



***Making Puget Sound Work for People:
An Introduction to Ecosystem Services***

World Resources Institute
NOAA Fisheries
The Nature Conservancy

March 4, 2008



World Resources Institute

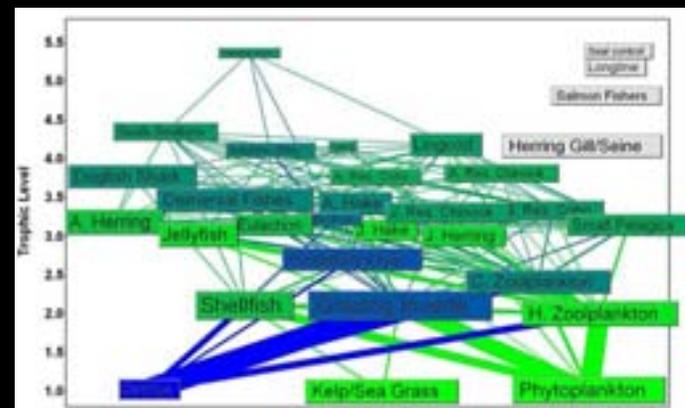
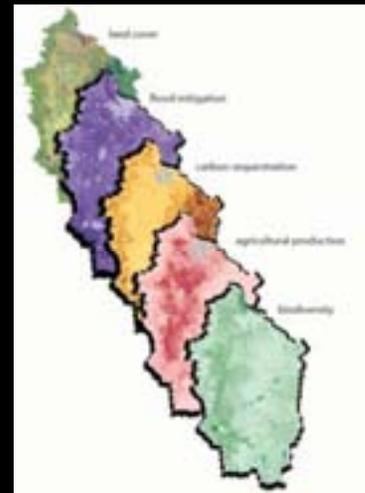
Protecting and Restoring Puget Sound's Natural Capital

How can the concept of ecosystem services help sharpen our objectives and prioritize our actions?



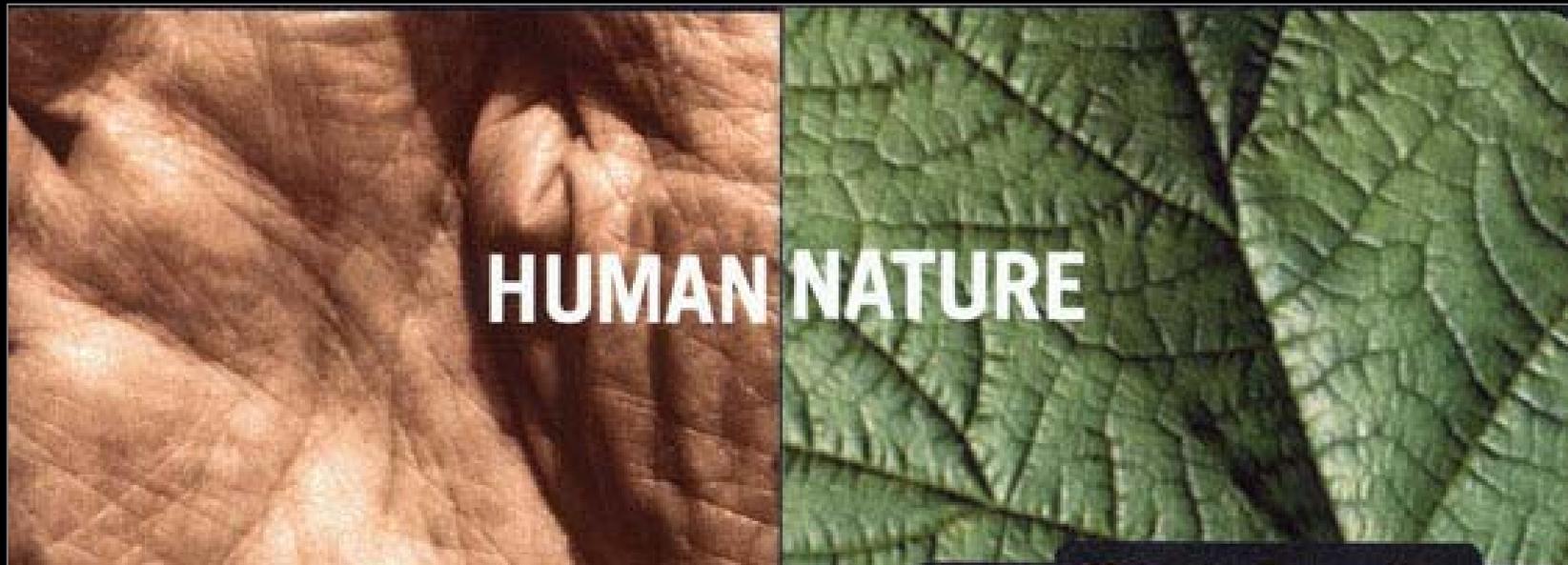
Protecting and Restoring Puget Sound's Natural Capital

- Mapping current ecosystem services (TNC)
- Understanding how ecosystem function affects services provided (NOAA Fisheries)
- Prioritizing ecosystem services and identifying strategies to sustain them (WRI)



World Resources Institute (WRI)

A non-profit environmental think tank
that transforms ideas into action
to protect the planet and improve people's lives



WRI has played a pivotal role in many environmental achievements

People and ecosystems

- Millennium Ecosystem Assessment
- Global Forest Watch
- Global Environment Facility

Climate and energy

- Greenhouse Gas Protocol
- U.S. Climate Action Partnership
- First carbon offset with AES (1989)

Sustainable enterprise

- Green Power Market Development Group
- New Ventures

Institutions and governance

- Partnership for Principle 10
- Access initiative

Workshop agenda

Introducing Ecosystem Services

The Ecosystem Services Approach

The Puget Sound Action Agenda



What is this?



\$6 billion

Water filtration plant



What is this?



www.magazine.noaa.gov

Storm protection system

What is this?



\$5.2 billion annu



3 categories of ecosystem services

Provisioning



Regulating



Cultural



What was the Millennium Ecosystem Assessment (MA)?

Largest assessment of health of ecosystems ever undertaken



Examined **links** between ecosystems and human well-being



Photo courtesy of USDA NRCS

Partnership of UN agencies, five conventions, business, and NGOs



VNU <www.vnu.com>

Provide **authoritative** source of information to decision-makers



Photo courtesy of USDA NRCS

1360 experts from 95 countries over 4 years; peer reviewed

What do we know about the status of the world's ecosystem services?

	<u><i>Degraded</i></u>	<u><i>Mixed</i></u>	<u><i>Enhanced</i></u>
<i>Provisioning</i>	Capture fisheries Wild foods Biomass fuel Genetic resources Biochemicals Fresh water	Timber Fiber	Crops Livestock Aquaculture
<i>Regulating</i>	Air quality regulation Climate regulation Erosion regulation Water purification Pest regulation Pollination Natural hazard regulation	Water regulation Disease regulation	Carbon sequestration
<i>Cultural</i>	Spiritual values Aesthetic values	Recreation & ecotourism	

What's driving ecosystem change?

Direct drivers Factors—natural or manmade—that cause changes in an ecosystem and its ability to supply services

Indirect drivers Factors that cause changes in one or more direct drivers

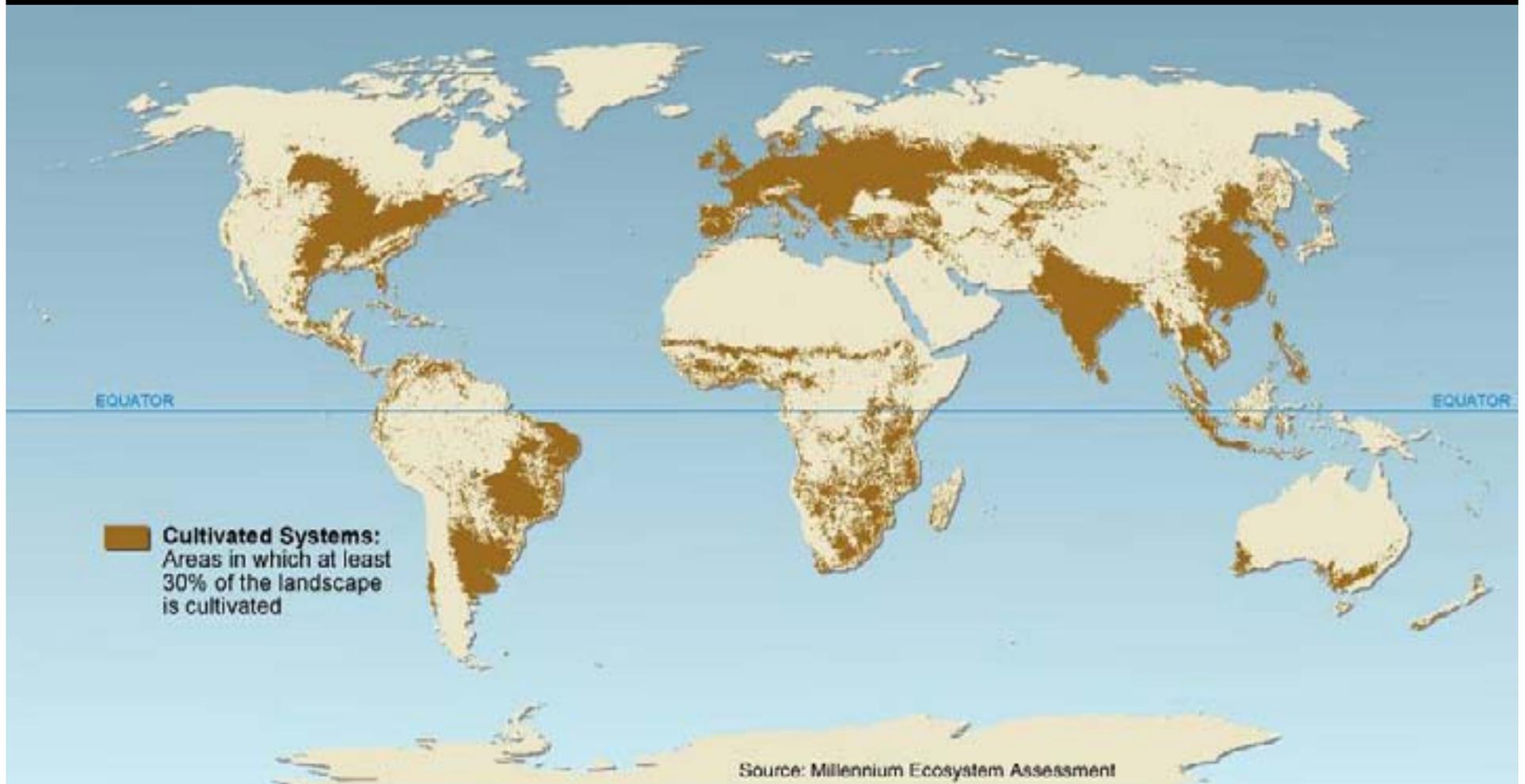


Direct drivers of ecosystem change

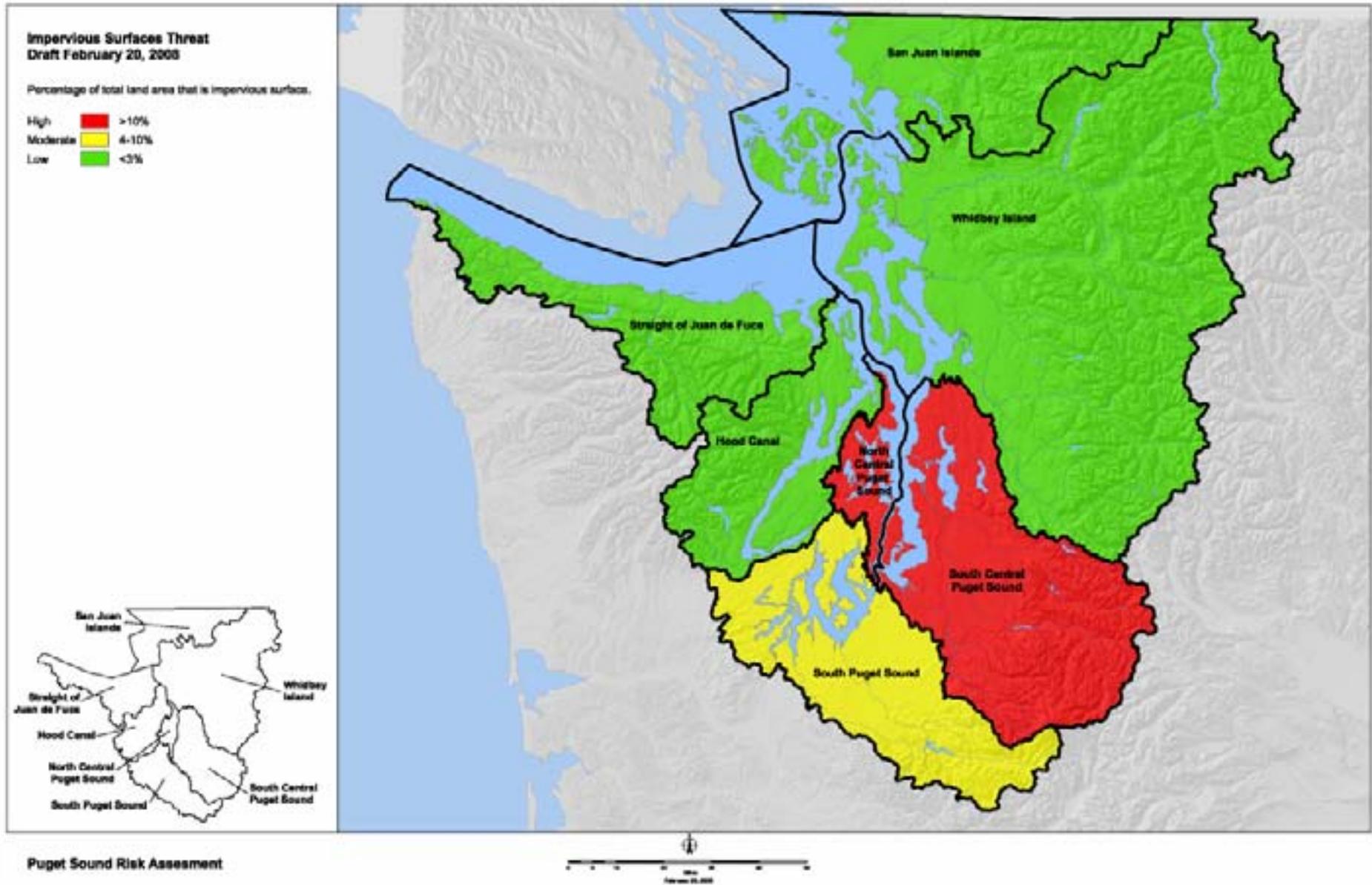
- Changes in land use
- Pollution
- Climate change
- Invasive species
- Overexploitation
- Other



Trends in direct drivers: changes in land use



Trends in direct drivers: changes in land use



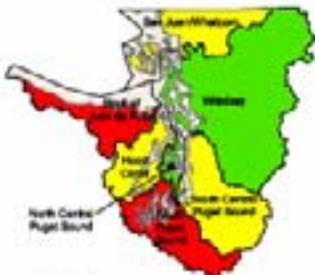
Draft

Change in Forest Cover Threat (1991 to 2001)
Subwatershed Scale (HUC 6)
Draft February 25, 2008

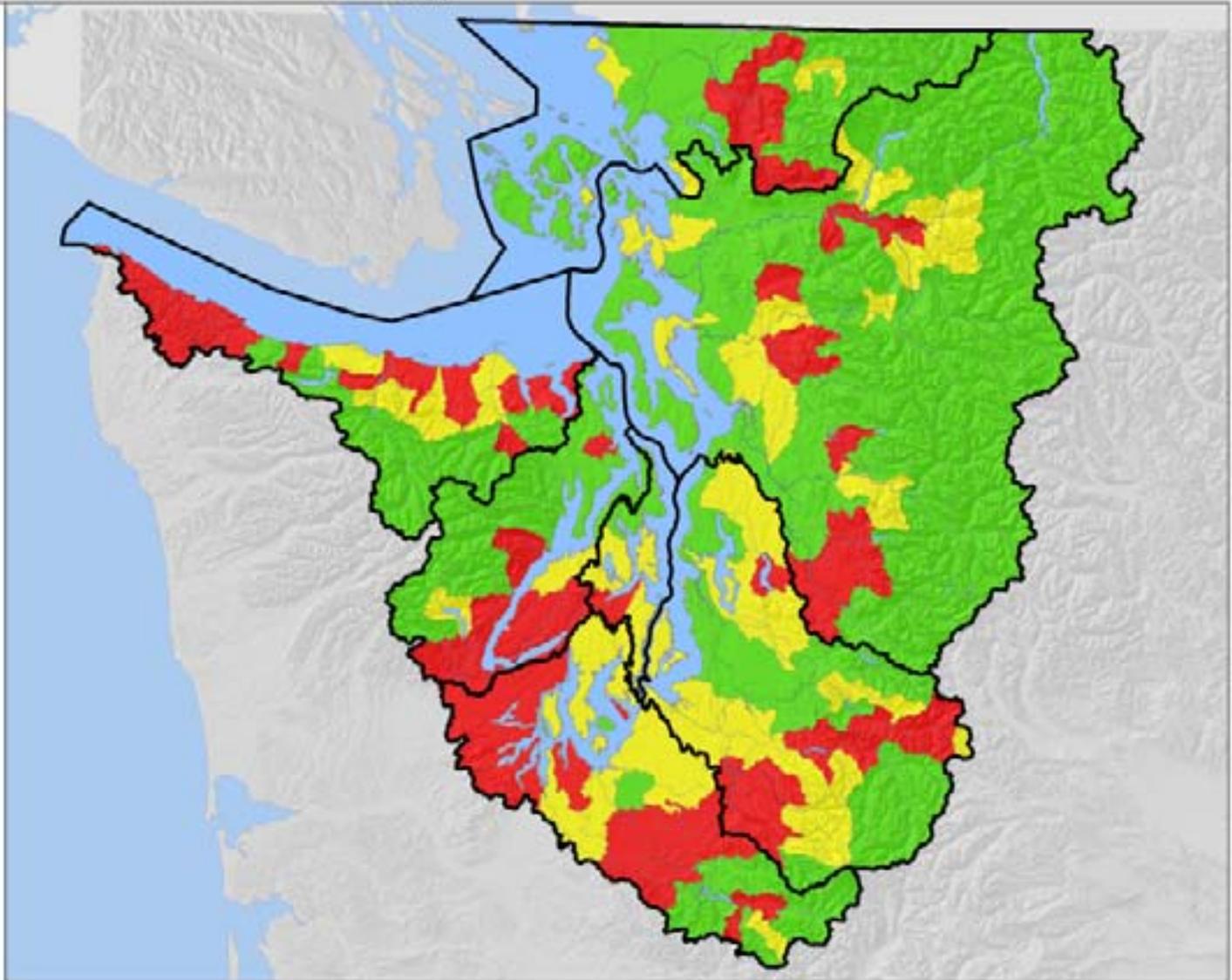
Percentage of land with lost canopy:

- High ■ > 3%
- Moderate ■ 1 - 3%
- Low ■ < or = 1%

Change in Forest Cover Threat (1991 to 2001)
Puget Sound Action Areas



- High ■ >3%
- Moderate ■ 1-3%
- Low ■ < or = 1%



Trends in direct drivers: pollution

World Hypoxic and Eutrophic Coastal Areas



Legend

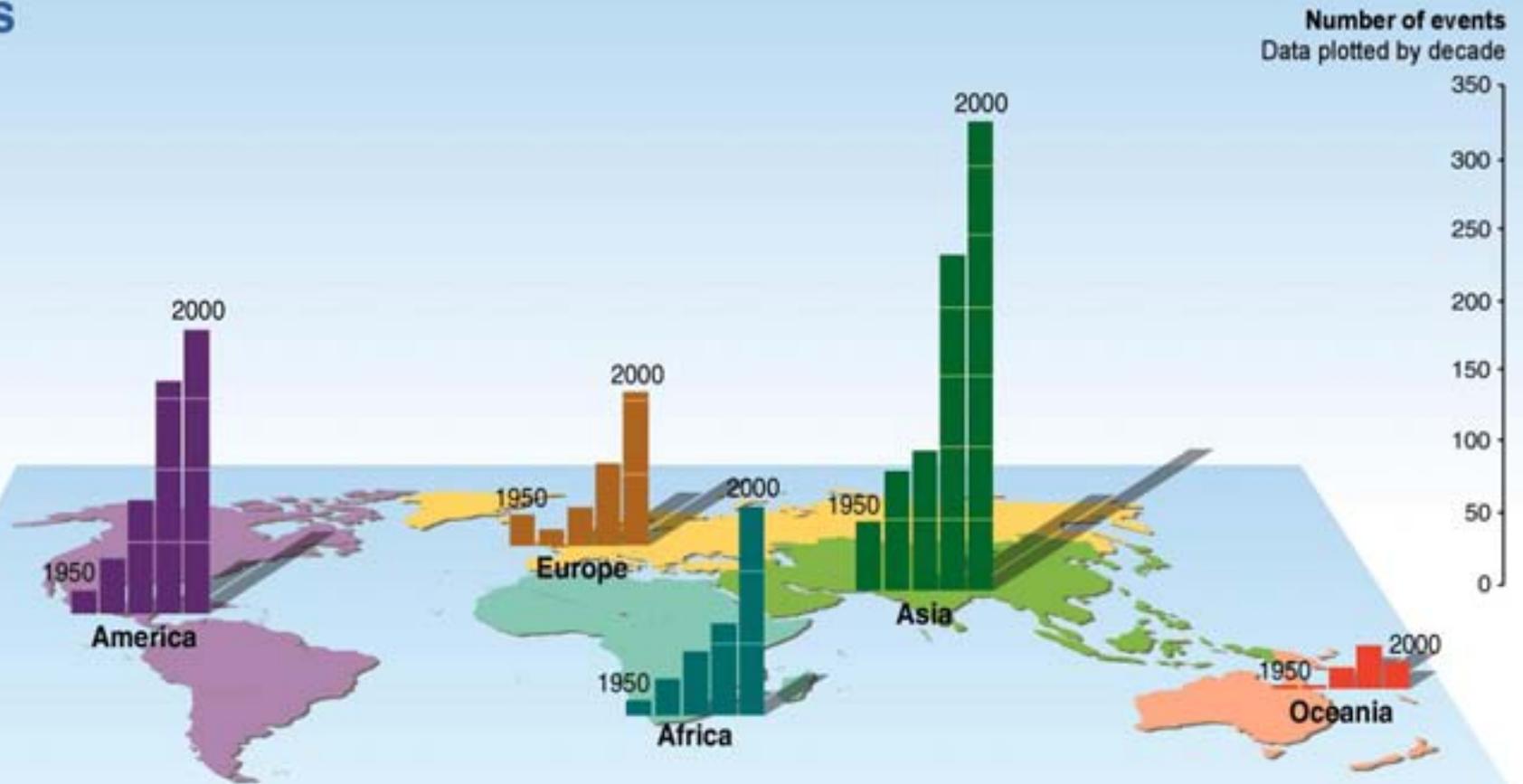
Eutrophic and Hypoxic Areas

- Areas of Concern
- Documented Hypoxic Areas
- Systems in Recovery

Data compiled from various sources by R. Diaz, M. Selman and Z. Sugg.

Trends in direct drivers: climate change

Floods



Source: Millennium Ecosystem Assessment

Trends in direct drivers: overexploitation (year of peak fish harvest)



1951



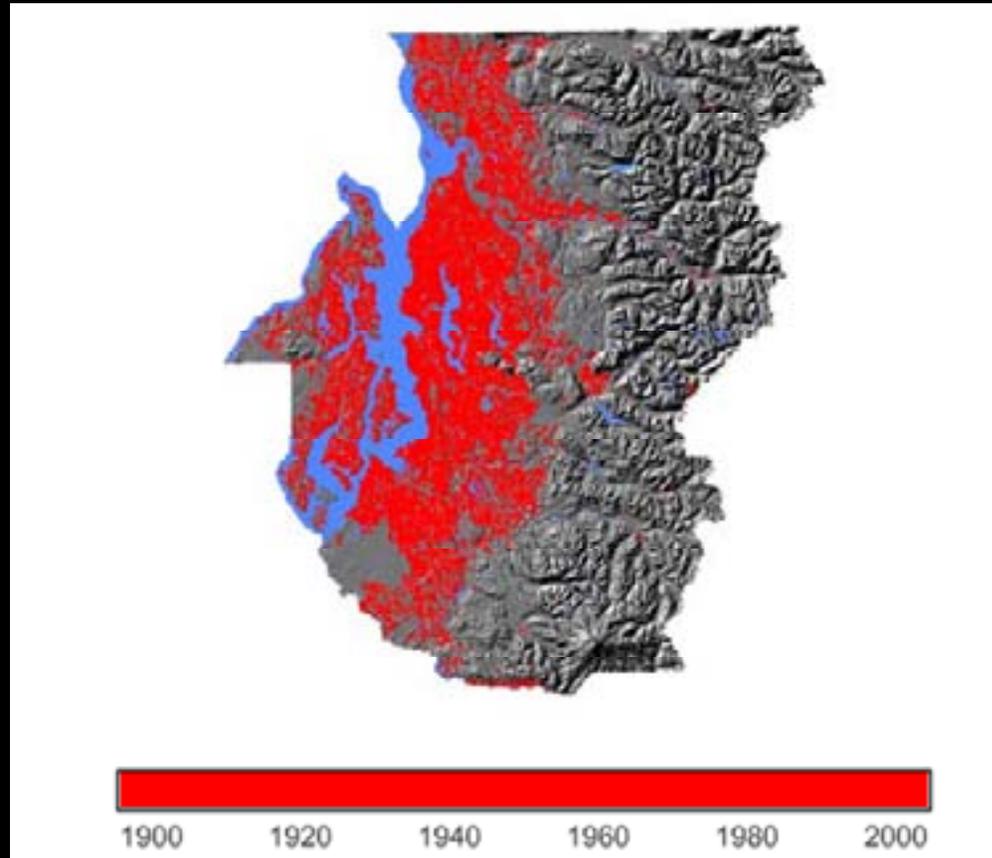
Source: Millennium Ecosystem Assessment and Sea Around Us project

Indirect drivers of ecosystem change

- Demographic
- Economic
- Sociopolitical
- Science and technology
- Cultural and religious



Trends in indirect drivers: demographic

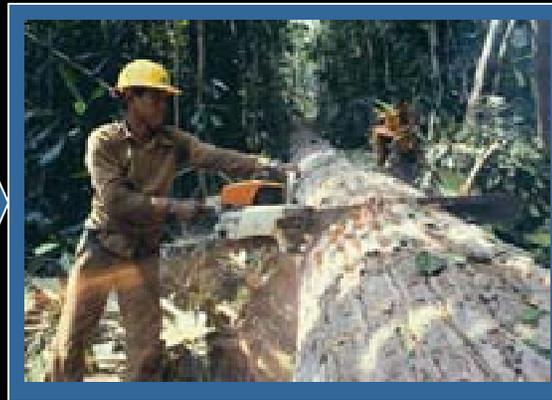


Central Puget Sound Urban Growth Simulation 1940-2000

Source: Urban Ecology Research Laboratory, "Central Puget Sound Urban Growth Simulation," *Land Cover Change Models*, University of Washington

Tradeoffs

Enhancement of some services often leads to degradation of others, creating new winners and losers



Workshop agenda

Introducing Ecosystem Services

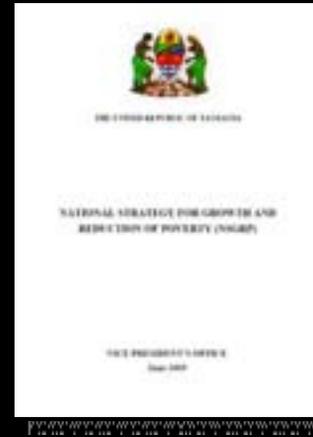
The Ecosystem Services Approach

The Puget Sound Action Agenda



Methods of the Ecosystem Services Approach

- Ecosystem service prioritization
- Trends analyses
- Ecosystem service mapping
- Economic valuation
- Scenario planning
- Portfolio of policy options



Who's using an Ecosystem Services Approach?

Deforestation rate in Costa Rica, 1960-2005



Ecosystem services prioritization

What: Exercise to identify those ecosystem services most relevant to decision-makers' goals

Who: Decision-makers
Stakeholder representatives

Why: Prioritize subsequent analysis
Ensure stakeholder values recognized
Familiarize with ecosystem services

Ecosystem services

Provisioning

Crops

Livestock

Capture fisheries

Aquaculture

Wild foods

Timber and other wood fibers

Other fibers (e.g., cotton, hemp, silk)

Biomass fuel

Fresh water

Genetic resources

Biochemicals, natural medicines, and
pharmaceuticals

Regulating

Air quality regulation

Global climate regulation

Regional/local climate regulation

Water regulation

Erosion regulation

Water purification and waste treatment

Disease regulation

Pest regulation

Pollination

Natural hazard regulation

Cultural

Recreation and ecotourism

Ethical values

Key criteria for identifying priorities

- Dependence
- Impact

Assessing dependence (per ecosystem service)

1. *Does this ecosystem service serve as an input or does it enhance your welfare?*

→ No →

Low
dependence

↓
Yes

2. *Does this ecosystem service have cost-effective substitutes?*

→ No →

High
dependence

↓
Yes

Medium
dependence

Assessing impact (per ecosystem service)

3. Do you affect the quantity or quality of this ecosystem service?

→ No →

Low impact

↓
Yes
↓

4. Does your impact limit or enhance the ability of others to benefit from this ecosystem service?

→ No →

Medium impact

↓
Yes
↓

High impact

- Large share
- Short supply relative to demand
- Nearing threshold

Priority ecosystem services: Mondi

Ecosystem services	Key input suppliers		Company operations*		Major customers	
	Dependent upon	Impact	Dependent upon	Impact	Dependent upon	Impact
Provisioning						
Crops				○ -		
Livestock				○ -		
Capture fisheries						
Aquaculture						
Wild foods				○ +		
Timber				● +		
Cotton, hemp, silk, etc						
Biomass fuel				○ +		
Fresh water			●	● -		
Genetic resources			○	○ ?		
Biochemicals, natural medicines and pharmaceuticals				○ +		
Regulating						
Air quality regulation				? ?		
Climate regulation				○ +		
Water regulation			●	● -		
Erosion regulation			○	○ -		
Water purification and waste treatment				○ -		
Disease regulation						
Pest regulation						
Pollination						
Natural hazard regulation						
Cultural						
Spiritual, religious, or cultural heritage values				○ +/-		
Recreation, ecotourism, or aesthetic values				● +/-		

- Some impact or dependence
- Significant impact or dependence
- + Positive impact
- Negative impact

* The business unit, facility, geographic operations, or product line being reviewed in the ESR

Ecosystem service trends analysis

What: Assessment of the condition and trends of ecosystem services

Who: Government agencies
Civil society
Local communities
Business
Scientists

Why: Assess drivers of change and trends
Understand how ecosystem services are changing
Establish baseline for monitoring progress
Identify emerging risks and opportunities associated with ecosystem change

Ecosystem service trends analysis

Indirect drivers

- Demographic
- Economic
- Sociopolitical
- Scientific & technological
- Cultural and religious



Direct drivers

- Changes in land use
- Pollution
- Climate change
- Invasive species
- Overexploitation
- Other



Trends in the ecosystem service

- Supply and demand
- Quantity and quality
- Present and future

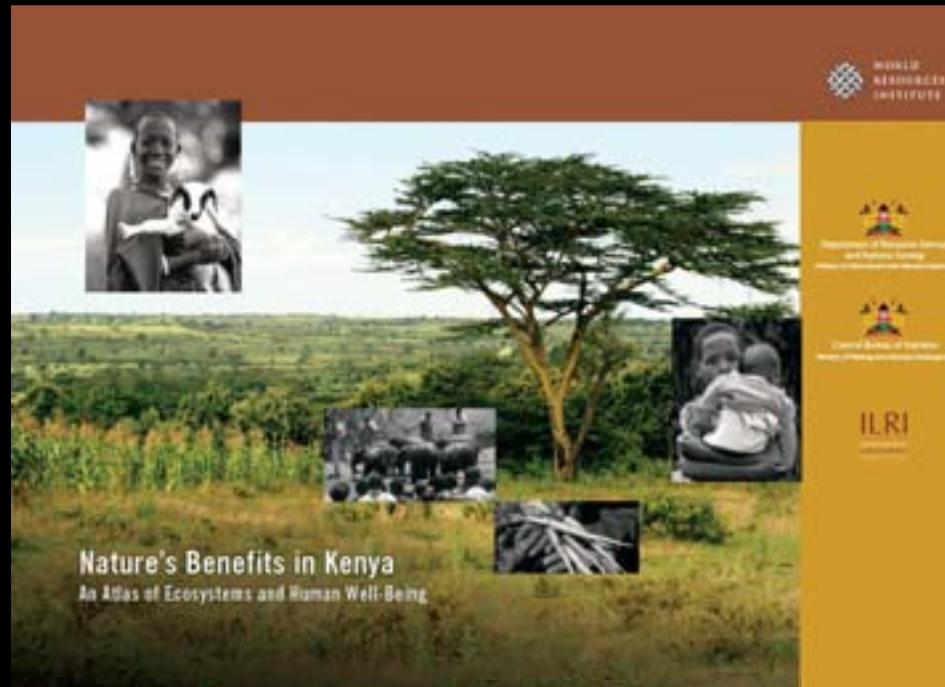
Ecosystem service mapping

What: Describe the spatial location of ecosystem services

Who: Government agencies
Civil society
Local communities
Scientists

Why: Identify who benefits and who bears costs of changes to ecosystem services
Highlight ecosystem(s) providing services

Ecosystem services mapping



Natures'
Benefits in
Kenya: an
Atlas of
Ecosystems
and Human
Well-Being

Building Partnerships for Better Poverty-Environment Analyses

PROFESSOR JAMES OLE KIVIAPI
*Permanent Secretary
Ministry of Environment and Natural Resources*

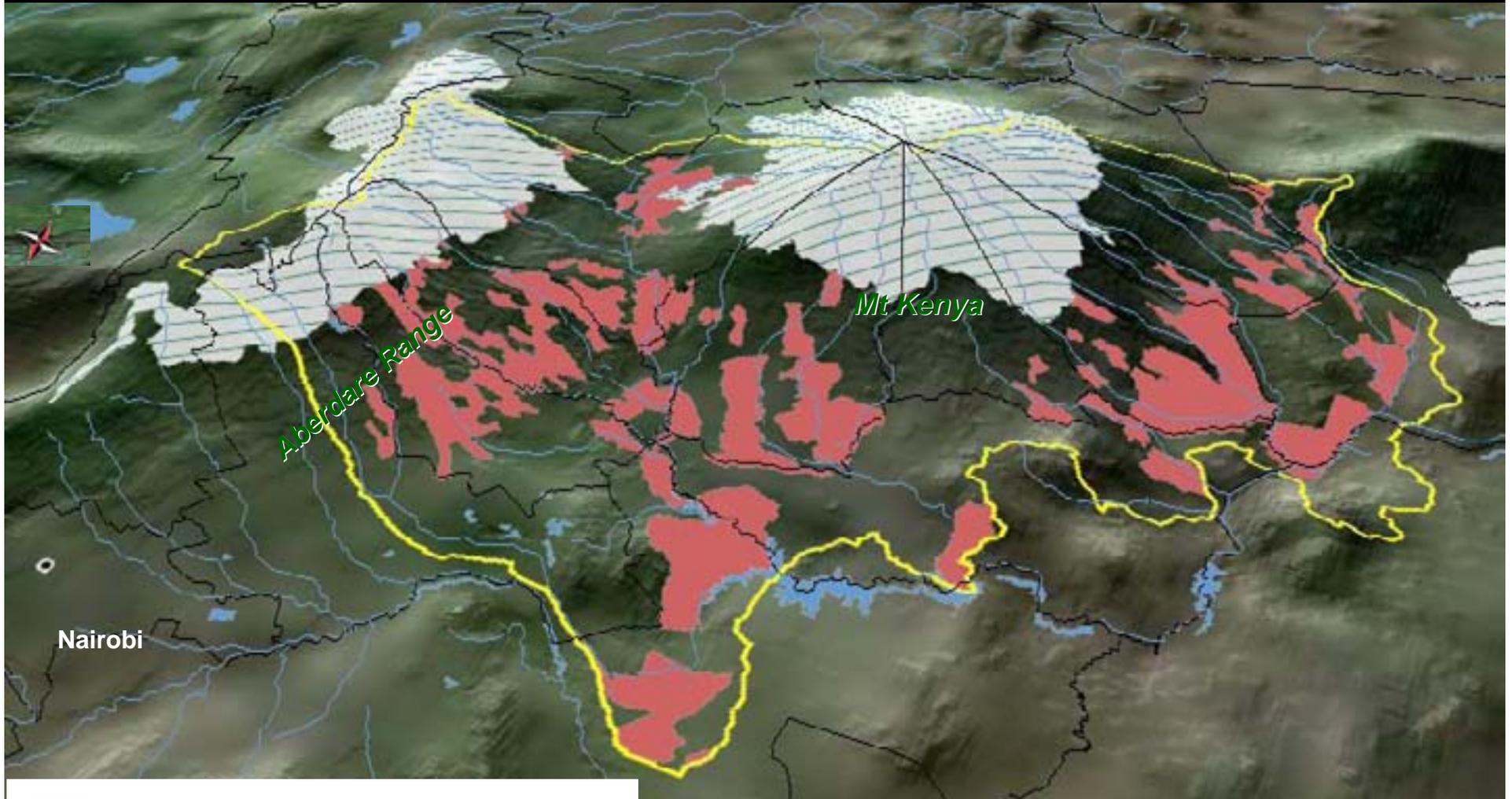
DR. EDWARD SAMBILI, C.B.S.
*Permanent Secretary
Ministry of Planning and National Development*

DR. JACOB OLE MIARON, C.B.S.
*Permanent Secretary
Ministry of Livestock and Fisheries Development*

MR. MAHABOUB MOHAMED MAALIM, O.G.W.
*Permanent Secretary
Ministry of Water and Irrigation*

MRS. REBECCA MWIKALI NABUTOLA, M.B.S.
*Permanent Secretary
Ministry of Tourism and Wildlife*

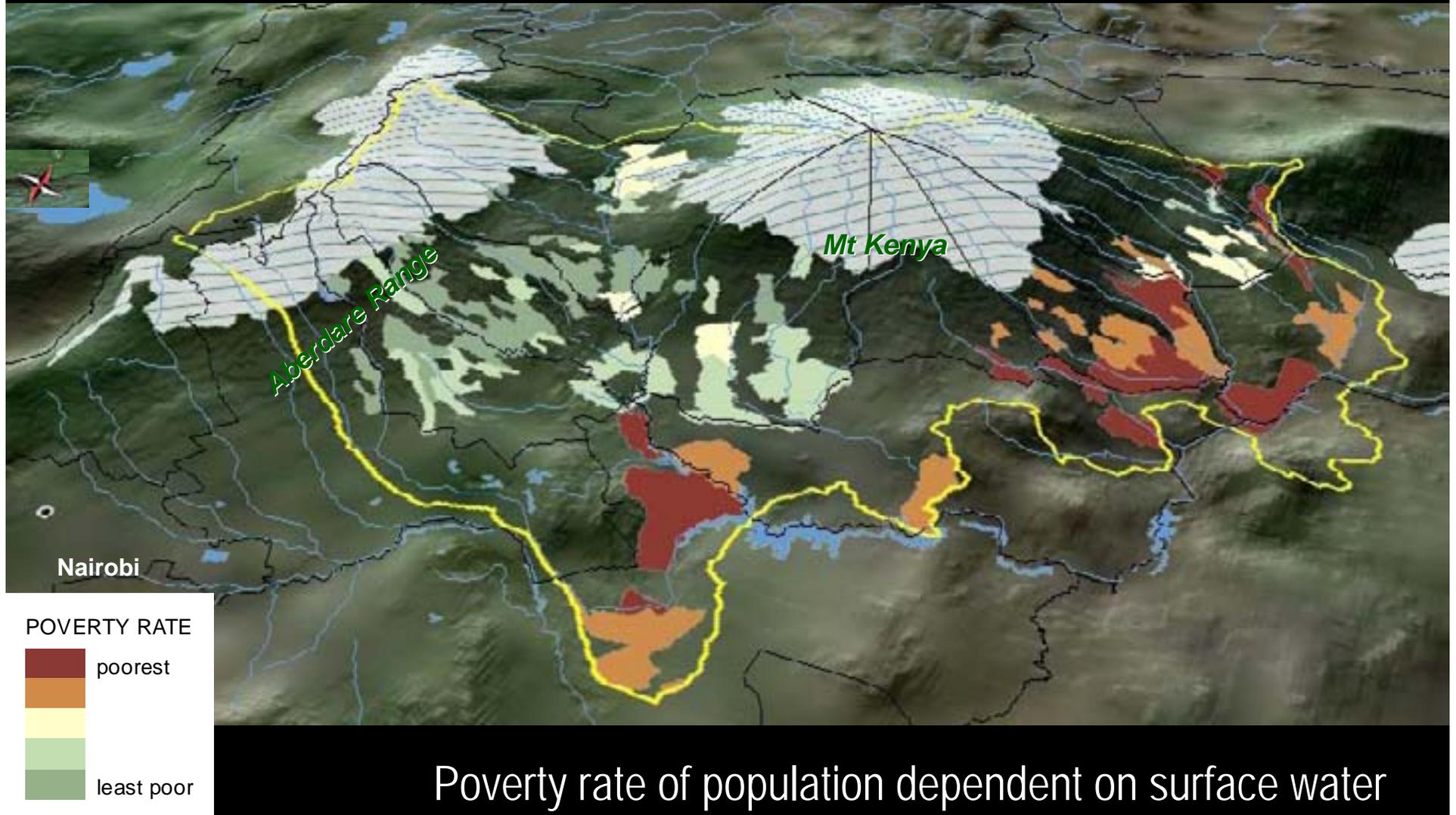
Ecosystem service mapping



More than 75% of households rely on surface water

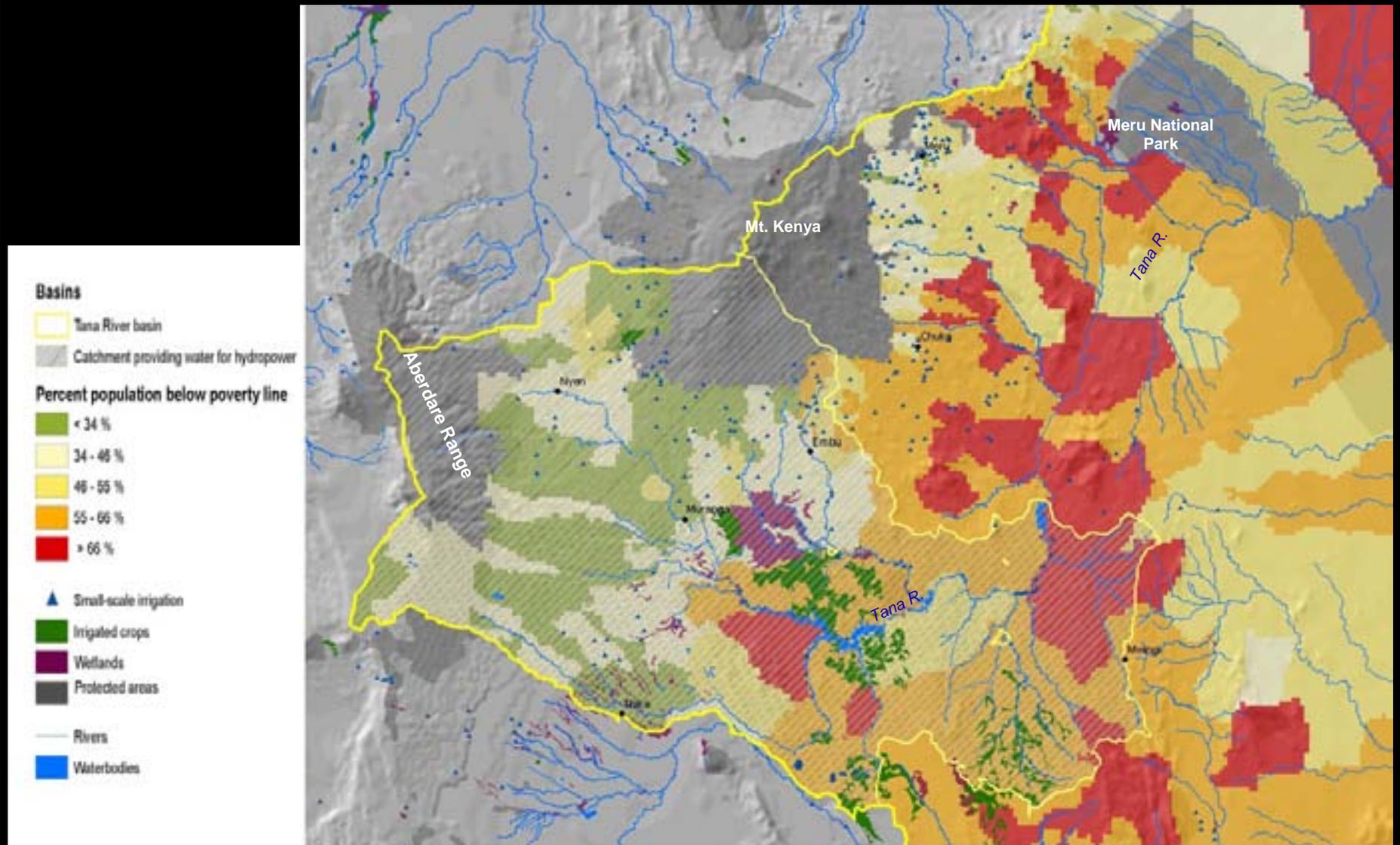
Population dependent on surface water

Ecosystem service mapping



Poverty rate of population dependent on surface water

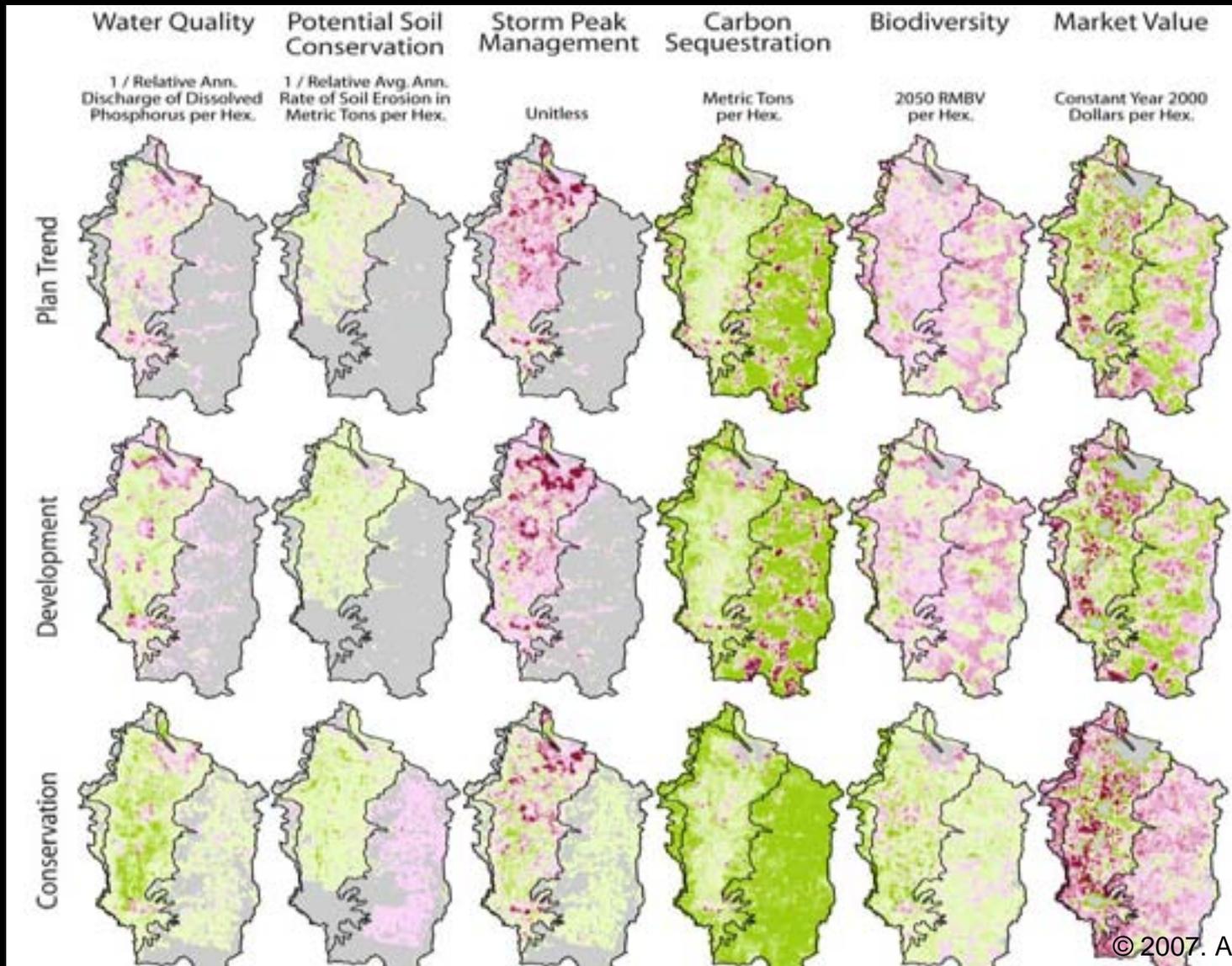
Ecosystem services mapping



Sources: Kenya Central Bureau of Statistics, International Water Management Institute, *Africover* – Food and Agriculture Organization of the United Nations, Kenya National Environment Management Authority, and World Conservation Monitoring Centre.

Ecosystem service mapping

Willamette, OR



Economic valuation

What: Assign quantitative economic value to ecosystem services, including non marketed services

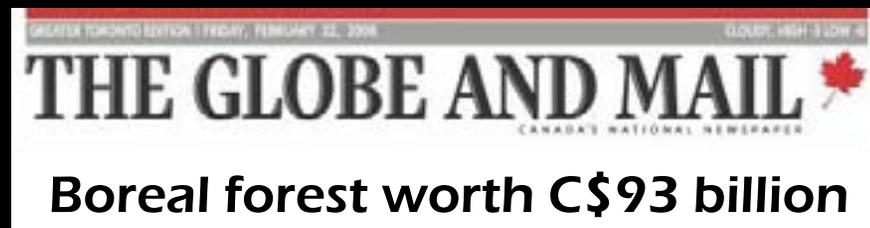
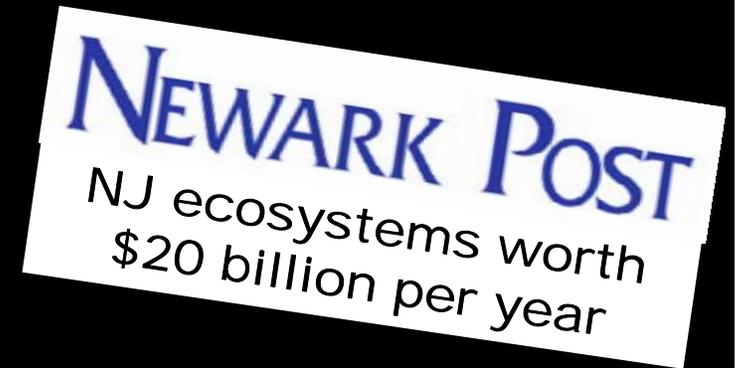
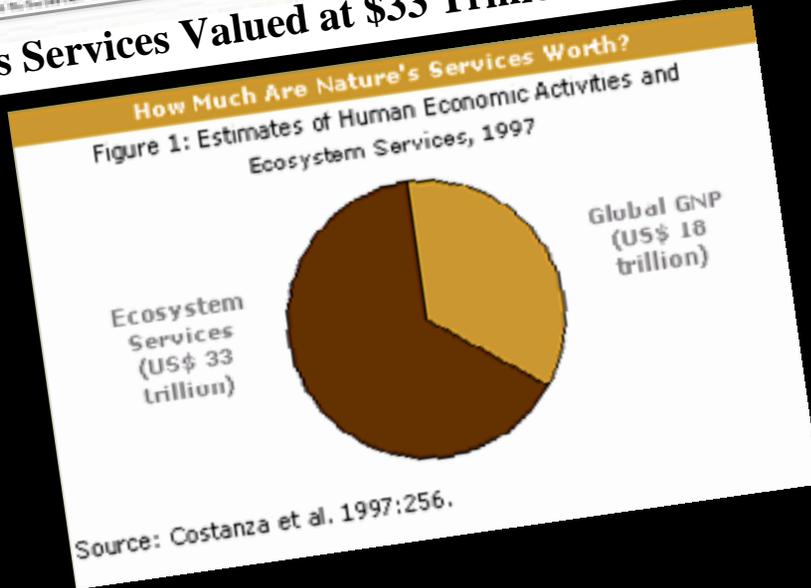
Who: Government agencies
Civil society
Local communities
Economists



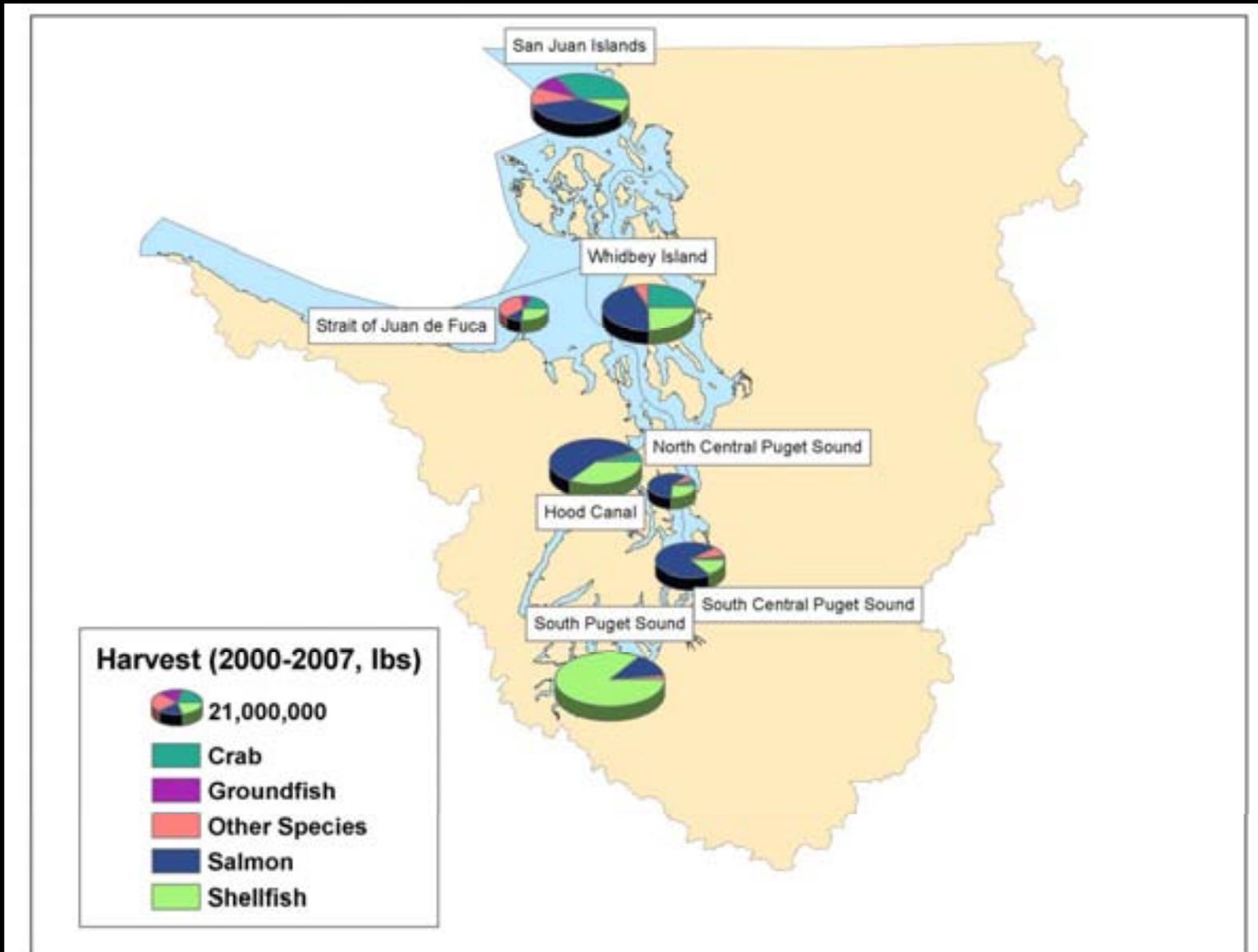
Why:

1. Communicate the value of ecosystem services
2. Compare the cost-effectiveness of an investment
3. Evaluate the impacts of development policies
4. Build markets for ecosystem services

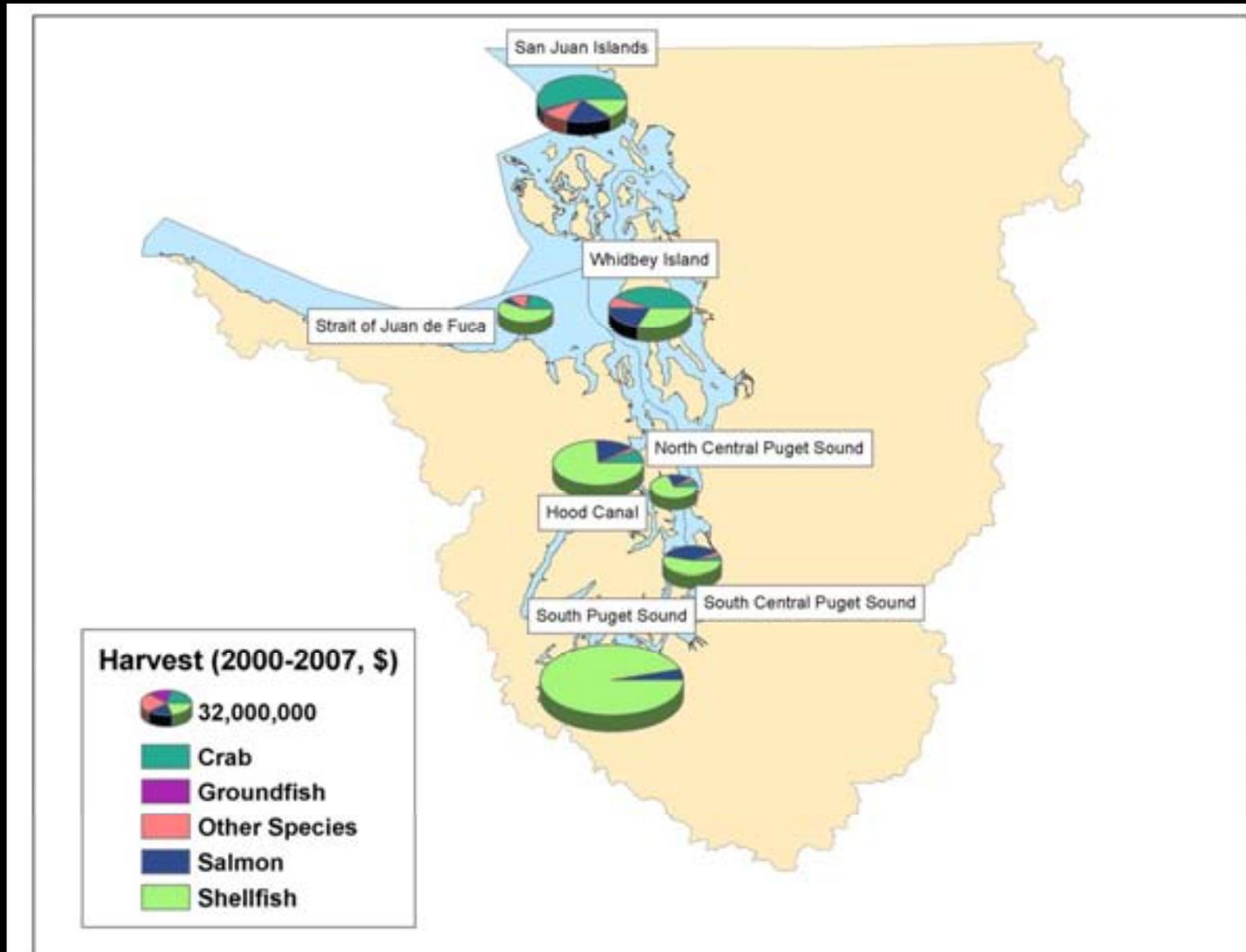
1. Communicate the value of ecosystem services



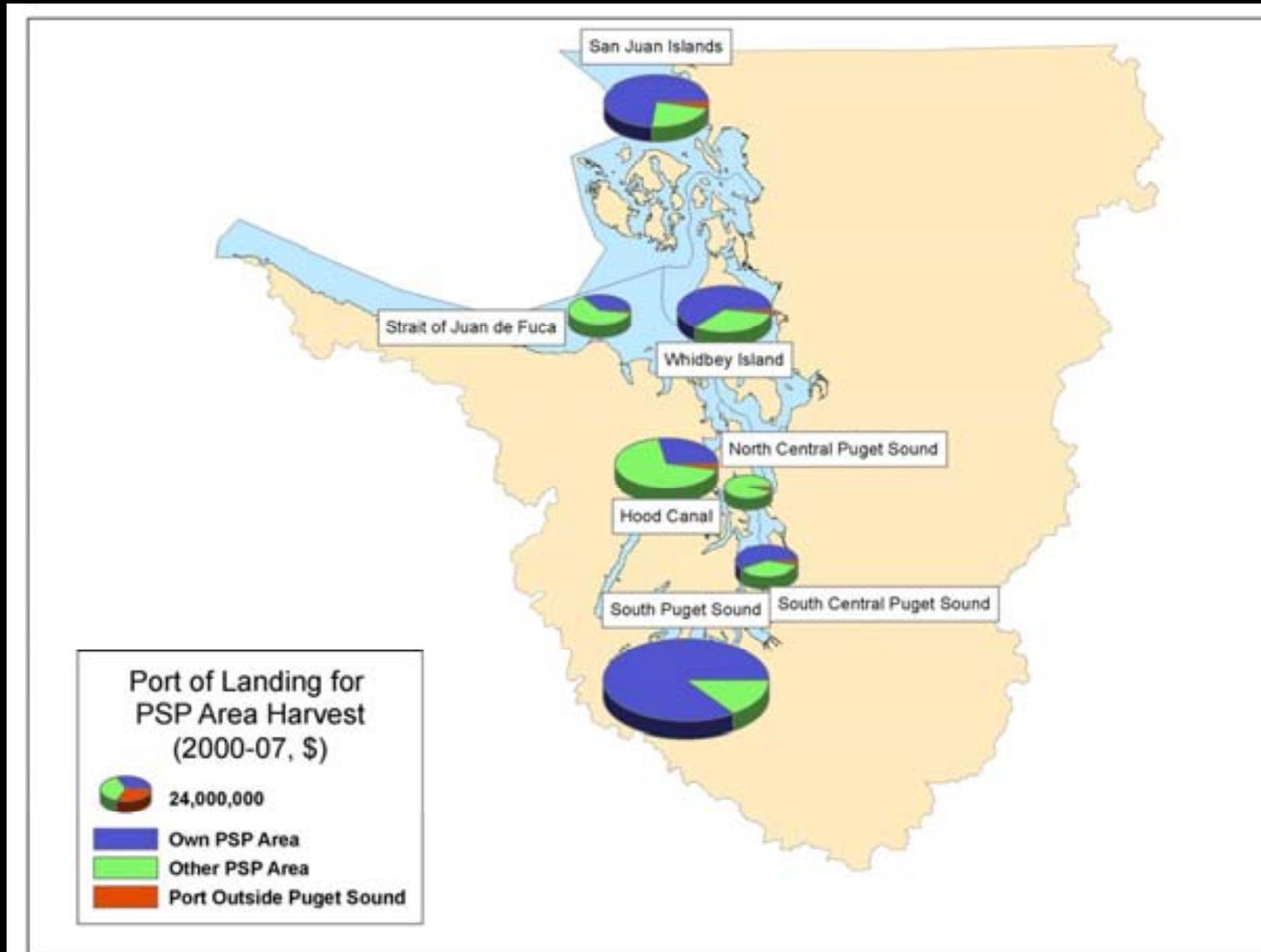
1. Communicate the value of ecosystem services



1. Communicate the value of ecosystem services



2. Communicate the value of ecosystem services



2. Compare the cost-effectiveness of an investment

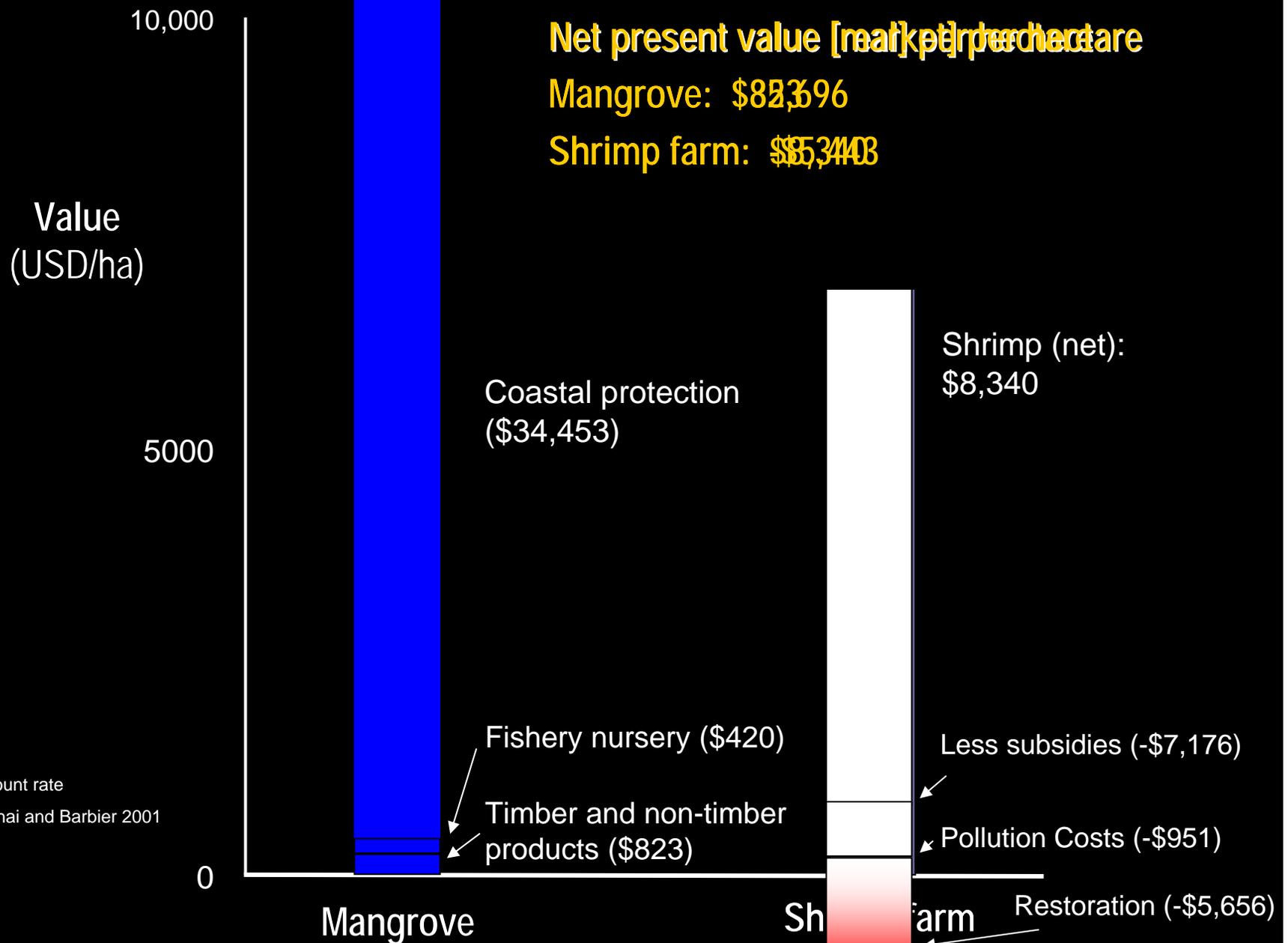


\$6 billion



\$2.7 billion

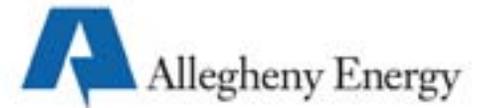
3. Evaluate the impact of development policies



Note: 10% discount rate

Source: Sathirathai and Barbier 2001

4. Build markets for ecosystem services



Scenario Planning

What: Develop set of plausible alternative futures about what might happen under particular assumptions

Who: Government agencies
Civil society
Local communities
Business

Why: Understand implications of different policy choices for ecosystems
Create a platform to talk across interest groups, disciplines, and philosophies
Build trust and cooperation and resolve conflicts

Scenarios Planning - example BC Hydro

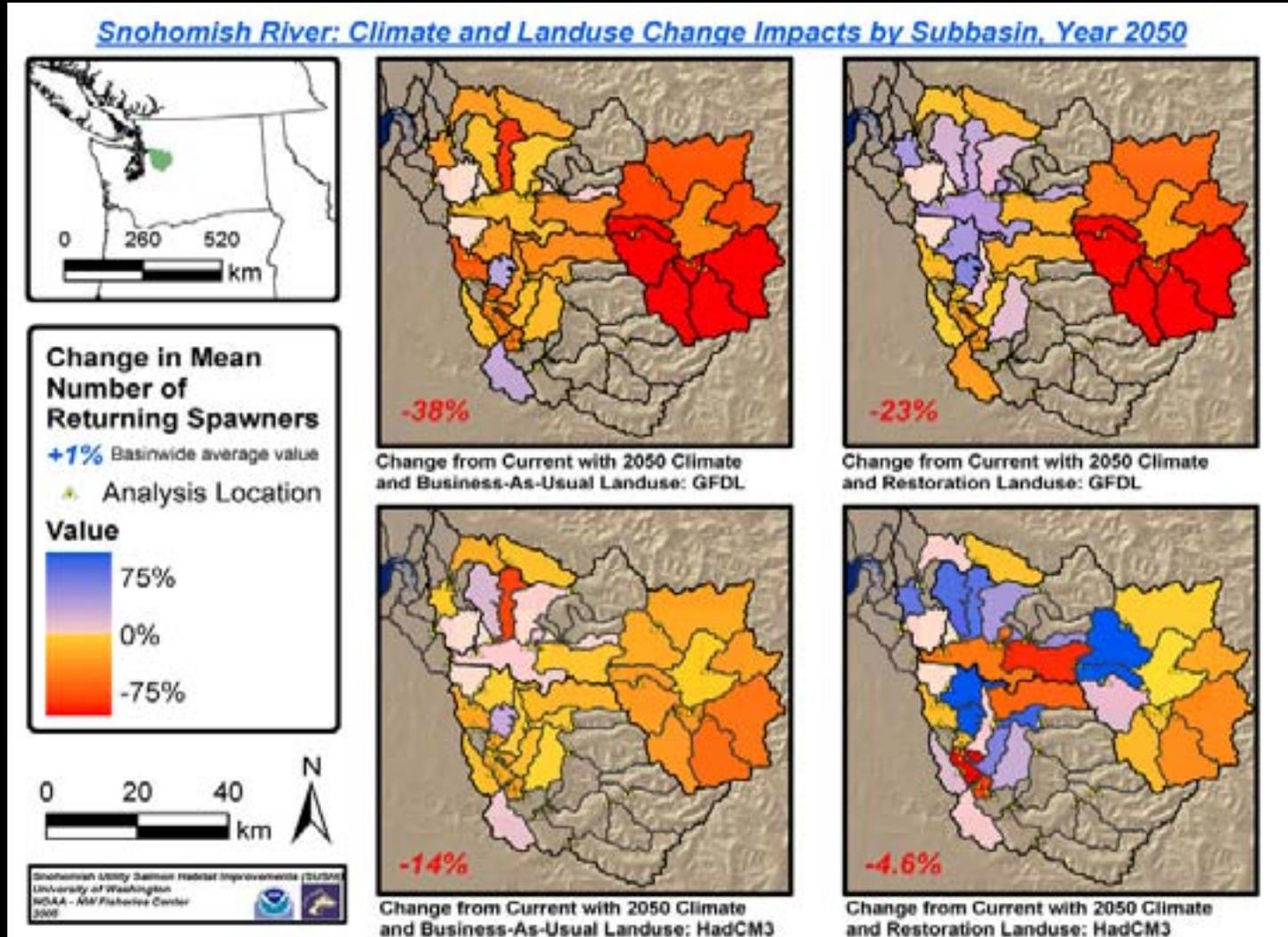


Scenario planning – example Snohomish River

Watershed management under future climate: Chinook

Current

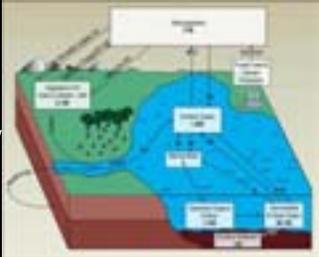
Restoration



GFDL

Hadley

Scenario planning



etc...

Portfolio of policy options

What: Select policies to address drivers of ecosystem change

Who: Government agencies
Civil society
Local communities
Business

Why: Restore or sustain ecosystem services

Portfolio of policy options - Illustrative examples

Policy type

Examples

National and sub-national policies and plans

- Technology/manufacturing standards
- Protected areas

Economic and fiscal incentives

- Green levies and fees
- Subsidy reform
- Payment for ecosystem services
- Cap-and-trade programs
- Government procurement policies

Sector policies and plans

- Land-use zoning
- Certification schemes
- Ecosystem mimicry

Governance

- Cross-governmental and multi-stakeholder partnerships
- New financing structures

Workshop agenda

Introducing Ecosystem Services

The Ecosystem Services Approach

The Puget Sound Action Agenda



The Puget Sound Action Agenda

NOT EXHAUSTIVE

Key questions

- 1. What is a healthy Puget Sound?*
- 2. What is the current status of Puget Sound's health and what are the biggest threats to it?*
- 3. What actions must be taken that will move us from where we are today to a healthy Puget Sound by 2020?*
- 4. Where should we start?*

Relevant methods

- Prioritization
- Mapping

- Trends analyses
- Mapping
- Scenarios

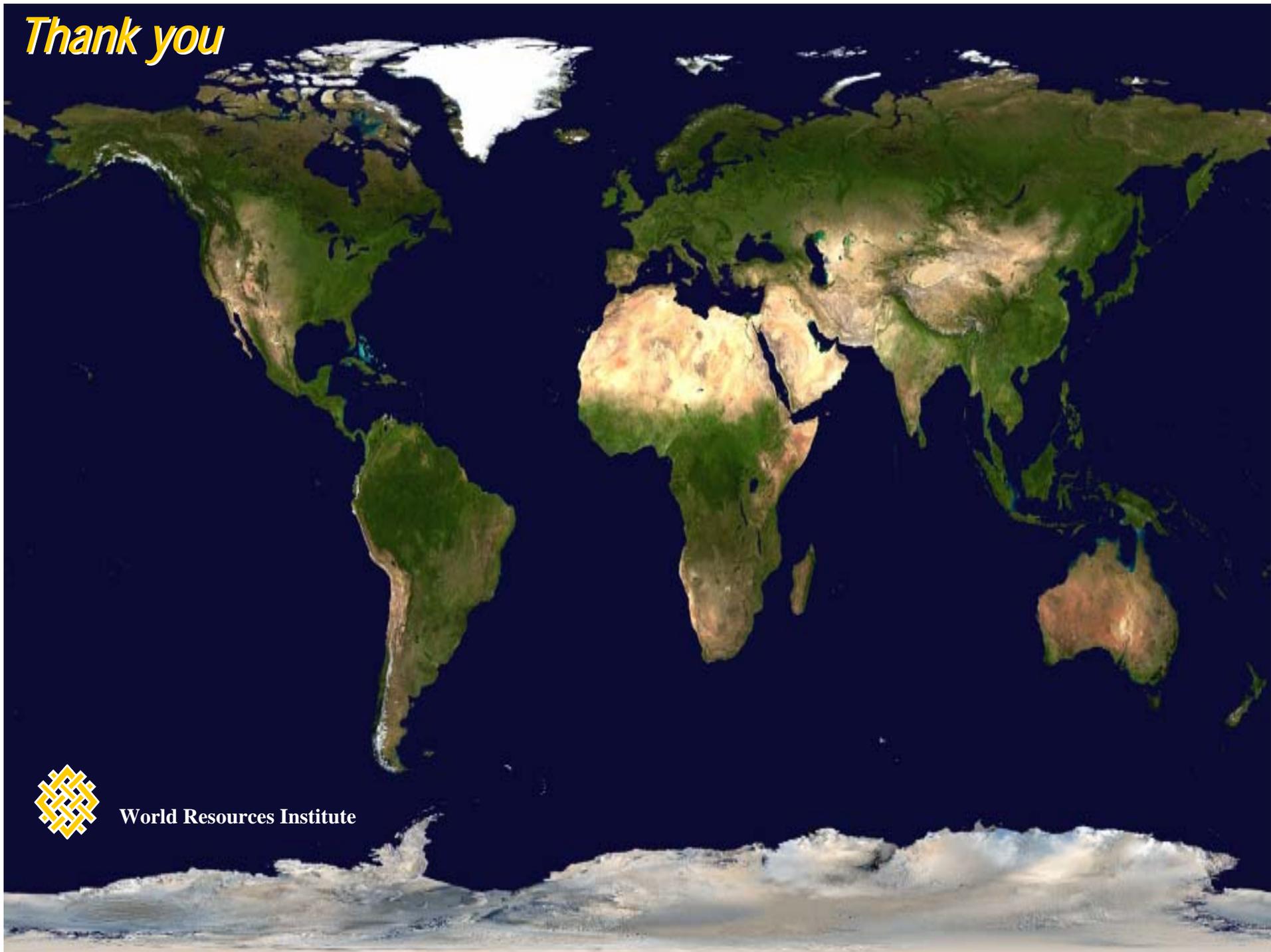
- Scenarios
- Portfolio of policy options

Questions?

Breakout Session Questions

- 1. Which 5-7 ecosystem services in the Puget Sound region are the highest priority?*
- 2. Which ecosystem functions provide these priority services?*
- 3. Which ecosystem service methods could help inform the Puget Sound Action Agenda (by September)?*

Thank you



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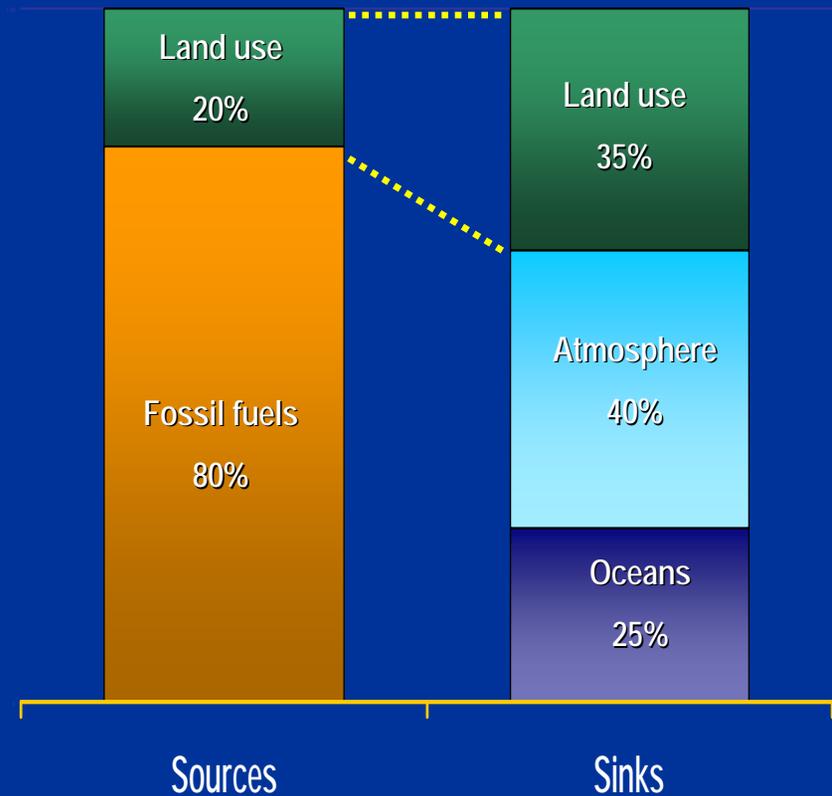
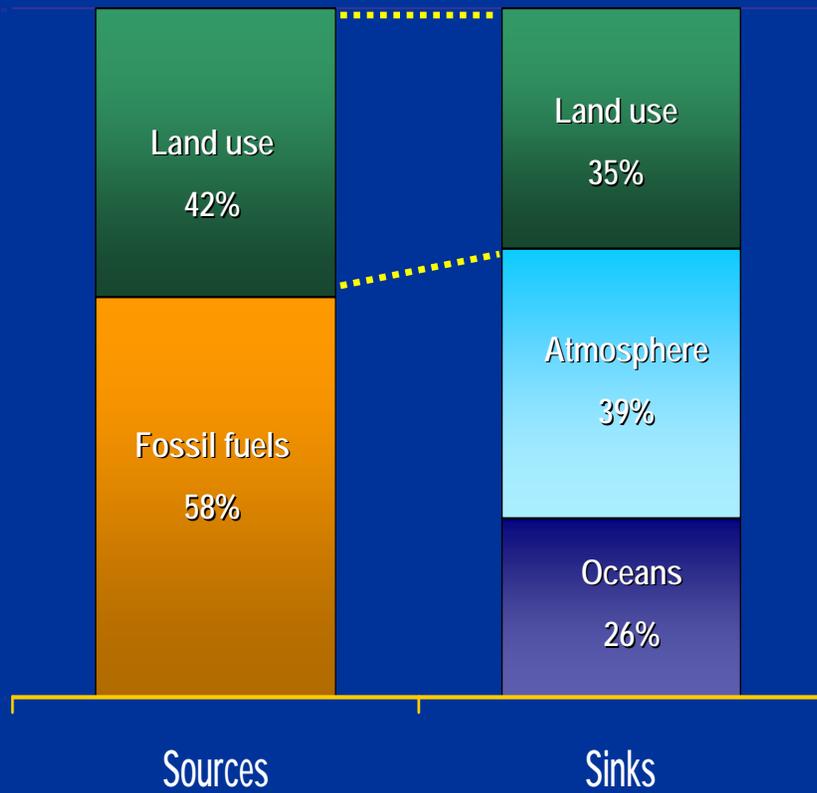
Sources and sinks of carbon

Carbon flow over past two centuries

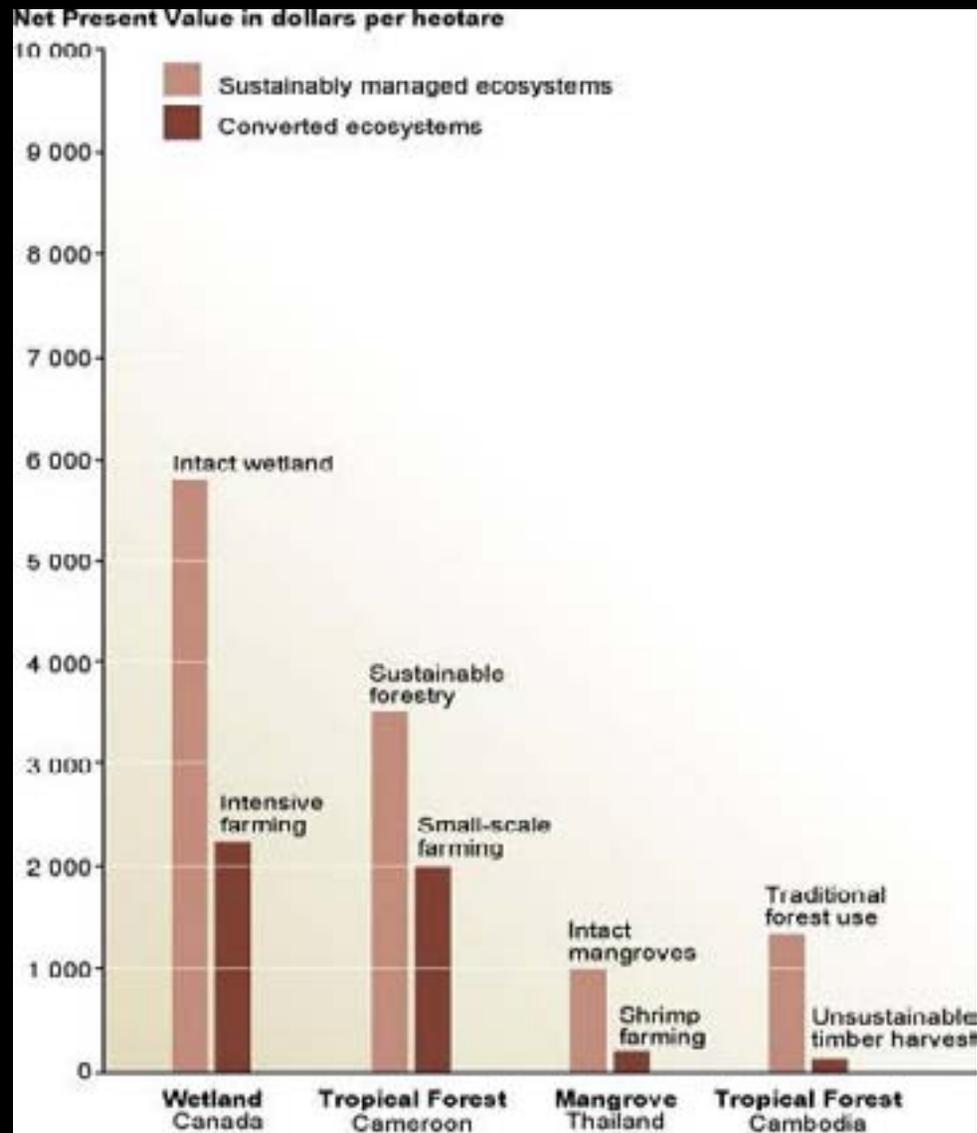
100% = 480 gigatons of carbon

Annual carbon flow in 1990s

100% = 7.9 gigatons of carbon per year



Evaluate the impacts of development policies



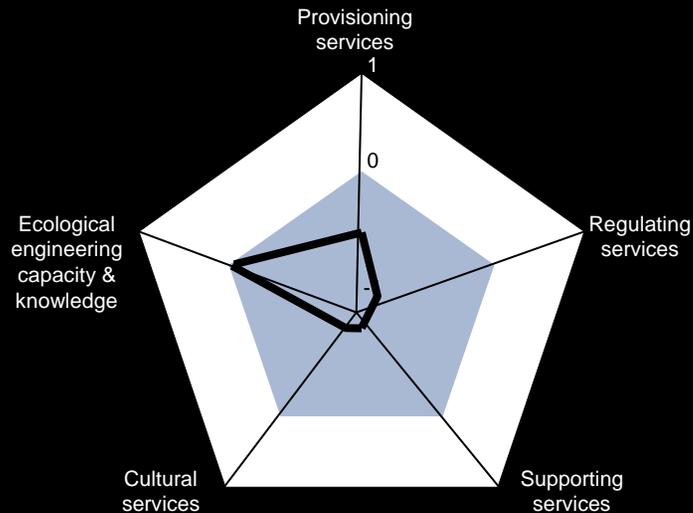
Source: Millennium Ecosystem Assessment

Scenario planning – example Colorado River

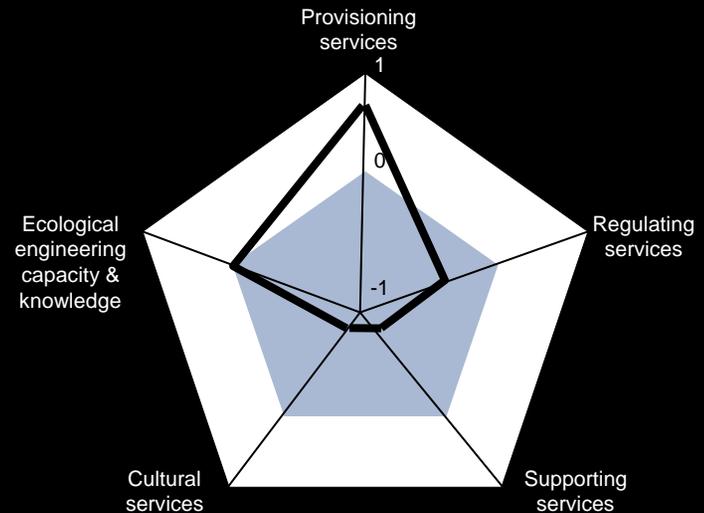


Colorado Scenario Trade-offs

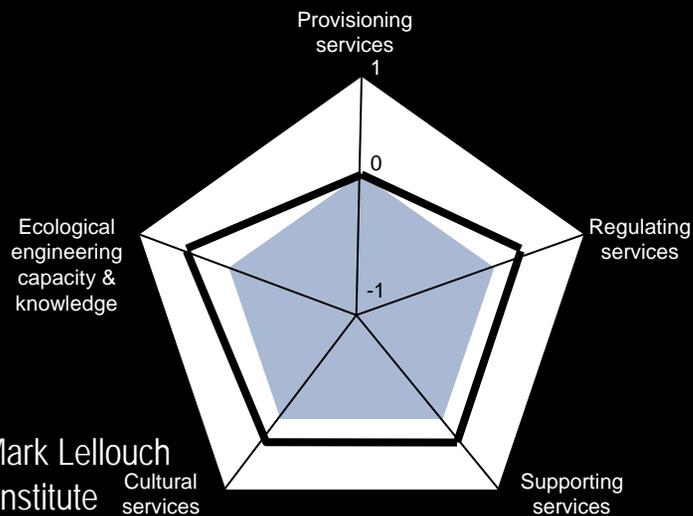
Dry Future



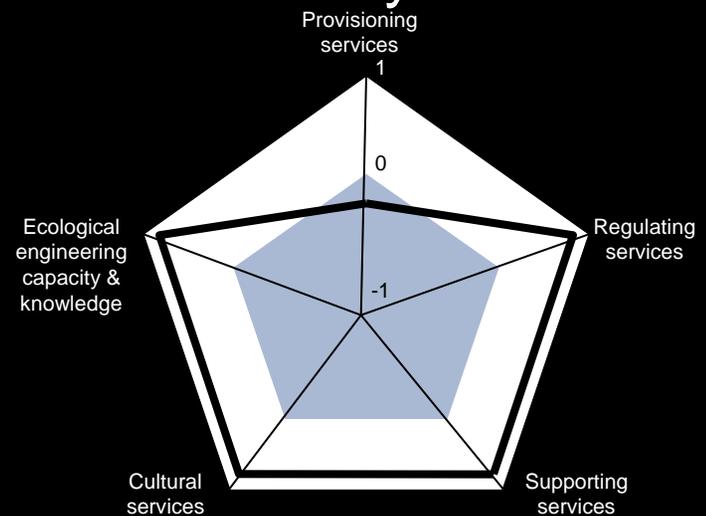
The Market Rules



Powell's Prophecy



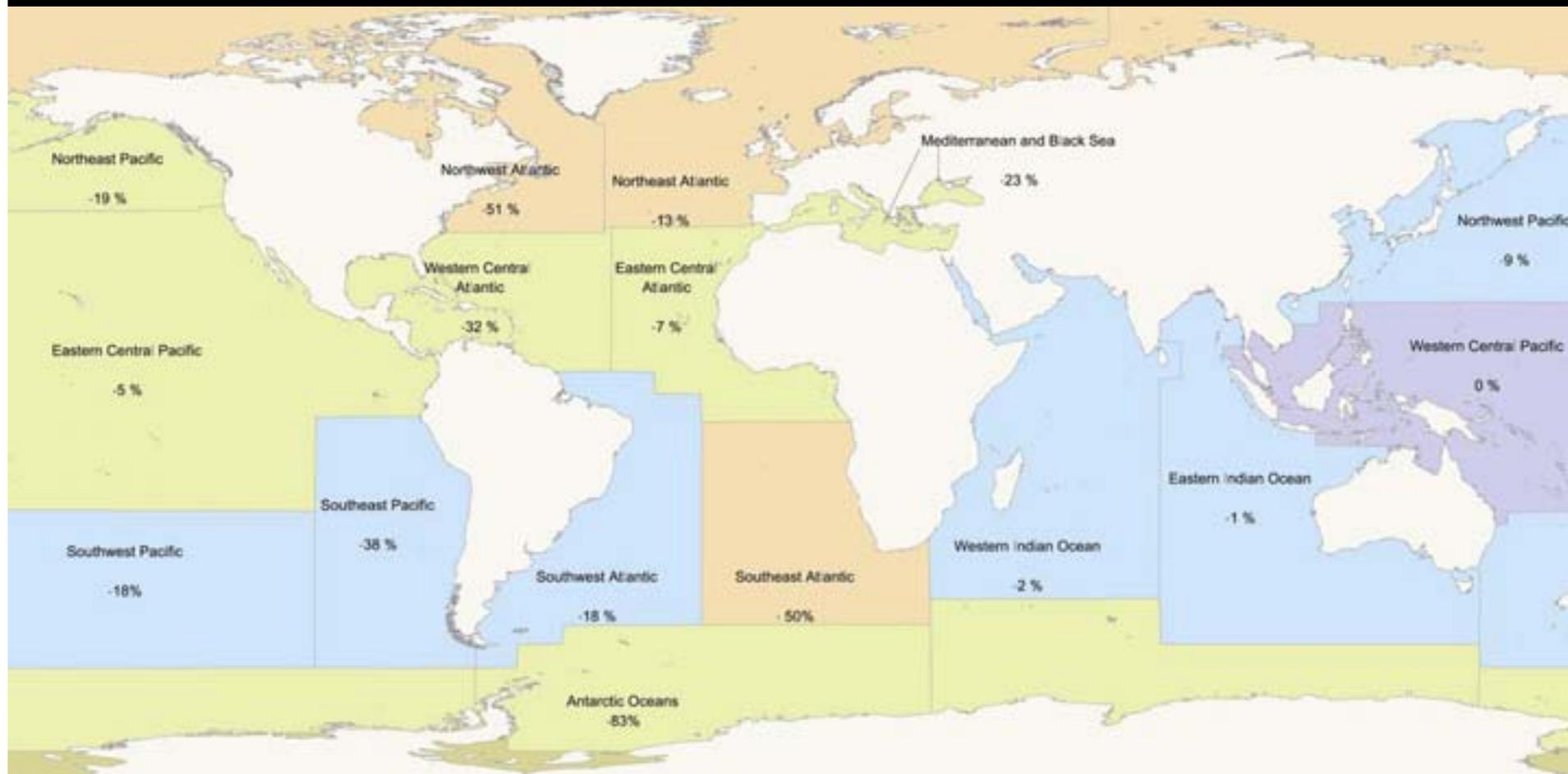
A Delta and Estuary Once More



Source: Mark Lellouch
Sonoran Institute

Trends in direct drivers: overexploitation

Decade of peak fish harvest and percent decline (peak year vs. 2001)



Before 1980 1980s 1990s Peak catch not yet reached

FishStat, 2003