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Joint Research Centre (JRC)

The European Commission's Research-Based Policy Support Organisation

Digital Observatory for Protected Areas; Helping Earth's Beleaguered Biodiversity

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Picture credits JRC, dailymail.co.uk

Outline

- Because of human activities Earth is losing biological species at unprecedented rates
- Protecting tracts of land and ocean is one factor in reducing this trend
- Deployment and management of ‘Protected Areas’ requires data from many scientific disciplines
- The Digital Observatory for Protected Areas (DOPA) connects data and scientific disciplines



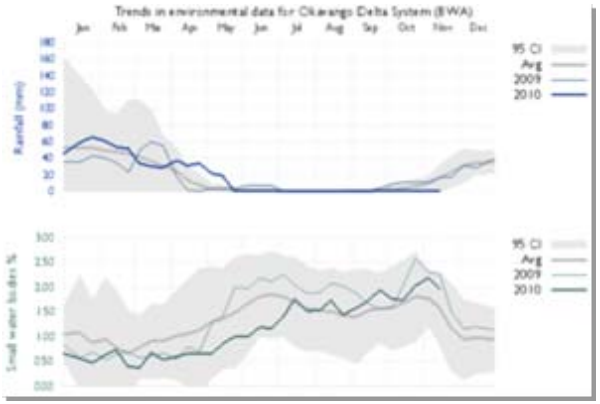
Picture credits American Museum of Natural History, Stanford.edu, luirig.altervista.org/

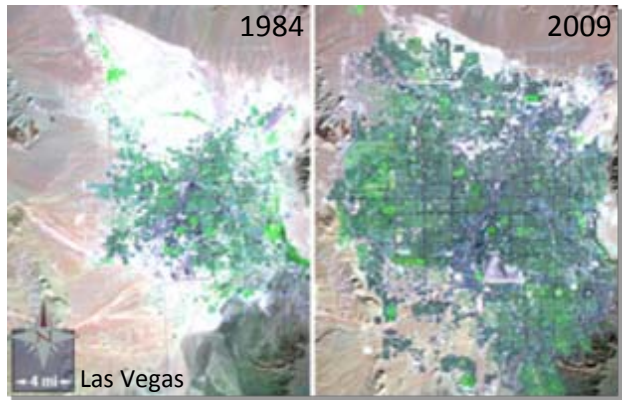
Earth's changing biodiversity

- Earth's biodiversity is not fixed
  - Species extinctions occur without human intervention
  - Species extinctions are irreversible
  - Extinction of distinct populations is significant
- When an entire species disappears the consequences are unpredictable
- Human activities are significantly increasing species extinction rates

Measuring change through multi-scale natural sciences

- Local: recording species
  - location, population, range, migrations
- Regional: characterizing habitats
  - Physical measurements (temperature, rainfall, slope, aspect, altitude…), biophysical characteristics (growing season, fire regimes, water…)
- Global: mapping
  - Boundaries, cover types, changes over time, land use, species distributions





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Measuring change through multi-scale social sciences

- Local: threats and pressures
  - Mining, pollution, poaching, charcoal, illegal logging
- Regional: human geography
  - Demography, shifts in agricultural practices, water demands
- Global: governance and infrastructure
  - Multilateral Environmental Agreements, economic conditions, technological capacity

Picture credits, crisisobserver.com, Guardian.co.uk, MA

Cross-disciplinary science for biodiversity protection

- Determines key drivers of global biodiversity loss
  - changes in land use
  - atmospheric CO2 concentration
  - nitrogen deposition and acid rain
  - climate
  - biotic exchanges
- Highlights the need for protection

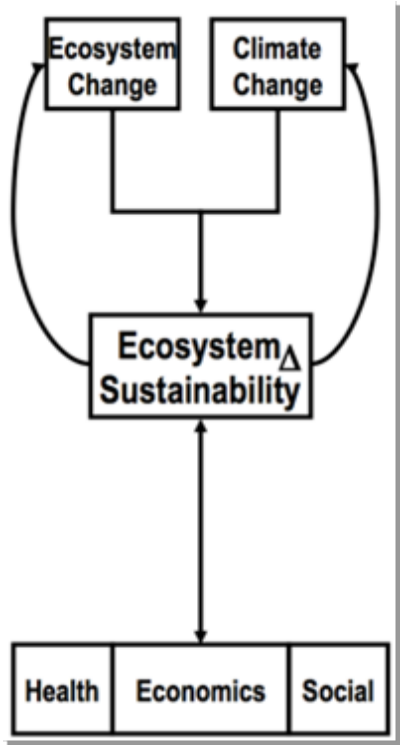


Photo credit championsportsradio.com/

Habitat loss; the major threat to biodiversity

Photo credit championsportsradio.com/, JRC

Millions of individuals

Photo credit championsportsradio.com/, JRC

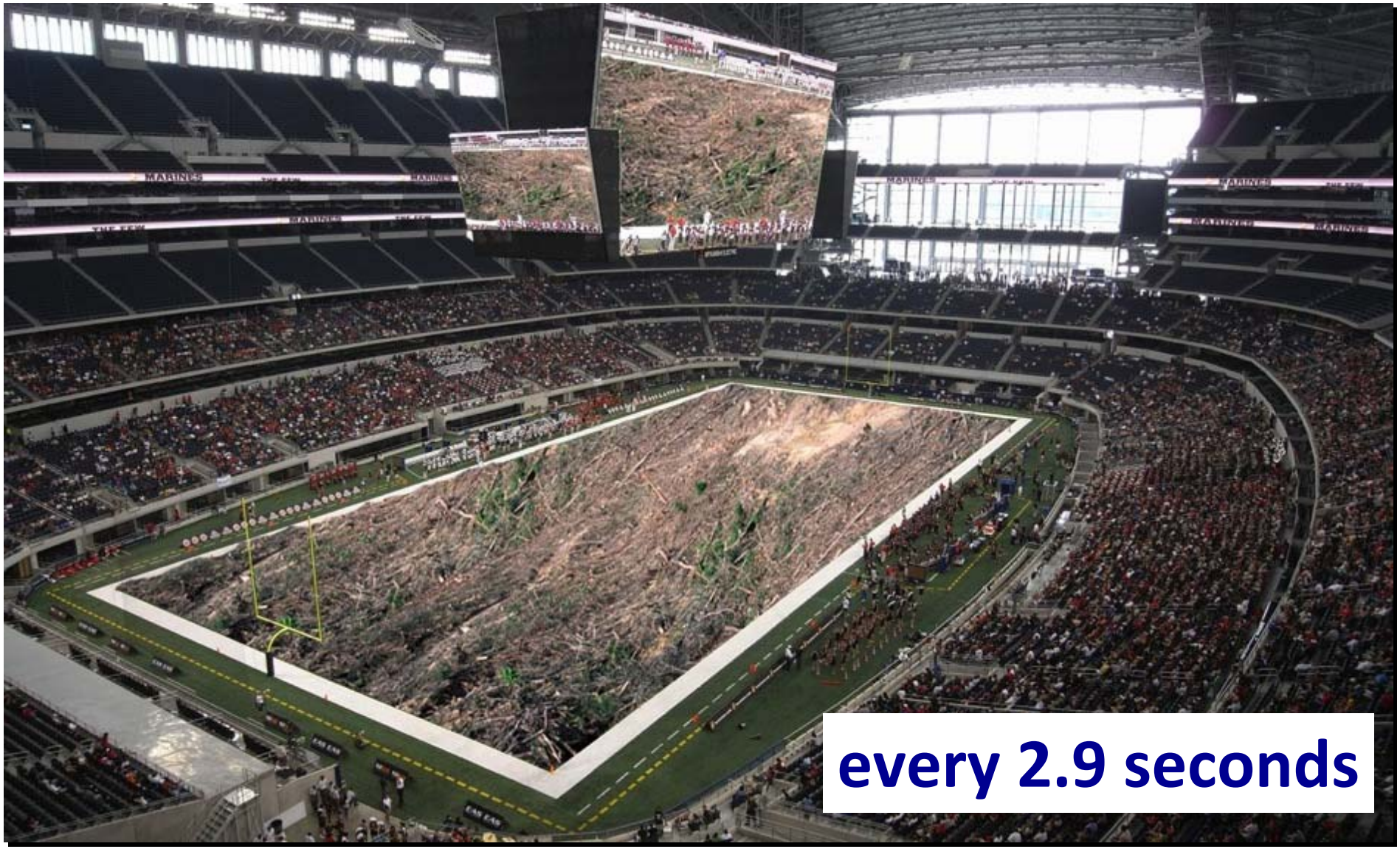
Millions of individuals are damaged or destroyed

Photo credit championsportsradio.com/, JRC

Millions of individuals are damaged or destroyed every 2.9 seconds

Photo credit championsportsradio.com/, JRC

Millions of individuals are damaged or destroyed every 2.9 seconds of every day



5.8 mha/yr humid tropics Achard et al. (2002), Science 297, 999-1002
13 mha/yr globally FAO (2010) Global Forest Resource Assessment Key Findings
http://www.fao.org/forestry/fra/fra2010/en/

Photo credit nadir.org, nationalgeographic.com

Setting geographical limits to human action; Protected Areas

- Protecting defined regions of land or ocean
  - Conserves reservoirs of **genetic resources**
  - Preserves **corridors** and **connections** for movement
  - Provides reservoirs of **traditional knowledge**
  - Provides **employment** and income
  - Stores **carbon** and reduces CO2 emissions
  - **Stabilizes hydrological** functions

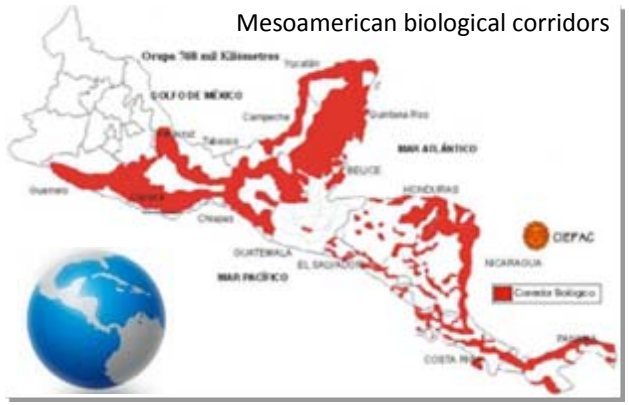


Photo credit luontoon.fl, wow.wetlands.org, sharmexcursions.net

The degree of protection in Protected Areas varies

- Strict Nature Reserves / wilderness exclude permanent human habitation
- National Parks are managed for ecosystem conservation and recreation
- Natural Monuments conserve specific features
- Species Management Areas target specific species
- Landscapes and seascapes (essentially resulting from human intervention in the first place) are included
- Managed Resource Areas balance protection with sustainable resource/service use

Protection ranges from almost total human exclusion … to full time sustainable use



Photo credit jouyx.joensuu.fl, postconflict.unep.ch, forestjustice.org (Erik Patel)

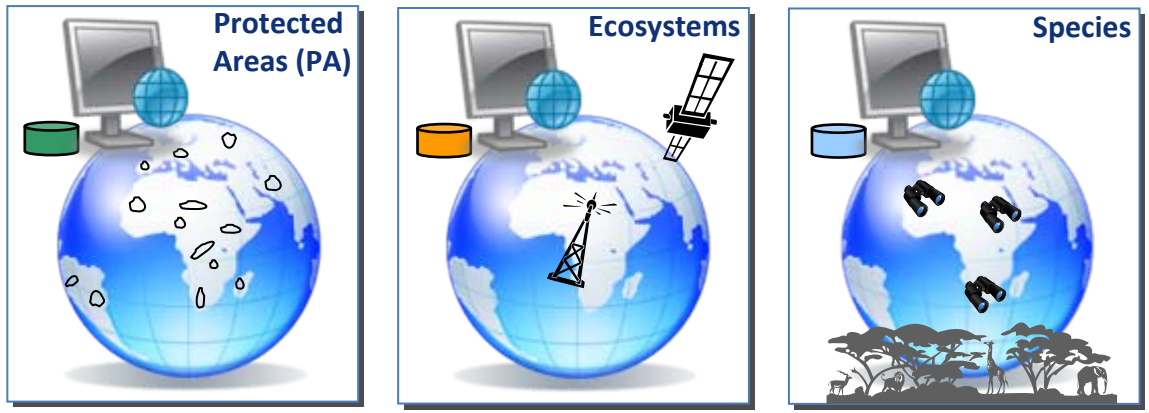
Management issues today – and tomorrow

- Are the Protected Areas really protected?
- Are the Protected Areas in the right place?
- Are they optimally connected?
- Where should new Protected Areas be located?
- Where should funds be targeted?
- How will the above change as human populations, infrastructure, economy and climate change?



Bridging scientific and data borders

- Studies at **different scales and disciplines** are rich, but compartmentalized
  - A very large number of databases are built and populated
  - Web services provide access to specific information
- Data ownership, formats and access **differ**
- The answers to many management issues remain elusive – or at least **incomplete**



The Digital Observatory for Protected Areas (DOPA)

- Combining data to monitor conditions in PAs and provide forecasts and scenarios to support management
  - **Integrates** data from different owners and sources
  - Detects uncertainties and **error propagation** between web services
  - Increases the **reusability** of data, models and IT infrastructure
  - Captures ecological information from the **ground and space**
  - **Automates** data exchange and modeling
  - Supports **repeated assessments**

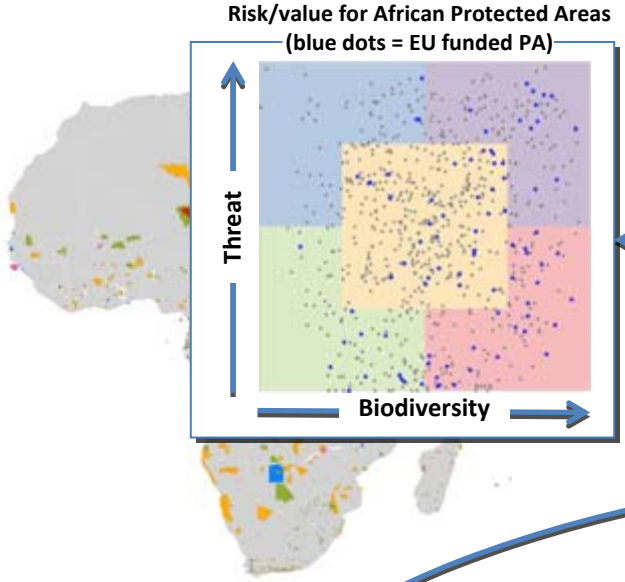
Combining data across scales/disciplines is a priority

Create new information for Protected Area management

Make datasets Interoperable

Provide Web Services, but share their input/output

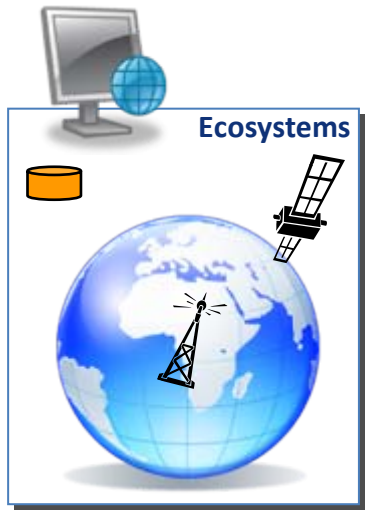
Collect data
Update data
and
Build databases



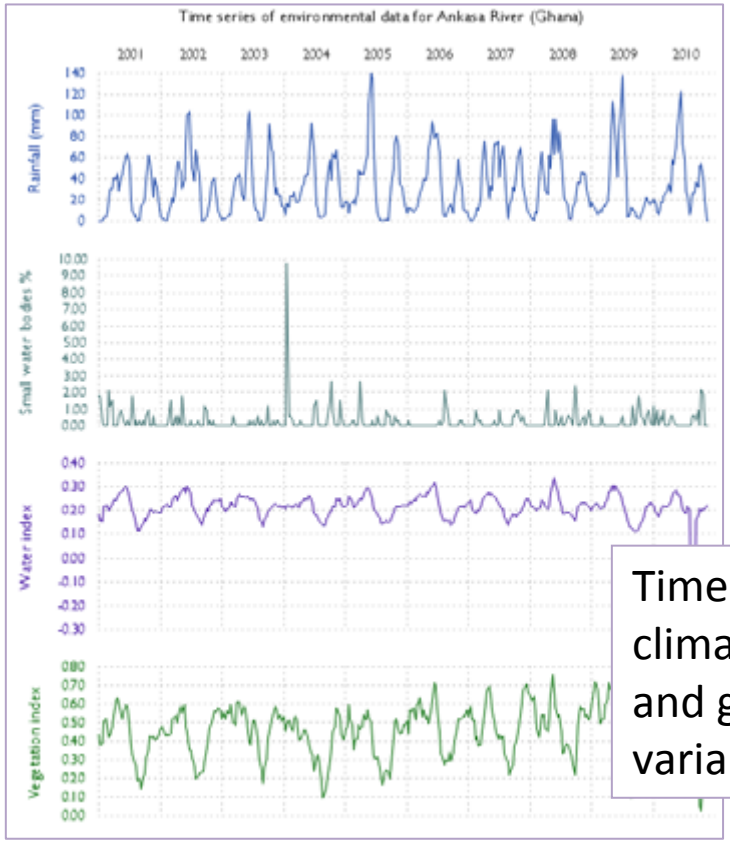
Monitoring Scenarios Forecasts

Provide Web Processing Services

Integrate datasets

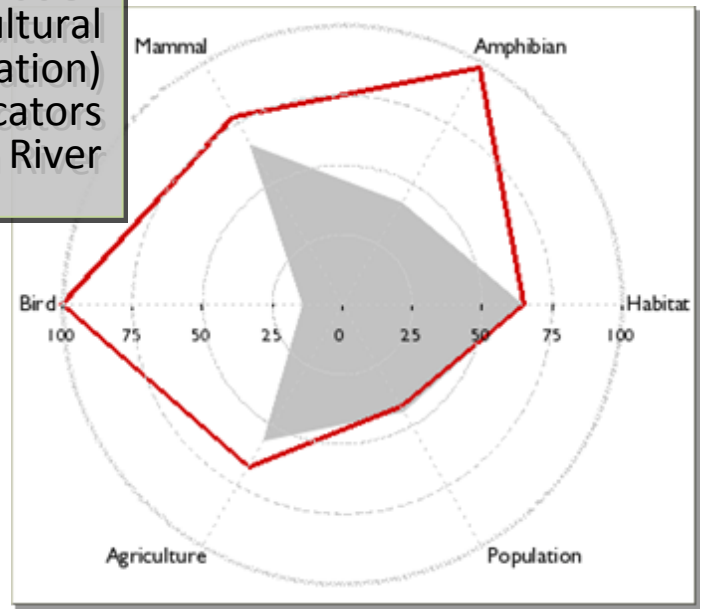


Monitoring past and present conditions

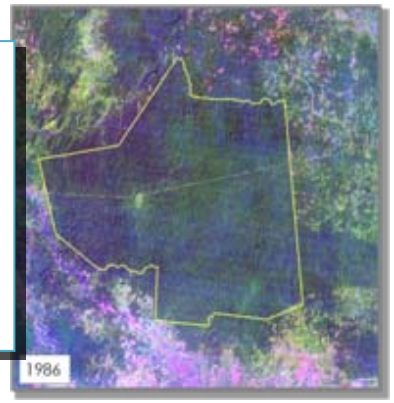


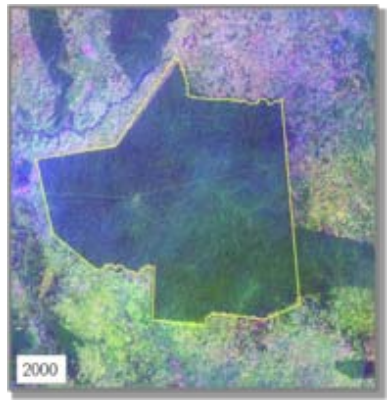
Time series of climate, fire, water and growing season variables

Irreplaceability (species) & Pressure (population and agricultural intensification) indicators Ankasa River



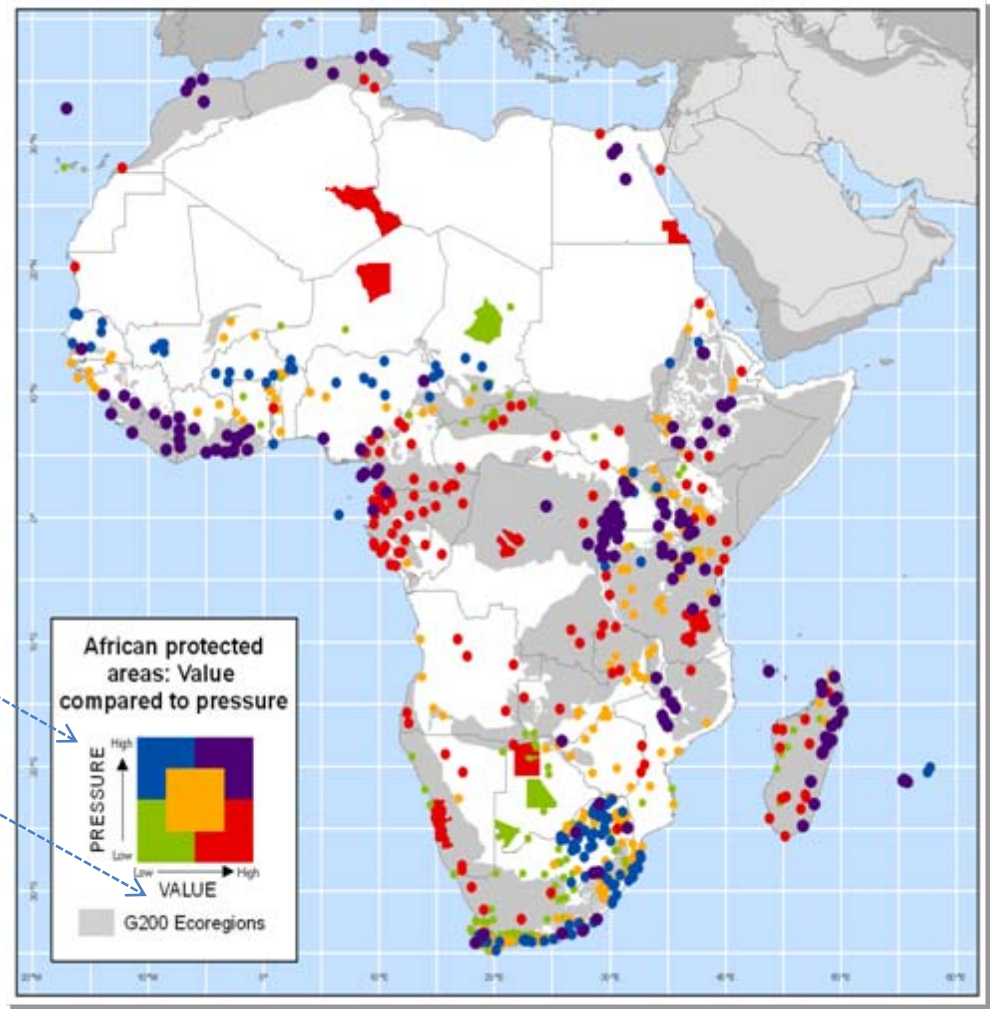
Land use intensification at the borders of the Ankasa River Protected Area in Ghana. By 2007 the park is surrounded by farmland

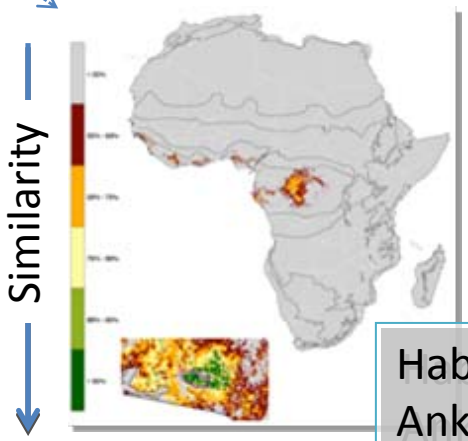




Comparison and evaluation of 741 protected areas in 50 countries

- Species distributions
  - 280 mammal, 381 bird and 930 amphibian species
- Climatic data
  - rainfall, temperature
- Environmental data
  - growing season, fire regime, water resources
- Socio-economic information
  - population, land use, transport
- Combined to produce
  - Anthropogenic pressure indicator
  - Biodiversity indicators
  - Index for habitat irreplaceability



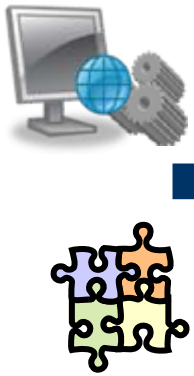


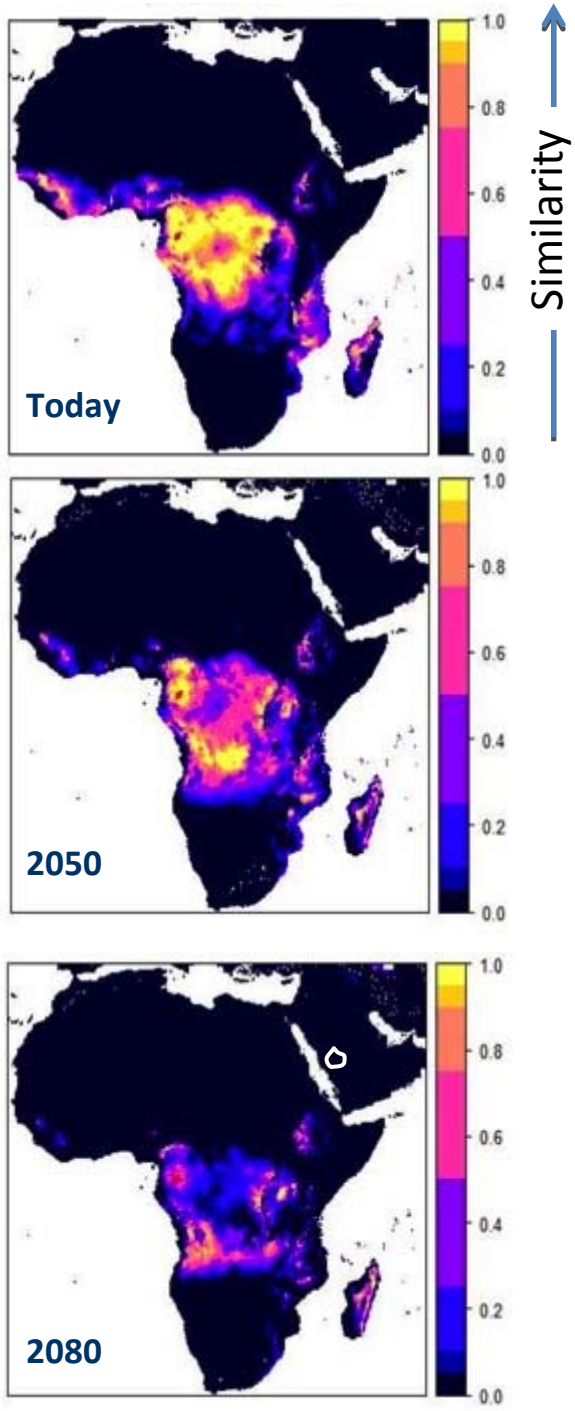
Habitat irreplaceability
Ankasa River

Building forecasts and scenarios

Likelihood of finding similar ecosystems over time as climate changes

- Rainfall
- Temperature
- Evapotranspiration
- Elevation
- Slope
- % water bodies
- % forest cover





Conclusions I

- DOPA hasn't stopped biodiversity loss
- More Protected Areas and more effective Protected Area management will help
- By permitting new combinations of data DOPA
  - leads to **informed decisions** concerning deployment
  - **better assessments** of management effectiveness
  - **forecasts** of Protected Area status in the future

An area of forest about the size of Central Park has gone during this talk…

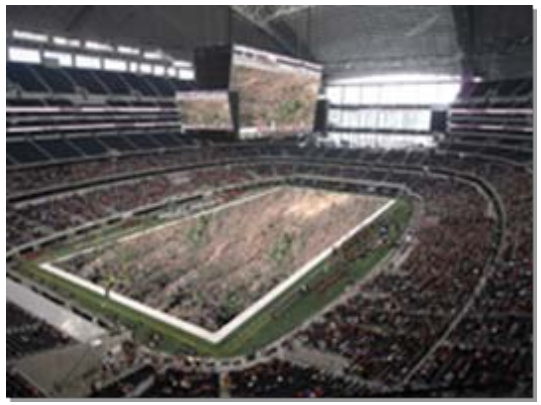




Photo credit protectedplanet.net

Conclusions II

- It has taken almost 200 years to get to the level of protection we have today
- Around ½ the 130,000 existing Protected Areas (12% of the land surface) were only created in **the last 20 years**
- The Convention on Biological Diversity's 10th Conference of the Parties, October 2010 pledged to **expand this to** 17% of terrestrial areas by 2020
- Such expansion cannot take place in an uninformed manner – the **need for DOPA is greater than ever**

“We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely”

E.O. Wilson, 1998, Consilience: The Unity of Knowledge

Acknowledgements

http://dopa.jrc.ec.europa.eu/
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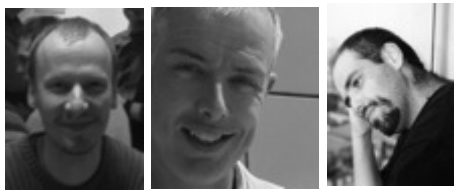
The JRC Team

eStation (remote sensing)

Fire ecology and monitoring

Land cover mapping



Information Systems

Modelling (threats, habitats, connectivity)

The DOPA partners

BirdLife INTERNATIONAL

UNEP WCMC

RSPB

GBIF