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## ECOLOGICAL RESEARCH PROGRAM

BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

# ***EPA's Ecosystem Services Research Program*** ***2009 – 2014:*** ***Conserving ecosystem services through*** ***proactive decision-making***

Rick Linthurst and Iris Goodman  
National Program Director and Deputy for Ecology  
Office of Research and Development  
US EPA

SAB, April 23, 2009

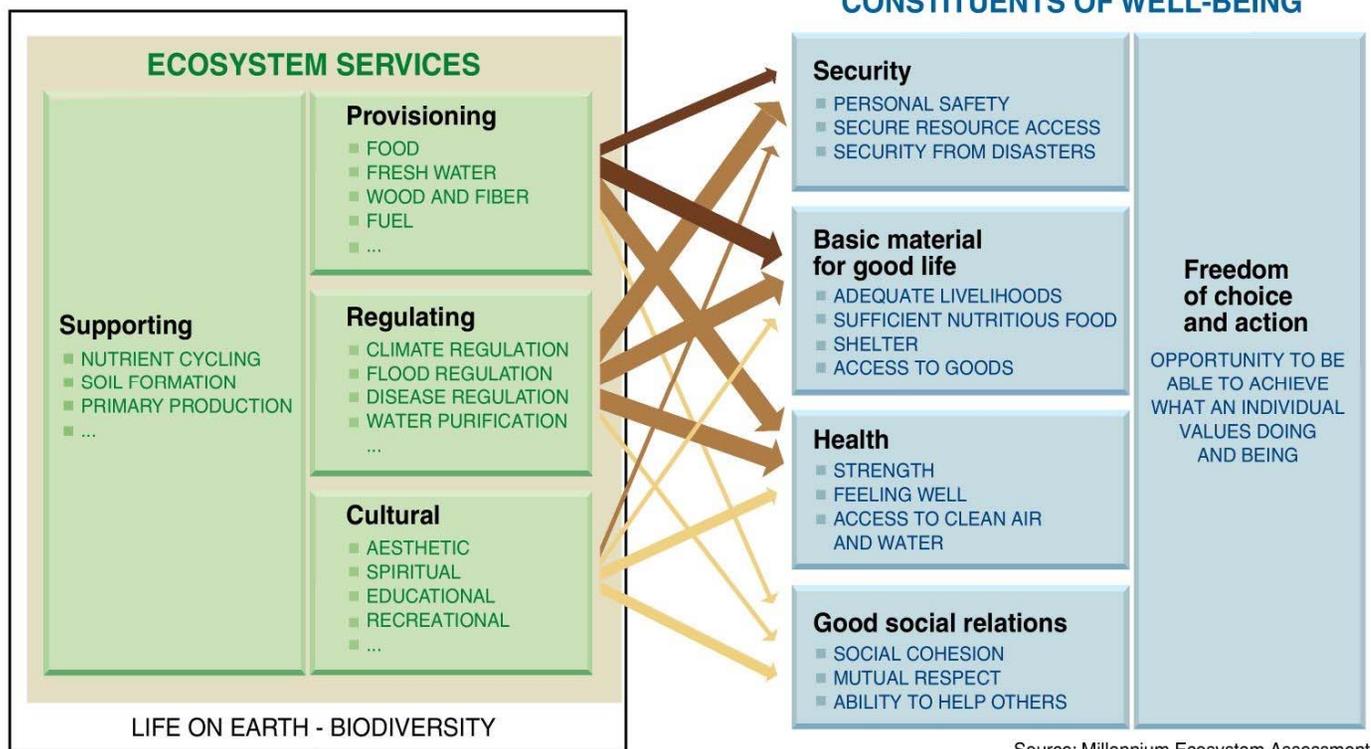


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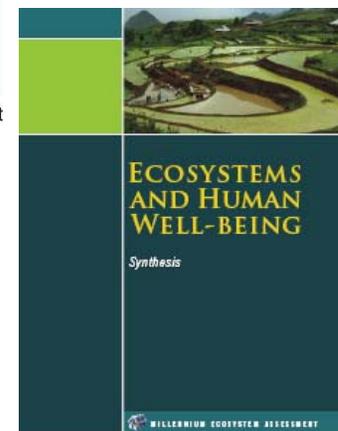
## CONSTITUENTS OF WELL-BEING



Source: Millennium Ecosystem Assessment

# Consequences for People

U.S. Environmental Protection Agency  
Office of Research and Development





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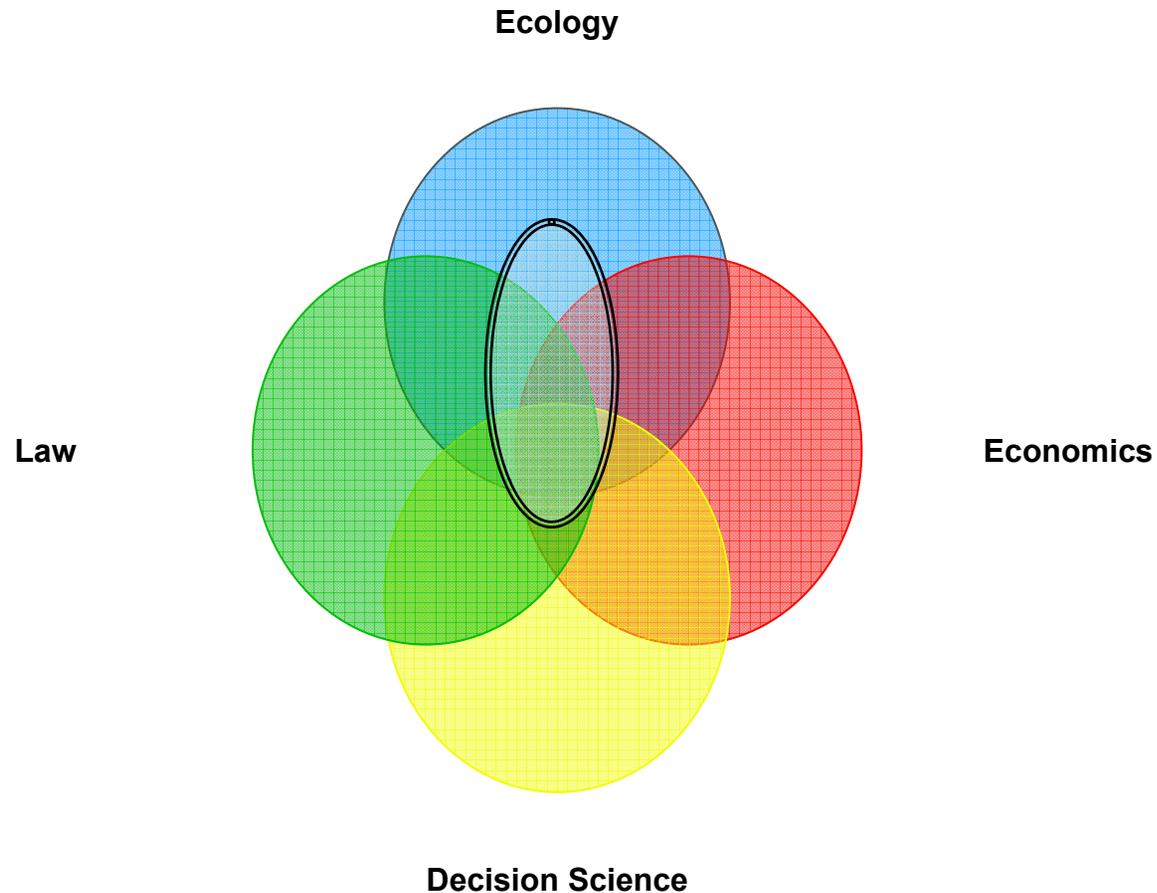
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***Core ecosystem services: all will be quantified in biophysical metrics, some will be monetized***

- ***Supporting Services:***
  - Carbon storage
  - Habitat/maintenance of biodiversity
- ***Regulating Services:***
  - Nutrient cycling
  - Flood reduction
  - Storm-surge protection
- ***Provisioning Services:***
  - Food and Fiber production
  - Fuels
  - Water-provisioning (described separately as water quality, quantity, and timing of flows)
- ***Cultural Services:***
  - Recreational opportunities
  - Sense of place

\*see also Appendix A, ERP Multi-Year Plan  
for extended list and proposed metrics

# ***Transdisciplinary Approach to Conserving Ecosystem Services***



Regional Centers of Excellence?



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### How can ecology help?

- Create geo-spatial products that describe ecosystem services.
- Develop scenarios that envision alternative combinations of services and provide a means to assess trade-offs.
- Develop methods to restore and enhance ecosystem services through restoring or creating new ecological production functions.
- Identify, quantify, and anticipate ecological “tipping points” that threaten loss of services – and manage accordingly.

. . . . We're finding this information is of tremendous interest to policy makers, state governments, planning councils, economists, financial institutions, NGOs, and many others

=== > enabling us to forge transdisciplinary collaborations.



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### ***Goal: to transform the way we account for changes in ecosystem services that result from decisions***

1. ***Keeping the end in mind:*** integration, decision support and outreach
2. ***Monitor, map, and model*** ecosystem services at multiple scales
3. ***Pollutant-specific studies:*** effects of nitrogen on ecosystem services
4. ***Ecosystem-specific studies:*** ecosystem services provided by wetlands and coral reefs
5. ***Place-based studies:*** Willamette OR, Tampa Bay FL, Future Midwest Landscapes (including effects of biofuels on ES), Coastal Carolinas, Southwest U.S.

- **SAB EPEC review, April 2008:** *“commends the Agency for developing a research program, that if properly funded and executed, has the potential to be transformative for environmental decision-making as well as for ecological science.”*
- **ESRP matrix:** we have integrated, multi-disciplinary teams drawn from across all Labs & Centers
- Program level research framework infused with *“experimental design”* concepts, i.e., foundational research x exploratory research x replicated demonstrations
  - *methods standardized sufficient for comparative testing and evaluation,*
  - *flexible enough for innovation and refinement.*
  - *advances promoted at the intersections – the “x’s”*
  - *“replications” include decision analytic tools with clients, since framework designed by ultimate outcomes –i.e., decision-making*
  - \*\*\* these aspects critical at this juncture for ecosystem services science*
- Now in implementation: **12 detailed IP for each row / column of matrix** *All are cross-Lab and Center products*

Projects and Long term Goals →		Ecosystem Specific Studies: LTG 4 - 23%		Community Based Demonstration Projects: For National, Regional, State and Local Decisions (includes Nitrogen and Wetlands services) LTG 5 - 28%				Theme Leads
	Cross Program Themes and Research Objectives	Wetlands (19%)	Coral Reefs (4%)	Willamette (5%)	Tampa Bay (7%)	Mid-West (7%)	Coastal Carolinas (9%)	
Inventory, Map, and Forecast Ecosystem Services at multiple scales (National Atlas) LTG 2 38%	Landscape Characterization and Mapping (10%)	Ric Lopez	Anne Neale	Don Ebert	Taylor Jarnagin	Megan Mehaffey (New Hire in the future)	Deb Chaloud	Anne Neale
	Inventory and Monitoring of Services (21%)	Jack Kelley	Bill Fisher	Spence Peterson	John Macauley	Joe Flotemersch	Darryl Keith	Mike McDonald
	Modeling for Scenarios and Forecasting for different management options (7%)	Brenda Rashleigh	Susan Yee	Bob McKane	Sandy Rimondo	Russ Kreis	Steve Kraemerr	Tom Fontaine
Integration, Decision Support and Outreach LTG 1 8%	Ecosystem Services and Human Health (2%)	Kevin Summers	Kevin Summers	Steve Klein	Lisa Smith	Betsy Smith	Deb Mangis sending name	Laura Jackson
	Valuation of Ecosystem Services (2%)	Chuck Lane	Dan Campbell & Suzanne Ayvazian	Matt Weber	Sharon Hayes	Alex Macpherson	Alex Macpherson	Wayne Munns
	Decision Support Platform Created to Integrate Findings from Entire Program (3%)	Tim Canfield	Pat Bradley	Dave Burden	Marc Russell	Vasuki Ilaru	Drew Piliant	Ann Vega
	Outreach & Education (1%)	Janet Nestlerode	Pat Bradley	Bill Hogsett	Jim Harvey	Brenda Groskinsky	Walt Galloway	Suzanne Marcy
Eco-system Specific Studies LTG 4	Wetlands (23%)				Janet Nestlerode	Chuck Lane		Steve Jordan
Pollutant Specific Studies LTG 3	Nitrogen (5%)	Steve Jordan	Jim Latimer	Bill Hogsett	Richard Devereaux	Ken Fritz	Brent Johnson	Jana Compton
Project Area Leads	Rick Linthurst And Iris Goodman	Janet Keough	Bill Fisher	David Hammer	Marc Russell	Randy Bruins/ Betsy Smith	Dorsey Worthy	Rick Linthurst Iris Goodman
				Hal Walker				

<b>ESRP Research Activities</b>	<b>Applied Uses</b>	<b>Implementation Partners</b>
LTG 1: Decision support	-- engaging stakeholders --- improved participatory, deliberative decision-making	-- <i>World Resources Institute</i> -- <i>Business for Social Responsibility</i>
LTG 1: Valuation, trade-offs	-- quantification of eco service changes, -- systems analysis of trade-offs -- improved benefit cost analyses	-- EPA NCEE -- new ES Research Partnership
LTG 2: framework to <i>inventory and monitor</i> selected ecosystem services nationwide	-- “green” national income accounts -- Potential use in <u>Report on the Environment</u>	EPA’s National Center for Environmental Economics* NEON, ROE , Heinz Center, GAO
LTG 2: <i>Mapping</i> selected ecosystem services nationwide	-- see spatial distribution of services, baseline, projected, & retrospective -- can see ES sources and beneficiaries	<i>National Geographic</i> <i>USGS Geography Division</i>
LTG 2: Modeling key interactions among services, ecological production functions, scenarios, tipping points	-- optimizing service “bundles” -- creating “community of practice” (ICPP-like) -- “engine” for simulation portion of Decision Support framework	-- <i>Gund Institute for Ecological Economics</i> -- <i>Natural Capital Project</i> * -- <i>Smithsonian Institution</i>
Matrix theme leads: LTG 3, 4, 5 Cross-them analyses to identify emergent properties for place-based, ecosystem-based, and pollutant-based studies. Office of Research and Development	-- comparative testing, evaluation -- cross-fertilization to “advance at intersections” -- identify cross-scale issues & dynamics -- identify attributes that confer ecosystem resilience	<i>Stakeholders (local, state)</i> <i>EPA Regions 2, 4, 5,7,8, 10</i> <i>Other federal agencies</i> <i>Many NGOs</i> <i>MA Sub “II” sub-global assessments</i>

4/23/2009

infectious disease mediation

crop production

forest production

preserving habitats and biodiversity

water flow regulation

water quality regulation

carbon sequestration

regional climate and air quality regulation

natural ecosystem

infectious disease mediation

crop production

forest production

preserving habitats and biodiversity

water flow regulation

water quality regulation

carbon sequestration

regional climate and air quality regulation

intensive cropland

infectious disease mediation

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forest production

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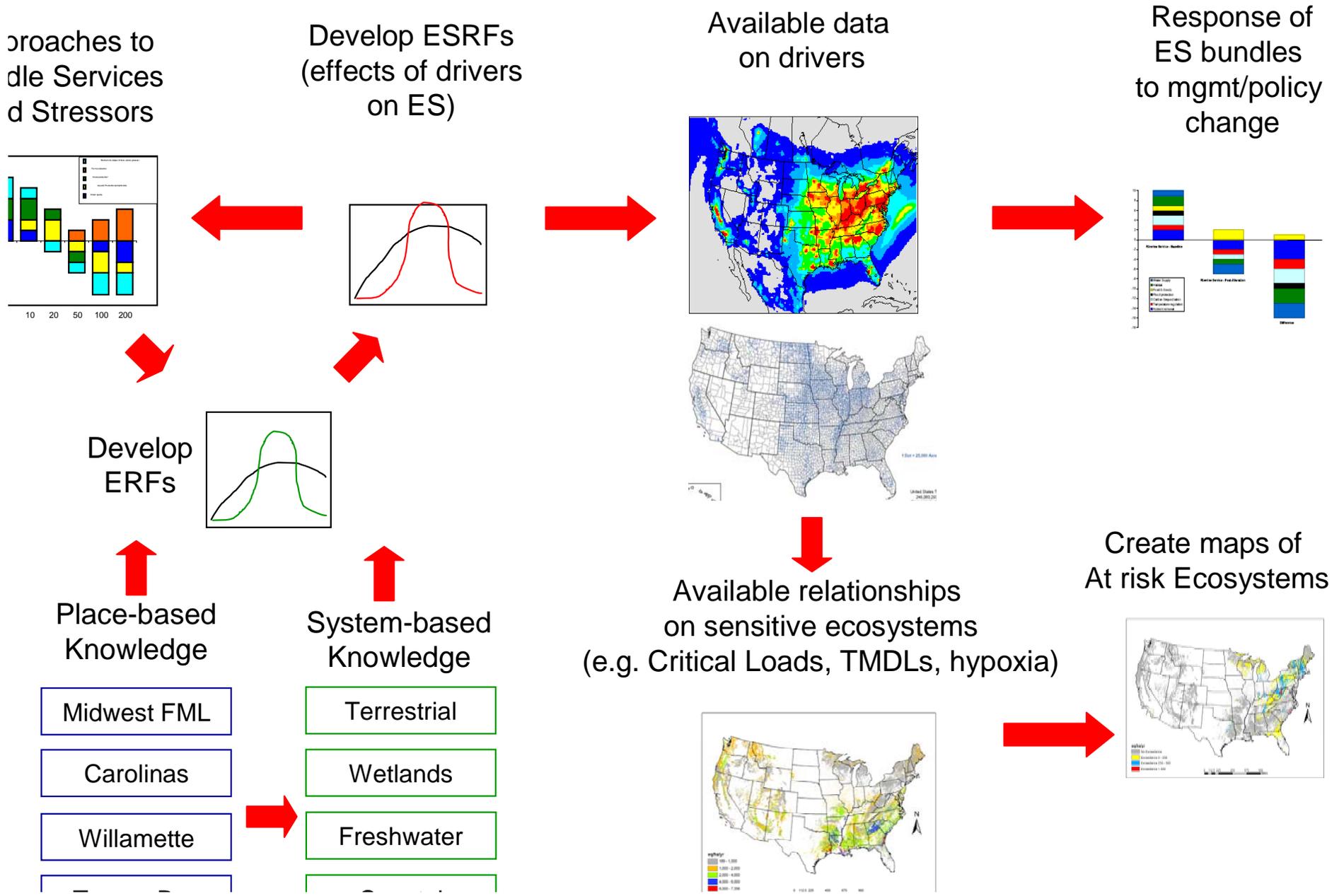
carbon sequestration

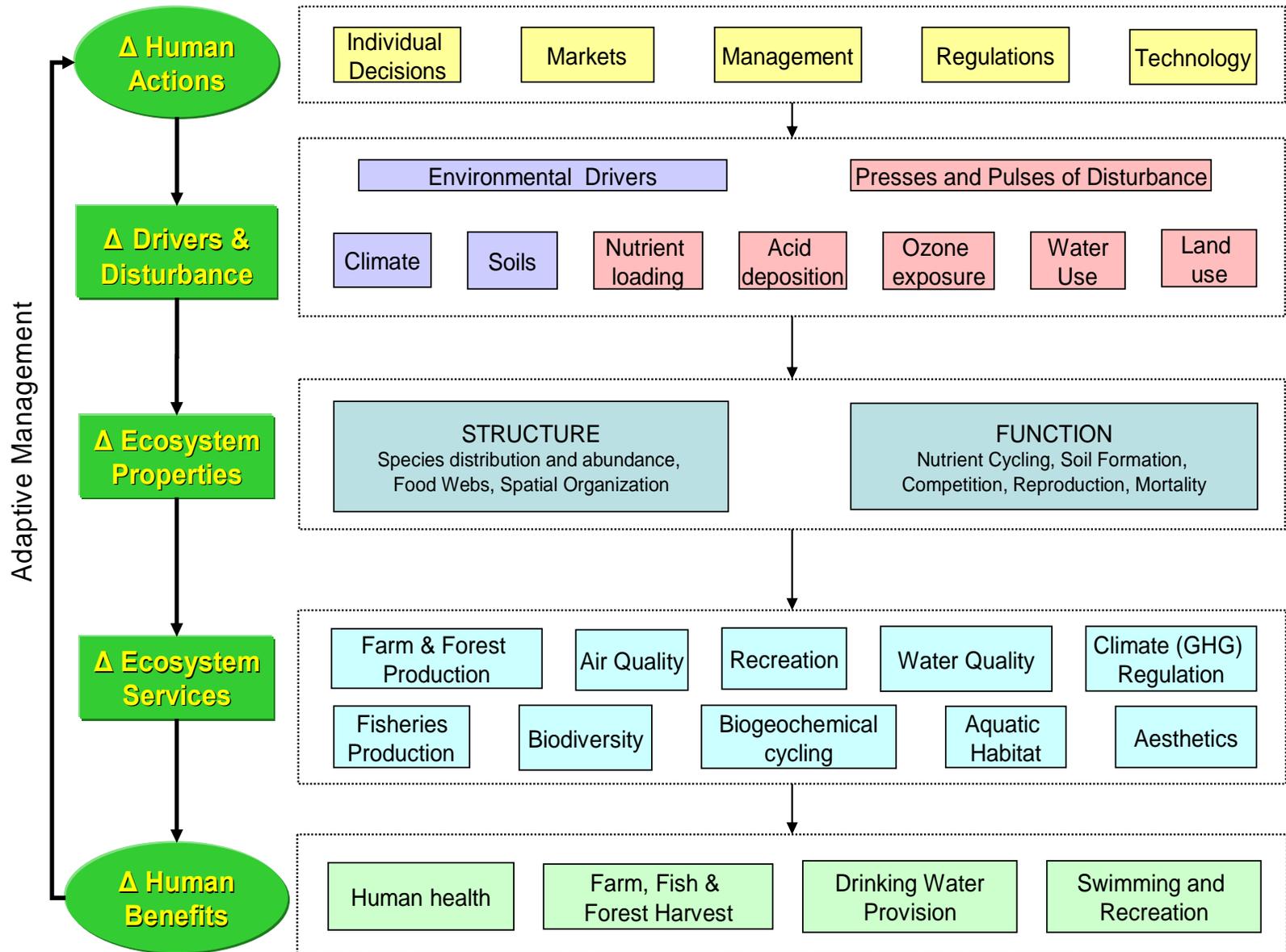
regional climate and air quality regulation

cropland with restored ecosystem services

## Conceptualization of enhanced eco services for agricultural lands.

# ESRP-Nitrogen Road Map







# Ecosystems Services Research Program

## Anticipated Future Accomplishments

- ***Incorporating ecosystem services into wetlands permitting decisions:*** new methods to support 2008 EPA & ACE rules.
  - First federal rule specific to ecosystem service
- Developing ***“community of practice” for ecosystem service modeling*** (similar in concept to IPCC climate modeling, as discussed by SAB)
- ***Accelerated pilot on reactive Nitrogen*** – in support of OW, OAQPS, Gulf of Mexico hypoxia issues, SAB’s Integrated Nitrogen Committee
  - “fast failure” test of ESRP approach to IMD: low risk / high reward.
  - potentially ground-breaking, with respect to Agency benefit / cost analyses
- ***National Ecosystem Services Research Partnership:*** more that 160 respondents
  - state resource agencies, regional planning councils, interdisciplinary departments at universities, professional societies, business, federal agencies, legal practitioners
  - acts a catalyst to most swiftly create, test, and apply tools
- ***Participation in MA “II” – sub-global assessments:*** via research underway at five ESRP community-based study areas