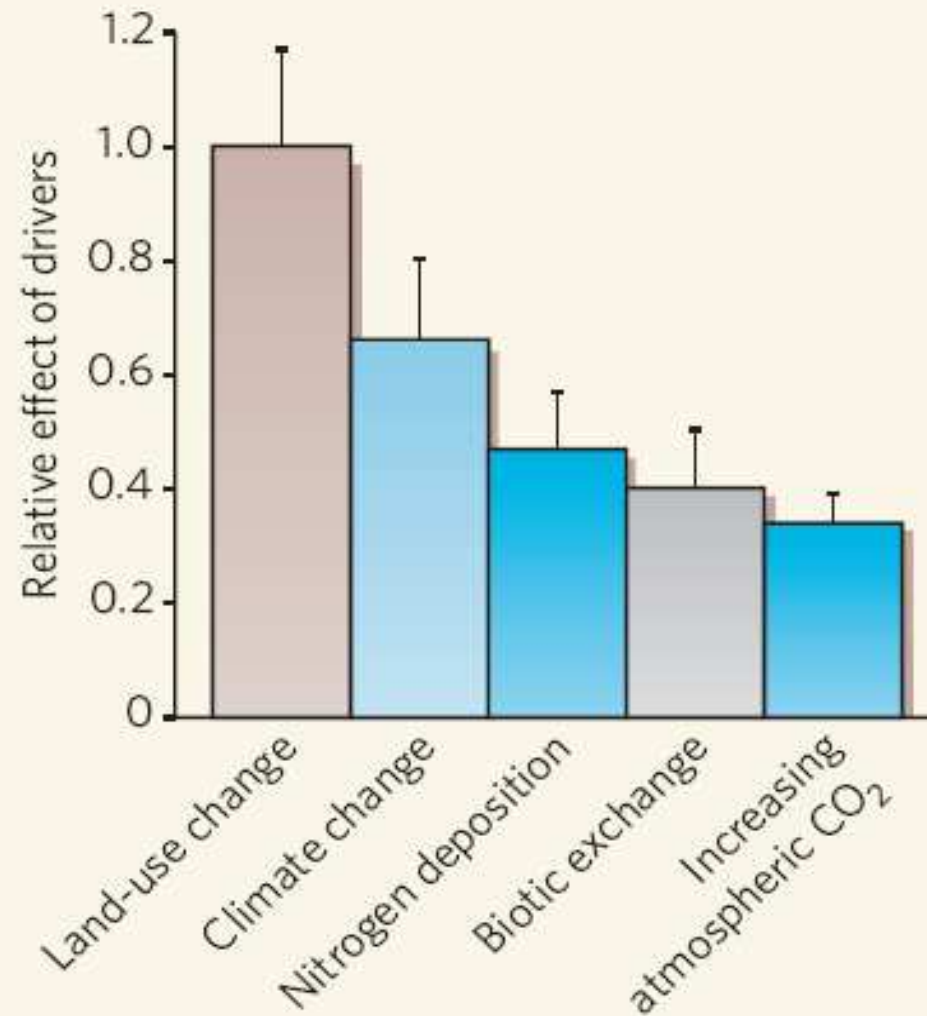
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One of the main causes of biodiversity loss is the Global Climate Change (GCC) and this is clearly reported from the Intergovernmental Panel on Climate Change (IPCC)



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Source: Sala *et al.* (Science, 2000).



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Climatic variables

Among the main drivers which generate impacts on species and ecosystems are the increase of temperature, the modification of rainfall and wind regimes, the variation of frequency and intensity of extreme events



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Climatic variables

Examples of indicators

- Mean temperature
- Min/max temperature
- Min/max rainfall
- Temperature regime
- Rainfall regime
- Wind regime
- Frequency and intensity of extreme events
- Sea level increase
- Sea mean temperature
- Maximum depth of summer thermocline in coastal waters and duration of any thermic anomaly



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Sensitivity

Many factors generate species sensitivity to GCC

The most sensitive species could be used as indicator

Some butterflies, for instance, are very sensitive and have a quick time response so that they can be considered ecological *fingerprints* of GCC



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Sensitivity

Main factors generating species sensitivity to GCC

- Narrow environmental tolerance (sensitivity to climatic variables changes)
- Specialized habitat and/or microhabitat requirements
- Dependence on specific environmental factors
- Dependence on interspecific interactions



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Sensitivity

Main factors generating species sensitivity to GCC

- Poor ability to disperse to or colonise a new or more suitable range
- Low intrinsic mobility
- Location which doesn't allow mobility (e.g. calcuminal species)
- Location at the climatic borders of the species range
- Very small area of the species range
- Other pressure and impacts (not related to GCC)



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Sensitivity

Main factors generating species sensitivity to GCC



Restricted to a very small range in north-west Ecuador, the Black-breasted Puffleg *Eriocnemis nigrivestis* has been assessed as both Critically Endangered according to the IUCN Red List and “climate-change susceptible” based on its biological traits.

These “climate-change susceptibility” traits include its habitat specialization, restriction to a climate change susceptible habitat, a narrow and high altitude range, very short typical dispersal distances and an extremely small population size. The species is suffering ongoing declines from deforestation.

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Exposure

At the project scale can be assumed the same modifications of the climatic variables for the whole territory, which has the same level of exposure to GCC

Nevertheless, some particular habitats (coastal habitats, wetlands, natural areas with a low ecological connection) have to be considered and checked



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Impacts

GCC impacts on species and ecosystems can be grouped in four categories:

- Impacts on physiology and behaviour
- Impacts on phenology
- Impacts on range
- Impacts on composition and species interactions in ecological communities



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Impacts on physiology

Plus 2°C of temperature for few days in summer can cause corals bleaching



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Impacts on phenology



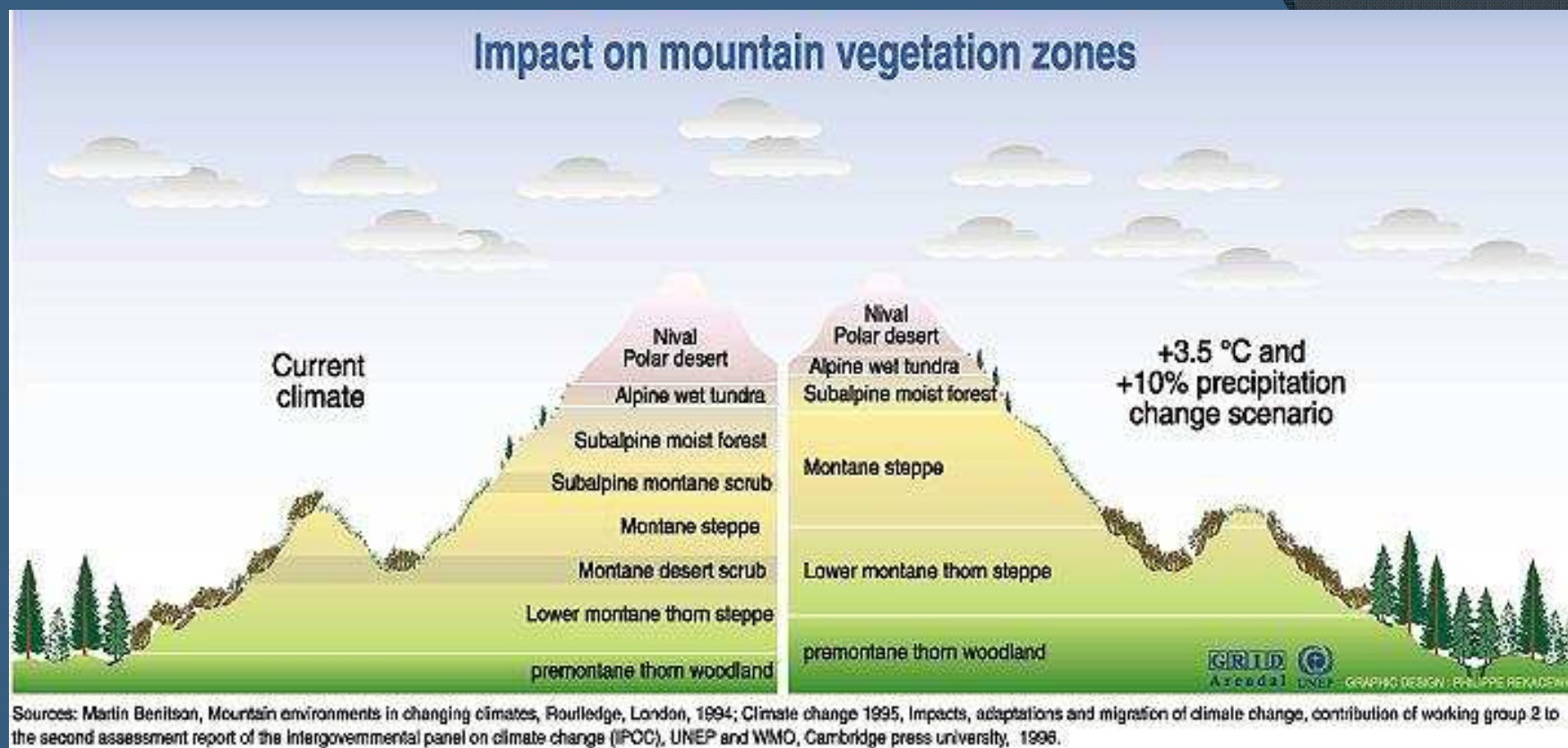
Phenology of migratory bird species is affected by climate modifications of the regions where they spend part of the annual biological cycle



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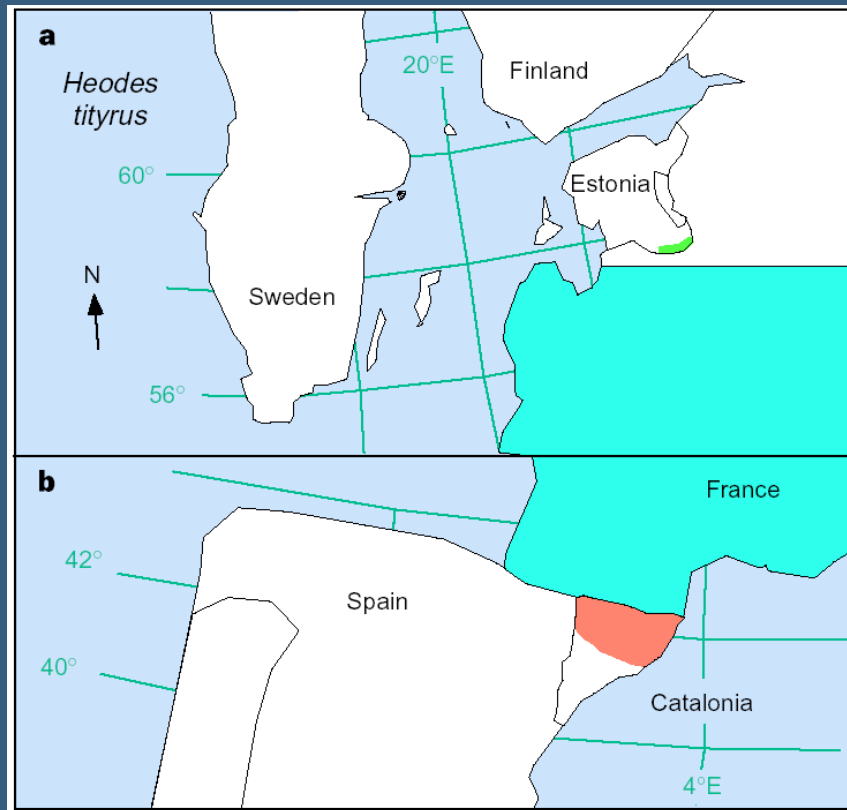
Impacts on range



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Impacts on range



Extending northern boundary +
retracting southern boundary

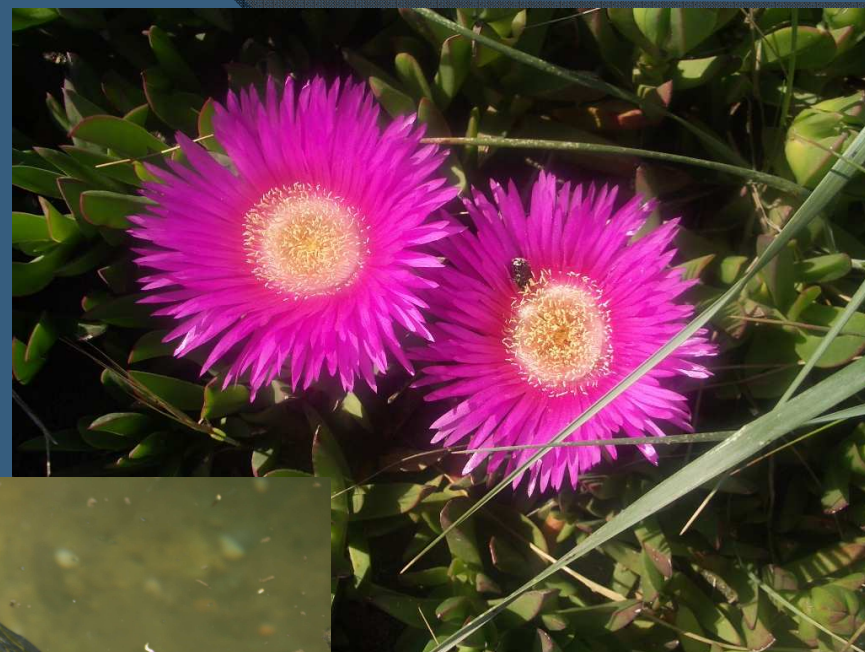


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Impacts on range

Spread of allochthonous species



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Impacts on composition and species interactions



E.g., GCC caused an anticipation of the reproductive phase of *Parus maior* and a mismatch with the availability of its main food (*Opheroptera brumata* caterpillars)



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Potential impacts

Methods, models and indicators to evaluate potential impacts are still in progress

The previsional capacity is highly limited by the poor knowledge of species behaviour and of ecosystems reaction to climate change



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Impacts

Examples of indicators

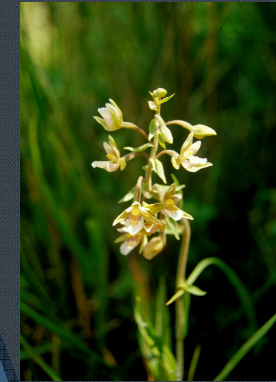
- Abundance and distribution of animal and plant species (particularly birds, butterflies, mountain plant species)
- Phenology of animal and plant species (particularly birds, butterflies, mountain plant species)
- Spread of allochthonous species
- Occurrence of forest fires



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Adaptive capacity



The biodiversity components' adaptive capacity to GCC impacts is related to:

- intrinsic factors (e.g. conservation status of species)
- extrinsic factors (e.g. protection laws)



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Adaptive capacity

Examples of indicators

- Conservation status of animal and plant species
- Conservation status of habitats
- Fragmentation of natural areas
- Number of studies on state and trend of local biodiversity
- Number and enforcement of laws to protect species and ecosystems
- Number and surface of protected areas



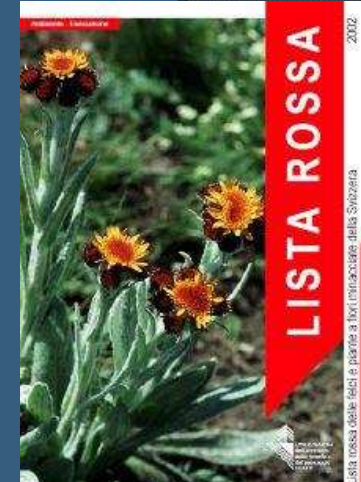
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Vulnerability

$V = f(\text{sensitivity, exposure, impacts, adaptive capacity})$

Particular care to “vulnerable” species which are also threatened and included in Red Lists



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Risk

$$R = (P \times I)$$

where P = impact probability; I = impact intensity

Risk assessment, depending mainly on potential impacts evaluation, has the same uncertainty because of lack of methods, models and indicators



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Adaptation options

Taking in account the results of the analysis carried out as above, it's possible to assume some adaptation options



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Adaptation options

Examples of indicators

- Integration of adaptation into regional natural resources management plans (policy indicator, short/medium term)
- Research into ecosystem-based adaptation (policy indicator, short/medium term)
- Monitoring of climate change sensitive species (measure indicator, short/medium term)
- Facilitation of shifts in species' distributions (measure indicator, short/medium term)
- Decrease of degraded ecosystems' area (outcome-based indicator, long term)



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Thanks for your attention!



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