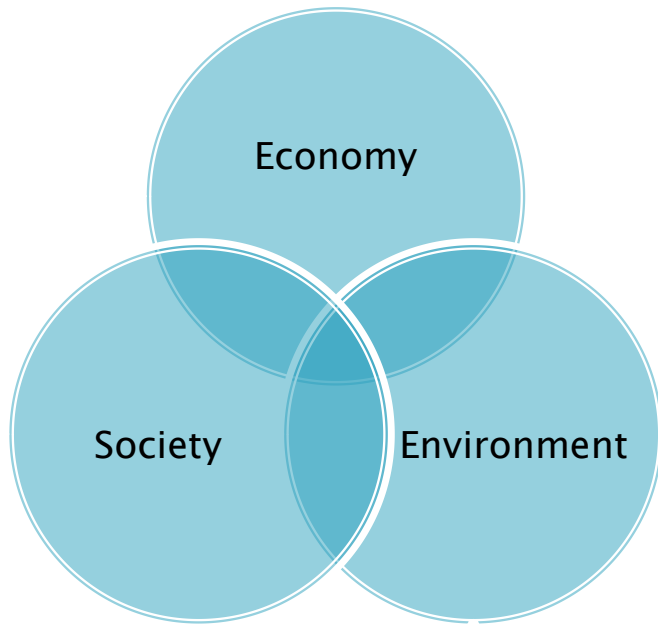


# Holistic Integrated Approaches to Water Resources Management and Ecosystem Services

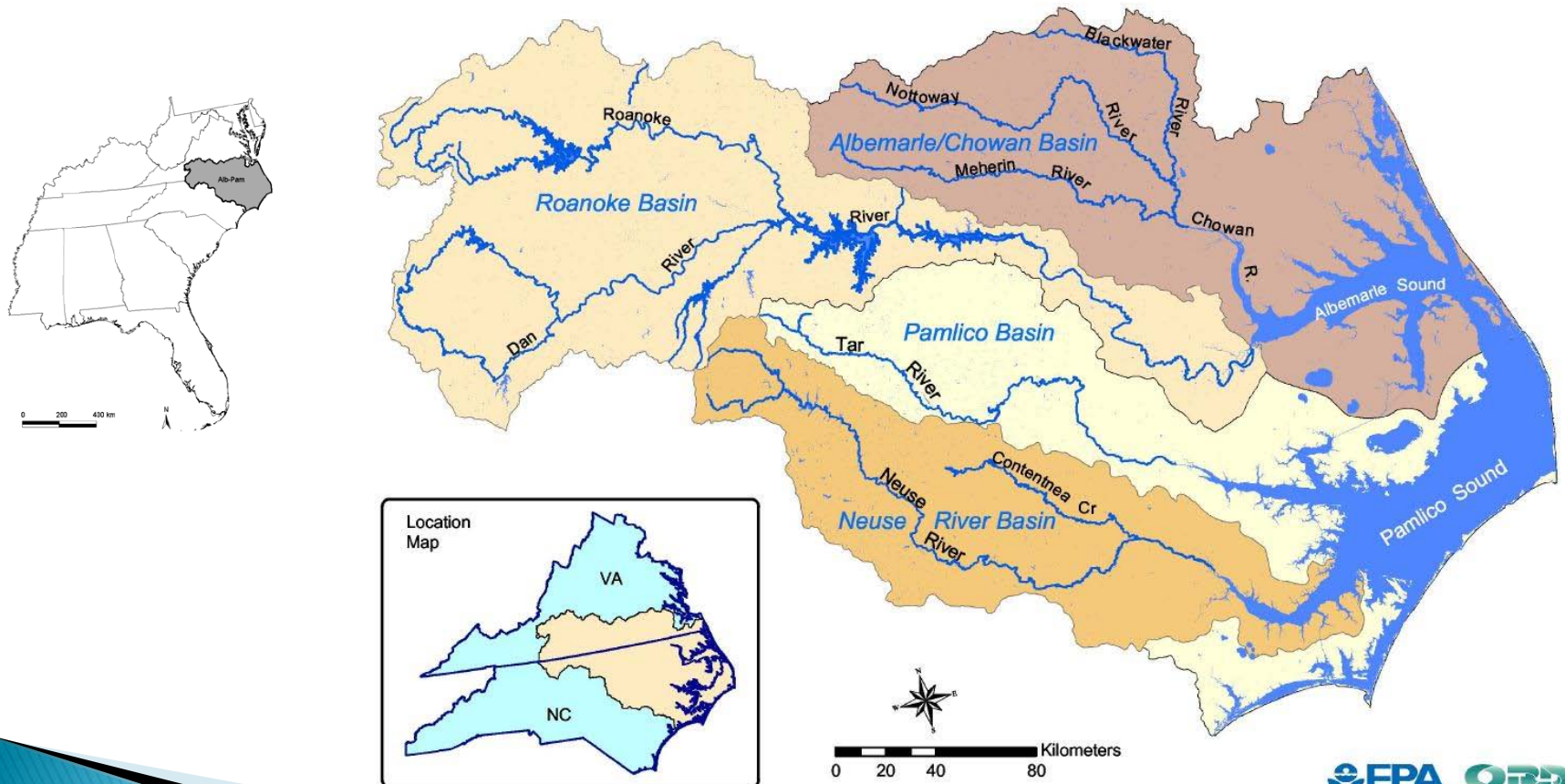
Brenda Rashleigh



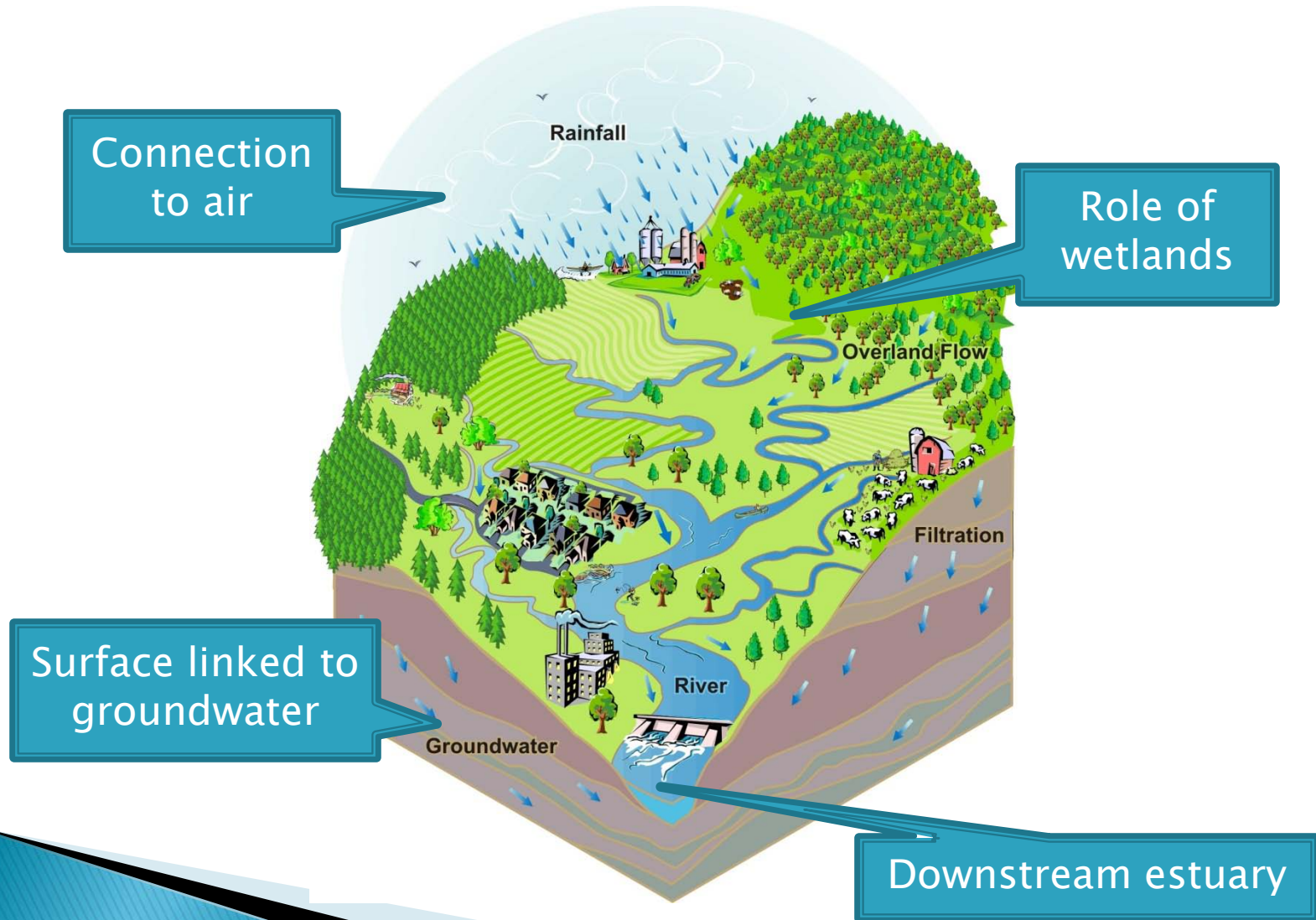
“International Development Cooperation and Sustainable Water Management”, 24 March 2011

# Water Resources Management

Major Waters of the Albemarle/Pamlico Drainage Basin  
with sub-watersheds (6-digit HUC)



# Integrate Across the Water Cycle





# Integrate Natural Environment with the Built Environment

- ▶ Human structure
  - Dams
  - Wastewater
- ▶ Human activities
  - Inter-basin transfers
  - Water withdrawals



# Integrate Across Ecosystem Services

## Provisioning

Food



## Regulating

Flood/Storm Protection



## Cultural

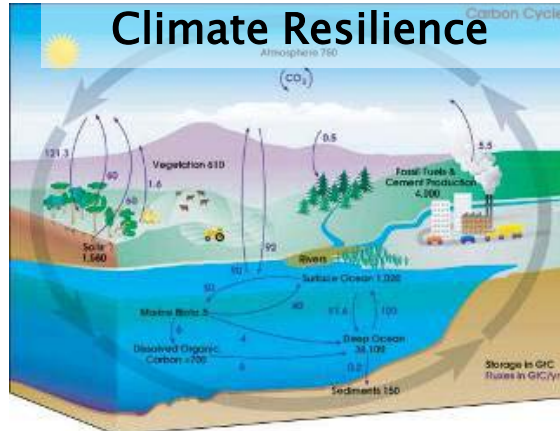
Recreation



## Clean Water



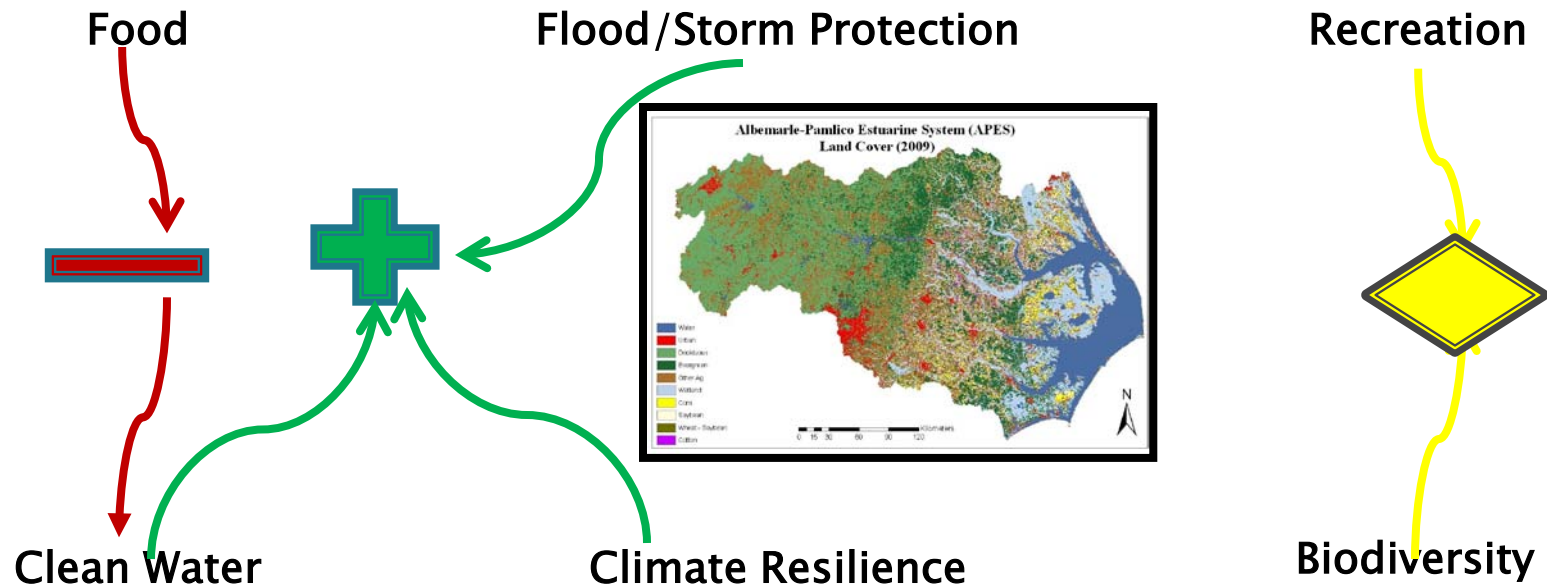
## Climate Resilience



## Biodiversity

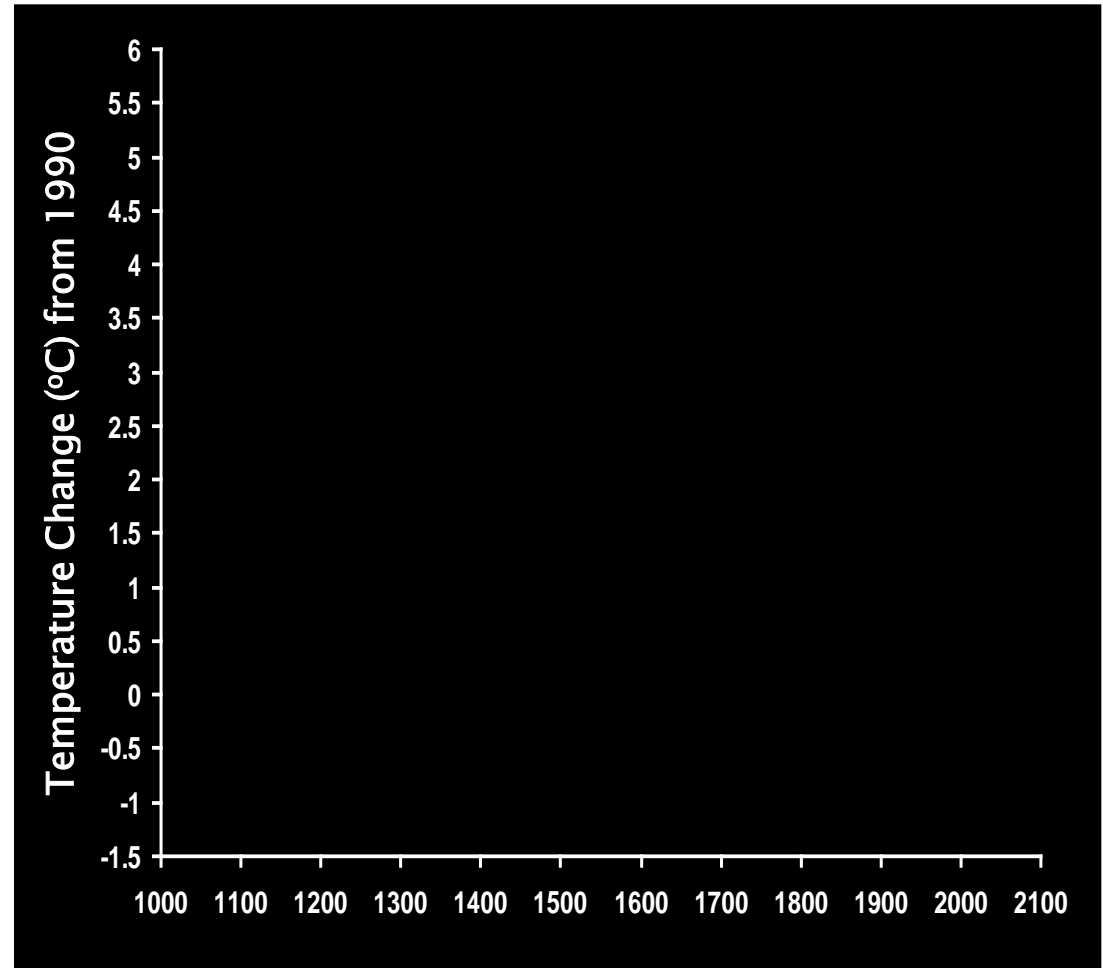
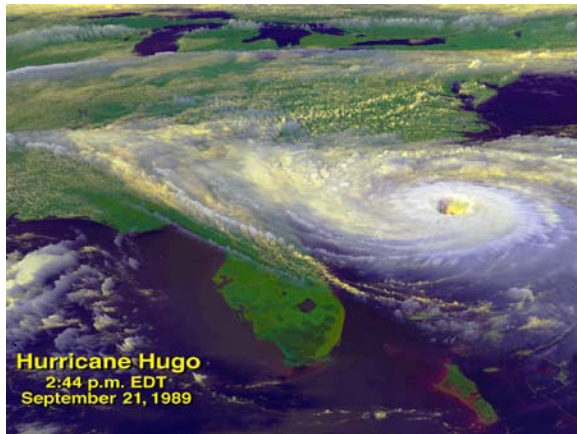


# Integrate Across Ecosystem Services






# ...Under Future Climate Change



Source: IPCC 2001

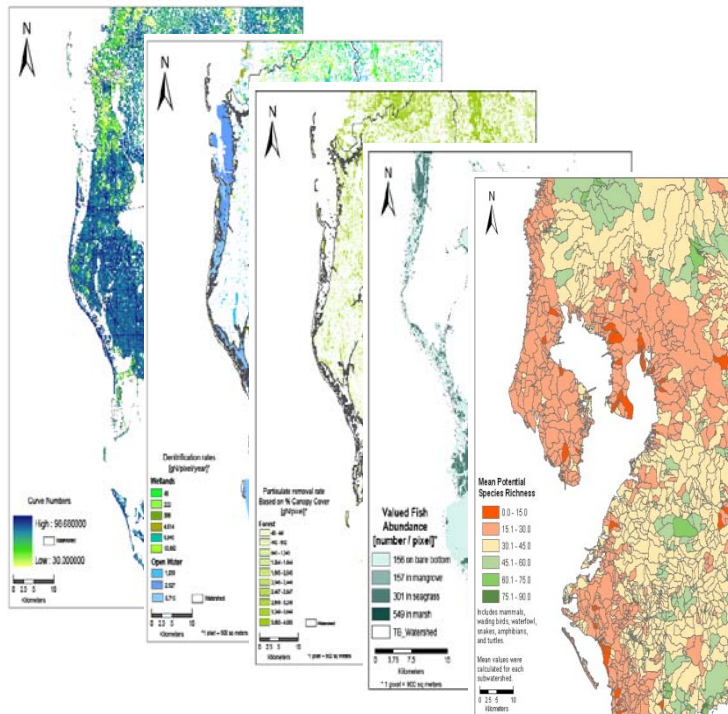
# Integration Across

- Water cycle,
  - human structures and activities,
  - and ecosystem services,
  - under a changing climate  
(and increasing population)
- 

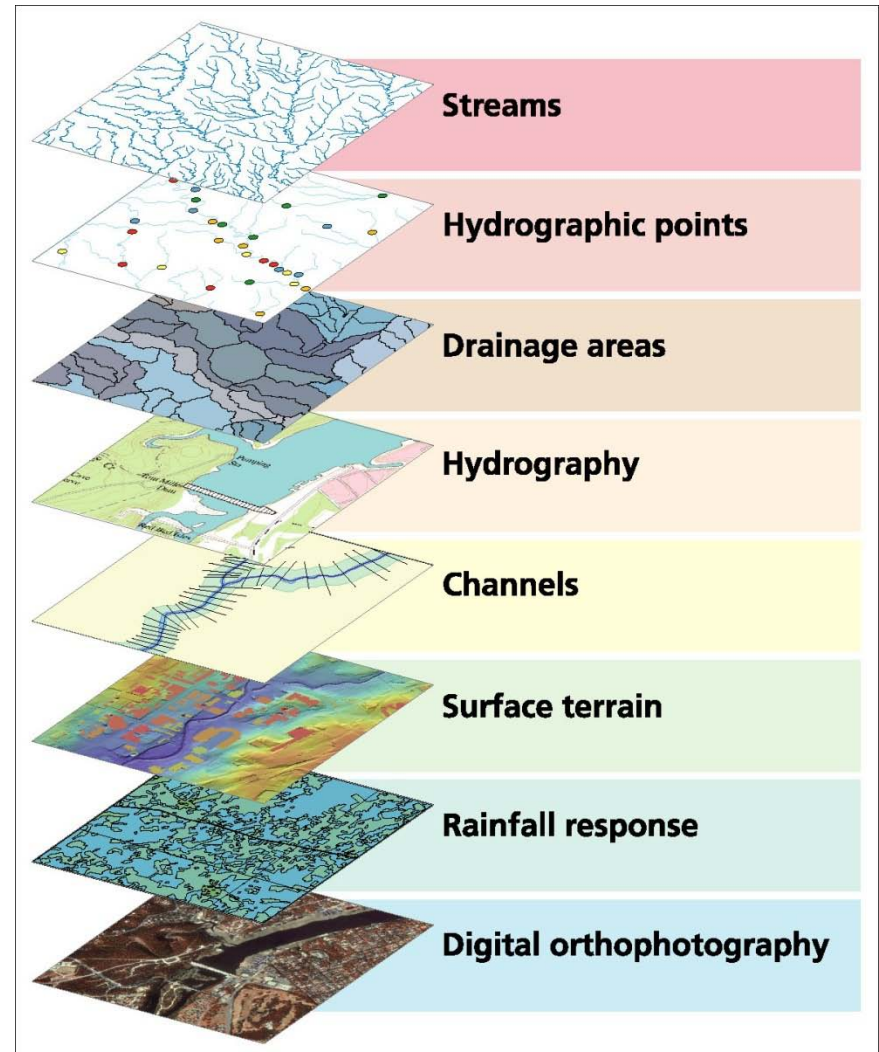


# Use Maps

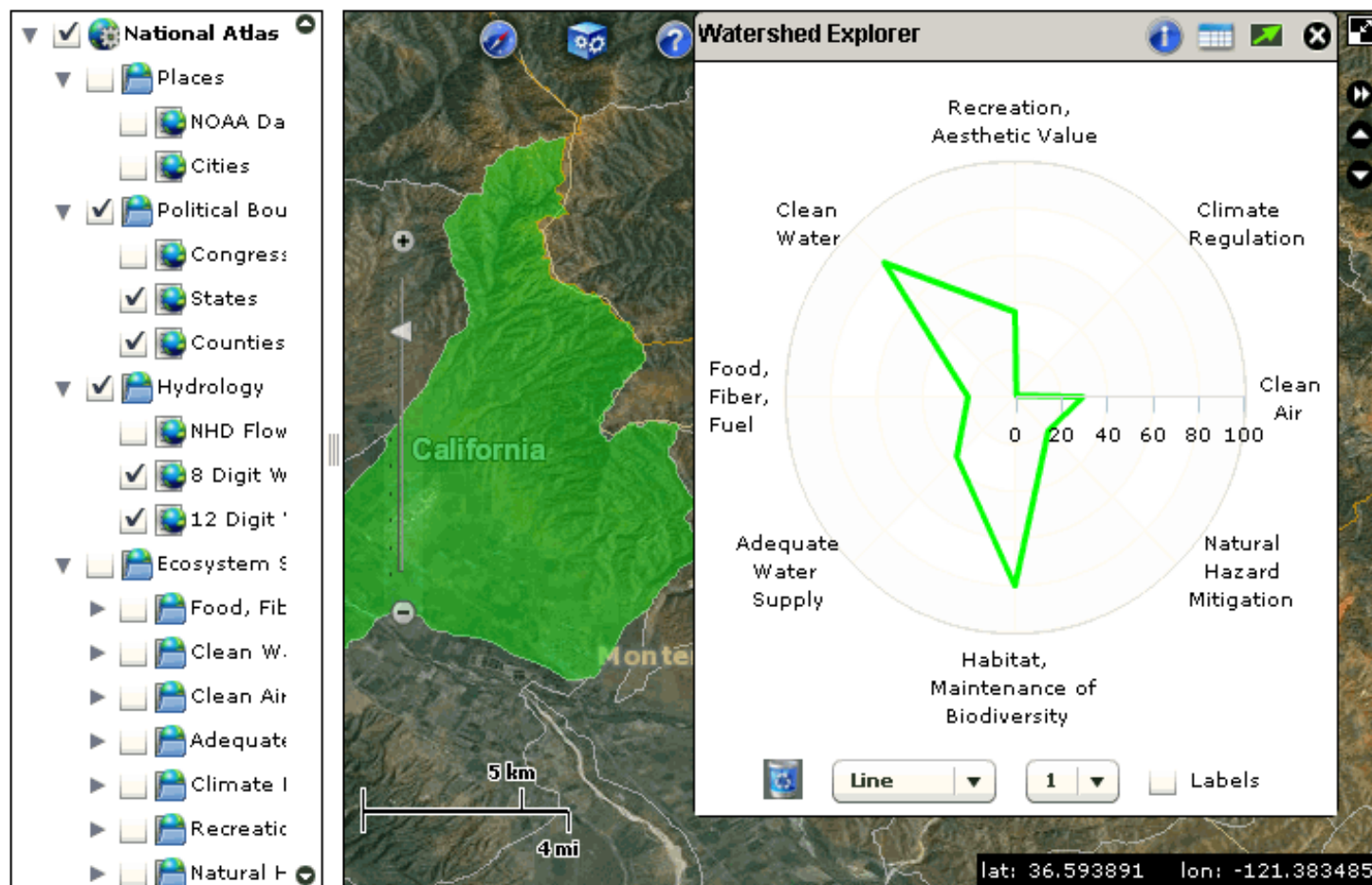
## Visualizing output



## Geographic data layers



# National Ecosystem Services Atlas



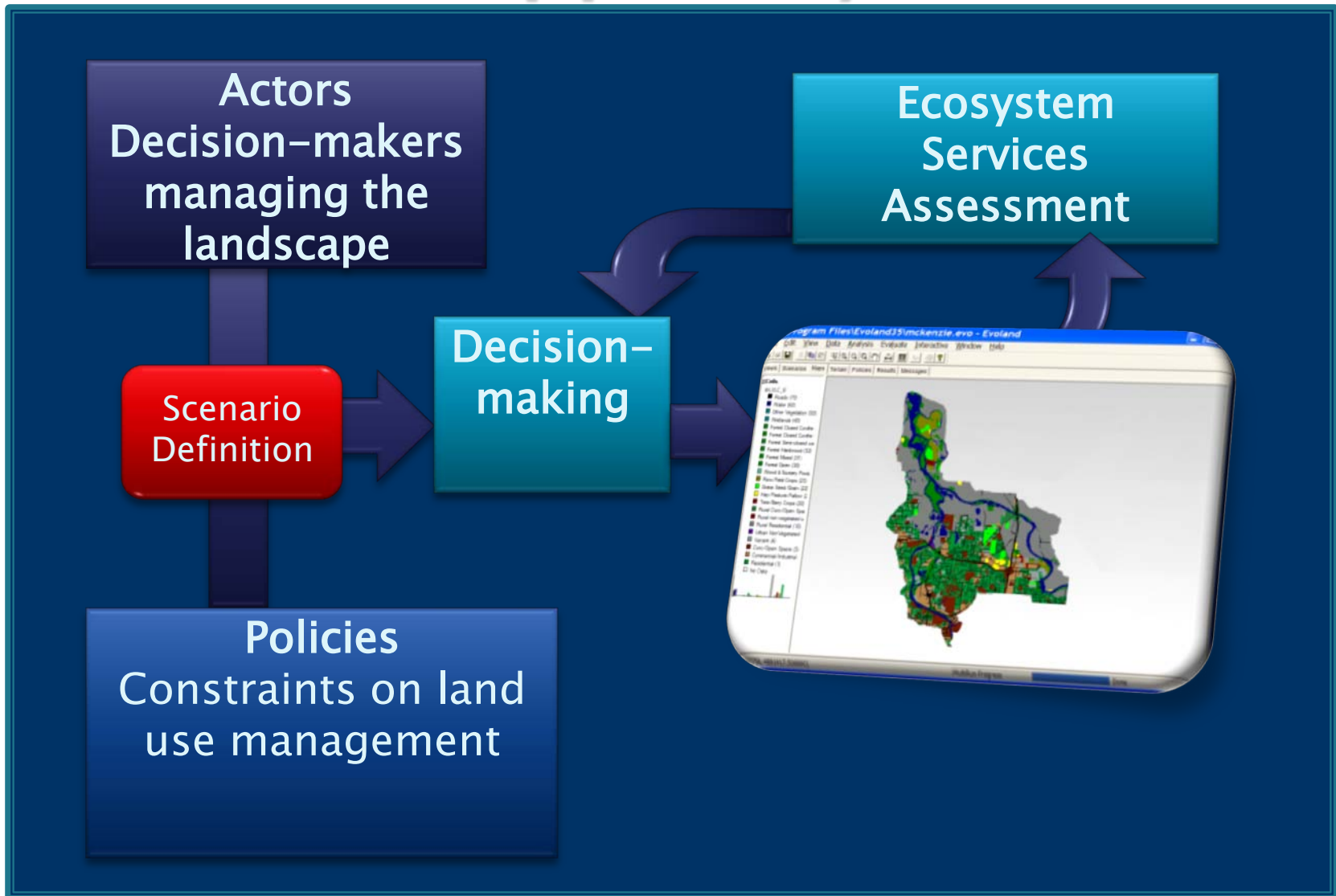
# Engage Stakeholders

- ▶ Participatory, interactive process
- ▶ Local acceptance and implementation





# Decision Support Systems



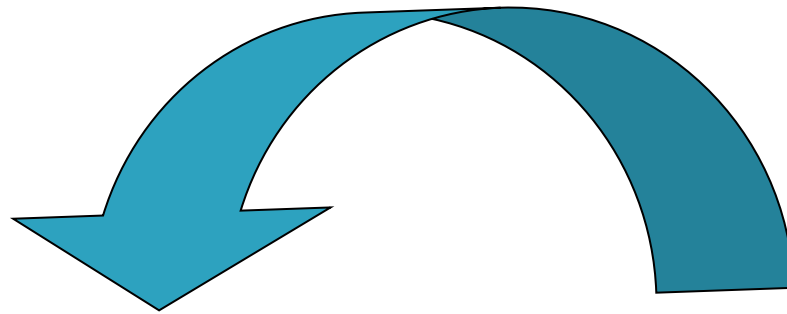
# Consider a Range of Technologies

- ▶ Water conservation
  - ▶ Reclaimed water
  - ▶ Aquifer storage and recovery
  - ▶ Desalinization
- 
- ▶ Economic incentives and markets



# Costa Rica Payments for Ecosystem Services (PES)

\$35–45 /  
hectare



Pay upstream  
landowners to maintain  
forest cover on their  
land

Downstream Users  
benefit from protection  
of upstream ecosystem  
services



1997 – 2001: 280,000 ha enrolled (\$30 million)



# Seek Co-Benefits

## Natural filtration

- Improved water quality  
= \$1.5 billion

< Water filtration plant –  
\$6 bill. + \$300  
mill./year



Catskills, New  
York, USA

# Summary

- ▶ View water resources in an integrated way
- ▶ Seek optimal solutions through stakeholder interactions and best available technology



Neuse River, North Carolina, USA