Dr. Alan Belward, Knowledge for Sustainable Development and Food Security Unit
European Commission, Joint Research Centre, Directorate for Natural Resources

SDG 13 Take urgent action to combat climate change and its impacts*

* Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

SDG Goal 13

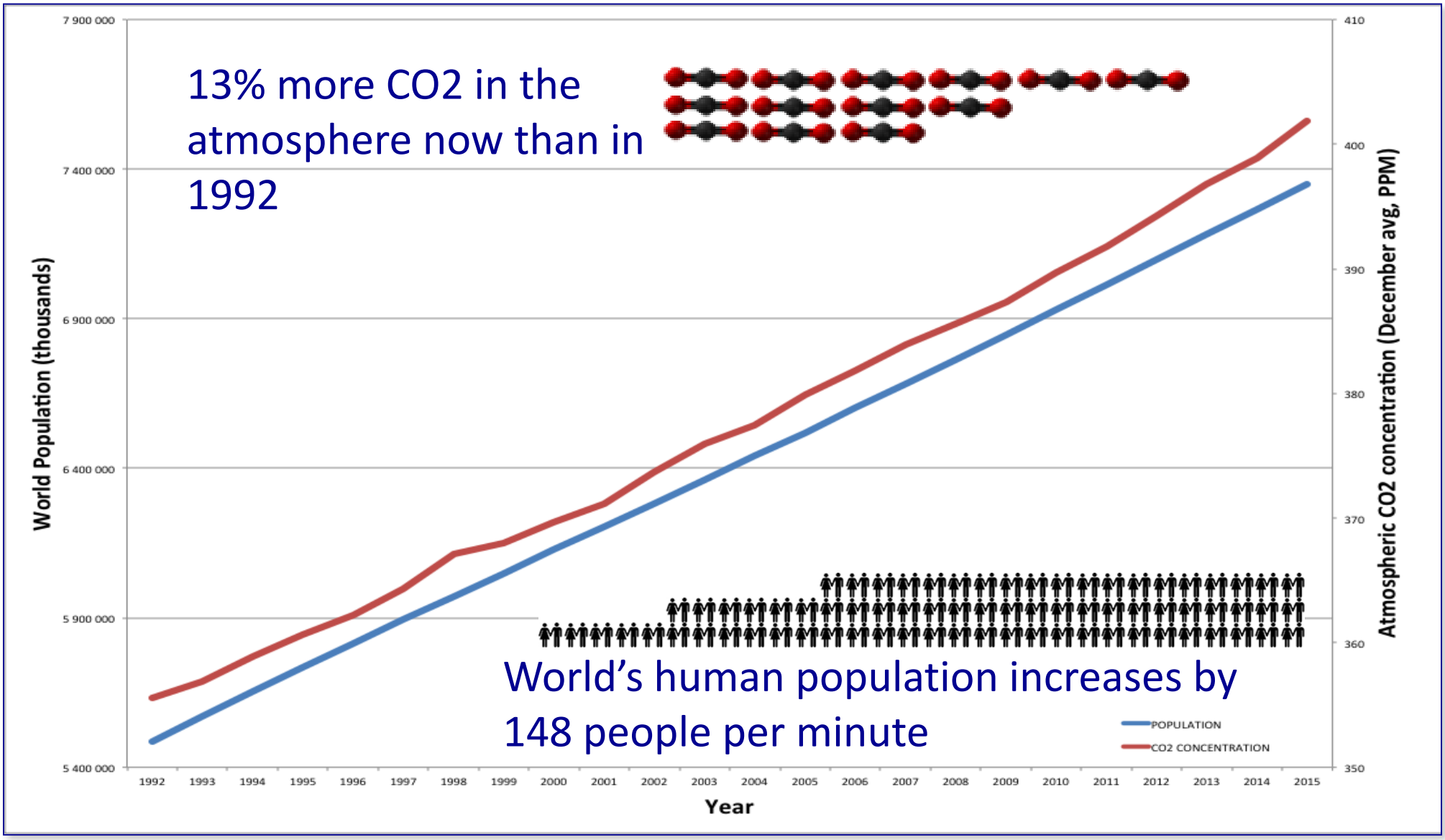
① 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

② 13.2 Integrate climate change measures into national policies, strategies and planning

③ 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

- 13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
- 13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

Changes in atmospheric CO2 concentration and world human population since the UNFCCC was established



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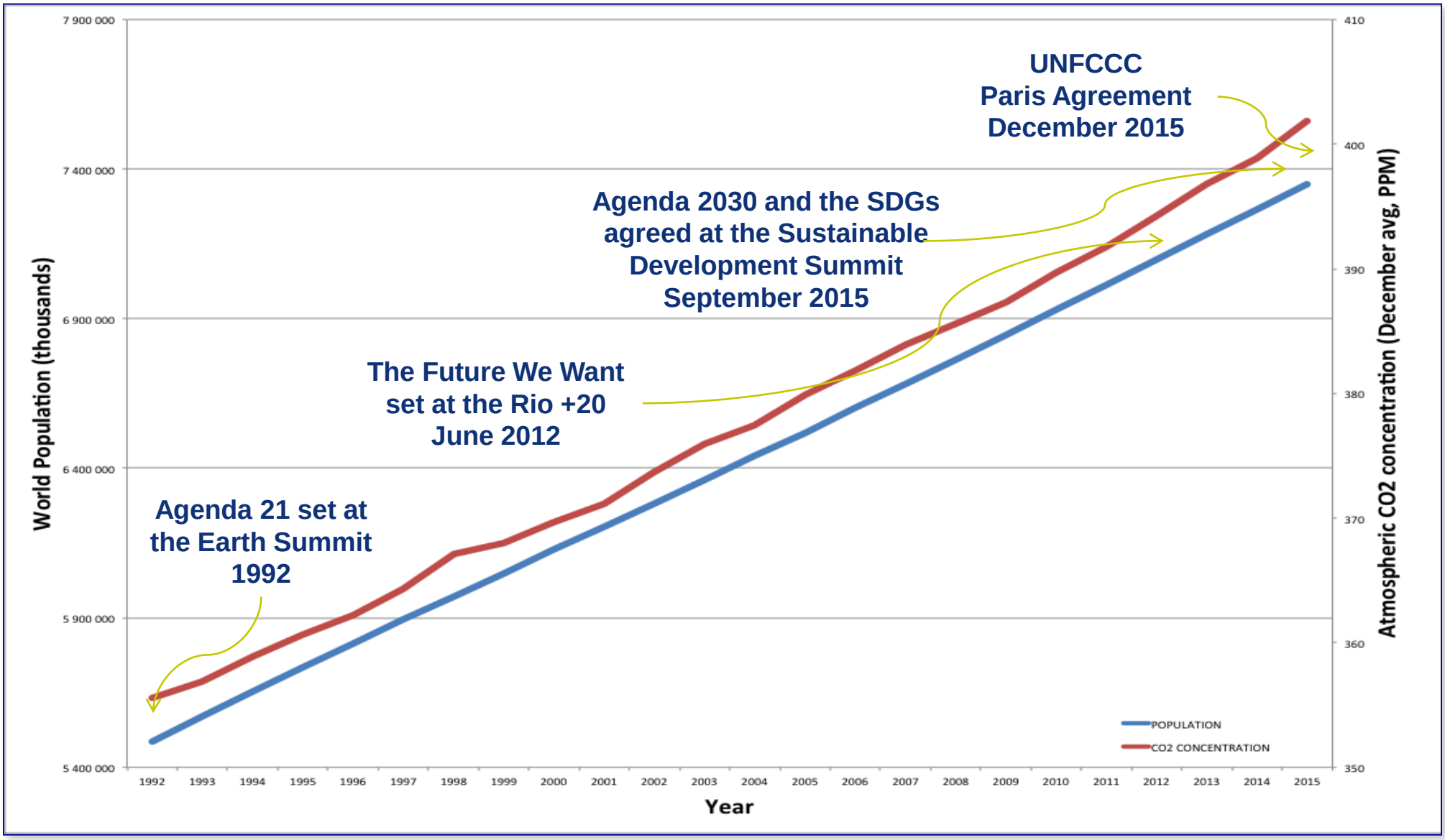
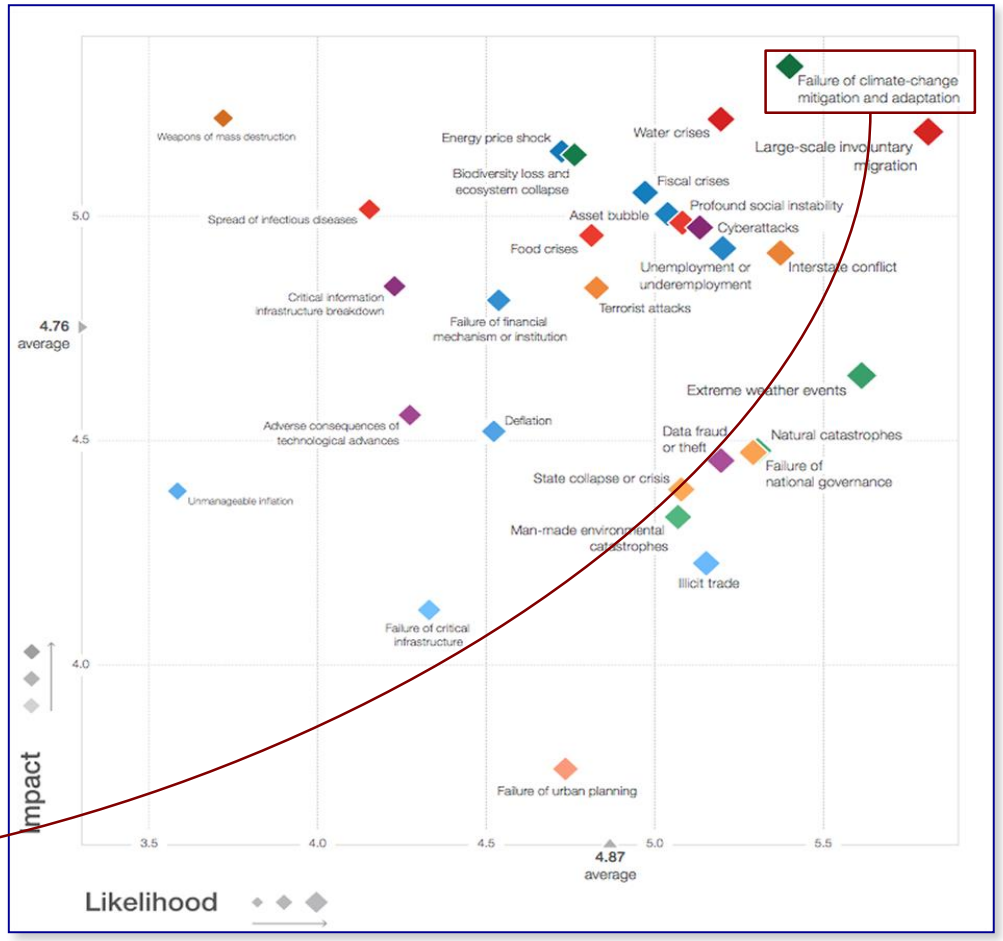


The Global Risks Landscape 2016

Source World Economic Forum Global Risks Report 2016
Copyright World Economic Forum 2016
http://www.weforum.org/reports/the-global-risks-report-2016

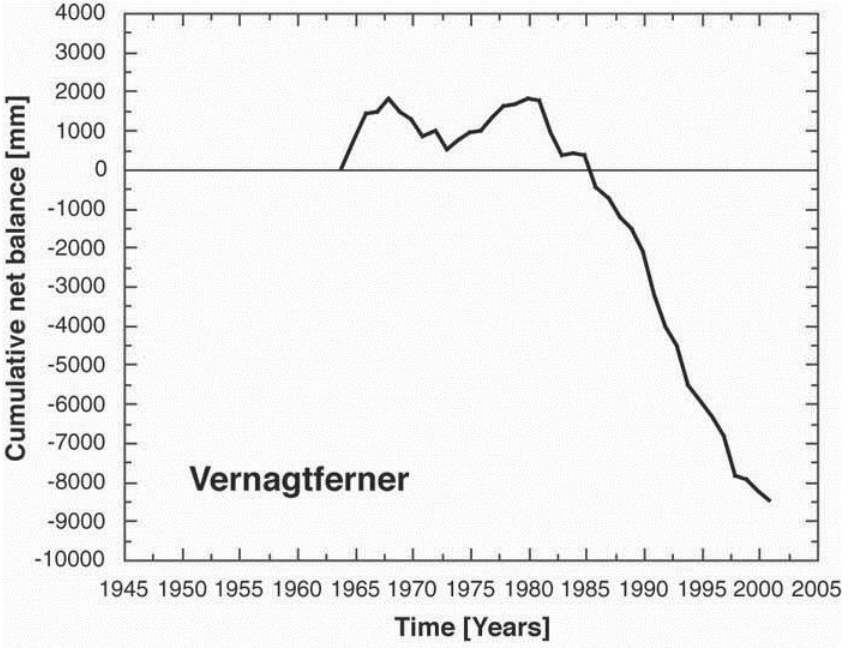
① A global risk is an uncertain event or condition that, if it occurs, can cause significant negative impact for several countries or industries within the next 10 years.

② In the face of considerable 'competition', failure of climate-change mitigation and adaptation is flagged as the #1 risk*



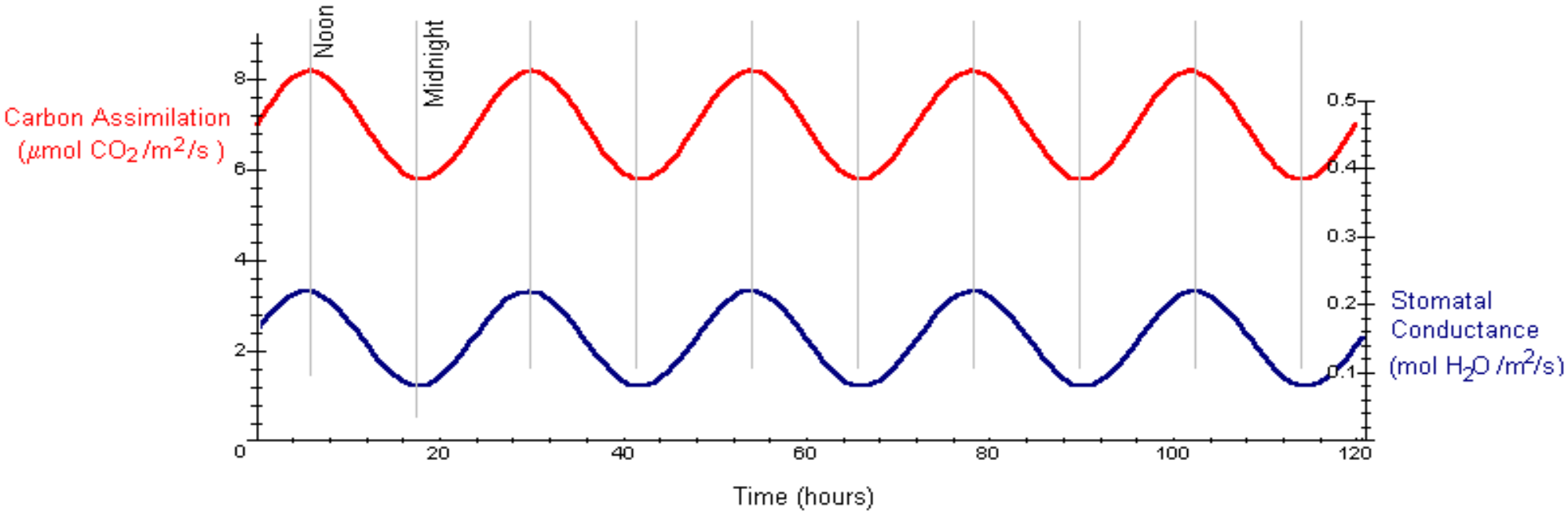
*greater than weapons of mass destruction (2nd), water crises (3rd), large-scale involuntary migration (4th) and severe energy price shock (5th).

Accelerating need for full access to standardised data…



http://www.geo.unizh.ch/wgms/pics/vernagt_bn_vs_alt.jpg and CNES/Google Earth

Daily



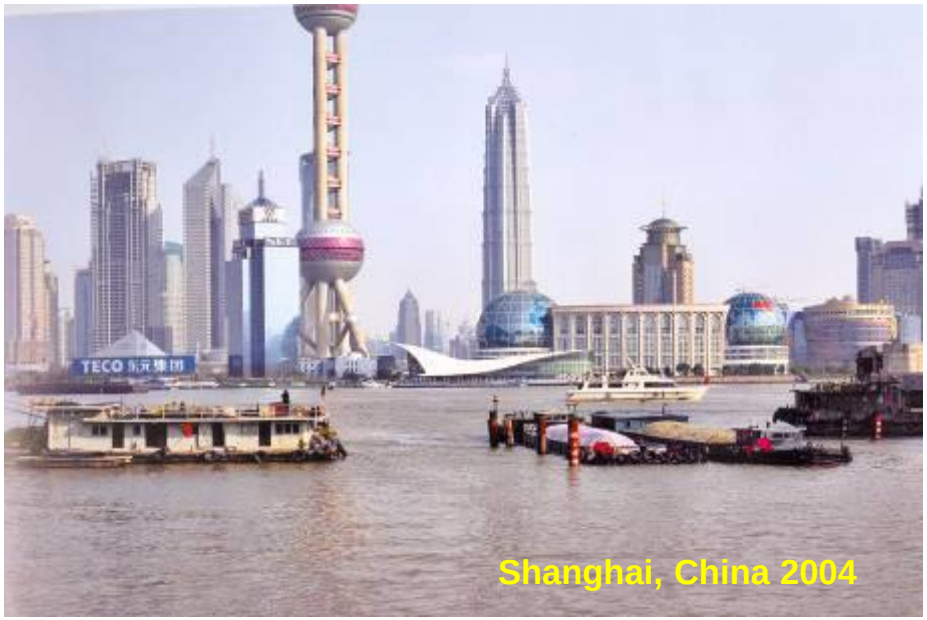
Under normal 24 hour day-night cycle or under constant moderate light and constant intercellular CO_2

http://www.tiem.utk.edu/bioed/webmodules/circadianrhythm.html

Seasonally

Alan Belward Ispra 22 Feb,, 22 Apr., 22 Jul.22 Oct. 2005

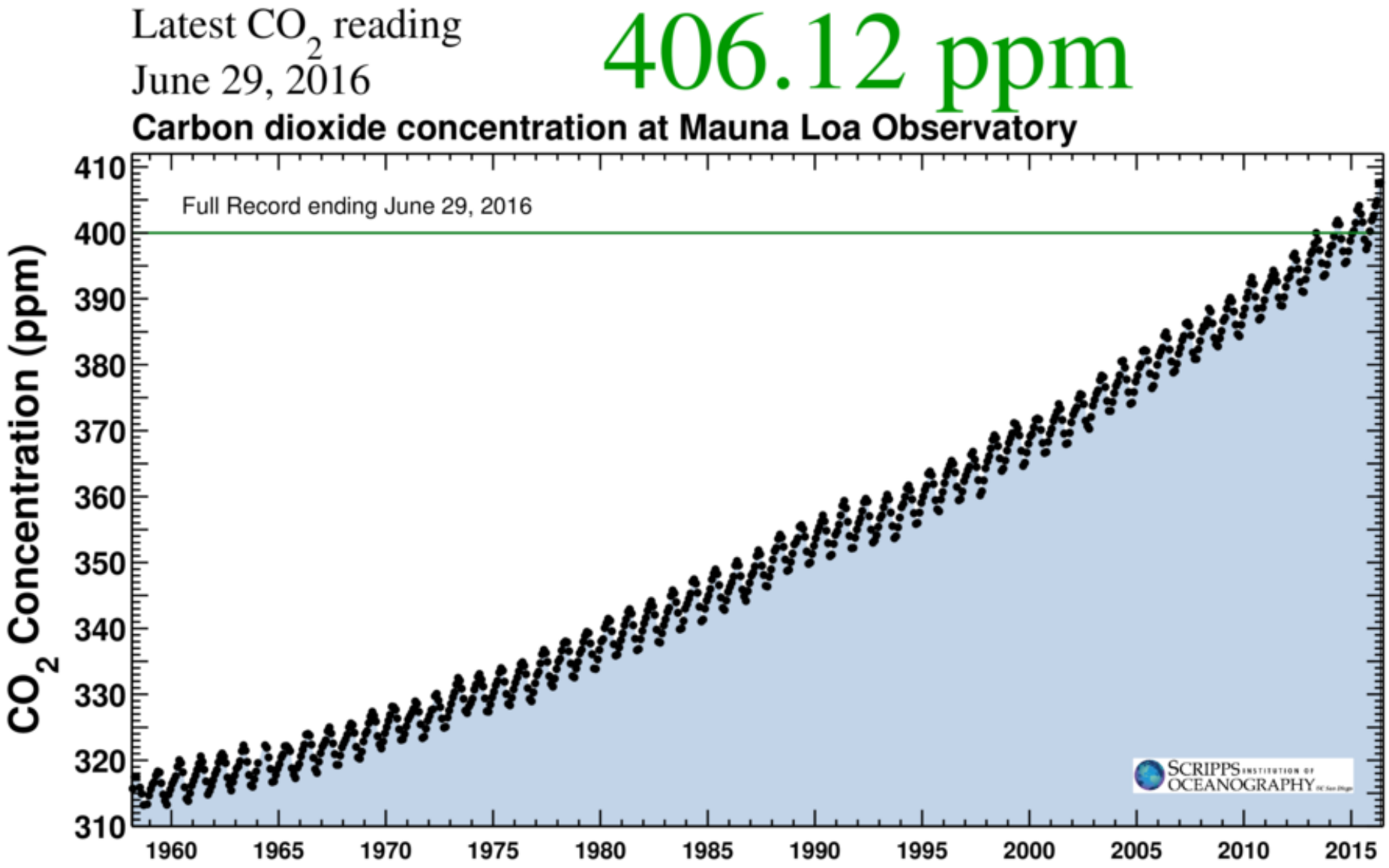
Annually

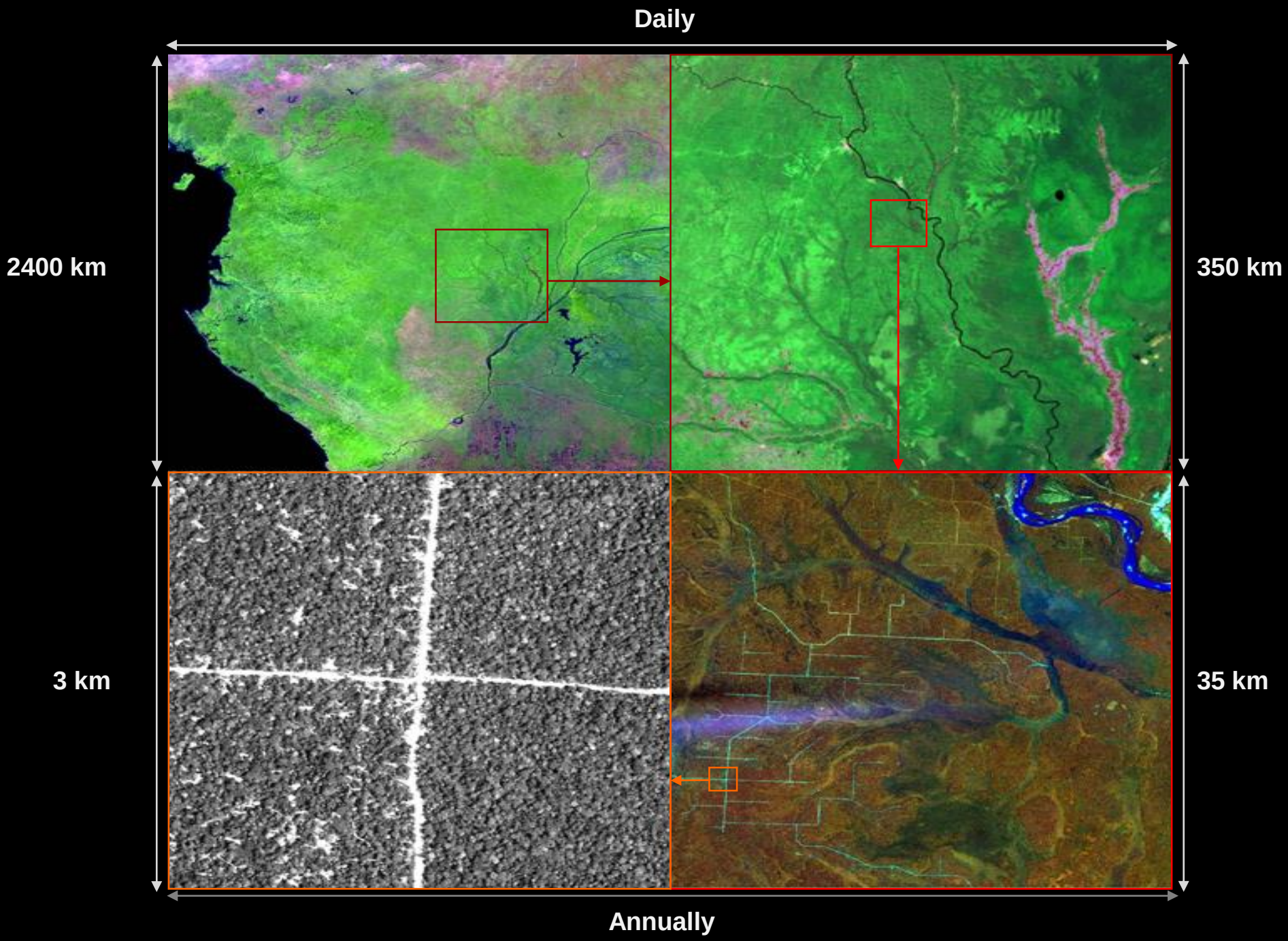


Michael Glantz NCAR
http://www.ronet.com.br/marrocos/pv-antig/pv1-18.html
http://www.skyscrapercity.com/showthread.php?t=344422

http://scrippsco2.ucsd.edu/home/index.php

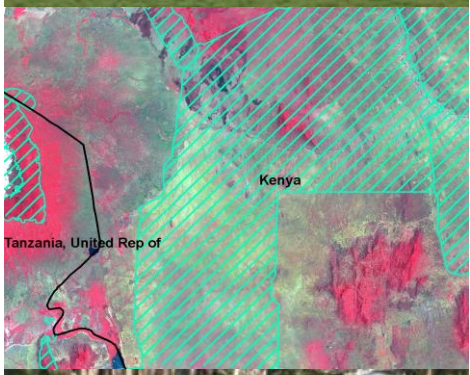
Multi Annual




Daily
2400 km
350 km
3 km
35 km
Annually

Climate information in the policy cycle

- **Policy definition**
  - Scientific information
  - Facts, forecasts, scenarios and speculations
  - Evaluation of new options (REDD+, Biofuels…)
- **Management and scenario building**
  - Fund allocation processes and prioritisation
  - Post-project audit and evaluation
- **Reporting requirements**
  - Mandatory reporting for MEAs
  - Preparation of Strategy Papers & Environmental Profiles
  - Mainstreaming environment into development aid programmes
  - Donor co-ordination
- **Alarm function**
  - Food security
  - Early warning (flood, drought…)
  - Sanction verification



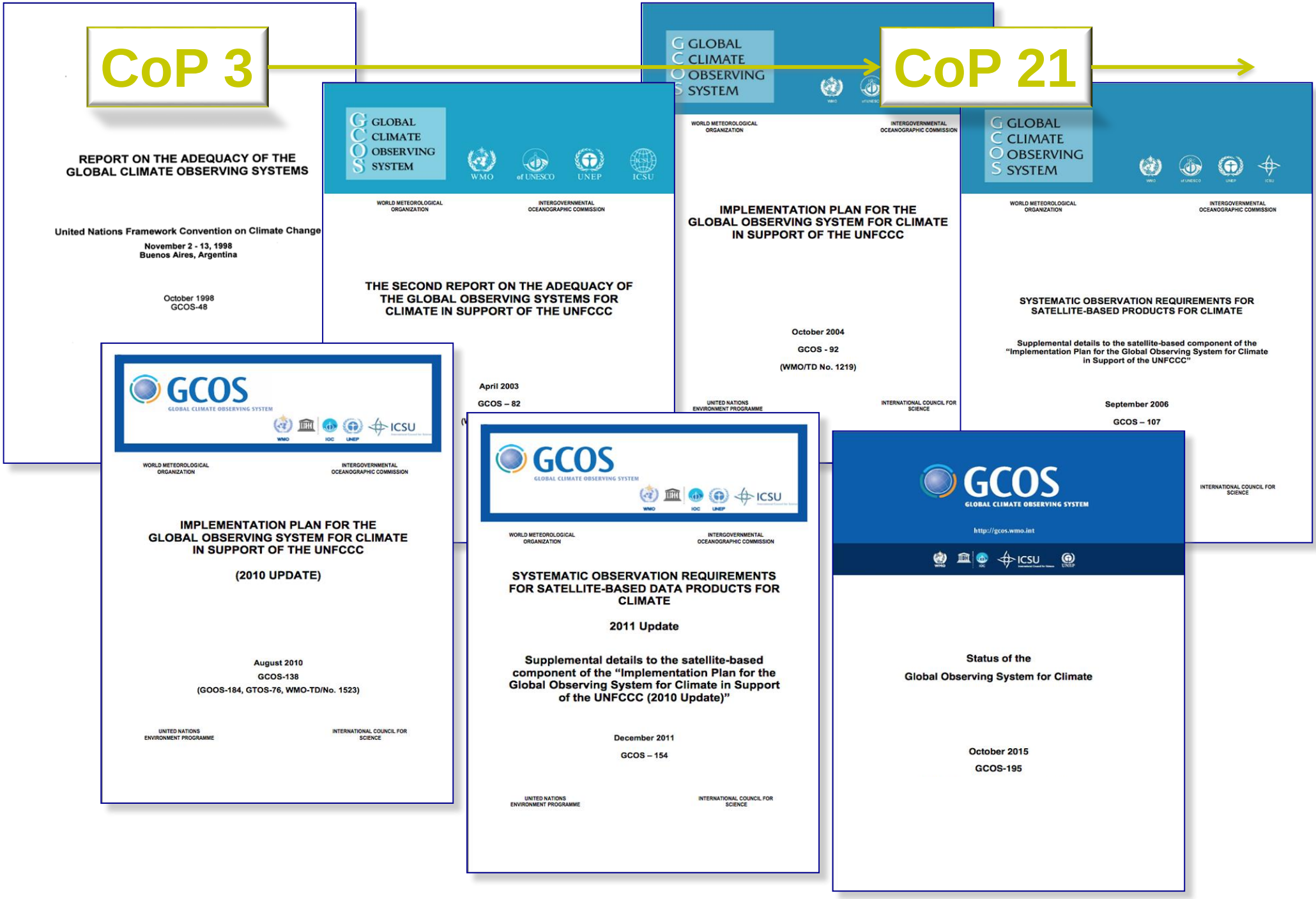
COP-21: Paris Agreement Article 7 (7c)

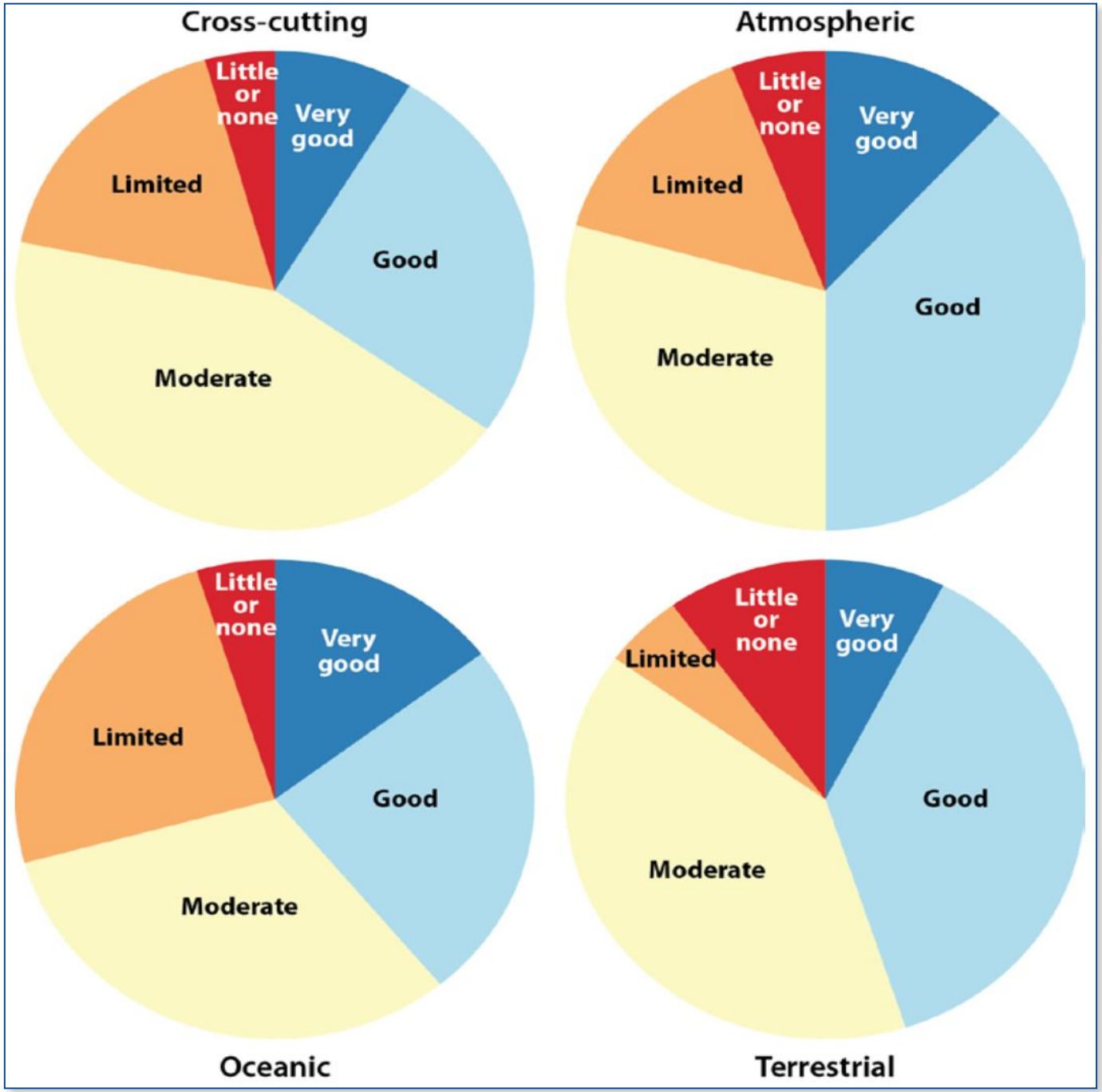
- Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision- making
- Developing the Transparency Framework (the need to promote transparency, accuracy, completeness, consistency, and comparability, and environmental integrity)

SBSTA Conclusions:

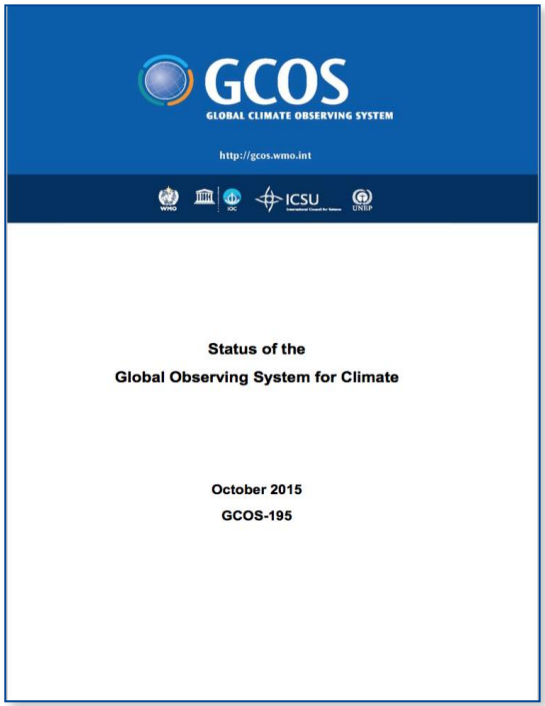
- Noted with appreciation the [Status] report by GCOS
- Encouraged GCOS to consider the outcomes of the twenty-first session of the Conference of the Parties when preparing the GCOS IP 2016
- Invited GCOS to collaborate with relevant partners to continue enhancing access to, and understanding and interpretation of, data products and information to support decision-making on adaptation and mitigation at national, regional and global scales

GCOS
GLOBAL CLIMATE OBSERVING SYSTEM
@
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11


CoP 3
REPORT ON THE ADEQUACY OF THE GLOBAL CLIMATE OBSERVING SYSTEMS
United Nations Framework Convention on Climate Change
November 2 - 13, 1998
Buenos Aires, Argentina
October 1998
GCOS-48
GLOBAL CLIMATE OBSERVING SYSTEM
WMO
of UNESCO
UNEP
ICSU
WORLD METEOROLOGICAL ORGANIZATION
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
THE SECOND REPORT ON THE ADEQUACY OF THE GLOBAL OBSERVING SYSTEMS FOR CLIMATE IN SUPPORT OF THE UNFCCC
April 2003
GCOS – 82
GLOBAL CLIMATE OBSERVING SYSTEM
IMPLEMENTATION PLAN FOR THE GLOBAL OBSERVING SYSTEM FOR CLIMATE IN SUPPORT OF THE UNFCCC
October 2004
GCOS - 92
(WMO/TD No. 1219)
UNITED NATIONS ENVIRONMENT PROGRAMME
INTERNATIONAL COUNCIL FOR SCIENCE
CoP 21
GLOBAL CLIMATE OBSERVING SYSTEM
SYSTEMATIC OBSERVATION REQUIREMENTS FOR SATELLITE-BASED PRODUCTS FOR CLIMATE
Supplemental details to the satellite-based component of the "Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC"
September 2006
GCOS – 107
GCOS
GLOBAL CLIMATE OBSERVING SYSTEM
IOC
UNEP
ICSU
IMPLEMENTATION PLAN FOR THE GLOBAL OBSERVING SYSTEM FOR CLIMATE IN SUPPORT OF THE UNFCCC
(2010 UPDATE)
August 2010
GCOS-138
(GOOS-184, GTOS-76, WMO-TD/No. 1523)
SYSTEMATIC OBSERVATION REQUIREMENTS FOR SATELLITE-BASED DATA PRODUCTS FOR CLIMATE
2011 Update
Supplemental details to the satellite-based component of the "Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2010 Update)"
December 2011
GCOS – 154
http://gcos.wmo.int
Status of the
Global Observing System for Climate
October 2015
GCOS-195



Progress against 138 actions in 2010 IP update



Measurement domain	*Essential Climate Variable*	
Atmospheric	Surface:	Air temperature, wind speed and direction, water vapour, pressure, precipitation, surface radiation budget
	Upper-air:	Temperature, wind speed and direction, water vapour, cloud properties, Earth radiation budget (including solar irradiance)
	Composition:	Carbon dioxide, methane, other long-lived greenhouse gases, ozone and aerosols, supported by their precursors
Oceanic	Surface:	Sea-surface temperature, sea-surface salinity, sea level, sea state, sea ice, surface current, ocean colour, carbon dioxide partial pressure, ocean acidity, phytoplankton
	Subsurface:	Temperature, salinity, current, nutrients, carbon dioxide partial pressure, ocean acidity, oxygen, tracers
Terrestrial	River discharge, water use, groundwater, lakes, snow cover, glaciers and ice caps, ice sheets, permafrost, albedo, land cover (including vegetation type), fraction of absorbed photosynthetically active radiation, leaf area index, above-ground biomass, soil carbon, fire disturbance, soil moisture	

Essential Climate Variables that are both currently feasible for global implementation and have a high impact on UNFCCC requirements

Domain	Essential Climate Variables
Atmospheric (over land, sea and ice)	**Surface:** Air temperature, Wind speed and direction, Water vapour, Pressure, Precipitation, Surface radiation budget **Upper-air:** Temperature, Wind speed and direction, Water vapour, Cloud properties, Earth radiation budget (including solar irradiance and spectral radiance) **Composition:** Carbon dioxide, Methane, and other long-lived greenhouse gases, Ozone, Aerosol, and Precursors
Oceanic	**Physics:** Temperature, Sea Surface Temperature, Salinity, Sea Surface Salinity, Currents, Surface Currents, Sea Level, Sea State, Sea Ice, *Ocean Surface Vector Stress (new), Sensible and Latent Heat fluxes (proposed/emerging?)* **Biogeochemistry:** Ocean Carbon, Nutrients, Oxygen, Tracers, *Non-CO2 Greenhouse Gases (Nitrous Oxide) (proposed/emerging?)* **Biology/Ecosystems:** Ocean Colour, Phytoplankton, (plus additional emerging?)
Terrestrial	**Hydrology:** River discharge, Anthropogenic water use, Groundwater, Lakes Emerging: Lake and River Ice (extended to river properties) **Cryosphere:** Snow cover, Glaciers, Ice sheets and Ice shelves, Permafrost **Ecology:** Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Above-ground biomass, Soil carbon, Fire disturbance, Soil moisture **Physics:** Land Surface Temperature, Land latent and sensible heat flux anthropogenic GHG emissions for new IP: discuss new ECV for “energy fluxes”

Work in progress:

incorporates 2015 GCOS Steering Committee input

will incorporate GCOS Science panel input 2016


UNCCD
UNCCD impact indicators


GEO GROUP ON EARTH OBSERVATIONS
GEO BON
esa
→ EBV WORKSHOP
Workshop on identifying Essential Biodiversity Variables
27-29 February 2012 | ESA-ESRIN | Frascati (Rome), Italy


1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

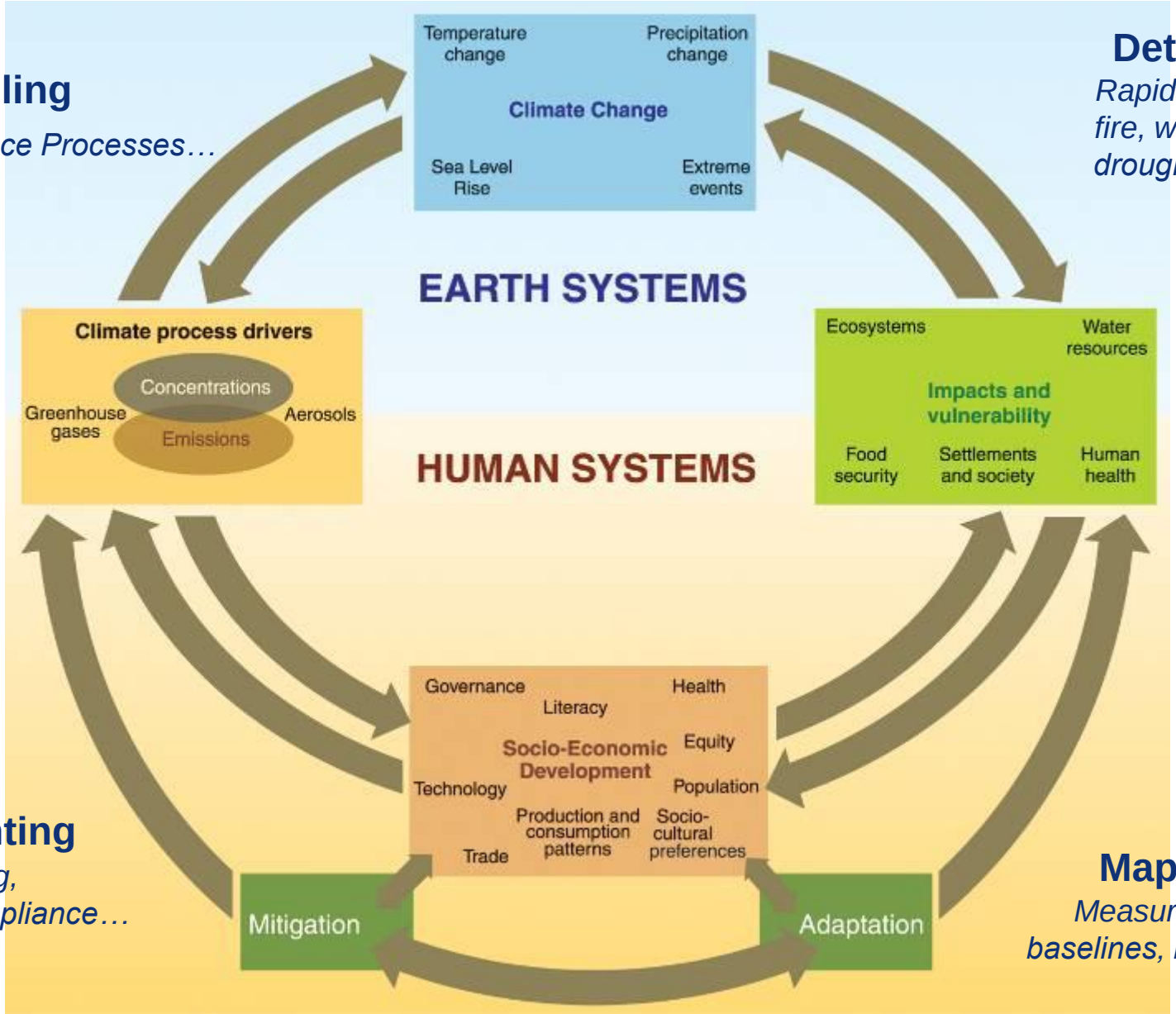
Earth system and human system connections

Modelling

GCMs, Land Surface Processes…

Detection

Rapid changes; fire, wind-throw, drought, flood…



Documenting

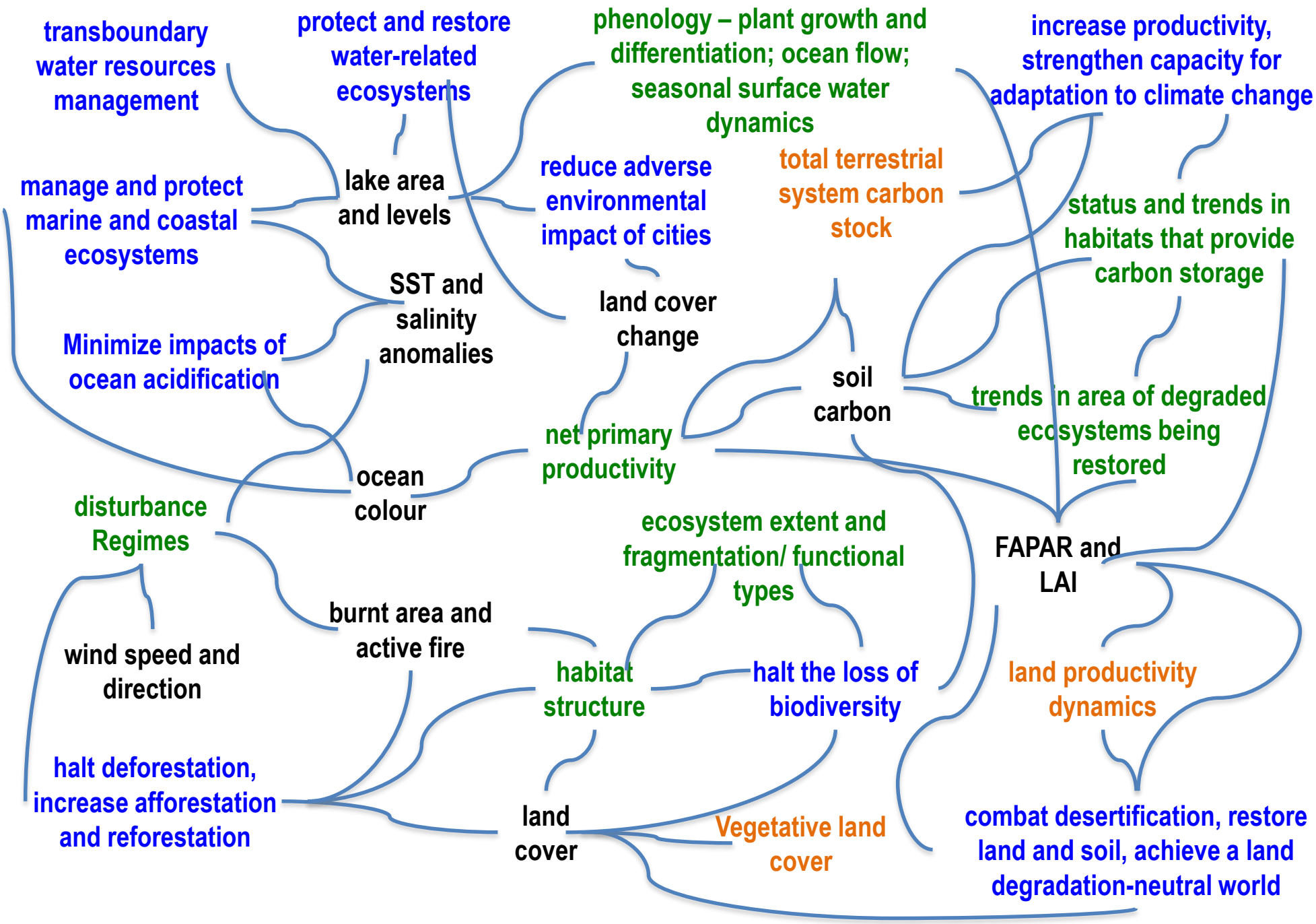
Reporting, Verification, compliance…

Mapping

Measurements, baselines, reference…

Figure IPCC AR4 2007

UNFCCC ECV	CBD EBV and/or Trend	UNCCD Progress Indicator	SDG Goals and Targets
Land cover and cover change	Ecosystem extent and fragmentation/ Ecosystem functional types	Vegetative land cover	Climate Action Sustainable Cities: Target 11.7
Soil carbon, land cover change, FAPAR, LAI and Ocean Colour	Trends in area of degraded ecosystems restored or being restored	Land productivity dynamics	Climate Action Zero Hunger: Target 2.4 Life on land: Target 15.3
Soil carbon, land cover change, FAPAR, LAI and Ocean Colour	Status and trends in extent and condition of habitats that provide carbon storage	Total terrestrial system carbon stock including above and below ground carbon	Climate Action Life on land: Target 15.1, 15.2, 15.3
FAPAR; Ocean Colour; Lake Area and Levels	Phenology – plant growth and differentiation; ocean flow; seasonal surface water dynamics	Land productivity dynamics	Climate Action Clean water: Target 6.5, 6.6 Life on land: Target 15.1
FAPAR and Ocean Colour	Net Primary Productivity		Climate Action Life below water: Target 14.2, 14.5
SST and Salinity anomalies; wind speed and direction; burnt area and active fire	Disturbance Regimes		Climate Action Life on land: Target 15.3, 15.2, 15.3
Land cover type; biomass	Habitat structure		Climate Action Life on land: Target 15.5


transboundary water resources management
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increase productivity, strengthen capacity for adaptation to climate change
manage and protect marine and coastal ecosystems
lake area and levels
reduce adverse environmental impact of cities
total terrestrial system carbon stock
status and trends in habitats that provide carbon storage
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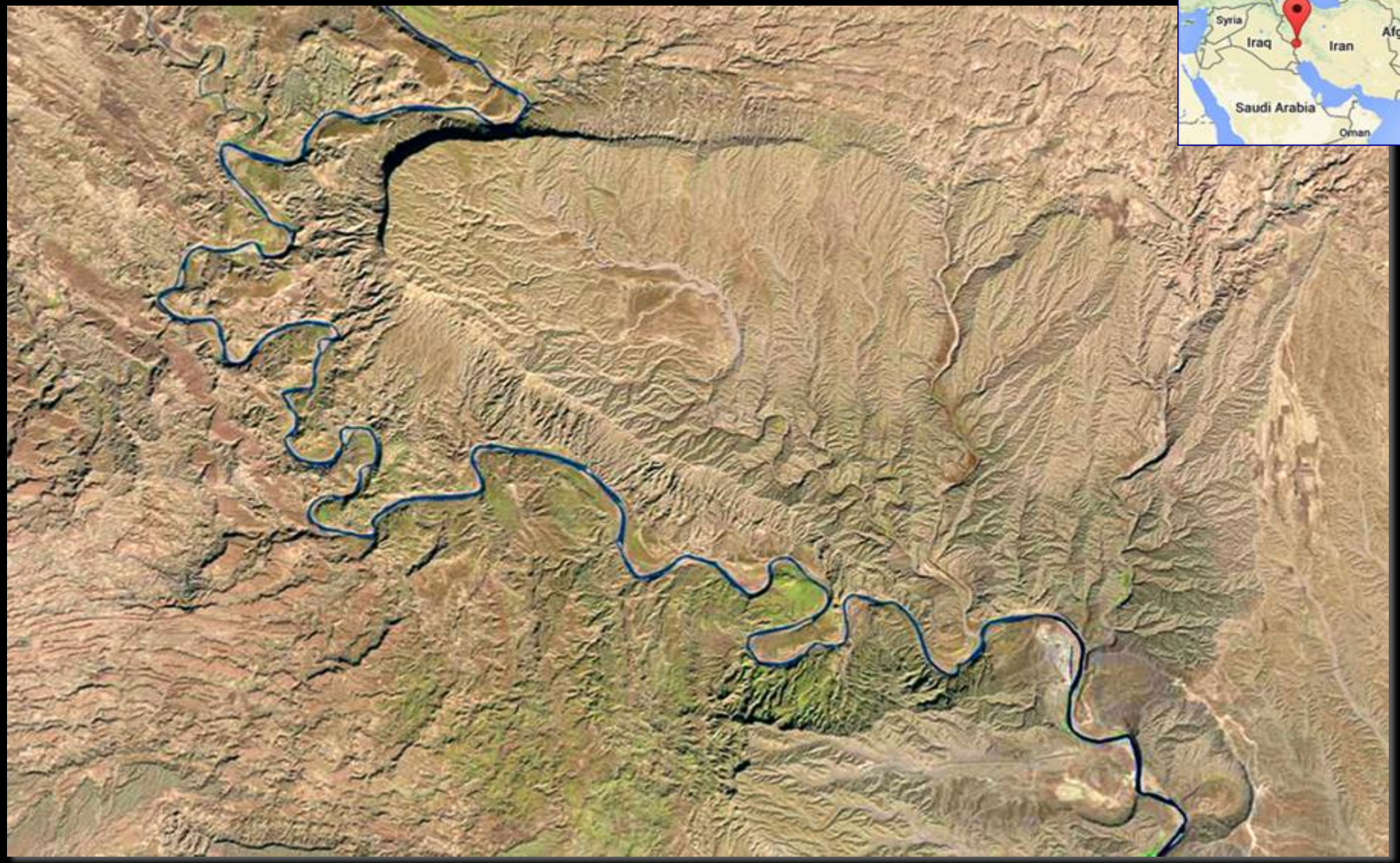
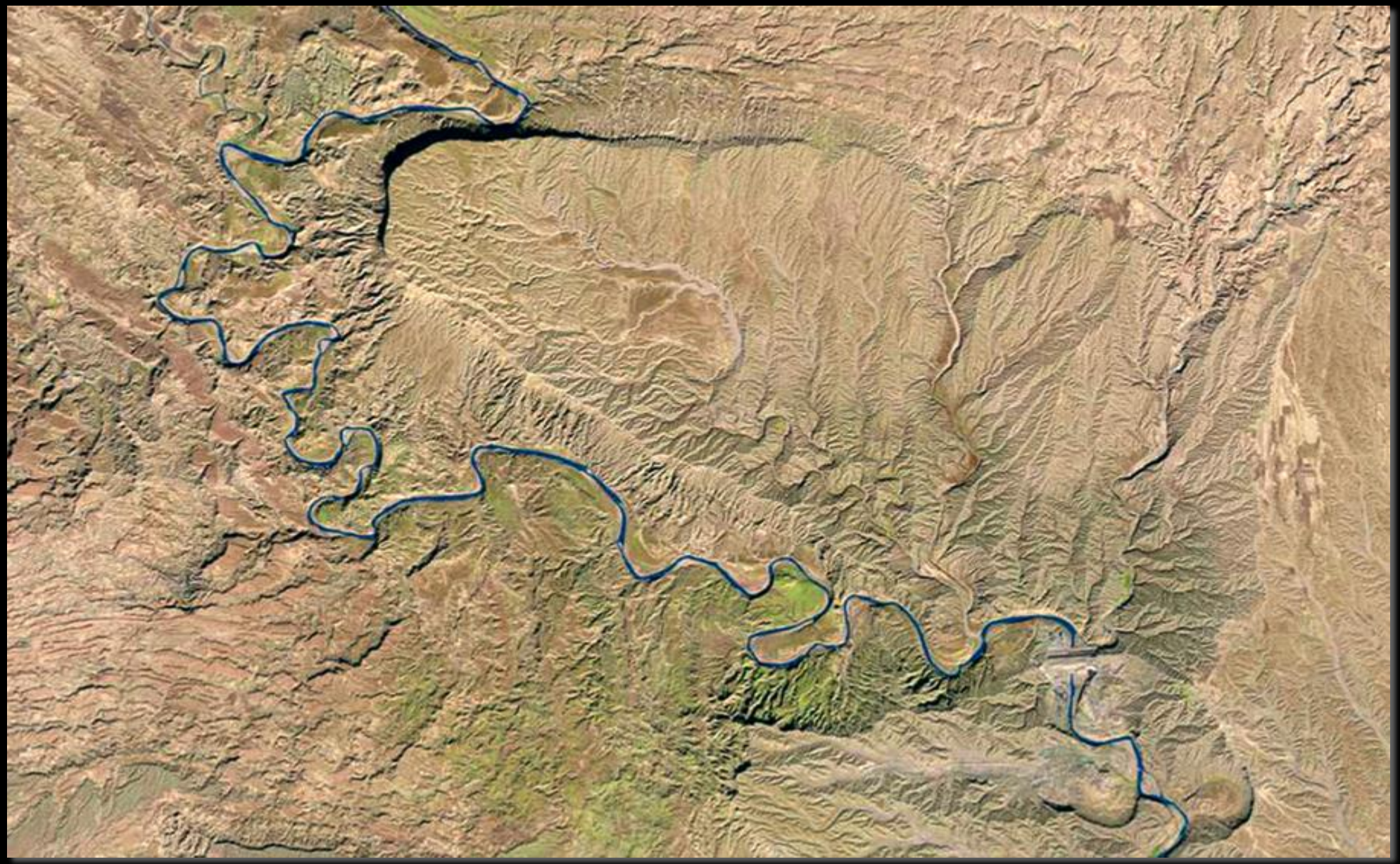
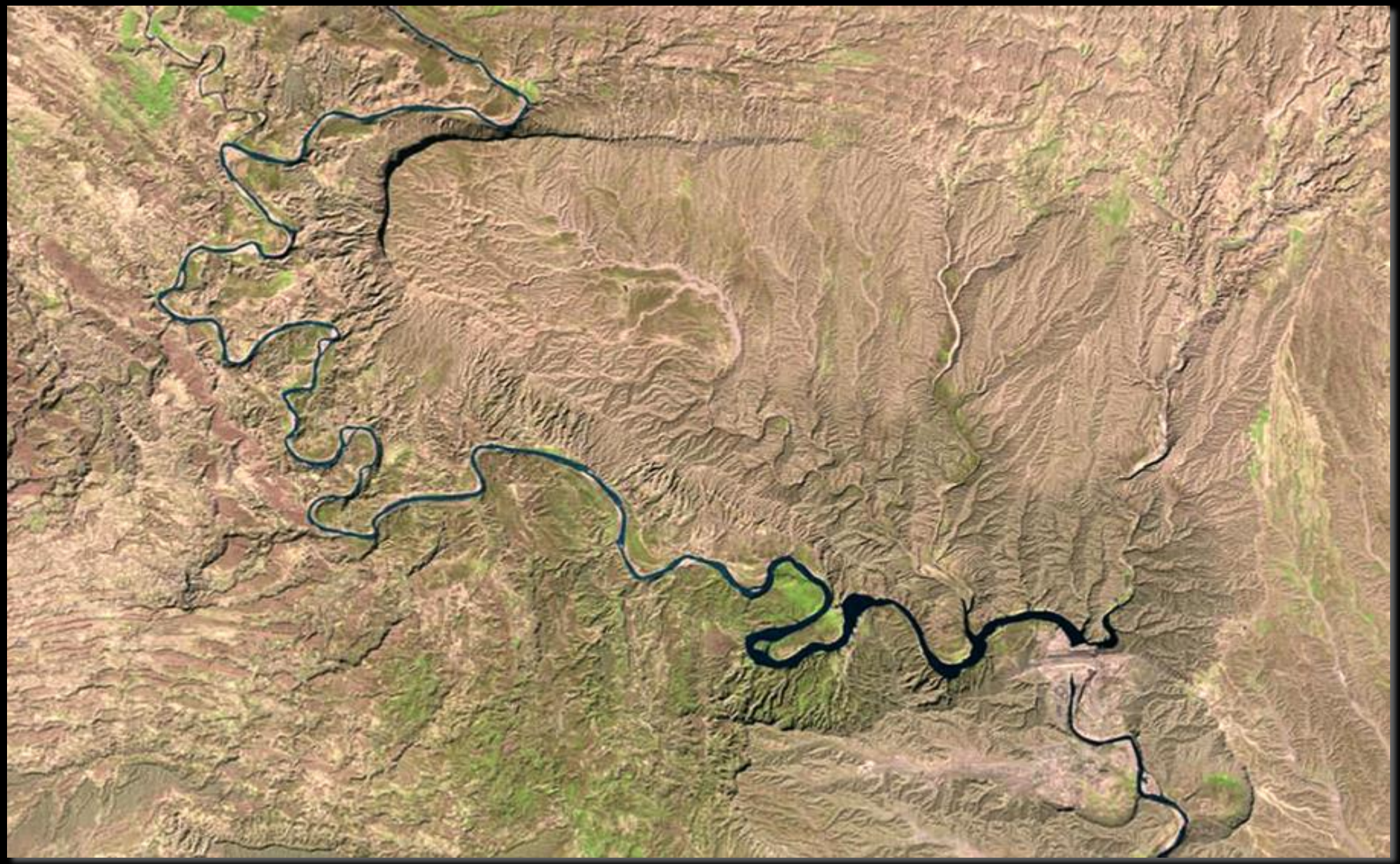
Minimize impacts of ocean acidification
soil carbon
trends in area of degraded ecosystems being restored
net primary productivity
ocean colour
disturbance Regimes
ecosystem extent and fragmentation/ functional types
FAPAR and LAI
burnt area and active fire
wind speed and direction
habitat structure
halt the loss of biodiversity
land productivity dynamics
halt deforestation, increase afforestation and reforestation
land cover
Vegetative land cover
combat desertification, restore land and soil, achieve a land degradation-neutral world



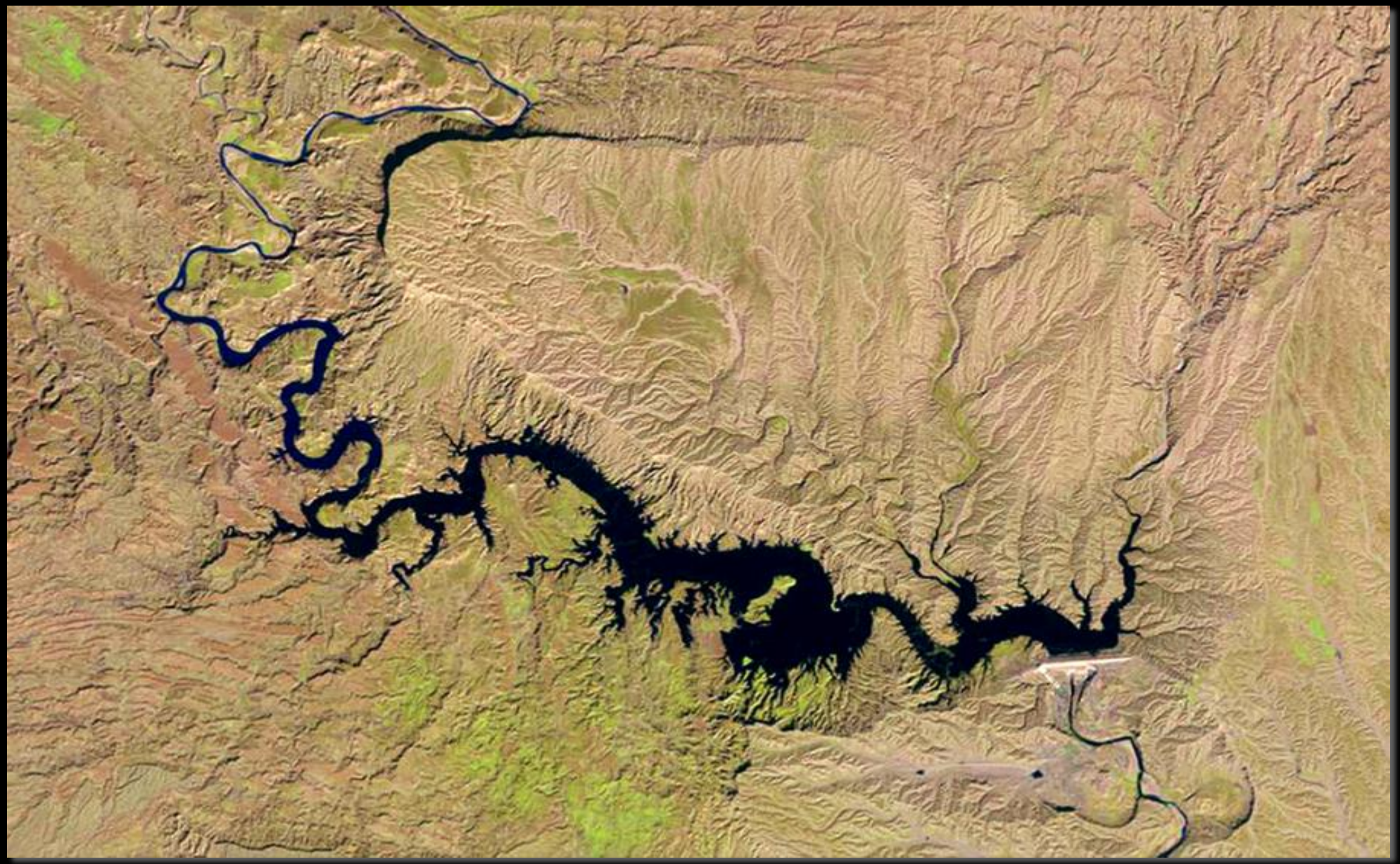
Karkheh River, Iran 21st July 1993 merged into 21st December 1999 Landsat courtesy USGS / NASA



Karkheh River, Iran 21st December 1999 Landsat courtesy USGS / NASA

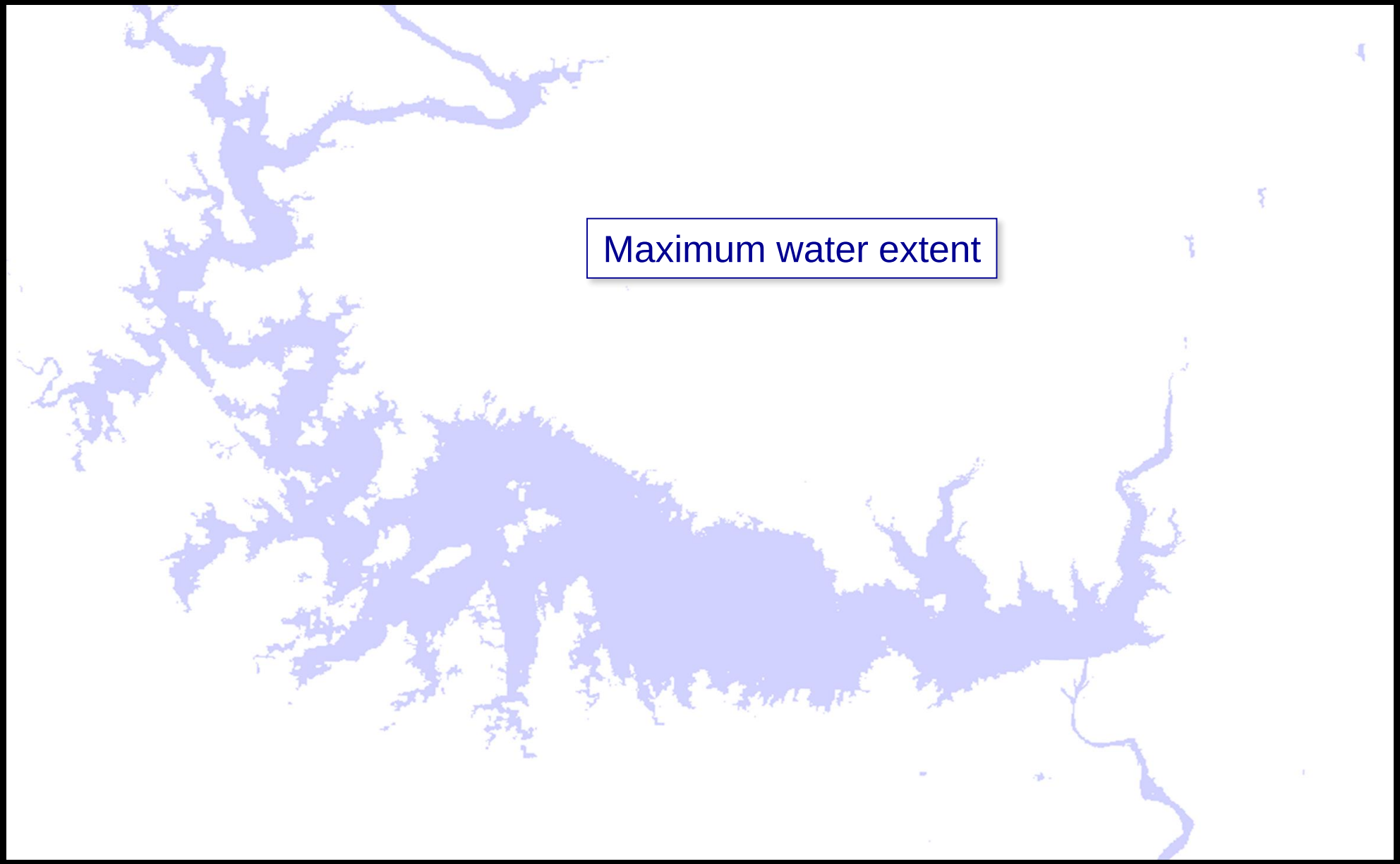


Karkheh River, Iran 23rd February 2000 Landsat courtesy USGS / NASA

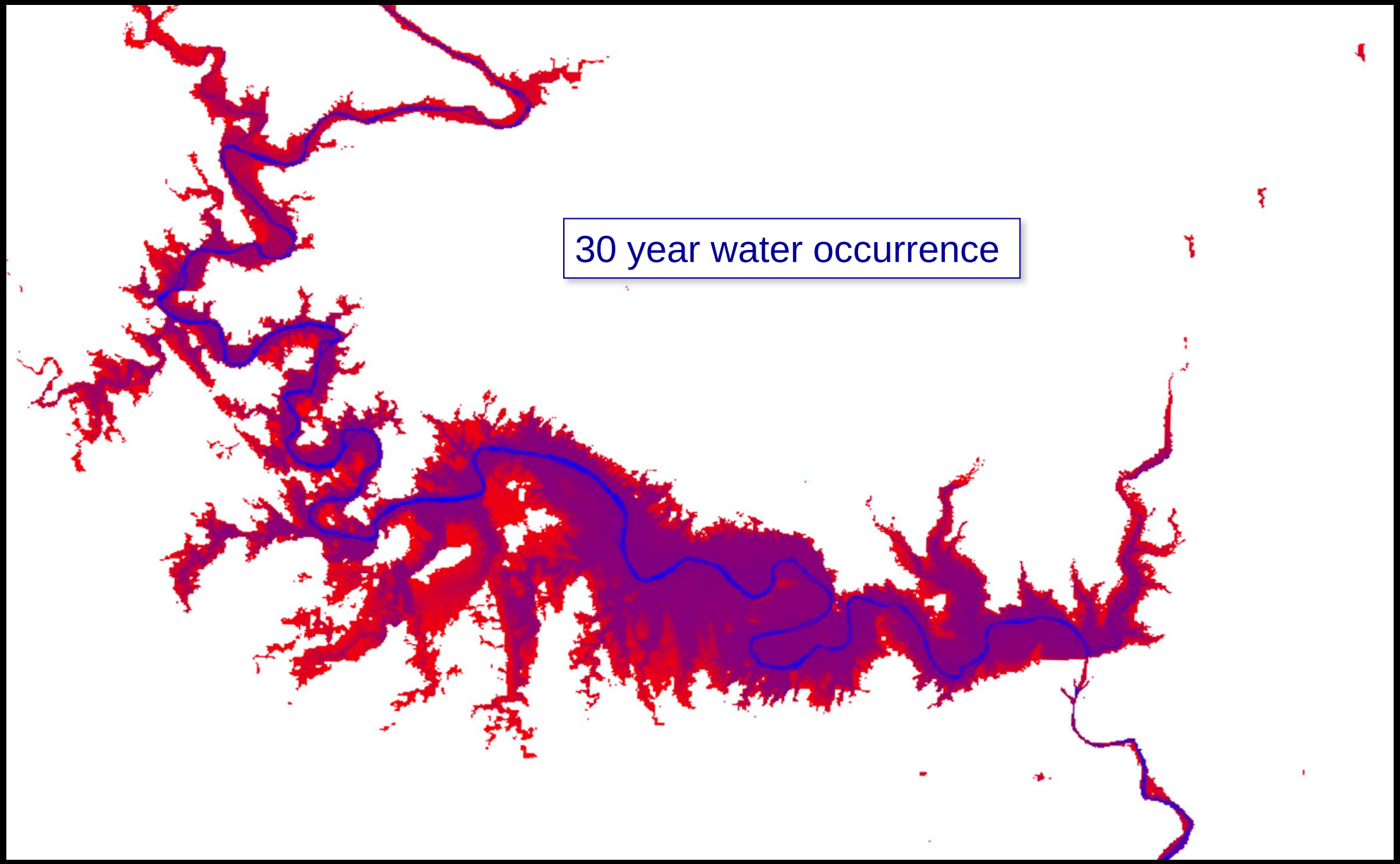


Karkheh River, Iran 24th January 2001 Landsat courtesy USGS / NASA

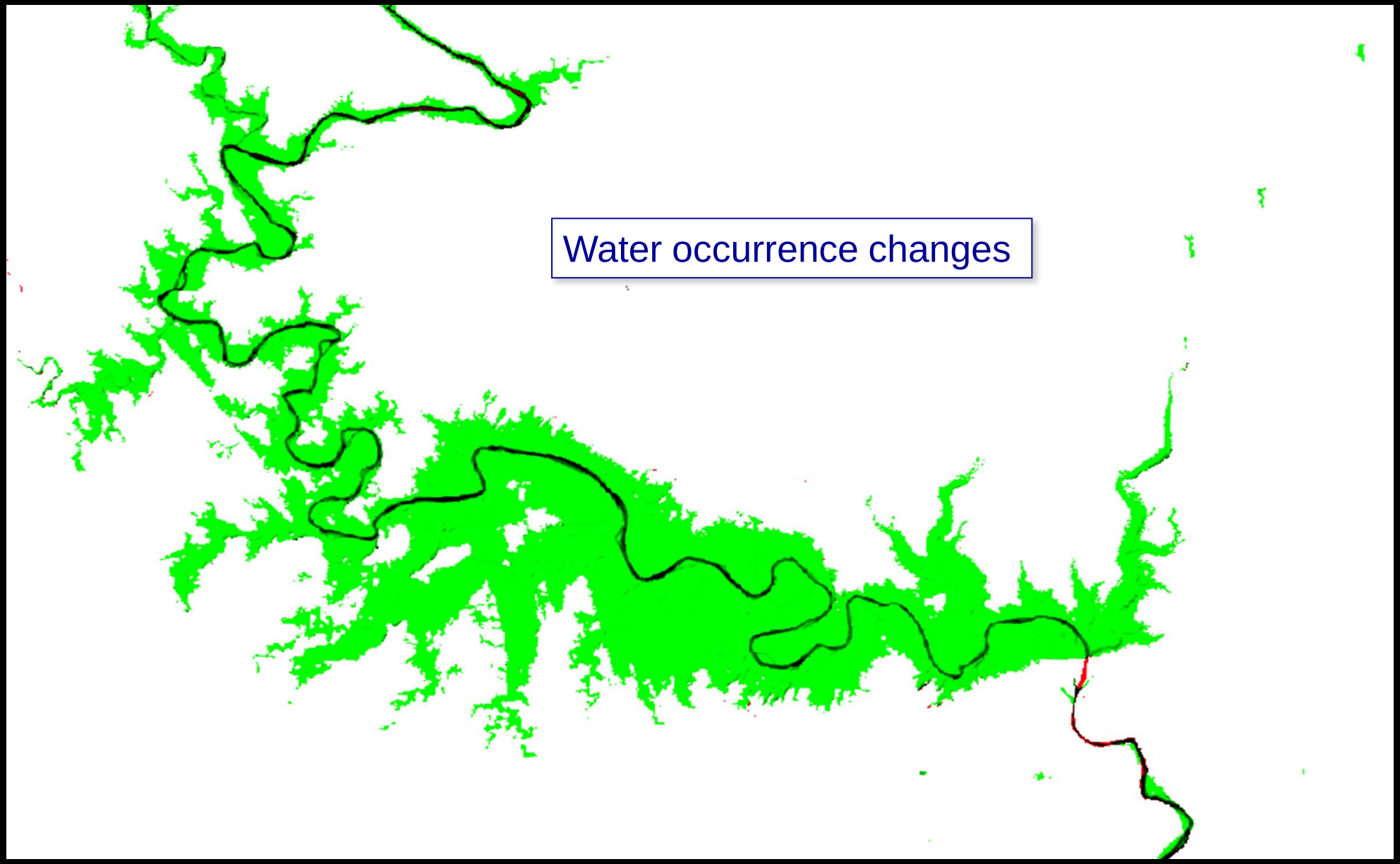
Karkheh River, Iran 27th January 2002 Landsat courtesy USGS / NASA



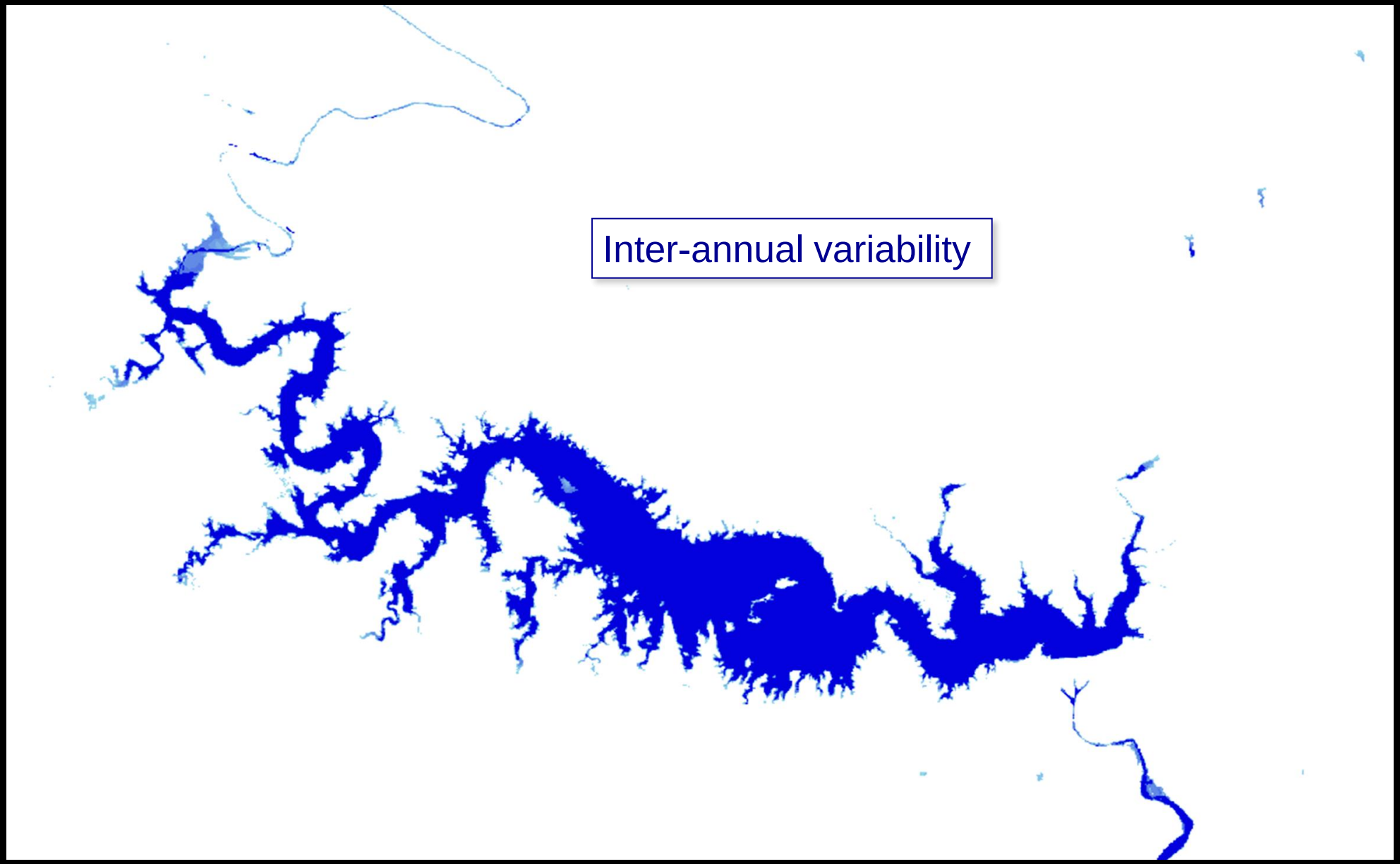
Karkheh River, Iran Global Water Extent 1984 – 2015 Source JRC and GEE (J-F. Pekel, A. Cottam, N. Gorelick, A.S. Belward)



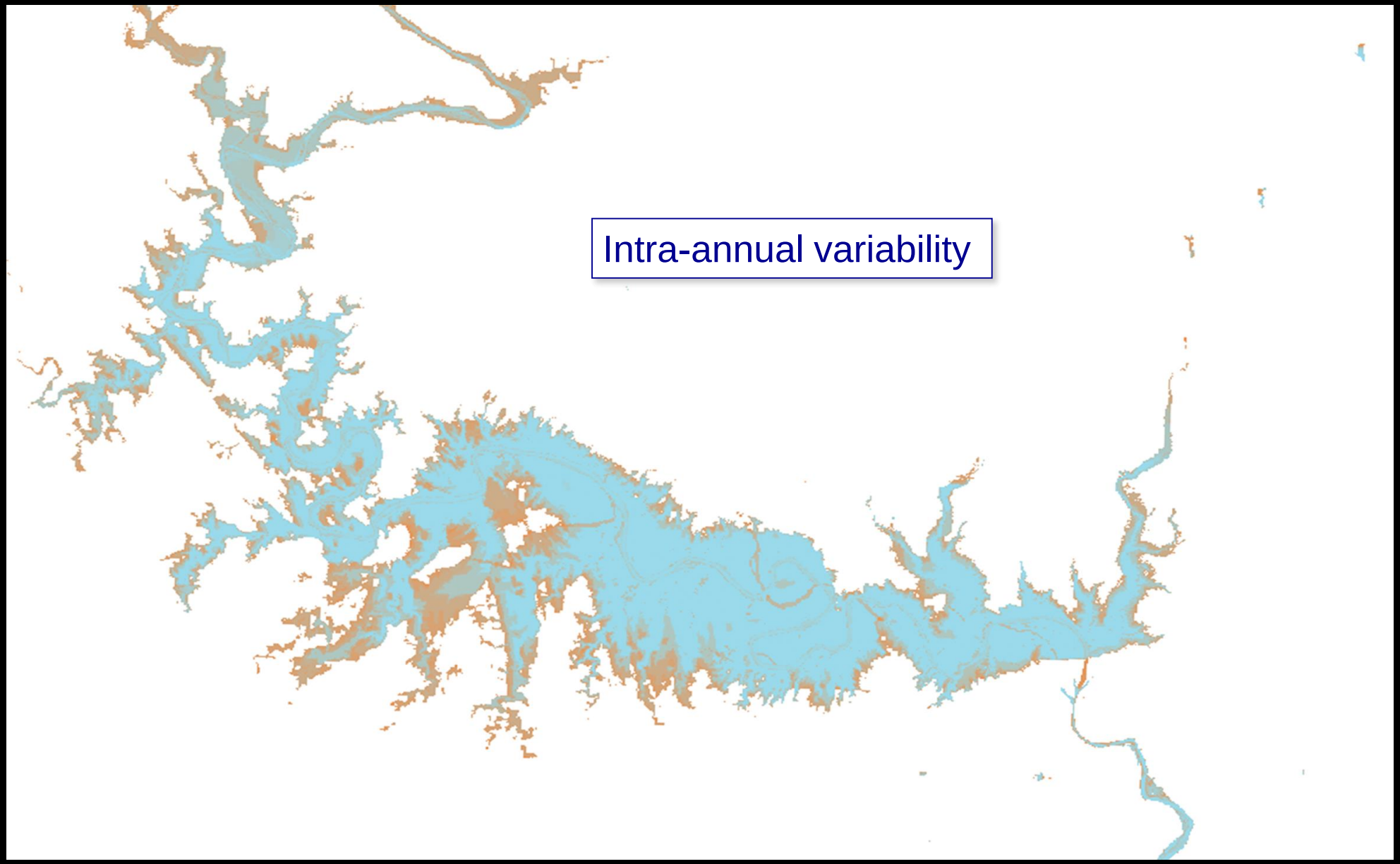
Karkheh River, Iran Global Water Occurrence 1984 – 2015 Source JRC and GEE (J-F. Pekel, A. Cottam, N. Gorelick, A.S. Belward)



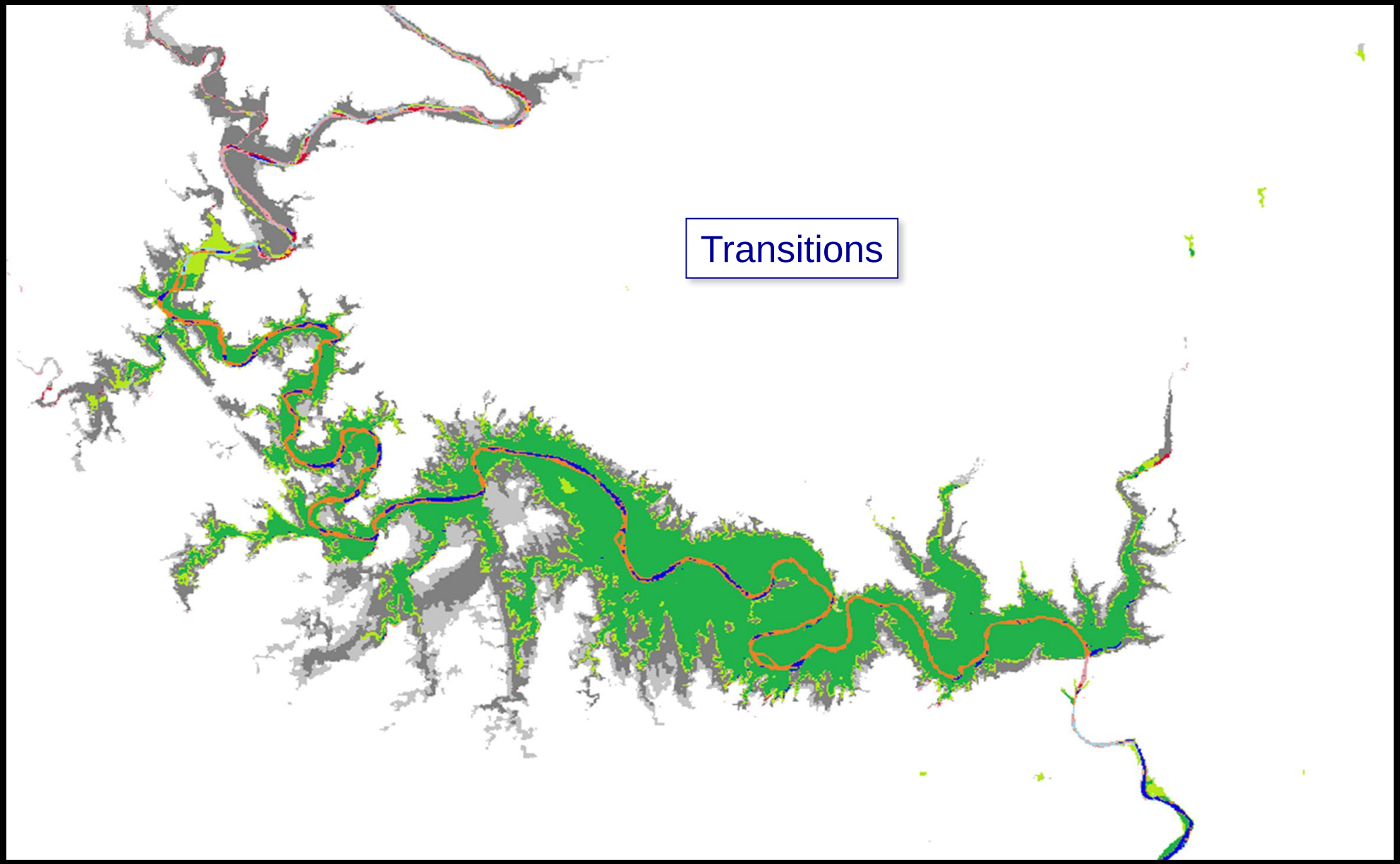
Karkheh River, Iran Global Water Occurrence Change Intenstity 1984 – 2015 Source JRC and GEE (J.F. Pekel, A. Cottam, N. Gorelick, A.S. Belward)



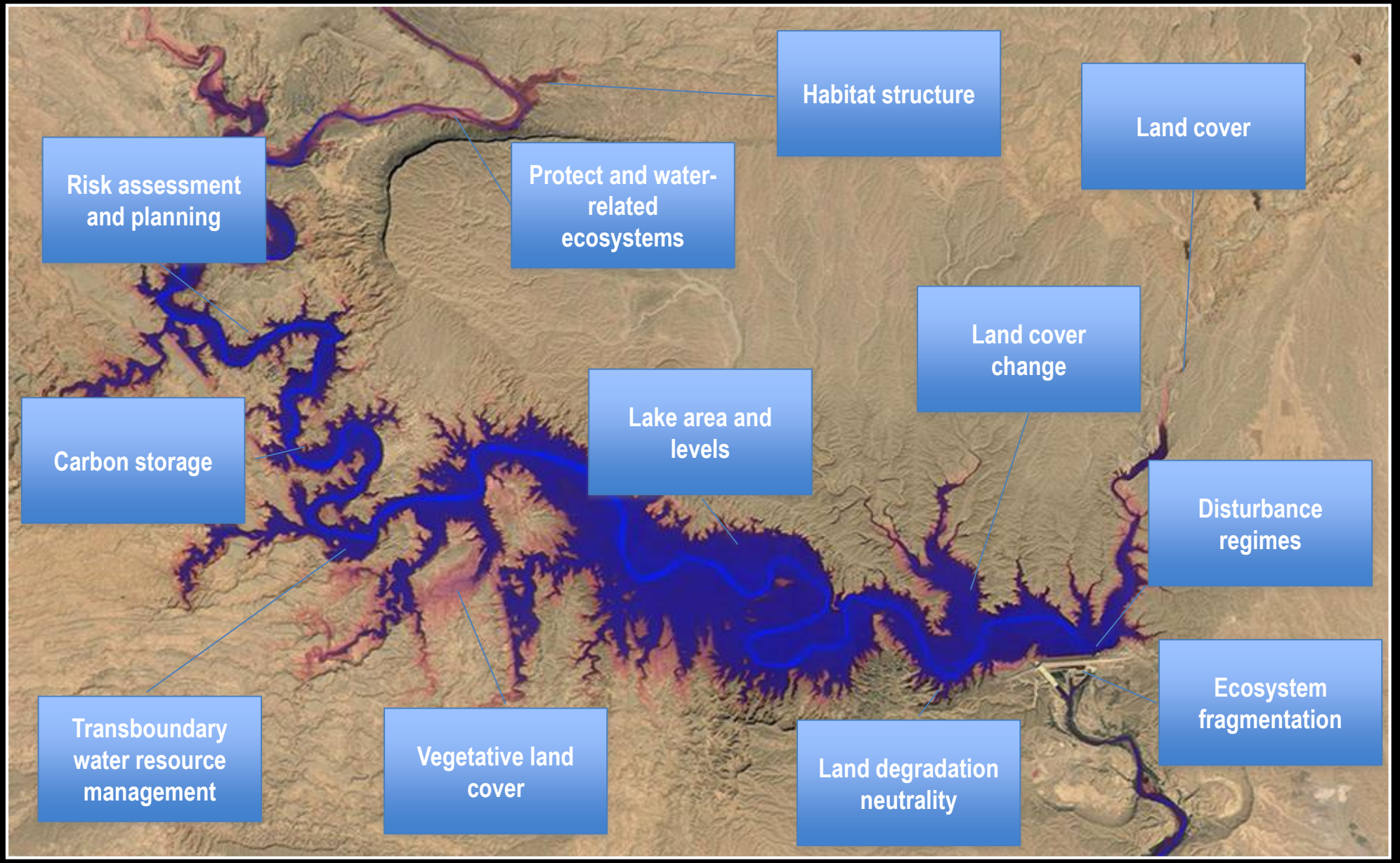
Karkheh River, Iran Global Water Seasonality 2014 Source JRC and GEE (J-F. Pekel, A. Cottam, N. Gorelick, A.S. Belward)



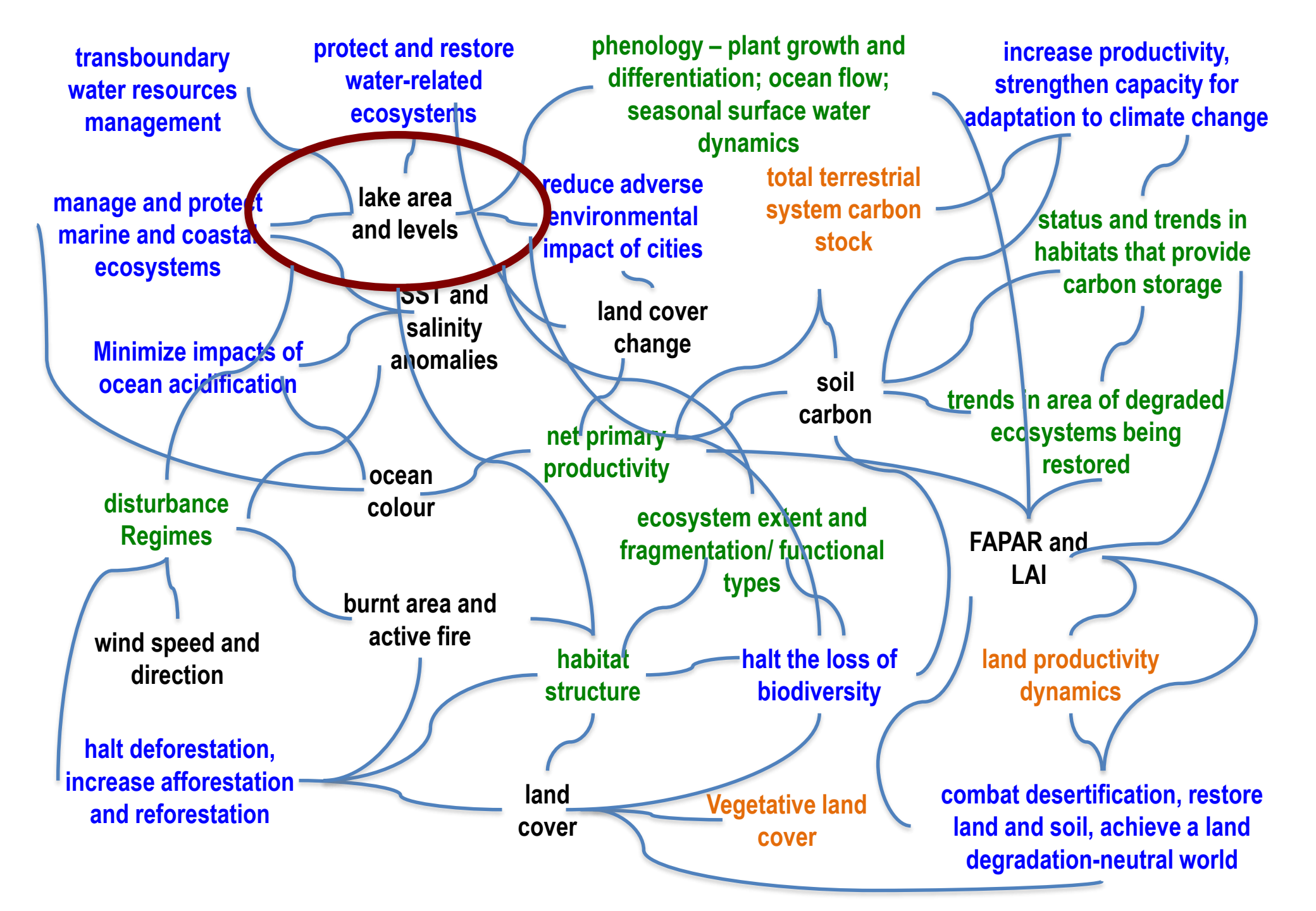
Karkheh River, Iran Global Water Recurrence 1984 – 2015 Source JRC and GEE (J-F. Pekel, A. Cottam, N. Gorelick, A.S. Belward)



Karkheh River, Iran Global Water Transitions 1984 – 2015 Source JRC and GEE (J-F. Pekel, A. Cottam, N. Gorelick, A.S. Belward)



Karkheh River, Iran Global Water Occurrence 1984 – 2015 Source JRC and GEE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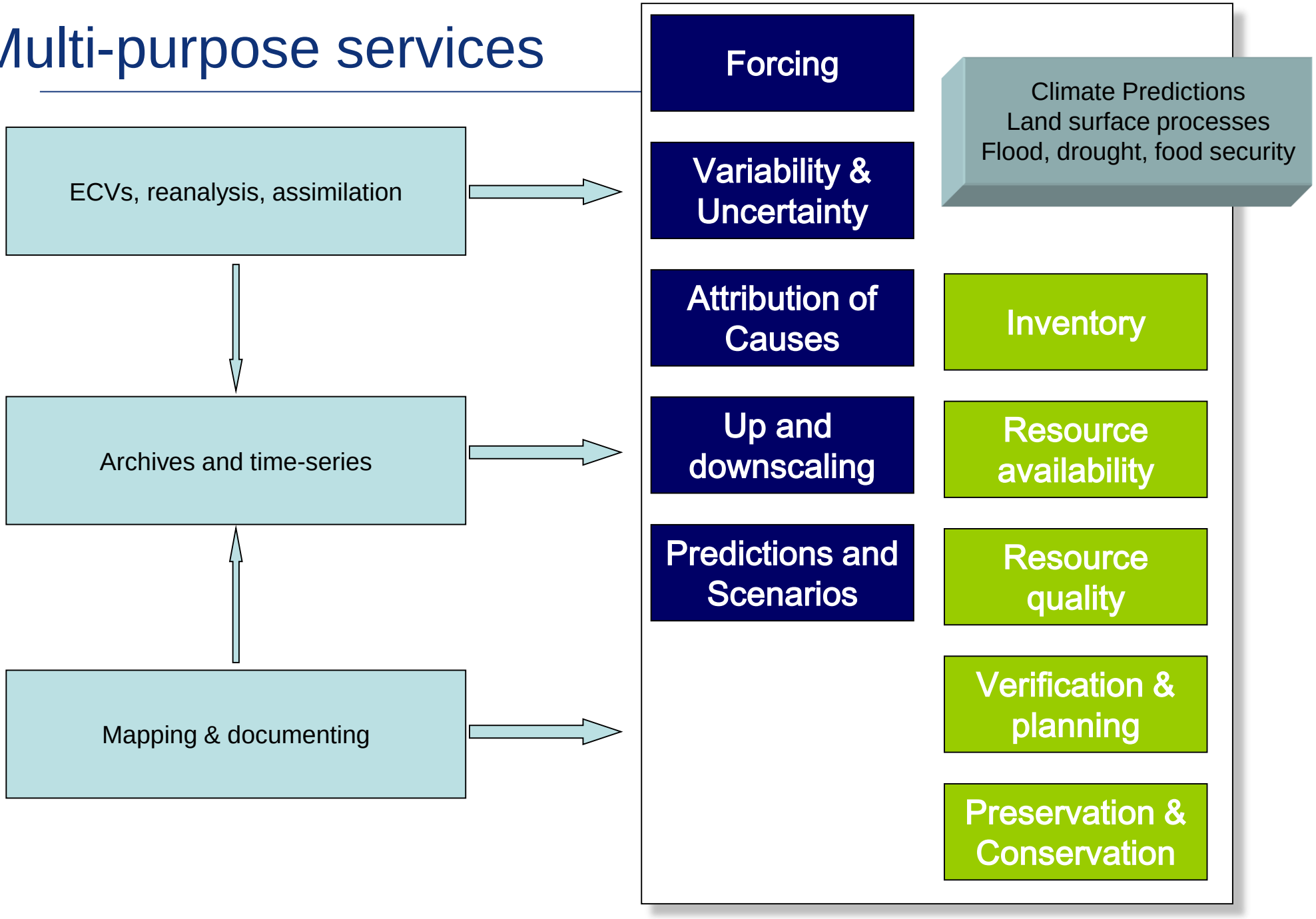
halt the loss of biodiversity
land productivity dynamics
halt deforestation, increase afforestation and reforestation
land cover
Vegetative land cover
combat desertification, restore land and soil, achieve a land degradation-neutral world

Multi-purpose services



Summary

- Climate variability and change impact significantly on economies and societies - climate observations are vital for development
- Global Climate Observing System (GCOS) implementation is essential
- Climate data should be recognised as public goods
- Research is a key factor in the operation of climate networks
- All countries should give high priority to national needs for observations
- Developed countries should make long-term commitments to assist developing countries to maintain their observing networks
- Capacity building should be increased
- COP – and other international forums, such as the Group on Earth Observation recognise the above – and are taking action