Center for GLOBAL CHANGE & Earth Observations Michigan State University

MICHIGAN STATE UNIVERSITY

SCIENCE AND TECHNOLOGY FOR SOCIETY

- DEVELOP SOLUTIONS TO GLOBAL CHANGE PROBLEMS

Jiaguo Qi

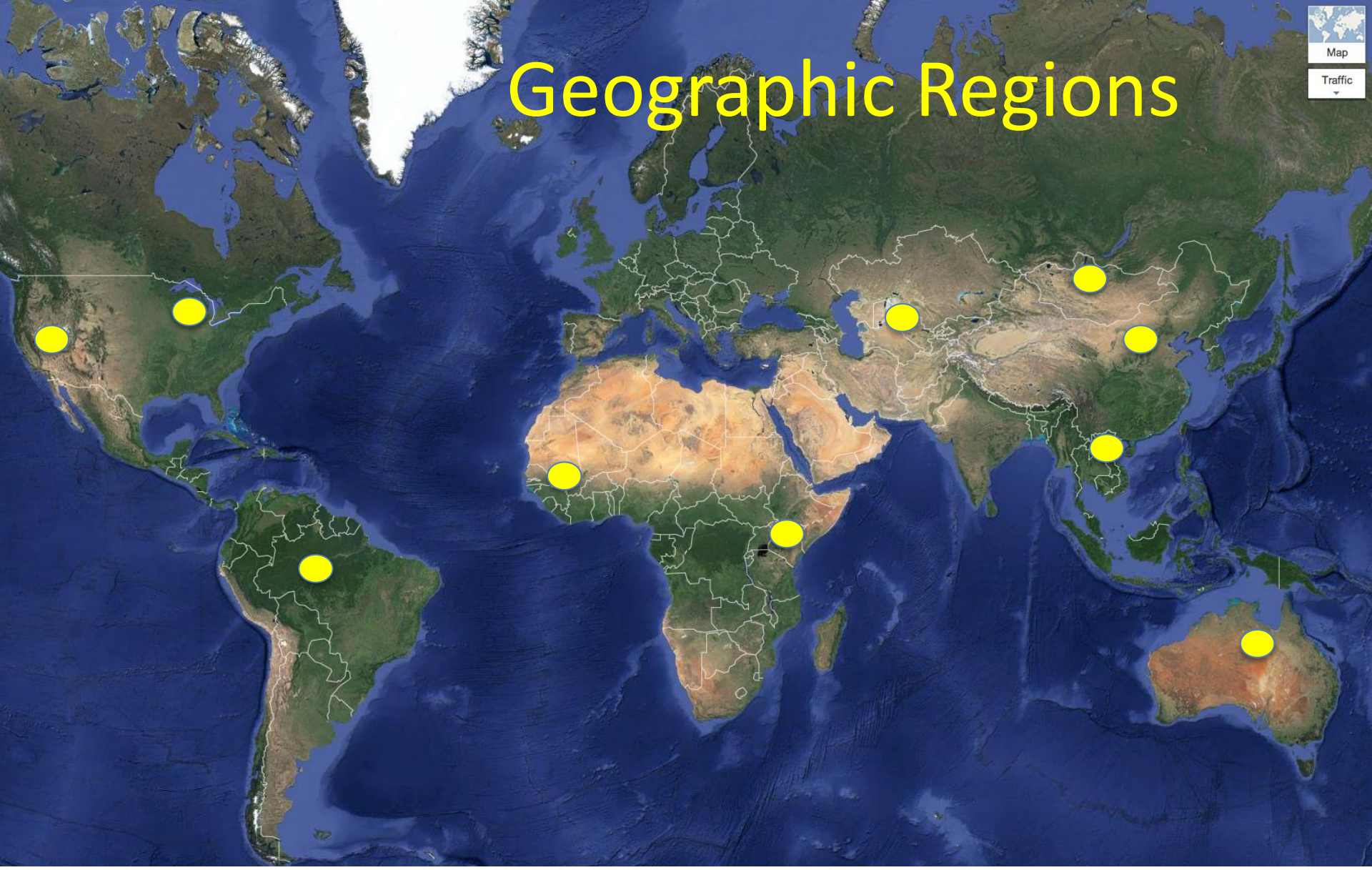
Director, Center for Global Change, Michigan State University, USA

qi@msu.edu

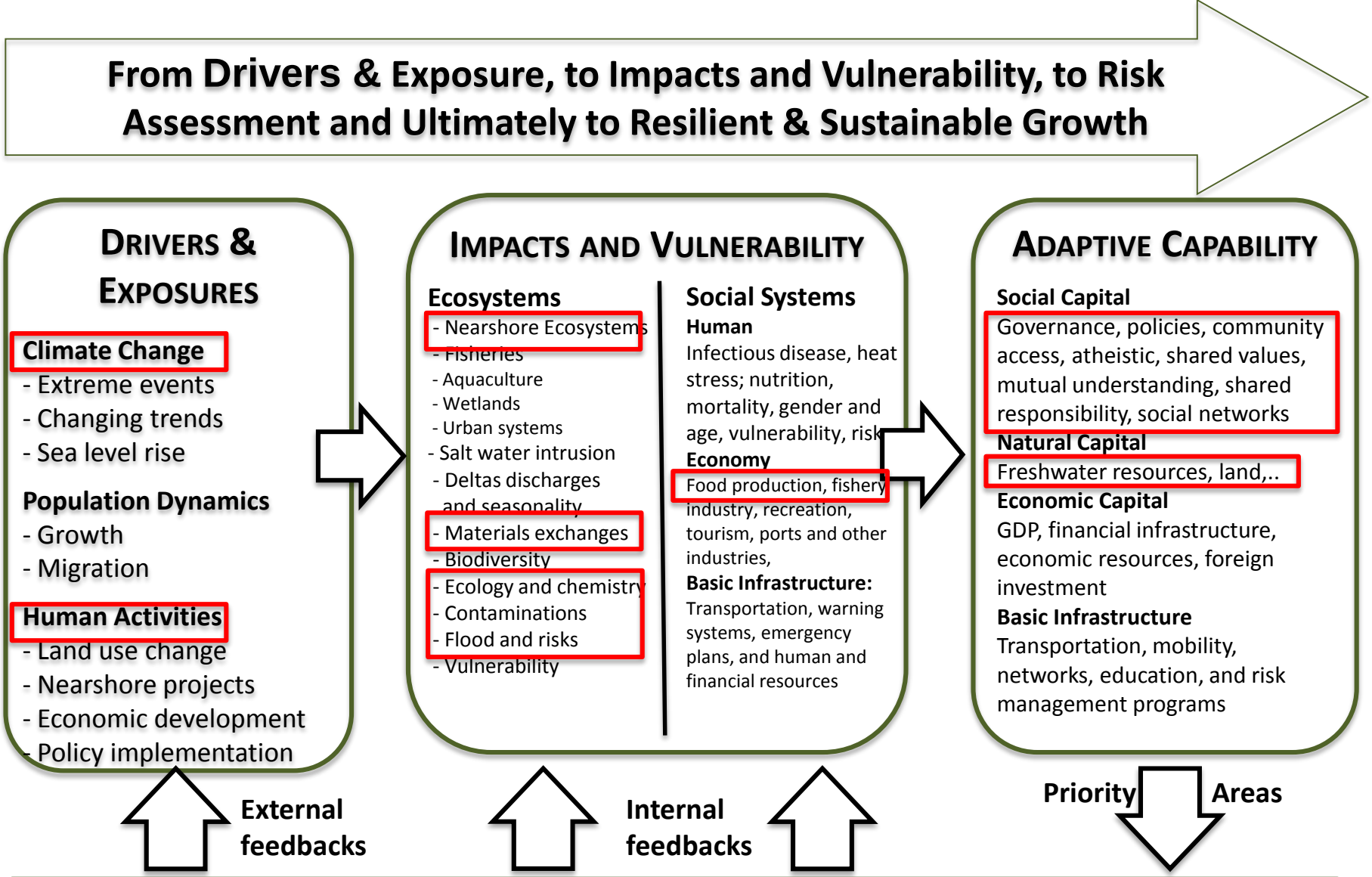
Background & Career Path

- Background
  - A degree in “Soil, Water and Environmental Sciences”
  - USDA-ARS-Southwest Watershed Research Center (93-98)
  - MSU Geography 98-
  - CGCEO 2003 –
- Career Path
  - Methods Development (RS, BRDF, VIs, Biophysical variables) (93-97)
  - Spatial Analysis (patterns of change, LULC) (97-05)
  - Processes (drivers and consequences of LULC) (05-10)
  - Interactions of CNH systems (11-??)
  - Solutions (science & technology for society)

Geographic Regions



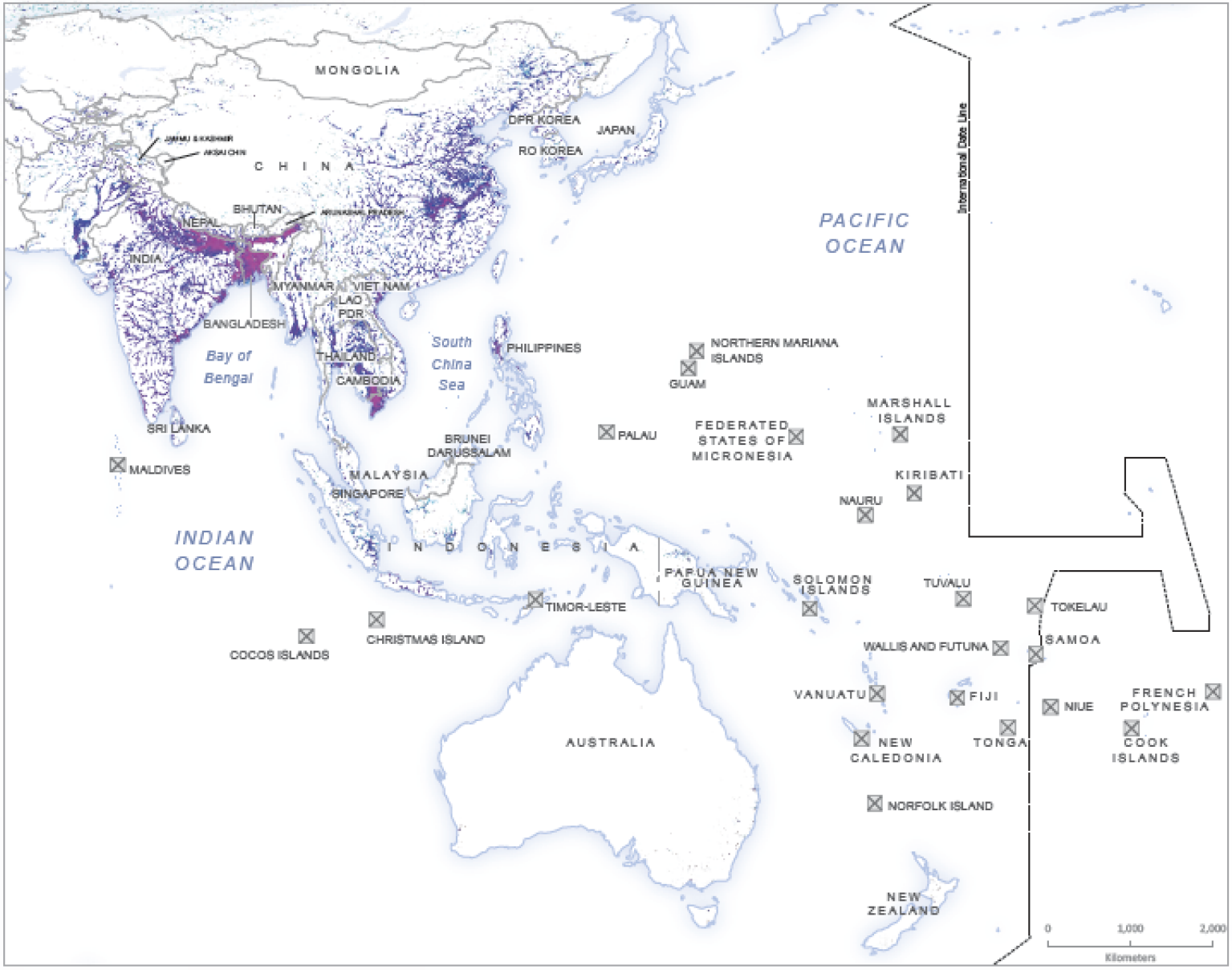
Australia; Brazil; China; SEA (Thailand, Vietnam, Philippines); Africa (Kenya, Tanzania, Senegal); Central Asia (Kazakhstan, Uzbekistan)


From Drivers & Exposure, to Impacts and Vulnerability, to Risk Assessment and Ultimately to Resilient & Sustainable Growth
Drivers & Exposures
Climate Change
- Extreme events
- Changing trends
- Sea level rise
Population Dynamics
- Growth
- Migration
Human Activities
- Land use change
- Nearshore projects
- Economic development
- Policy implementation
Impacts and Vulnerability
Ecosystems
- Nearshore Ecosystems
- Fisheries
- Aquaculture
- Wetlands
- Urban systems
- Salt water intrusion
- Deltas discharges and seasonality
- Materials exchanges
- Biodiversity
- Ecology and chemistry
- Contaminations
- Flood and risks
- Vulnerability
Social Systems
Human
Infectious disease, heat stress; nutrition, mortality, gender and age, vulnerability, risk
Economy
Food production, fishery industry, recreation, tourism, ports and other industries,
Basic Infrastructure:
Transportation, warning systems, emergency plans, and human and financial resources
Adaptive Capability
Social Capital
Governance, policies, community access, atheistic, shared values, mutual understanding, shared responsibility, social networks
Natural Capital
Freshwater resources, land,..
Economic Capital
GDP, financial infrastructure, economic resources, foreign investment
Basic Infrastructure
Transportation, mobility, networks, education, and risk management programs
External feedbacks
Internal feedbacks
Priority Areas
MAINSTREAM ADAPTATION STRATEGIES TO DECISION-MAKING
Policy recommendation; Decision support; Information dissemination; Societal engagement, Capital investment, and Education.

An Example

Asia-Pacific: Flood Risk

OCHA



Flood Risk

Disaster risks can increase or decrease over time according to a country's ability to reduce its vulnerability and strengthen response capacities. In recent decades, countries in the Asia-Pacific region have strengthened their capacities to reduce mortality risks associated with major weather-related hazards such as floods.

Flooding can happen anywhere, however certain areas are especially prone to serious flooding. This map shows a subset of the global estimated risk index for flood hazard. The unit is estimated risk index from 1 (low) to 5 (extreme).

This product was designed by UNEP/GRID Europe for the Global Assessment Report on Risk Reduction (GAR). It was modeled using global data.

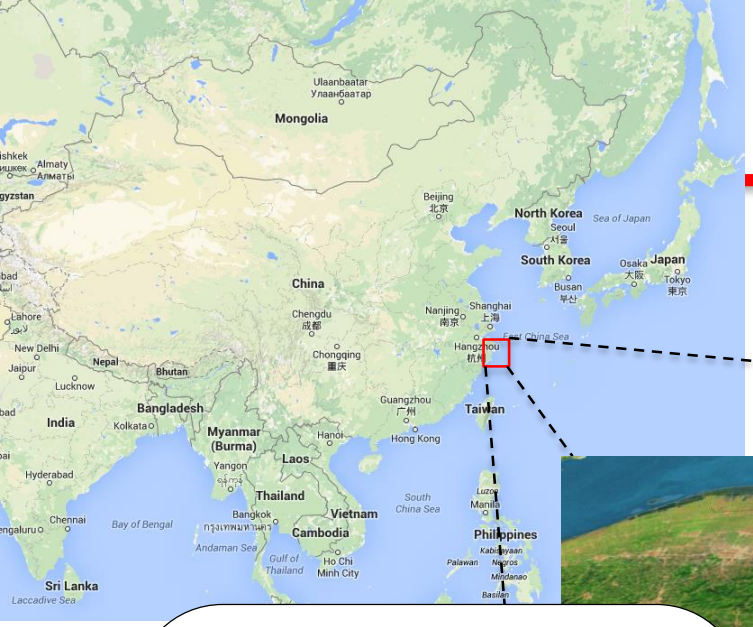
Credit: GIS processing UNEP/GRID Europe. http://preview.grid.unep.ch

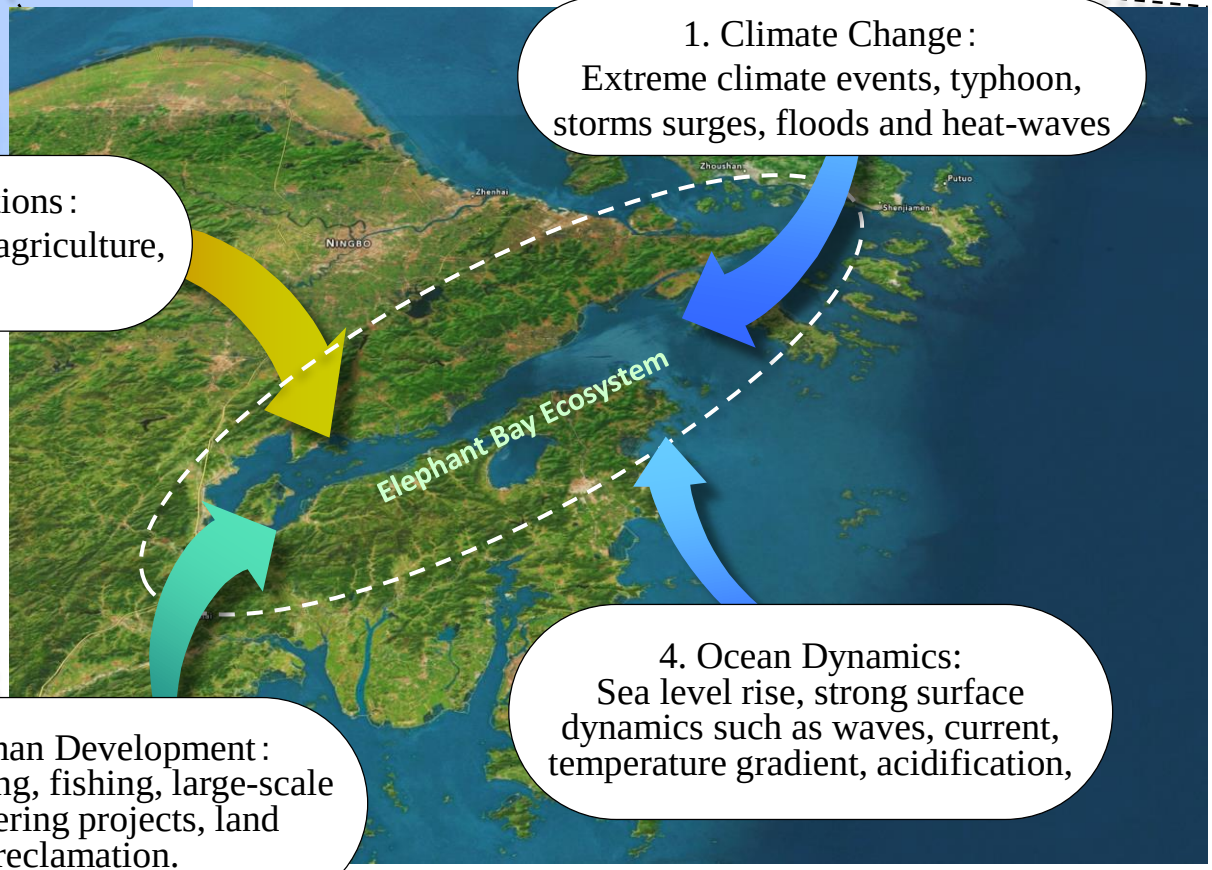
Flood Risk

- Low
- Moderate
- Medium
- High
- Extreme
- Insufficient data

Feedback: ocharoap@un.org **Creation date:** Dec 2014 **Map Doc Name:** OCHA_ROAP_Floods_v1_2014 **Sources:** UN Cartographic Section, FAO, Global Discovery, UNEP/GRID

Complexity of Coastal Ecosystems





1. Climate Change:
Extreme climate events, typhoon, storms surges, floods and heat-waves

2. Landscape Alterations:
Urbanization, , livestock, agriculture, hydro-projects.

3 .Human Development:
Fish farming, fishing, large-scale engineering projects, land reclamation.

4. Ocean Dynamics:
Sea level rise, strong surface dynamics such as waves, current, temperature gradient, acidification,


07/24/01


08/25/01


09/02/01


01/08/02

Fish farms impose ecological risk

Landfills – imposes environmental hazards

Industrial build ups Imposes health hazards

Ocean reclamation imposes flood hazards

Climate → Ridge → River → Reef = CR^3

Tsinghai Province

Climate Change: Water Recharge from Ridge Glaciers & Precipitation

Water Input

Climate Change

Ridge

River

Kunming

Yunnan Province

Vietnam

Myanmar (Burma)

Hanoi

Laos

Vientiane

Thailand

Hue

Bangkok

Cambodia

Vietnam

Phnom Penh

Ho Chi Minh City

Reef

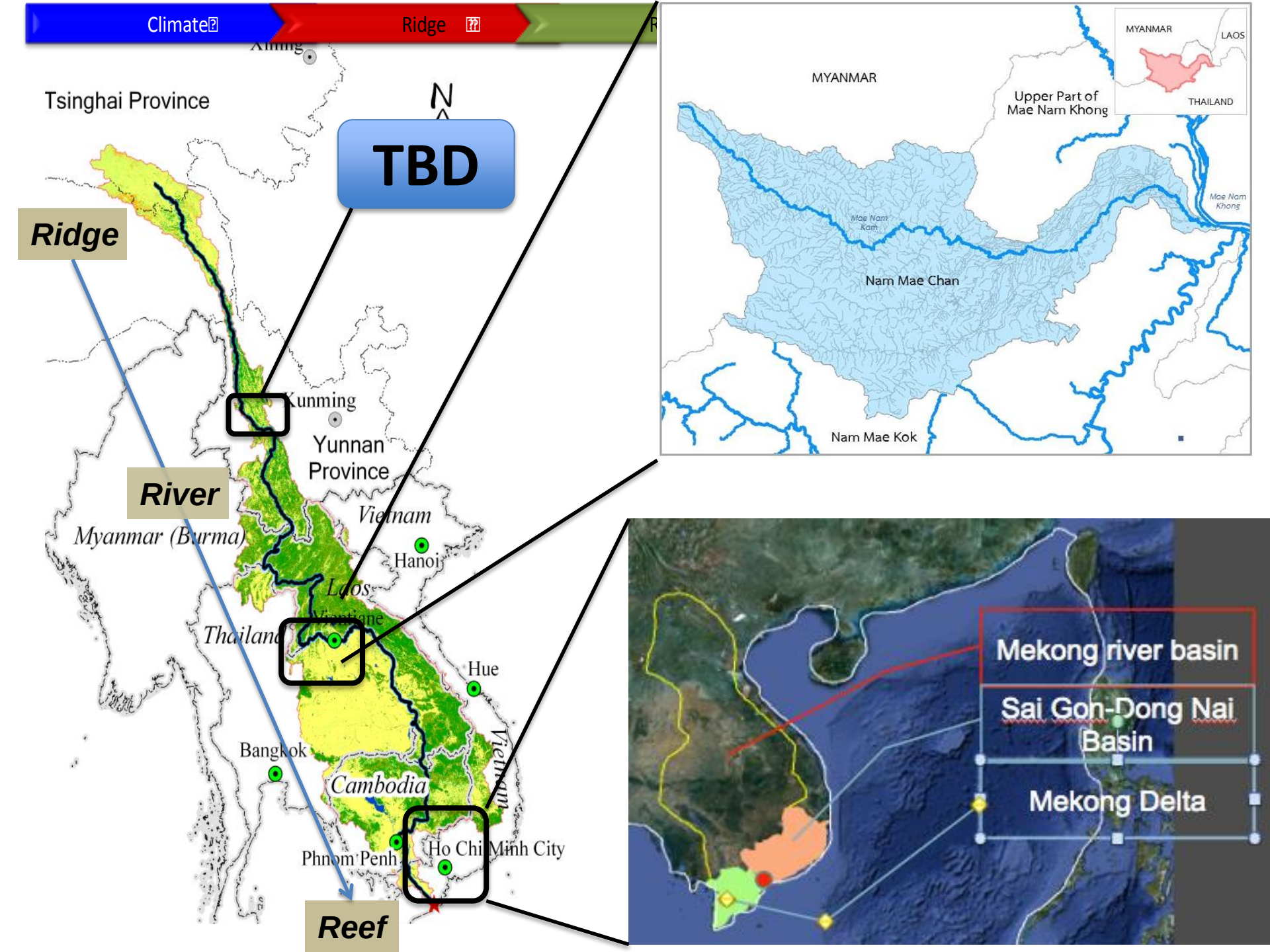
Coastal Ocean System (affected by river discharges)

Adaptive Water Management under Climate Change in the Mekong River Basin

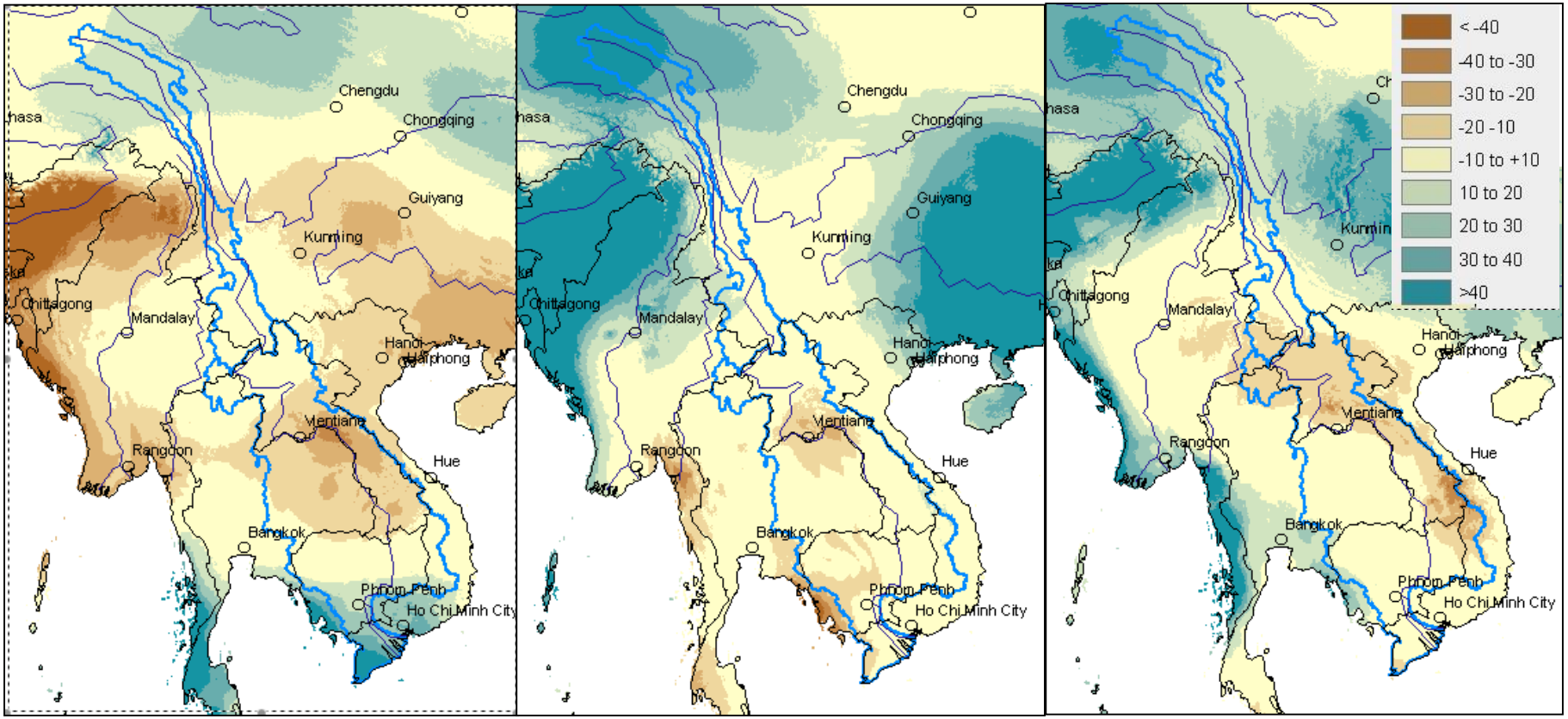
- **Leg A.** Economy
- **Leg C.** Social
- **Leg B.** Environment

- Education
- Technologies
- International Coordination
- Policy & Regulation
- Urban Uses
- Hydro Projects
- Residential Access
- Farming Practices

Balancing Water, Environment & Quality of Life


Climate
Ridge
Tsinghai Province
N
TBD
Ridge
River
Reef
Kunming
Yunnan Province
Vietnam
Myanmar (Burma)
Hanoi
Laos
Thailand
Hue
Bangkok
Cambodia
Phnom Penh
Ho Chi Minh City
MYANMAR
Upper Part of Mae Nam Khong
MYANMAR
LAOS
THAILAND
Mae Nam Khong
Mae Nam Kam
Nam Mae Chan
Nam Mae Kok
Mekong river basin
Sai Gon-Dong Nai Basin
Mekong Delta

SEA will experience increasing climatic variability (2050)



June July August

Sea Level Rise

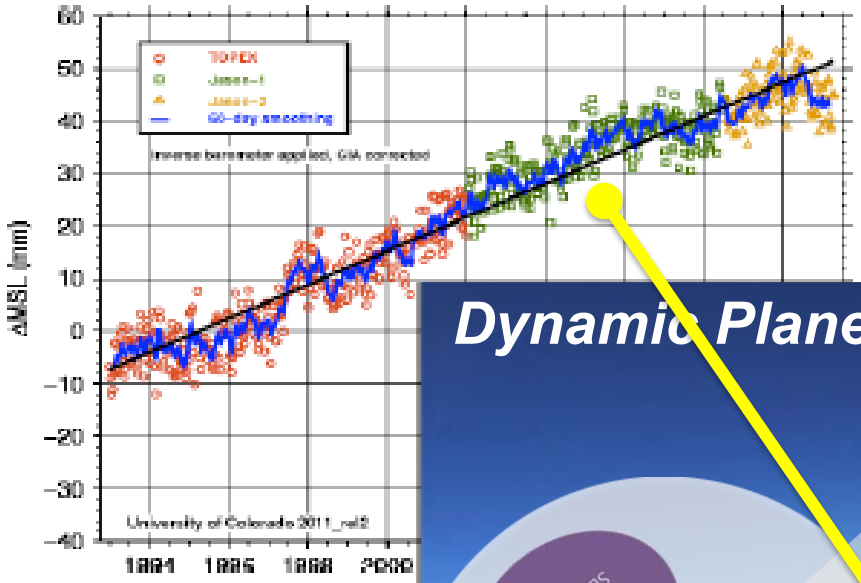
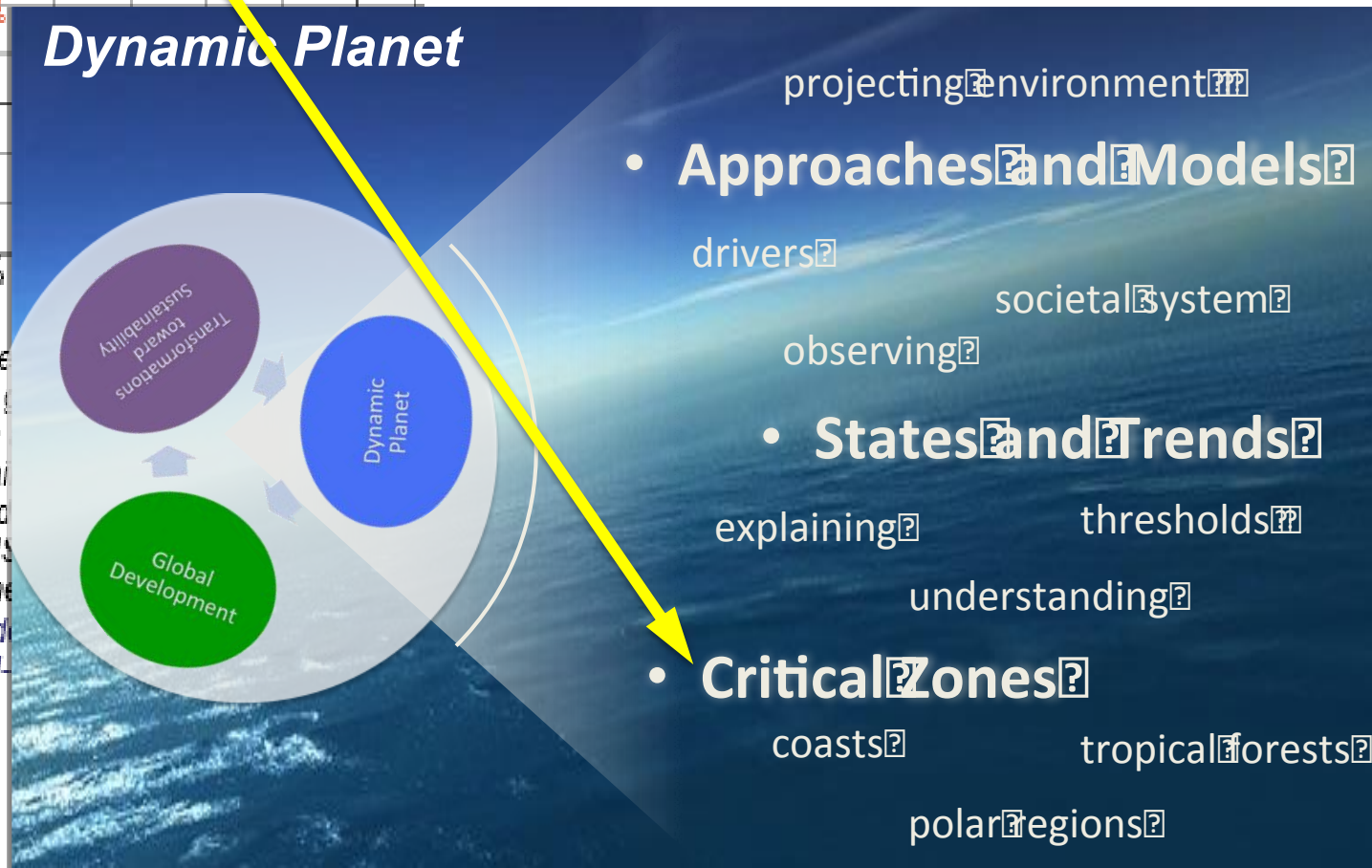
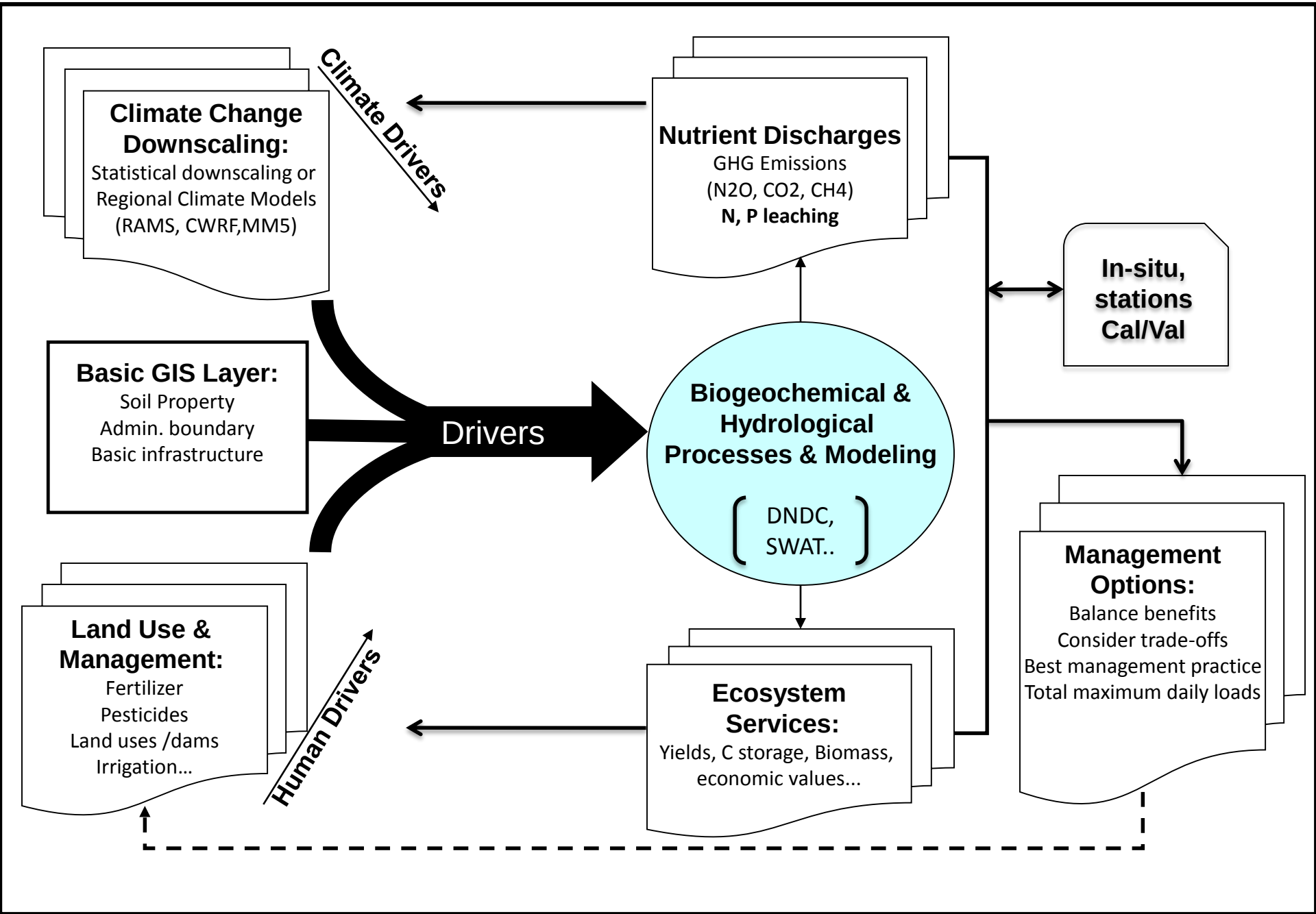


Figure B5.2: Global me
Documentation of this
been possible through
within USGCRP to mai
observing systems and
partnerships among US
and international partne
(http://sealevel.colorad
global-mean-sea-level-
signals-removed).

Coastal regions are very critical and vulnerable!

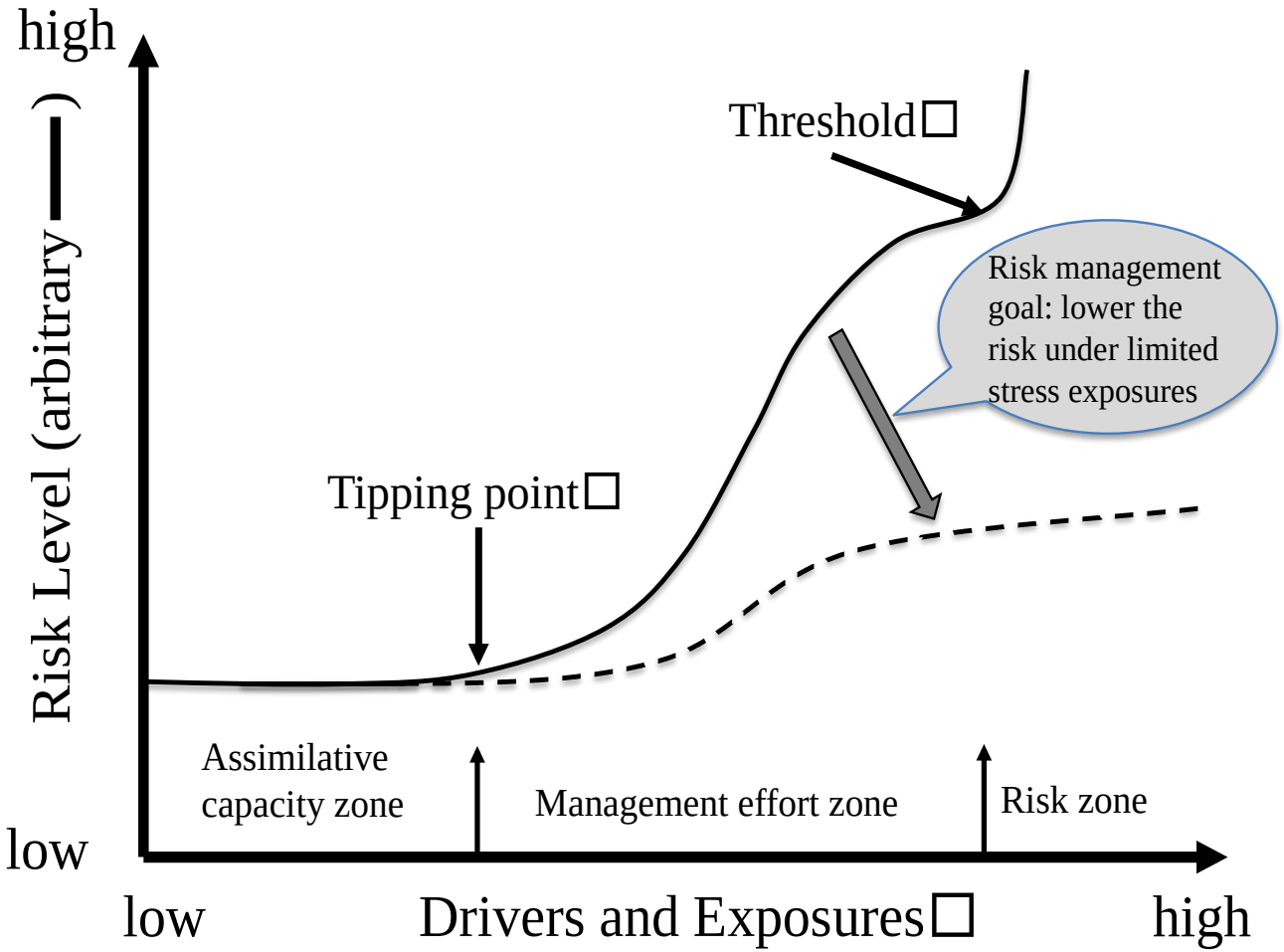


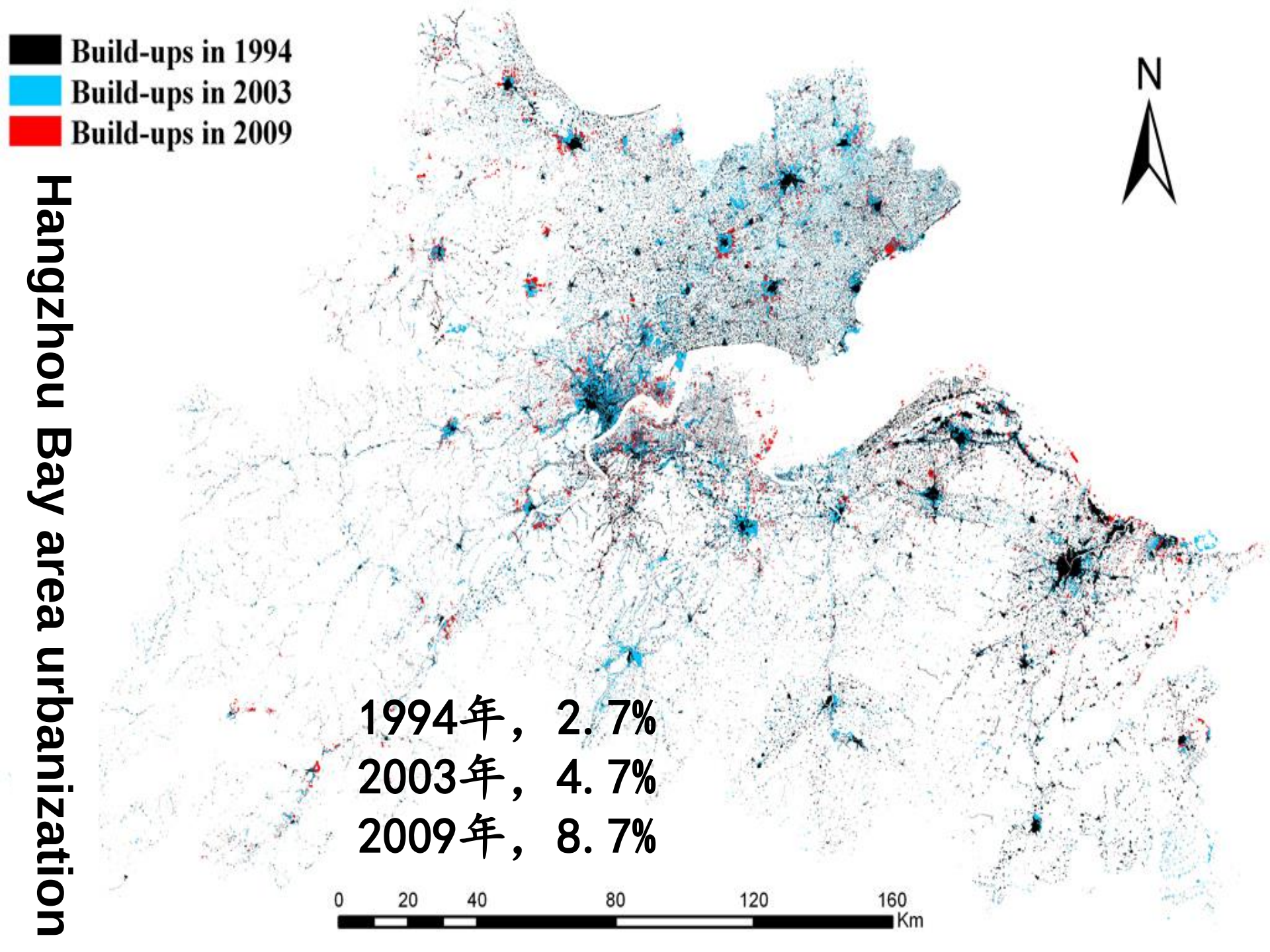
Quantifying risks through modeling – training



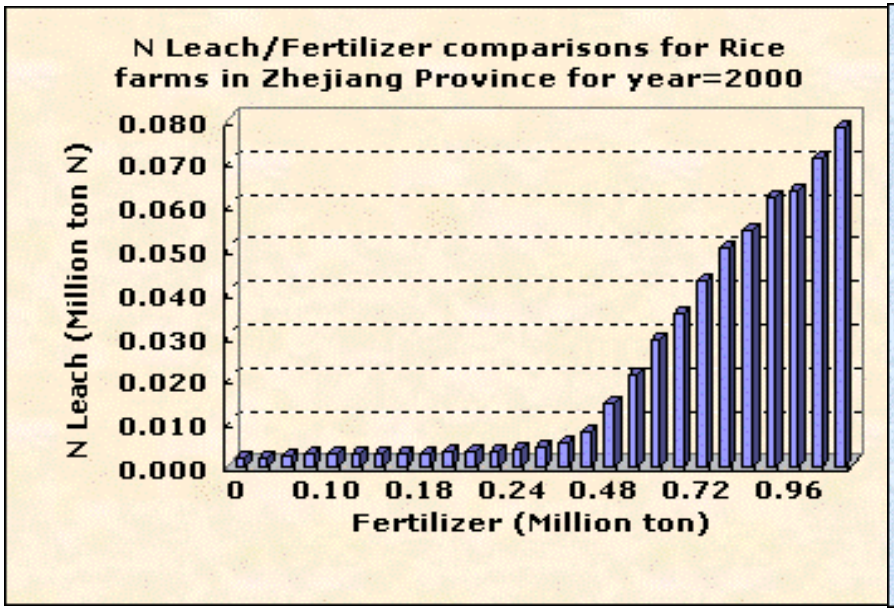
Key ideas

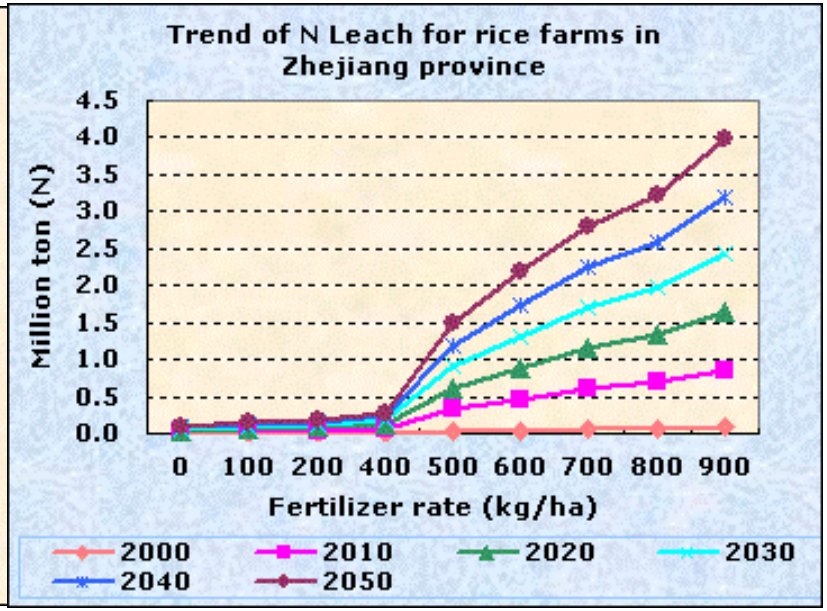
- Tipping points (Thresholds)
- Intensity (rate)
- Frequency
- Duration
- Extent



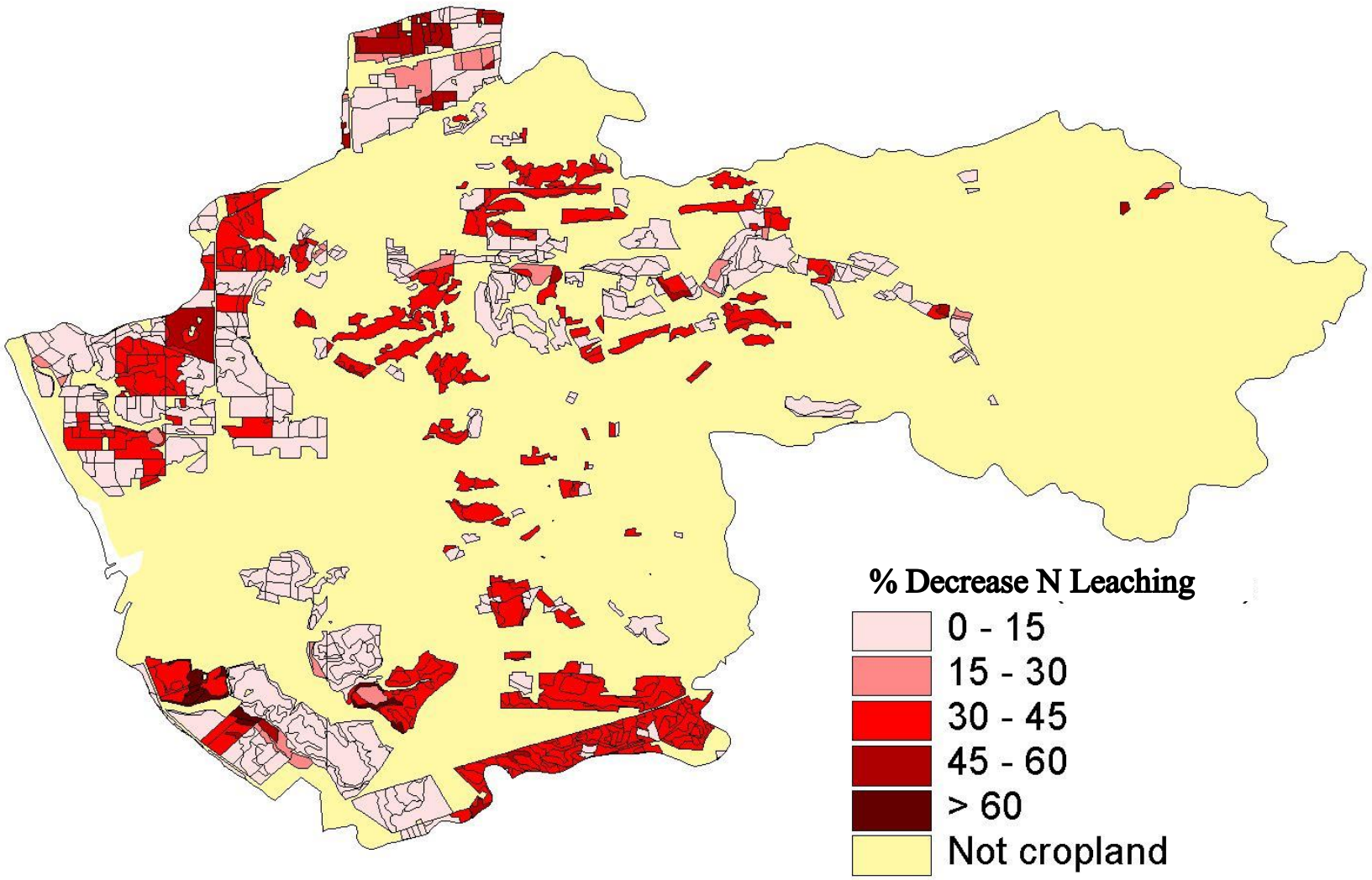

Build-ups in 1994
Build-ups in 2003
Build-ups in 2009
N
Hangzhou Bay area urbanization
1994年，2.7%
2003年，4.7%
2009年，8.7%
0
20
40
80
120
160
Km

N Leached from paddy rice fields





BMP vs Baseline Nitrogen Leaching



William Salas, AGS LLC

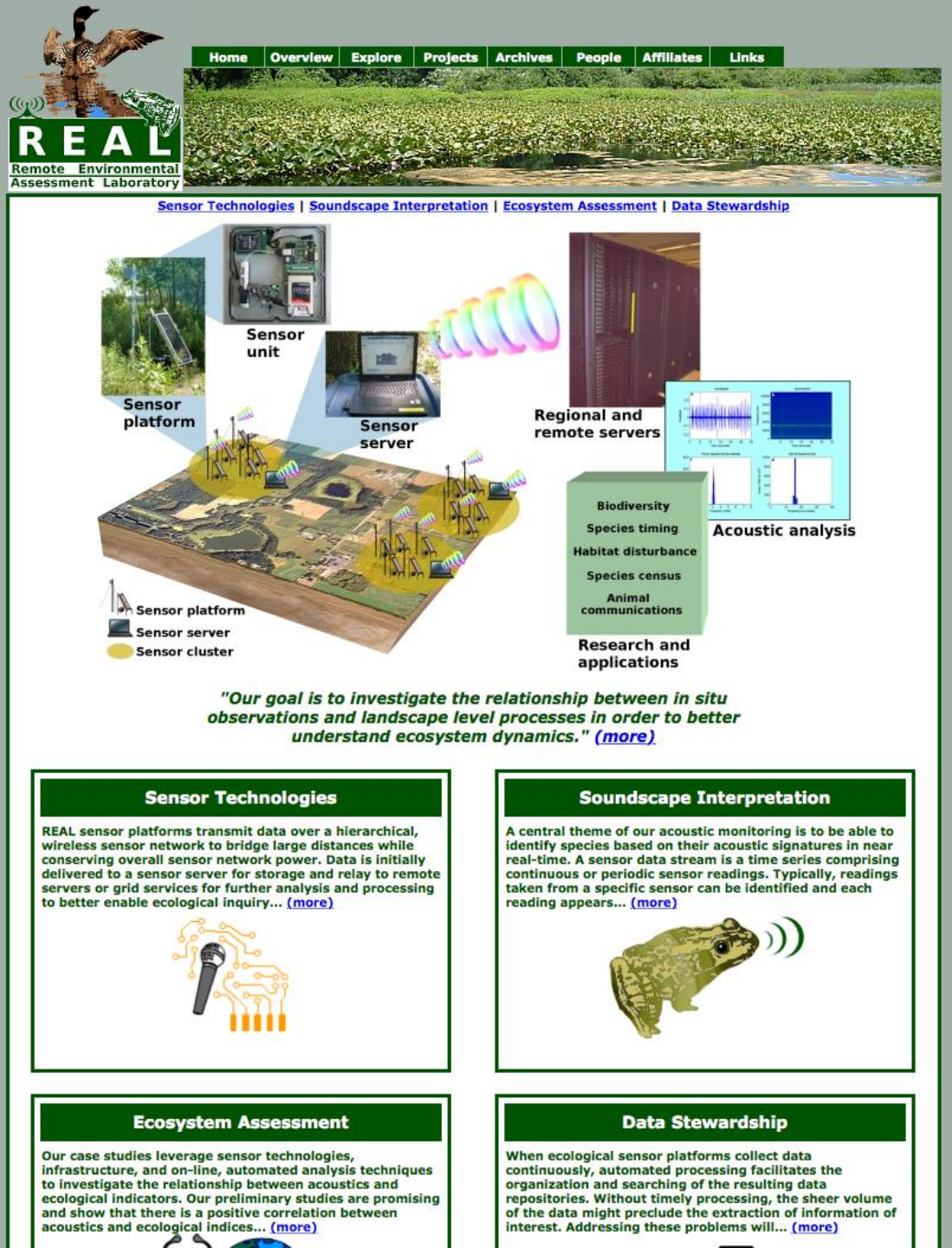
Impacts of Baseline vs. BMP Scenarios on N_2O Emission and Other C and N Fluxes from a Tomato Field in Davis, CA

	Baseline	BMP	Change rate
N_2O (kg N/ha)	5.9	2.7	-54%
NH_3 (kg N/ha)	4.4	2.1	-52%
N leaching (kg N/ha)	56	21	-63%
Crop yield (kg DM/ha)	3718	3710	-0.2%
dSOC (kg C/ha)	-1470	-1472	+0.1%

William Salas, AGS LLC

REAL – Remote Environmental Assessment Lab

- Stuart Gage
- Jiaguo Qi




Jiangsu
Shanghai
上海市
Suzhou
苏州市
Jiaxing
嘉兴市
Cixi
慈溪市
Questions?
北仑区
Fenghua
奉化市
Xiangshan Harbor
象山港
Xiangshan
象山县
Huangdun Harbor
黄墩港
Xinqiaozhen
新桥镇
Liyangzhen
力洋镇
Ninghai
宁海县
Changjiezhen
长街镇
Liyang Harbor
Dingtangzhen
Tongtou Island