Technology Opportunity – Inspiring New Ways to Protect Nature for the Benefit of Humanity

Peter Seligmann
CEO + Chairman
Conservation International

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CI Mission

Built upon a strong foundation of science, partnership, and field demonstration, CI empowers societies to responsibly and sustainably care for nature for the well-being of humanity

Using **Technology** to Maintain **Ecosystem Health** and Services

Sandy Andelman, Ph.D
Vice President
Conservation International

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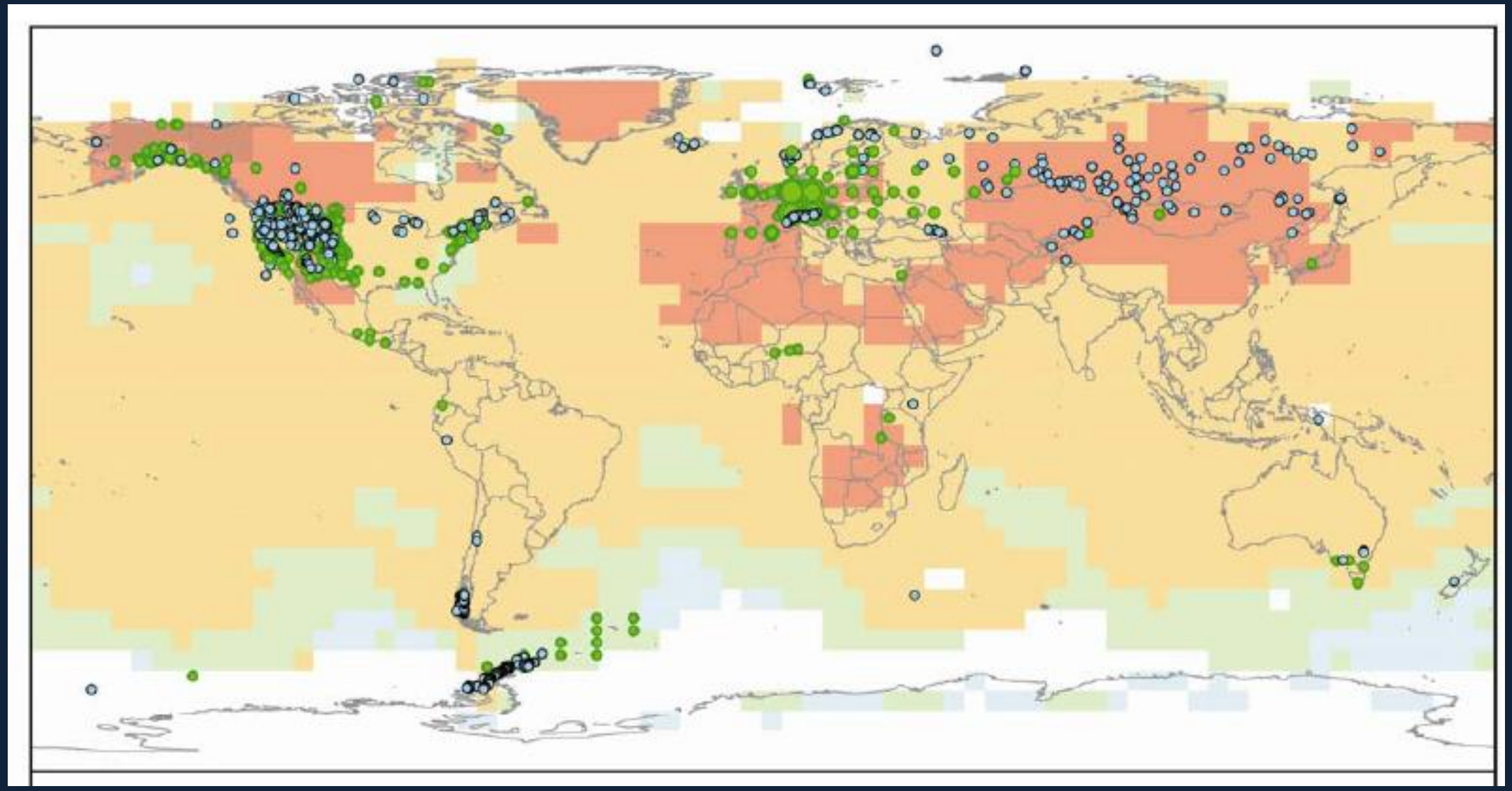

Inadequate monitoring and understanding of ecological change

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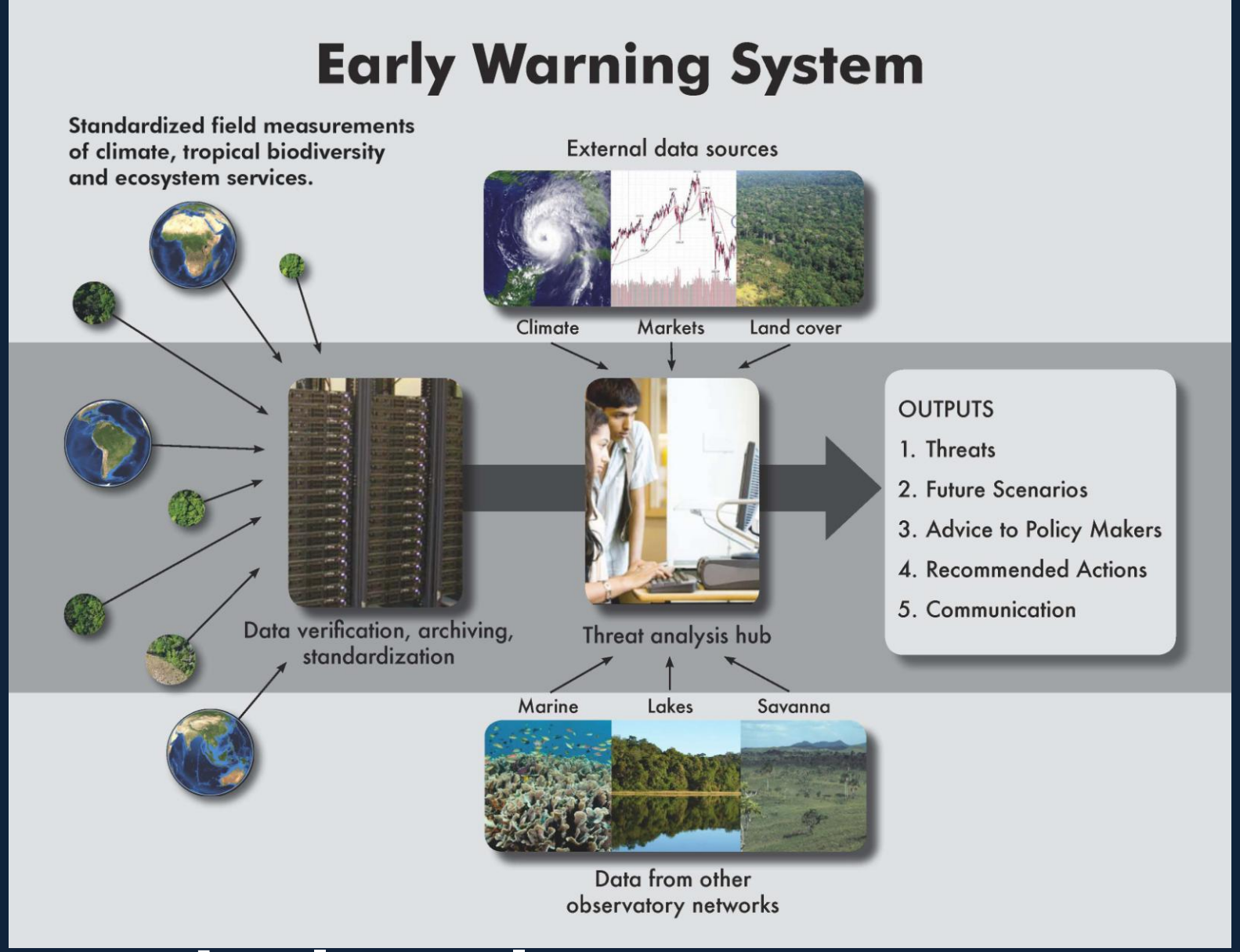

Tropical Ecology, Assessment & Monitoring Network

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- **Climate sensors**
- **Camera traps**
- **Acoustic sensors**
- **Soil sensors**
- **“Human sensors”**

Varying levels of connectivity

Sensor Arrays - CENS, UCLA

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Architecture – CALIT2/SDSC

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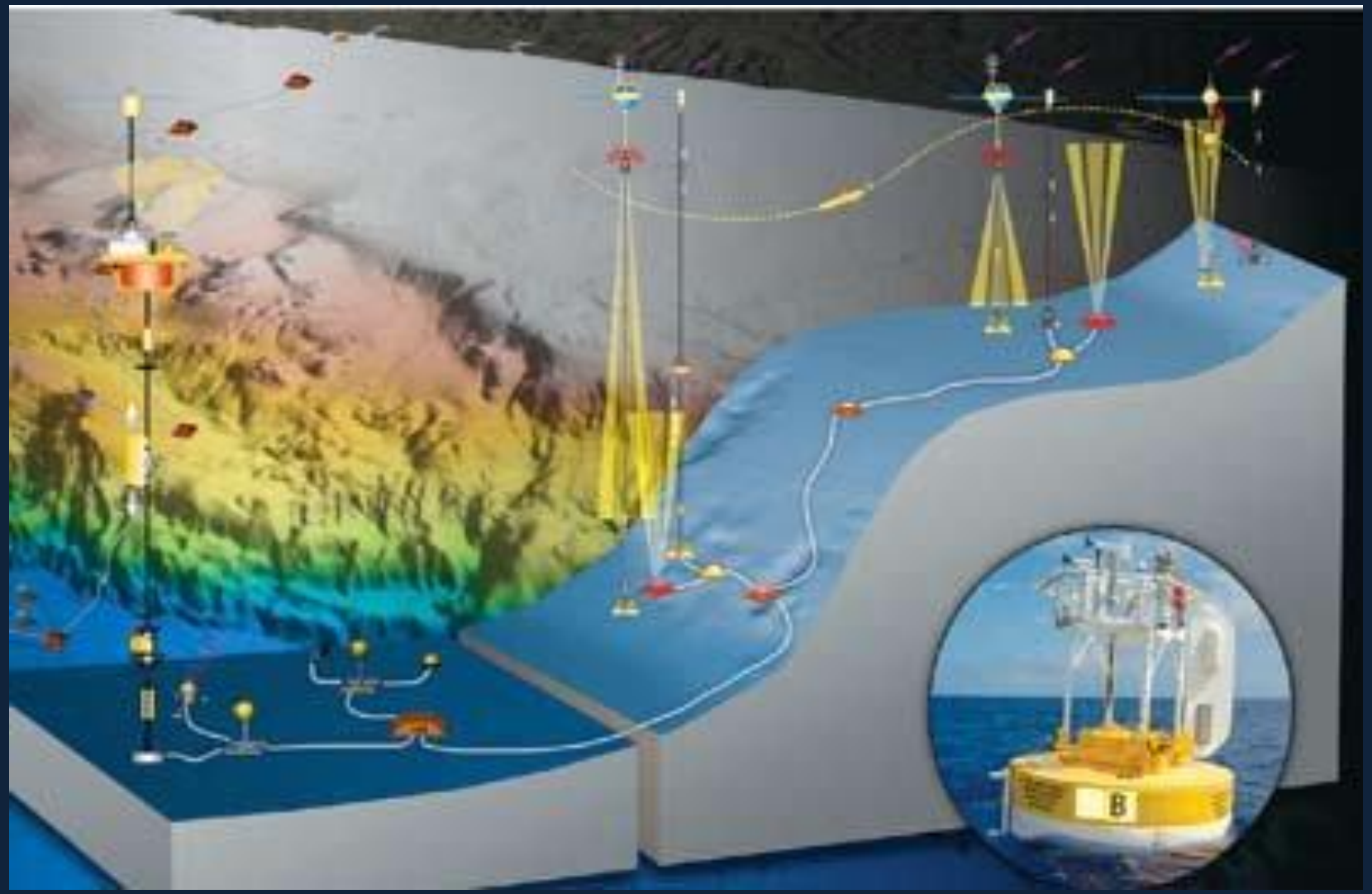

Needs: Scientific Workflow Tools

(e.g., Project Trident, *Roger Barga et al.)*

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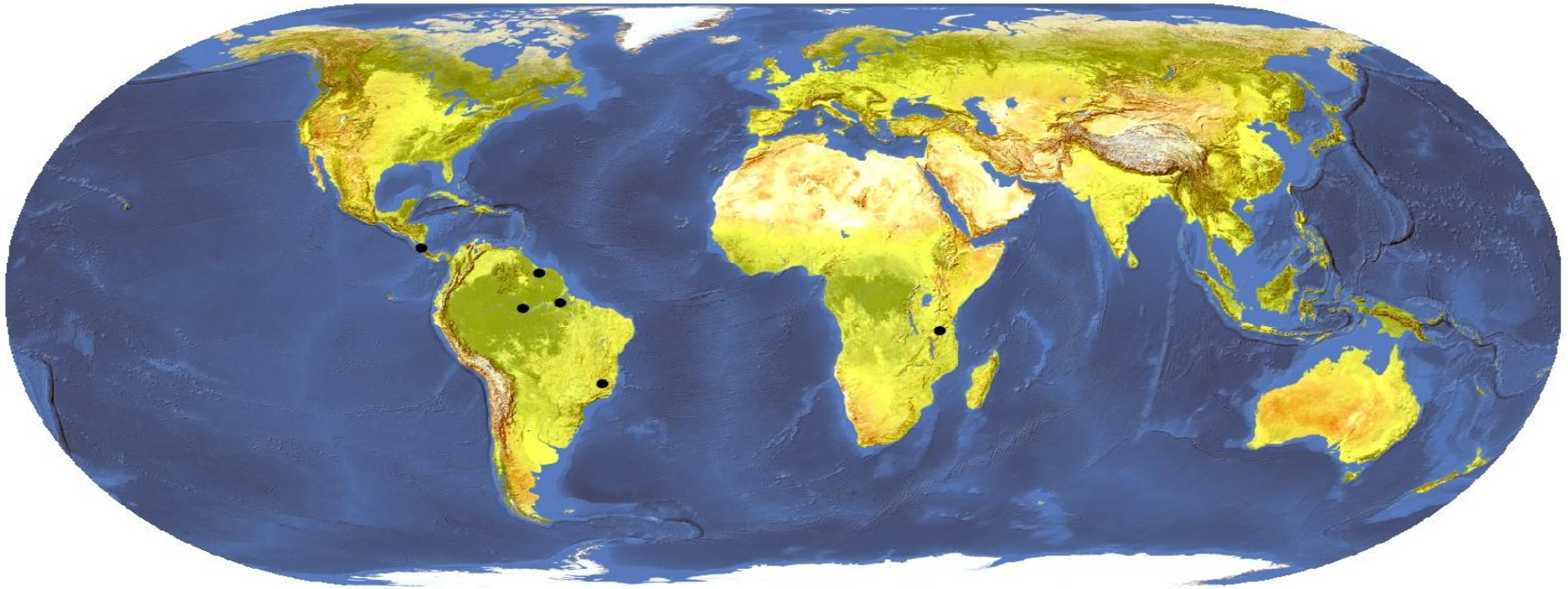
June 2008



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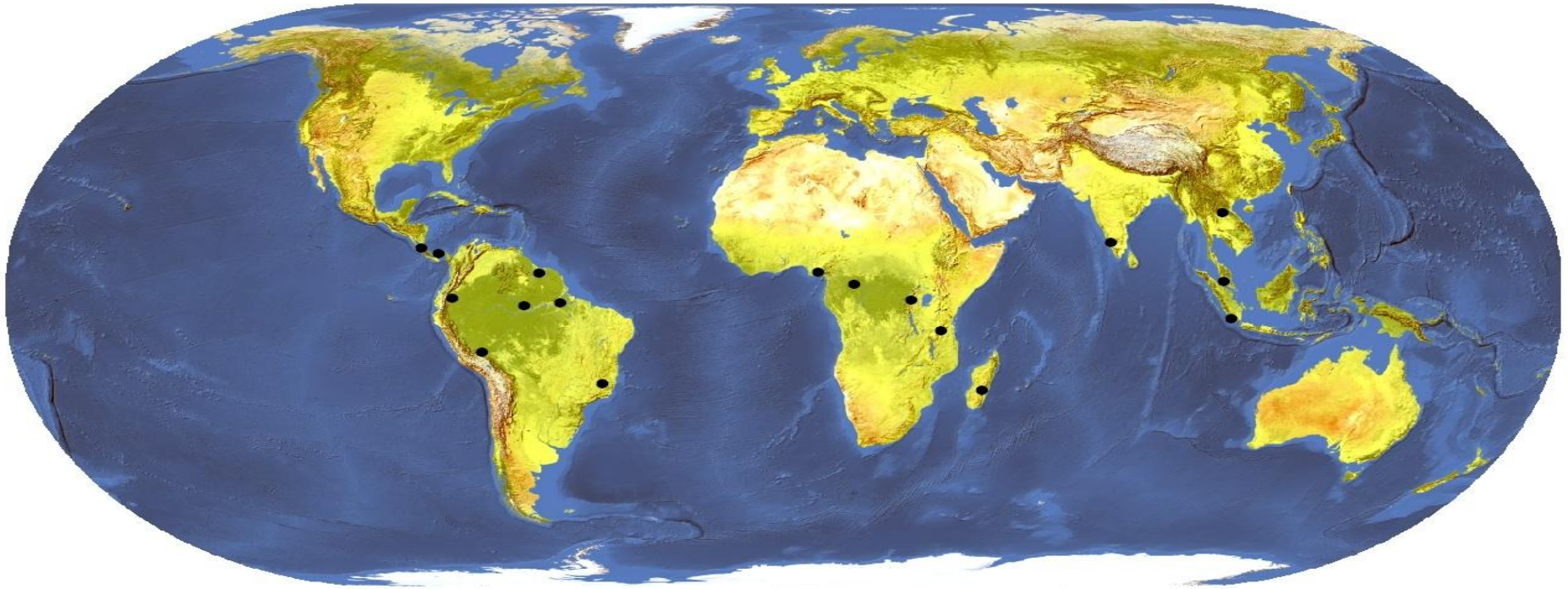
June 2009



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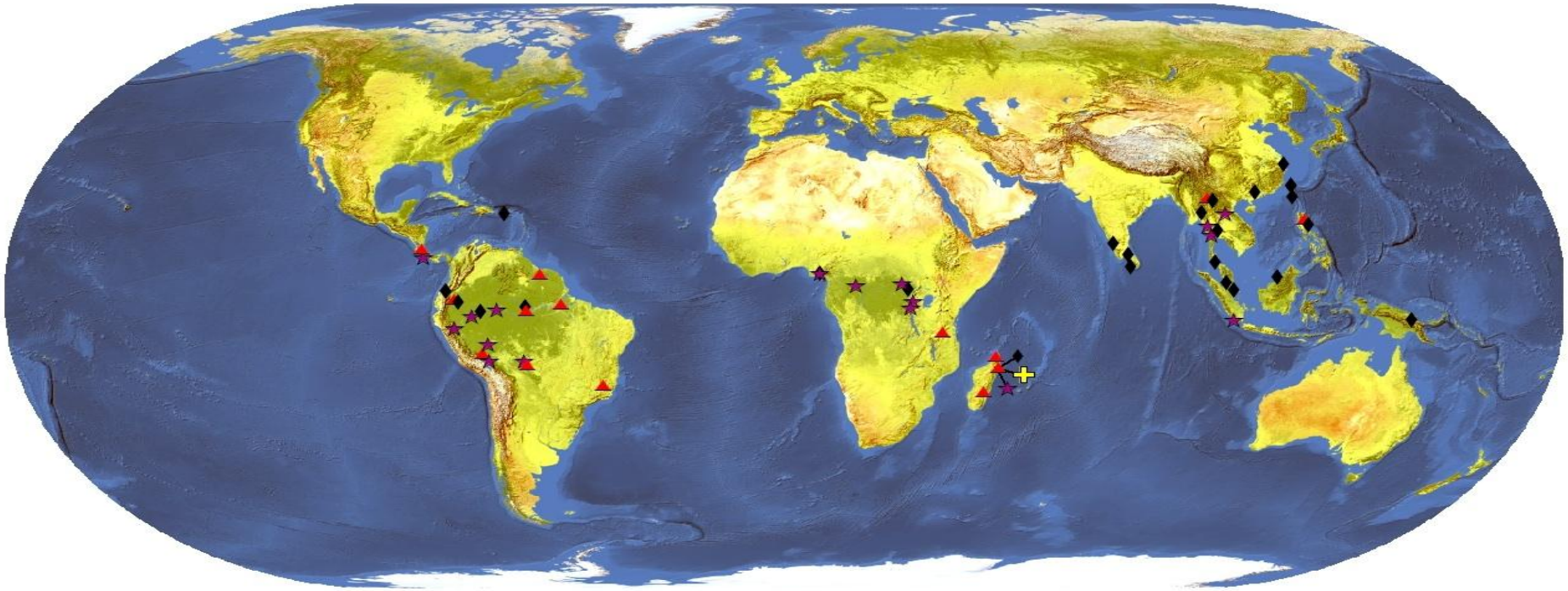
June 2010



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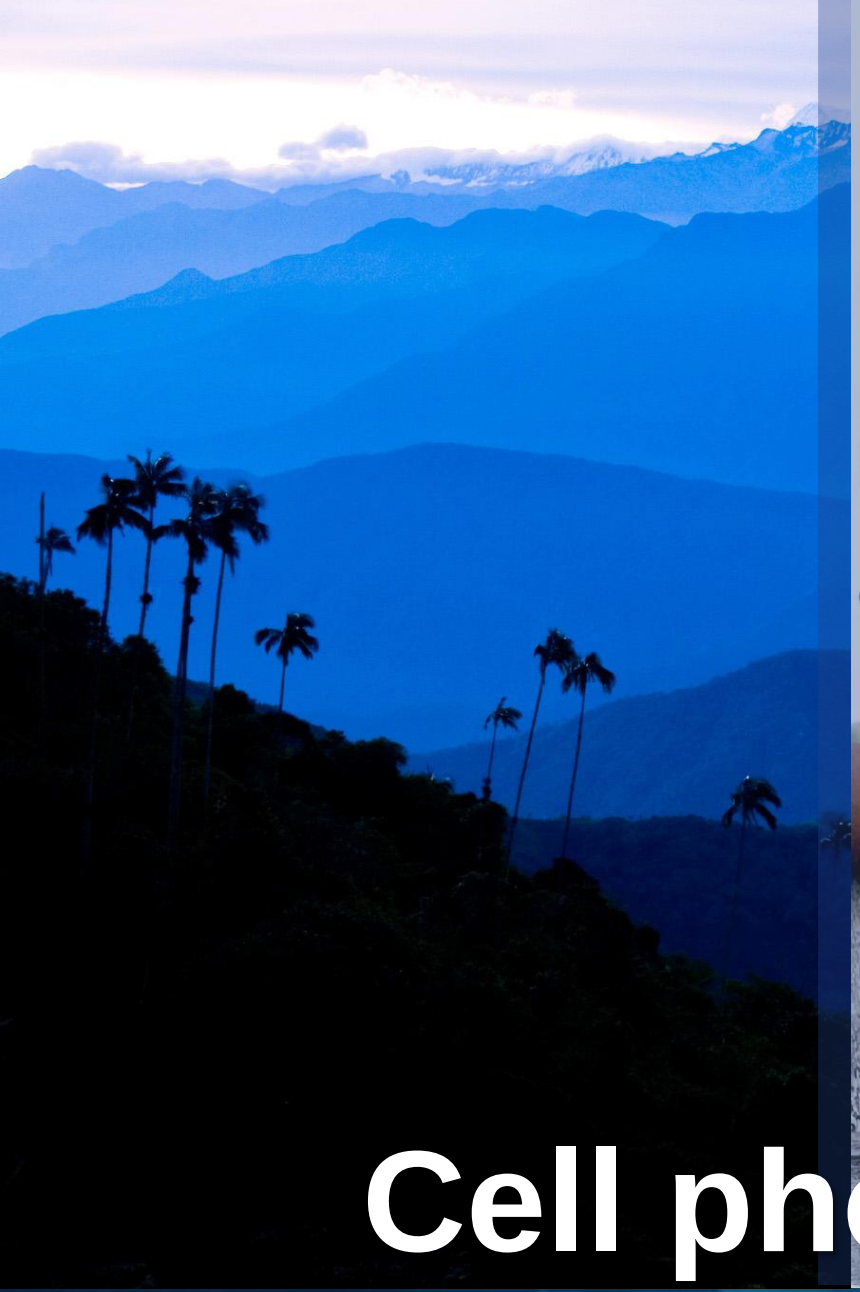

Cell phones as platform for ecosystem **health**

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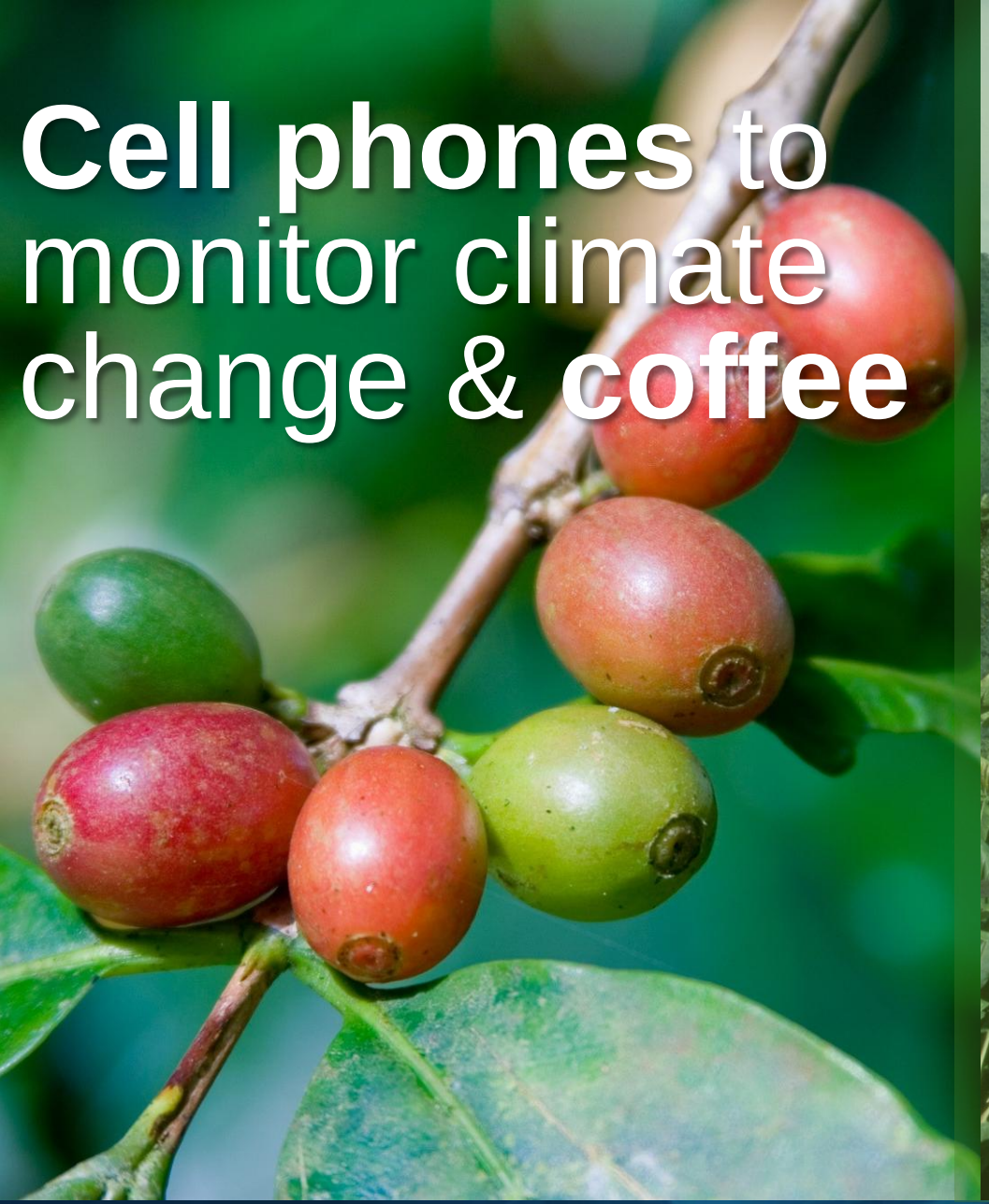
Mobile as the platform for:

- Participatory data collection
- Near real time mapping of global issues
- Local-scale impact and audit

Feedback to users:

- Fire alert system
- Fire risk / Forest flammability
- Flood alert system
- Agricultural drought alert
- Illegal logging alert
- Encroachment on protected areas

Cell phones to monitor climate change & **coffee**



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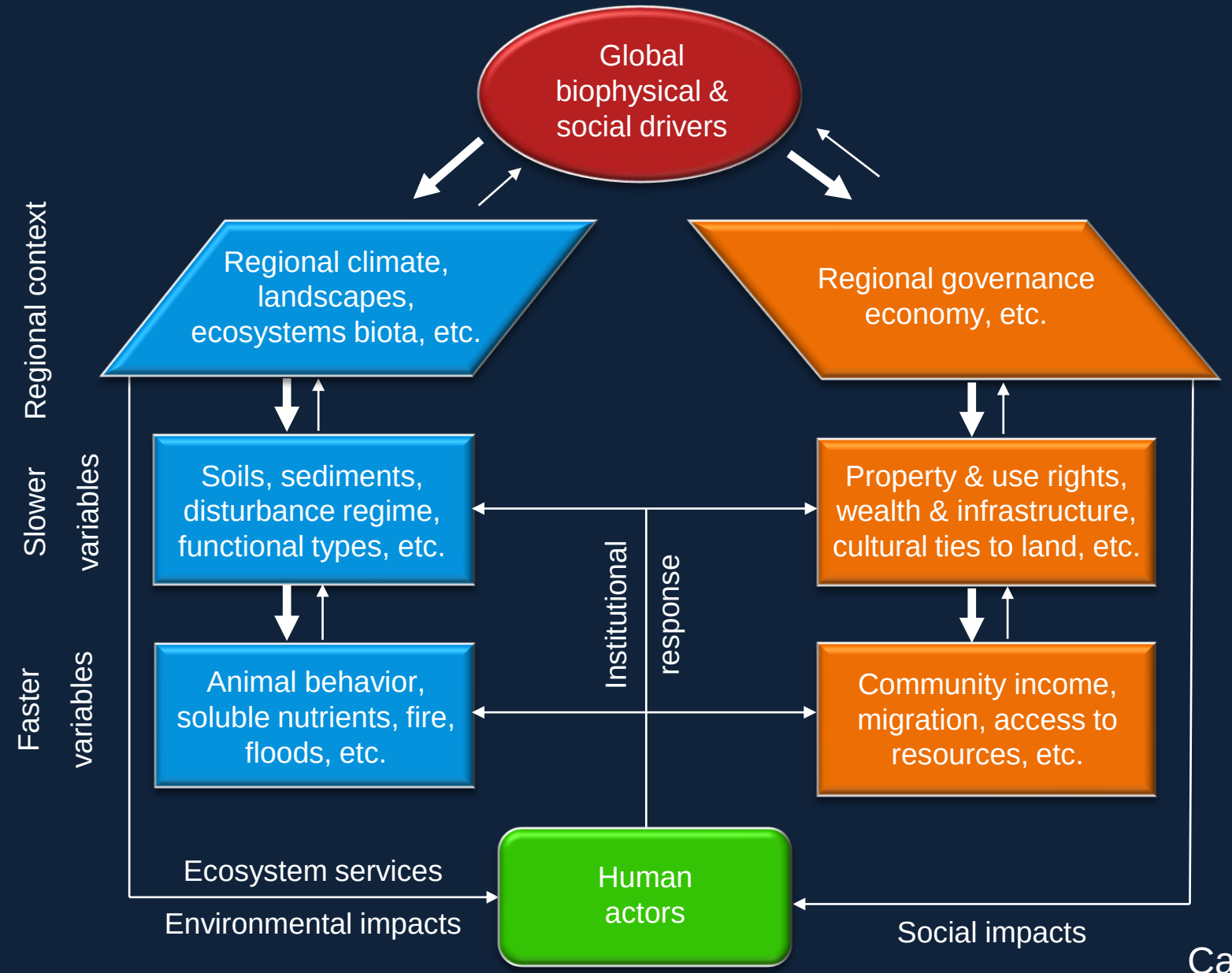
1 billion people are moving from poverty into the middle class in China

500 M people will move from rural to urban areas by 2020



Carpenter et al. 2009

Decision support tools

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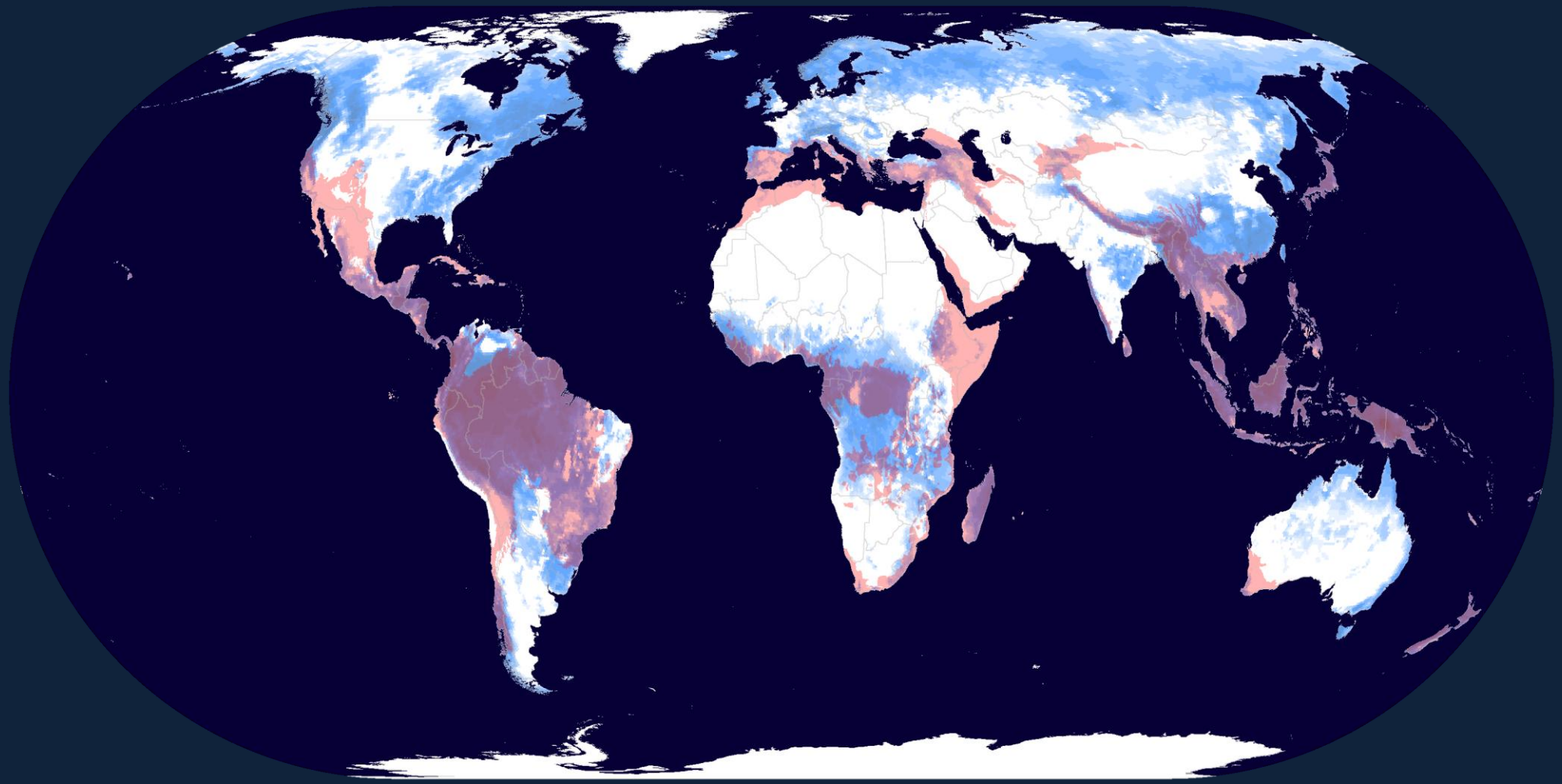
Potential Fresh Water Sources



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Water

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China - Mekong River

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Cambodia: Lake Tonle Sap

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Tonle Sap

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Key questions:

Forecasting

- How will land use change affect the provision, flows, benefits and values of ecosystem services?
- Where are critical areas for water flows for human uses?
- What will be the effects of climate change on water and food security?

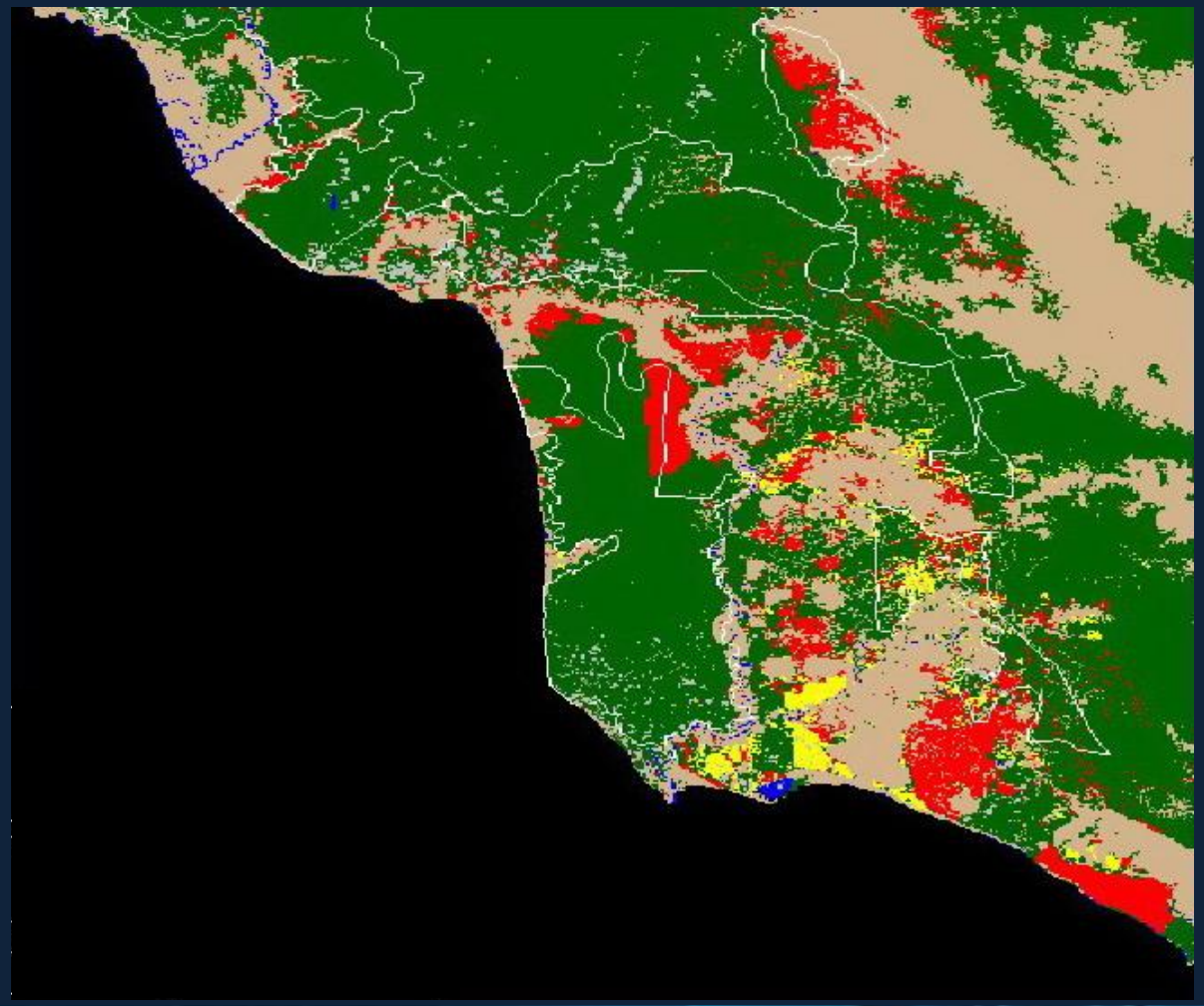
Conservation planning

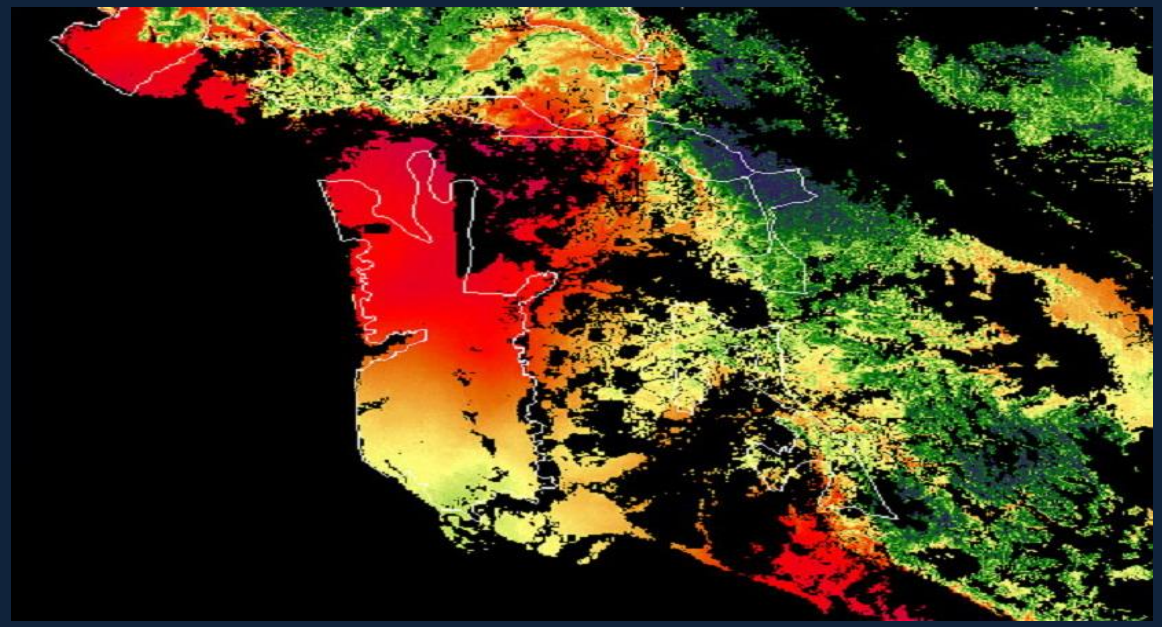
- Where is it most efficient and cost-effective to invest in conservation for the combined provision of biodiversity and important ES?

Policy optimization

- What policy tools are likely to be most effective for the maintenance of ES and the minimization of environmental impact?
- How are opportunity costs distributed?
- How are probabilities of land conversion distributed?
- How are liabilities distributed?

- ARIES
- IBAT
- OSIRIS
- CONSVALMAP





Conservation International Decision Support Tools

The ARIES Project

Artificial Intelligence for Ecosystem Services

- Gund Institute for Ecological Economics
  - Ferdinando Villa, Marta Ceroni, Sergey Krivov, Josh Farley, Kenneth Bagstad, Gary Johnson
- Conservation International
  - Rosimeiry Portela, Miroslav Honzak
- Earth Economics
  - David Batker
- National Science Foundation

ARIES in a nutshell

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- Rapid assessment toolkit for ecosystem services and their values; not a single model but an intelligent system that customizes models to user goals
- Mapping process for ecosystem service provision, use, and flow
- Probabilistic Bayesian models inform decision-makers of likelihood of all possible outcomes; explore effects of policy changes and external events
- Web based, customizable for specific user groups, geographic areas and policy goals; custom tools implement specific “bottom line”

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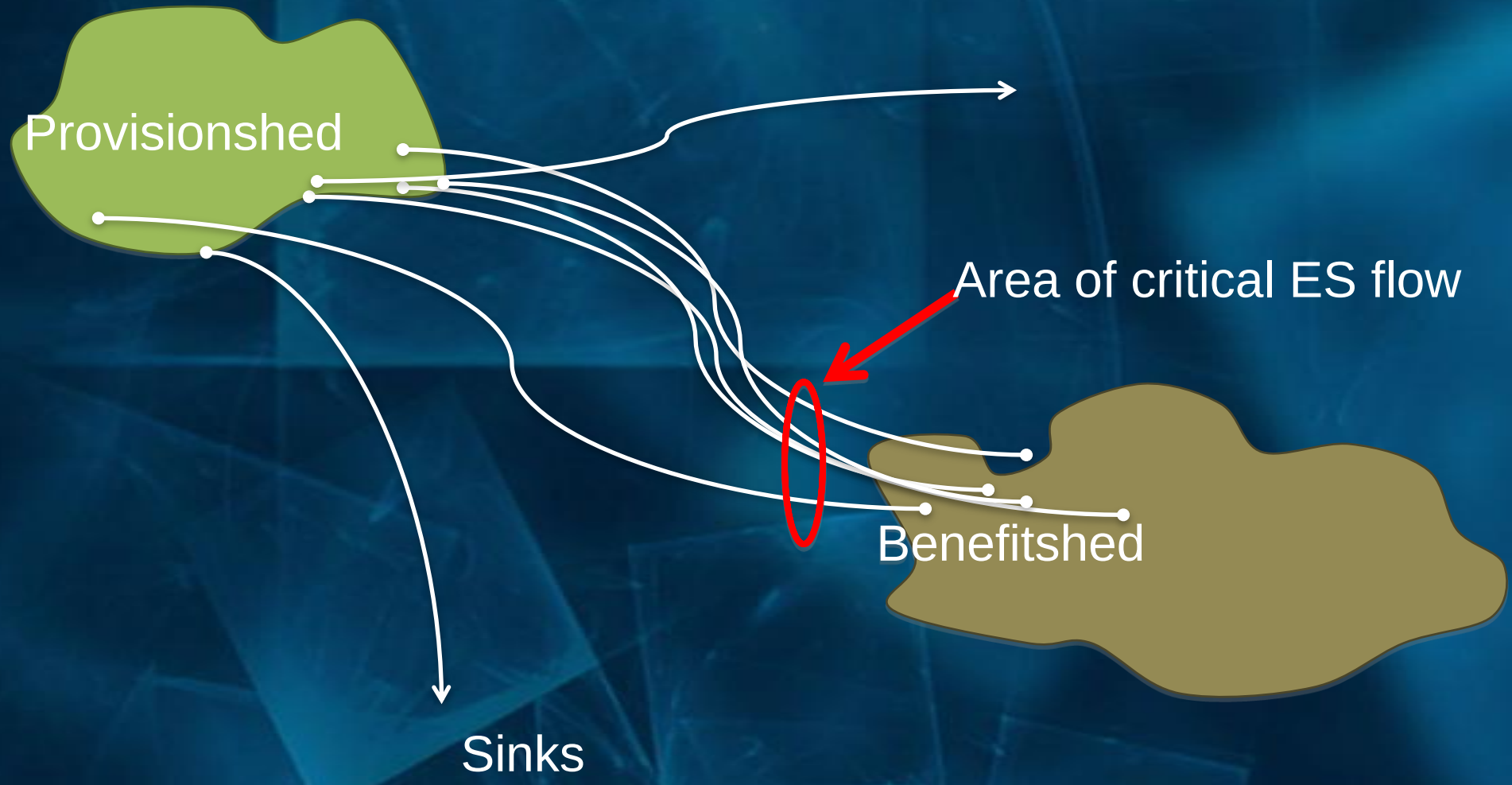
Five elements of modeling in ARIES



What Next: Interactive Models to Forecast Changes in Ecosystem Health and Services

- Interactive workflow systems for transparent, repeatable processing of large, complex data sets and algorithms
- Visualization tools to enable decision makers and society to understand complex information
- Integration of interactive models to forecast future states of ecosystem services and health

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Climate Change

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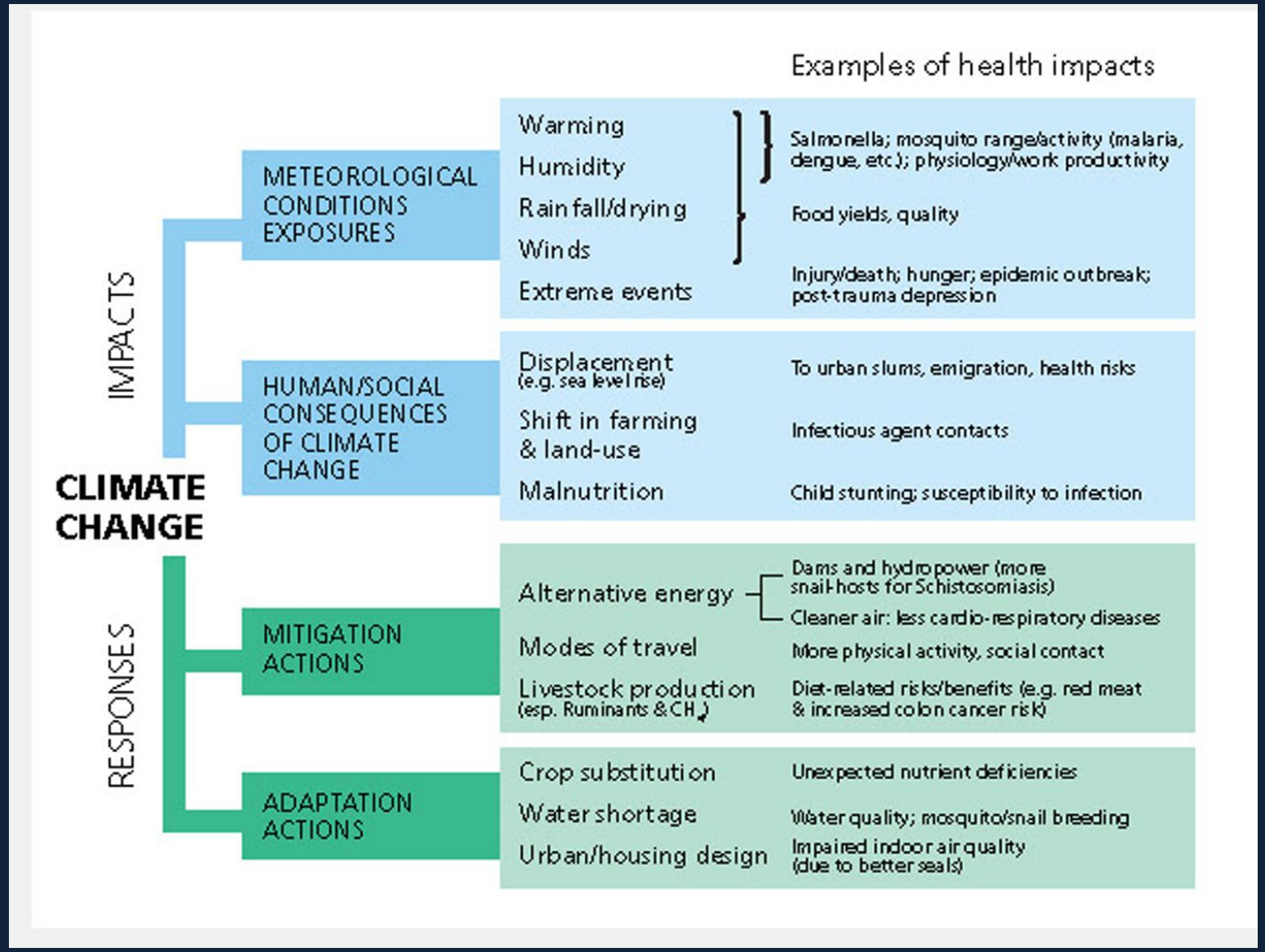

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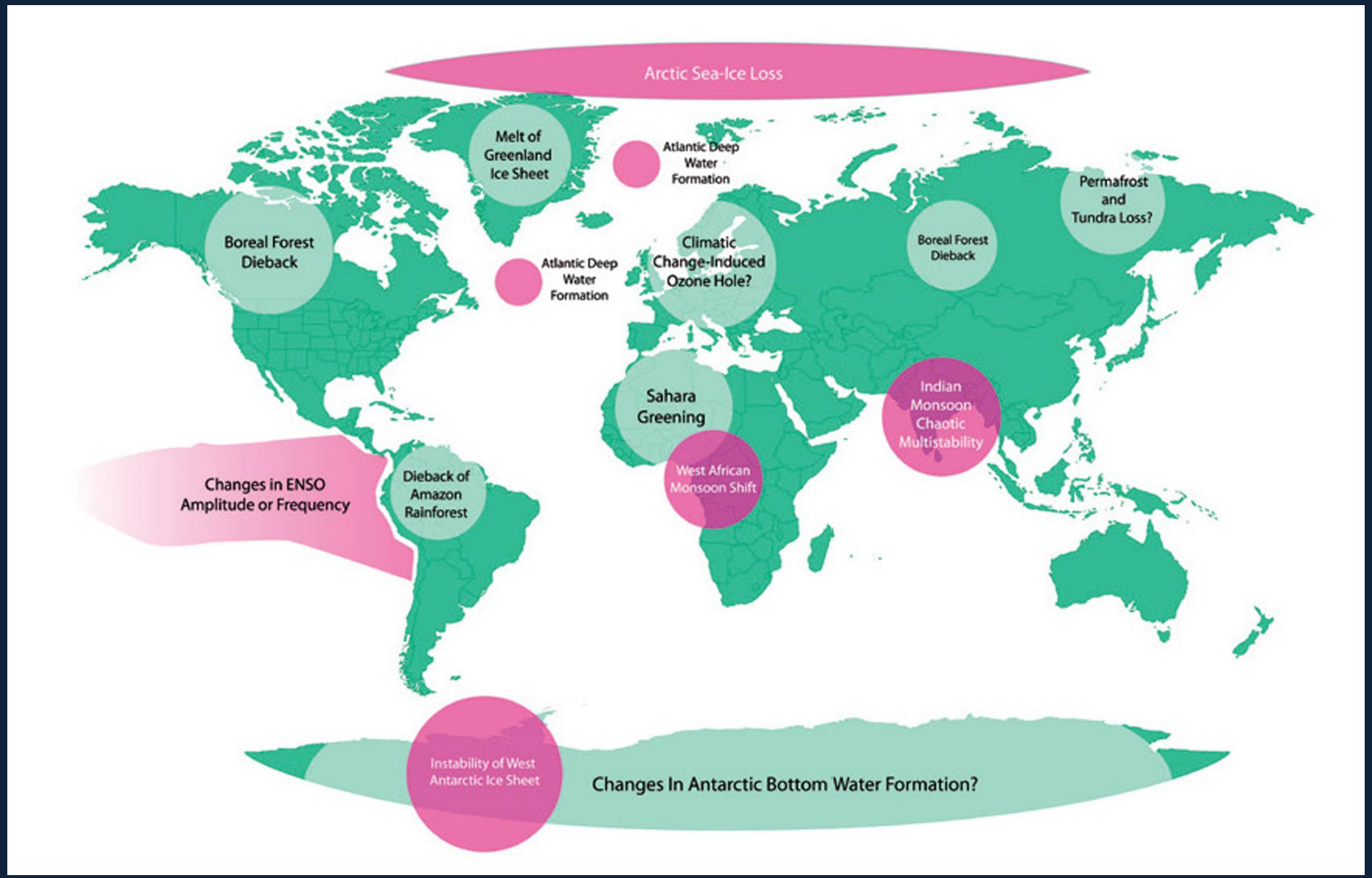

Tipping Points

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Key Concepts in REDD

Reduced Emissions from Deforestation & Degradation

- Additionality
- Reference Scenario
- Leakage

Deforestation carbon emissions / year =
Area cleared / year x biomass removed / unit area

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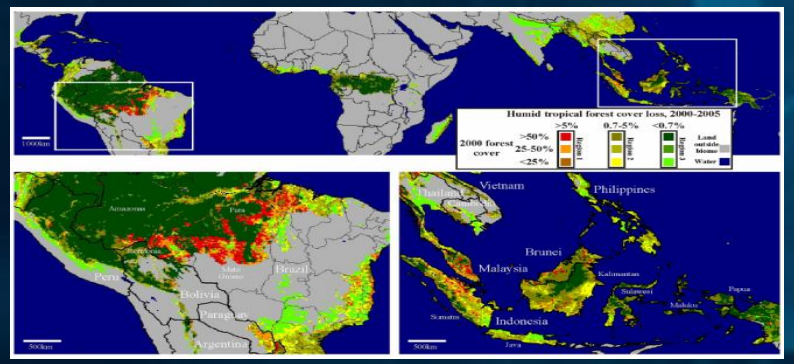
PAN-TROPICAL



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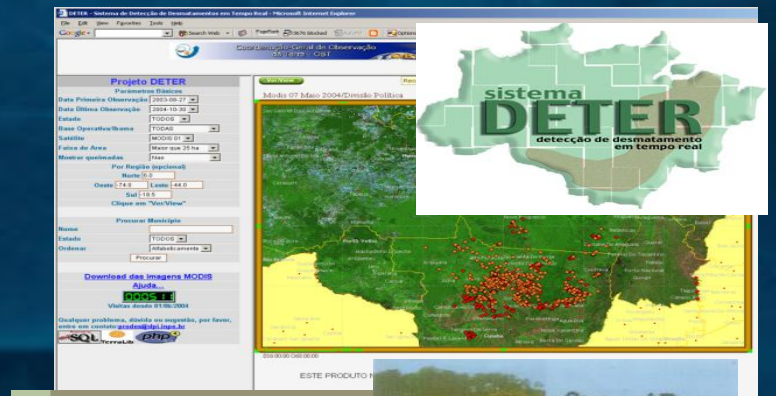
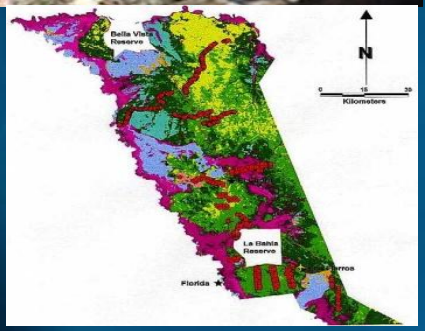


PROJECT



Methods are in-hand to measure changes in forest area at pan-tropical, national, and project levels

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DeFries 2009

Deforestation carbon emissions / year =
Area cleared / year x biomass removed / unit area

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DeFries 2009

Initial Emissions + Emissions from Decomposition − Carbon uptake through Regrowth

Need to know:

- original biomass
- emission factors for each component
- time scale of interest

Possible at project level but more difficult at national level

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	Project Level	National Level
Forest Area Change	✓ satellite and airborne	✓ satellite
Biomass	airborne and ground data	extrapolation only
Emission factor (initial fire, decay, uptake)	modeled; field measurements	modeled

Degradation is harder

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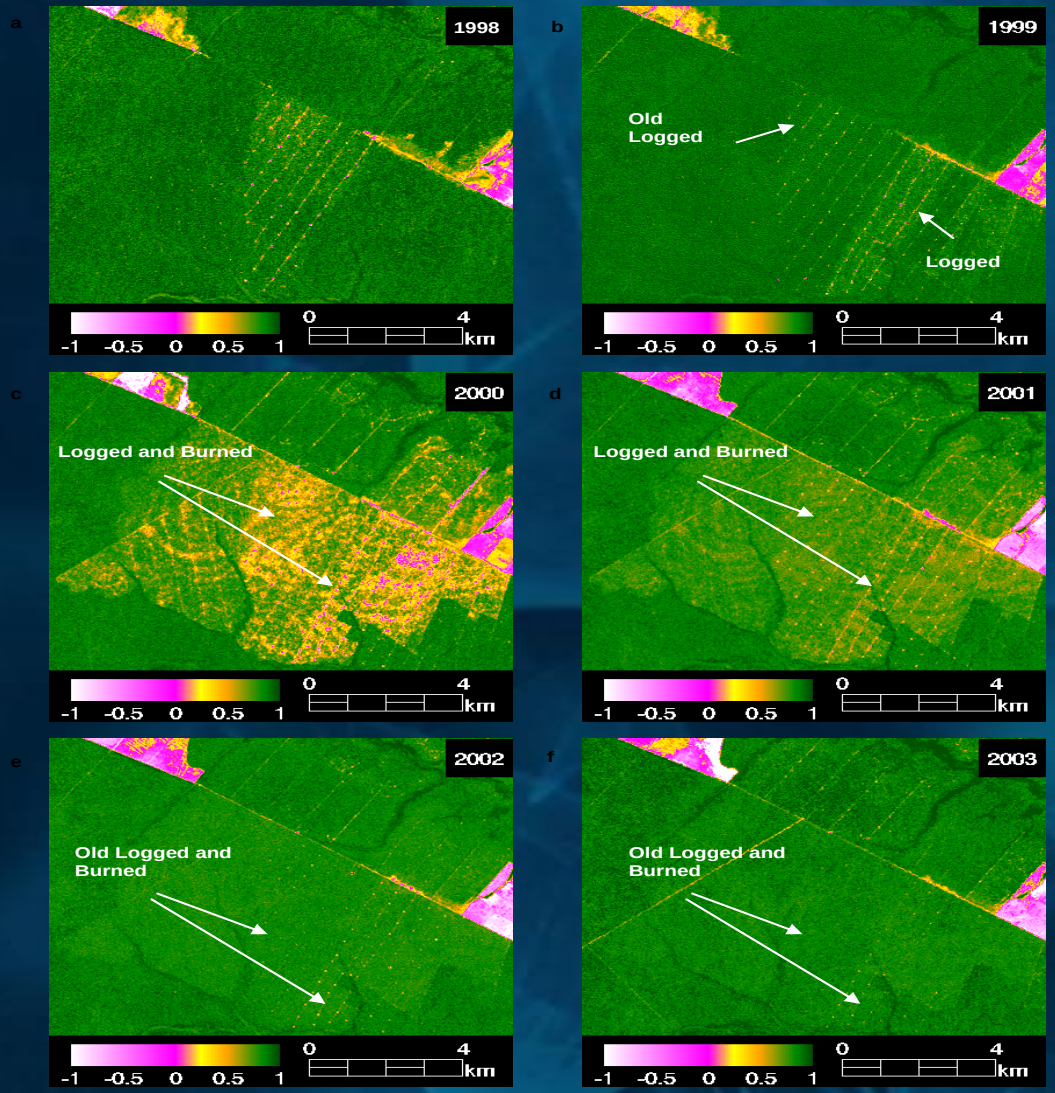

Logging in southern Amazon from satellite

Burned peat in central Kalimantan

DeFries 2009

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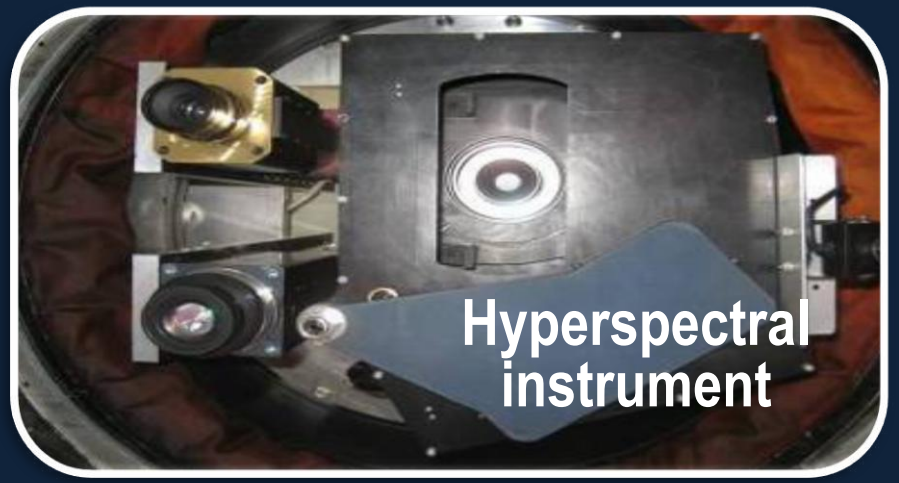
Integrated Multi-Resolution Monitoring

"EcoHawk"

"Eco-sensors"



Northrop Grumman

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Technology for managing, processing & visualizing data – establish baselines; visualize change

Knowledge Integration Centers – interpret complex information at scales relevant to particular user groups

4 Areas Where Technology Would be Transformational

- Cell Phone Platform for Ecosystem Health
- Workflow Tools
- Decision Support Tools & Integrated Modeling Platforms for Forecasting Change
- Technology to Support Climate Policy & Adaptation

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