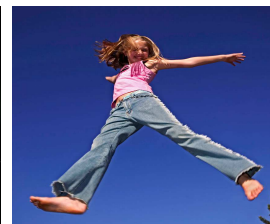
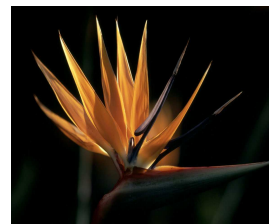
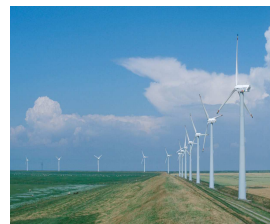
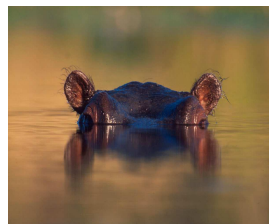
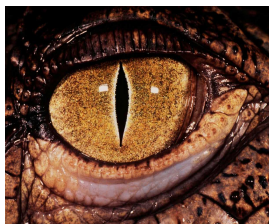
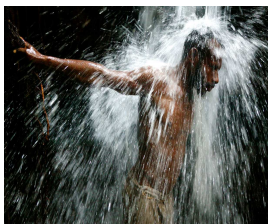




*for a living planet*

# Increasing ecosystem resilience as a measure to adapt to climate change

Water and climate change: How to develop adaptation strategies in transboundary basins, Geneva, 11 May 2010



# Climate adaptation – a new issue?

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- People and nature have been adapting to changing climate conditions for millennia and beyond

## What is different?

- Rate of change
- Type of change
- The world has changed!
  - Limited habitat
  - Limited connectivity
  - Limited (water) resources



*Mongolian Gazelle, Daurian Steppe*

# Adaptation is ultimately an *uncertainty* problem

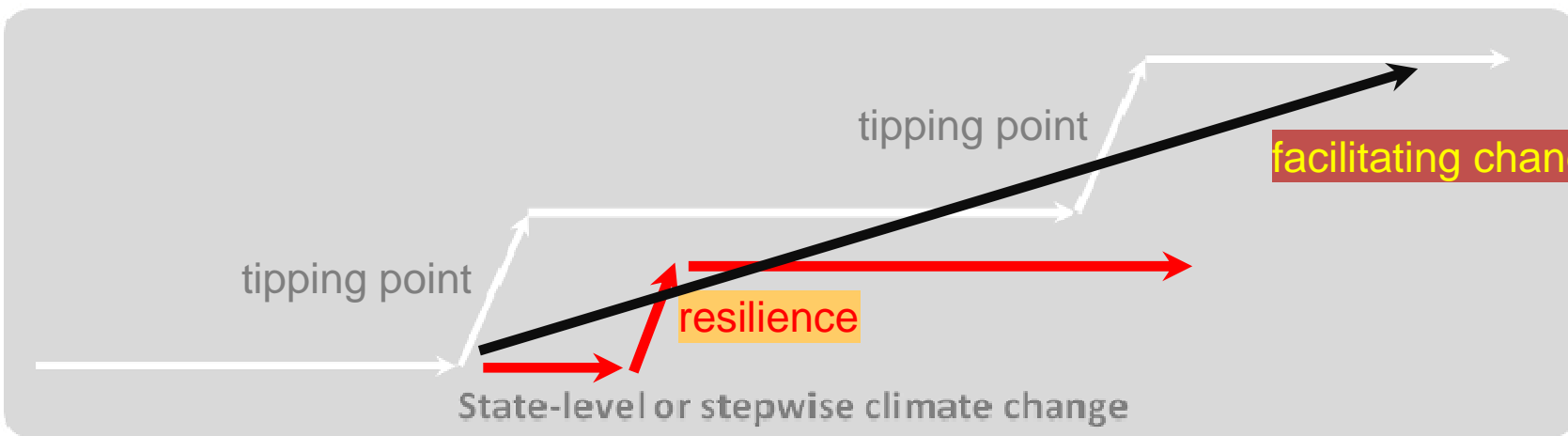
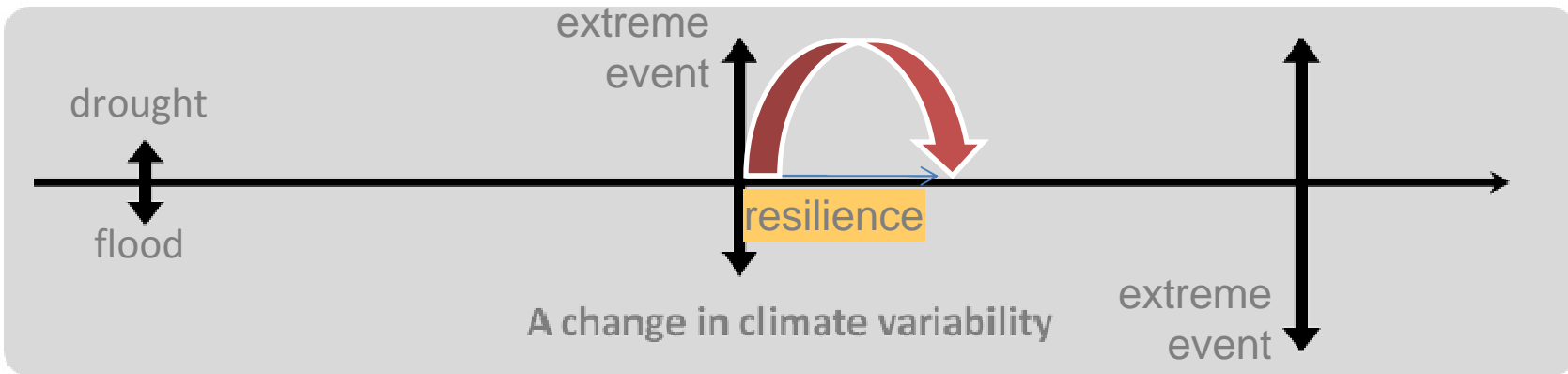
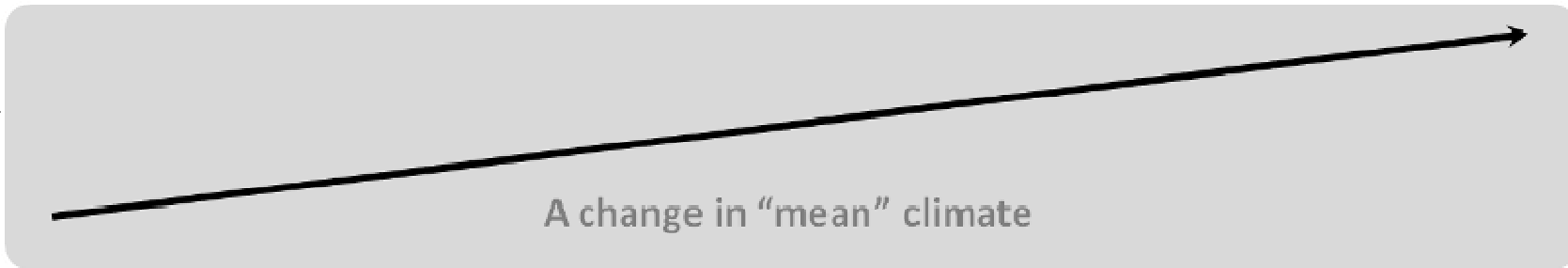
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- **Stationarity** — the assumption that the past is a good guide to the future (Milly et al., *Science*, 2008)
- Our policies, institutions, conservation, and even water infrastructure design and management largely assume *climate* stationarity
- We are not able to easily adjust to shifting or emerging climate conditions



*Blue Mosque, Istanbul, Turkey*

# Change? What change?



# Solutions

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- Assess vulnerability & resilience
- Explore adaptation options
- Monitor
  
- 80% of the solution is in our hands
  - Conservation Agriculture
  - IRBM -> IRBM +?
  - Environmental flows
  - EIA/SEAs



# Climate-adaptive people

Slow, occurs once,  
quantitative, deterministic

## Impacts thinking

“Current climate change adaptation practice places great faith in the ability of climate models to predict specific impacts.”

Quick & dirty, open ended,  
continuous or iterative, semi-  
quantitative, focused

## Adaptation thinking

“Ecosystems are dynamic entities ... Adaptation thinking emphasizes the **shifting** relationship between institutions and ecosystems.”

vulnerability

adaptation

vulnerability

adaptation



# “Soft” is the new “hard” infrastructure

- Natural, wild freshwater ecosystems often have the ability to adapt to changing climate conditions by themselves
- They have high natural resilience, can resist extreme events, and transition into new ecological conditions
- “Hard” water infrastructure usually restricts or eliminates some of this natural resilience
- Soft or “green” infrastructure to manage water can help combine control of water resources, restore flow regimes, and rebuild natural climate resilience



# Lower Danube River

- Extensive floodplain loss
- 2000 agreement for 9,000 km<sup>2</sup>, 2,236 km<sup>2</sup> restoration
- Big floods in 2005 & 2006
- 469 km<sup>2</sup> floodplain restoration at 2008 (14.4%)
- E 500/ha/yr ecosystem services
- Full restoration cost = E 183 M vs E 396 M damages from 2005 flood and E 85.6 M in benefits per year

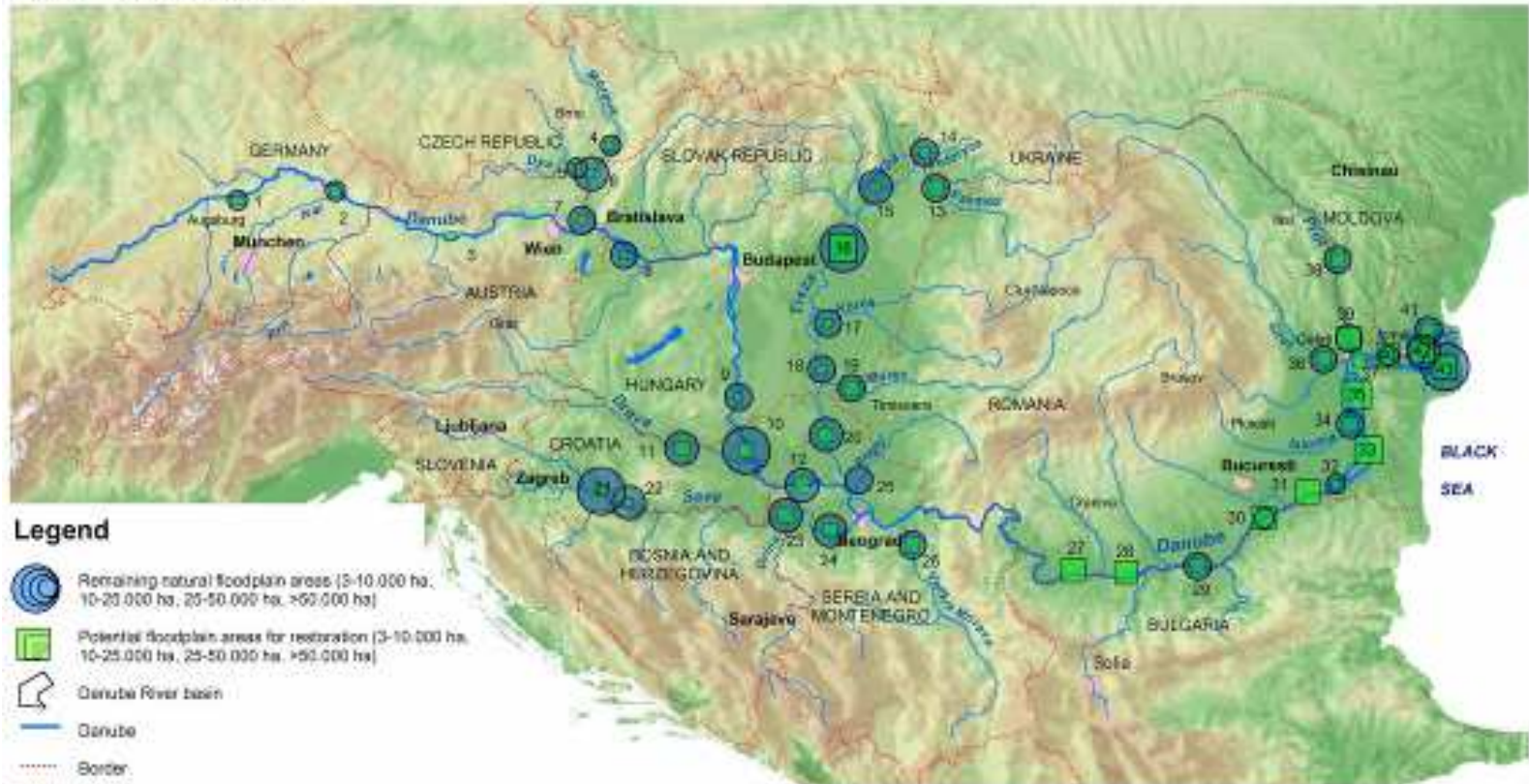


# Lower Danube River



WWF for a living planet®

Large floodplain areas with high potential for flood risk mitigation and restoration for the Danube and selected tributaries



## Legend

- Remaining natural floodplain areas (3-10,000 ha, 10-20,000 ha, 20-50,000 ha, >50,000 ha)
- Potential floodplain areas for restoration (3-10,000 ha, 10-20,000 ha, 20-50,000 ha, >50,000 ha)
- Danube River basin
- Danube
- Border
- Metropolis > 1 million inhabitants
- Other important cities

0 85 170 340 Kilometers

Prepared by FL/AM/US, Vienna, July 2006

- |   |  |                                     |                             |
|---|--|-------------------------------------|-----------------------------|
| 1 Danube near Ingolstadt (DE)             | 12 Middle Danube in Serbia at Beograd (CS) | 23 Dniepr mouth, Bosphorus (BA, CR) | 34 Small Braia island and   |
| 2 Danube and far north (DE)               | 13 Szamos, Upper Tisza (HU)                | 24 Cebotari lake (CS)               | Montia north (RO)           |
| 3 Danube Marchfeld (AT)                   | 14 Latorca (UR, SK)                        | 25 Lower Dniepr (CS)                | 55 Botta (Bosna) (RO)       |
| 4 Meisva near Madun (CZ)                  | 15 Rading mouth (HU)                       | 26 Lower Vukta Morava (CS)          | 36 Lower Siret              |
| 5 Lower Dye (CZ)                          | 16 Middle course of Tisza (HU)             | 27 Botta Hirtzu (RO)                | 37 Drobeta complex (RO)     |
| 6 Dye-Marava confluence (CZ, SK)          | 17 Korta confluence and Tisza (HU)         | 28 Botta Potaru (RO)                | 38 Lower Prut (MD, RO)      |
| 7 Morava and Danube (PT, SK)              | 18 Lower Tisza (HU)                        | 29 Balane island (BG)               | 39 Prut mouth (MD, RO)      |
| 8 Engelenk and Zita islov (HR, SK)        | 19 Lower Marva-Mura (HR, RO)               | 30 Botta Cruxa, Tutiskan (RO, BG)   | 40 Limes lake (UA)          |
| 9 Drenov-Beds, Kolpovata (HU)             | 20 Lower Tisza (CS)                        | 31 Botta Catorai (RO)               | 41 Utr, part of the CD (UA) |
| 10 Kopački Rb, Gornje Podunavlje (HR, CS) | 21 Latorca pisa (HR)                       | 32 Calarasi-Raul island (RO)        | 42 Podgorje (RO)            |
| 11 Lower Drava (HR, HU)                   | 22 Moko polje (HR)                         | 33 Batta Isabella (RO)              | 43 Danube Delta (RO)        |

Graphics © WWF DCPO





# Retaining ecological integrity

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- Secure ecosystems as the ultimate stakeholder in a basin
- Develop multiple “water futures” based on a range of possible qualitatively defined eco-hydrological conditions; use as the basis for flexible, low/no-regrets planning
- Vulnerability assessments should focus on both climatic and non-climate elements and flow regime and should be conducted iteratively
- Use tactical, active monitoring to trigger ecosystems & livelihoods resilience management (droughts, floods)
- Strategic, regular reevaluation of usage, flow, and climate data to determine which water future is evolving (facilitate state-level change)
- Maintain maximum natural connectivity

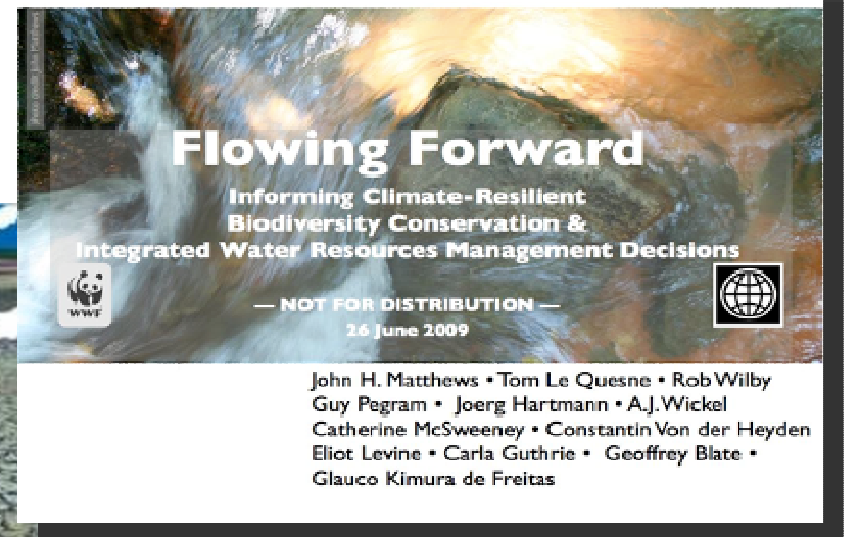
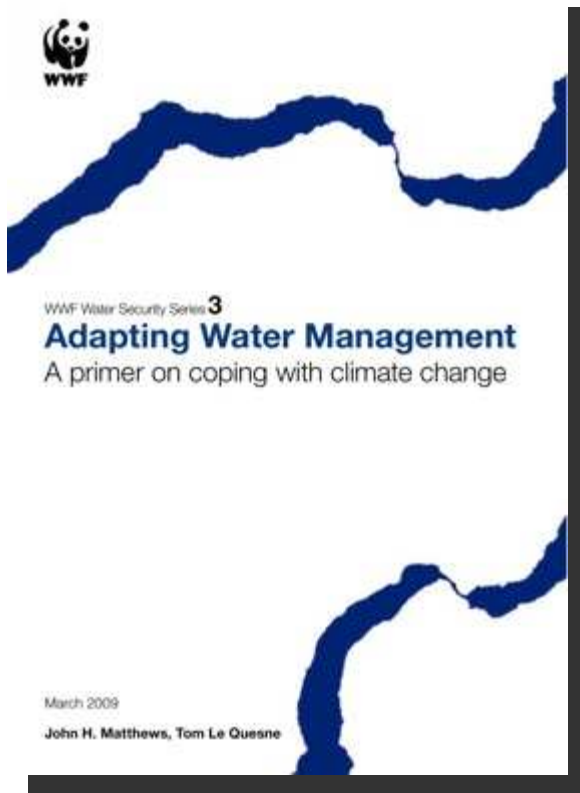


# Policy challenges

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- Develop institutional capacity
- Create flexible allocation systems and agreements
- Reduce external non-climate pressures
- Help species, human communities and economies move their range
- Paradigm shift in infrastructure planning and management
- Promote mainstreaming of climate change adaptation into sectoral policies
- Institute sustainable flood risk policies
- Support climate aware planning
- Improve monitoring and responsiveness capacity

# Adaptation guidance



[ClimatePrep.org](http://ClimatePrep.org)  
[AdaptationPortal.org](http://AdaptationPortal.org)  
[ClimateChangeWater.org](http://ClimateChangeWater.org)