Roanoke River Basin: Ecosystem Service Value Assessment

Dan River Basin Workshop
April 17, 2018

KEY-LOG. economics LLC

Project Team

Spencer Phillips, Ph.D.
Economist &
Principal

Anna Perry
Research Associate

Agenda

- Introductions
- Project Overview
- Ecosystem Service Framework & Tools

Break

- Baseline, Basin-wide Ecosystem Service Value

Lunch

- Group Discussion
- Break out Discussions
- Priority Actions and Next Steps

Project Overview

- Baseline Ecosystem Services Assessment
  - Basin-wide and for Upper & Lower Dan and for Lower Roanoke subbasins
- What are stressors, issues, opportunities, that may affect ecosystem service delivery
- Evaluate effects of those factors
- Develop the "ESValuator", a QGIS plugin to make ecosystem service valuation easier and more accessible.

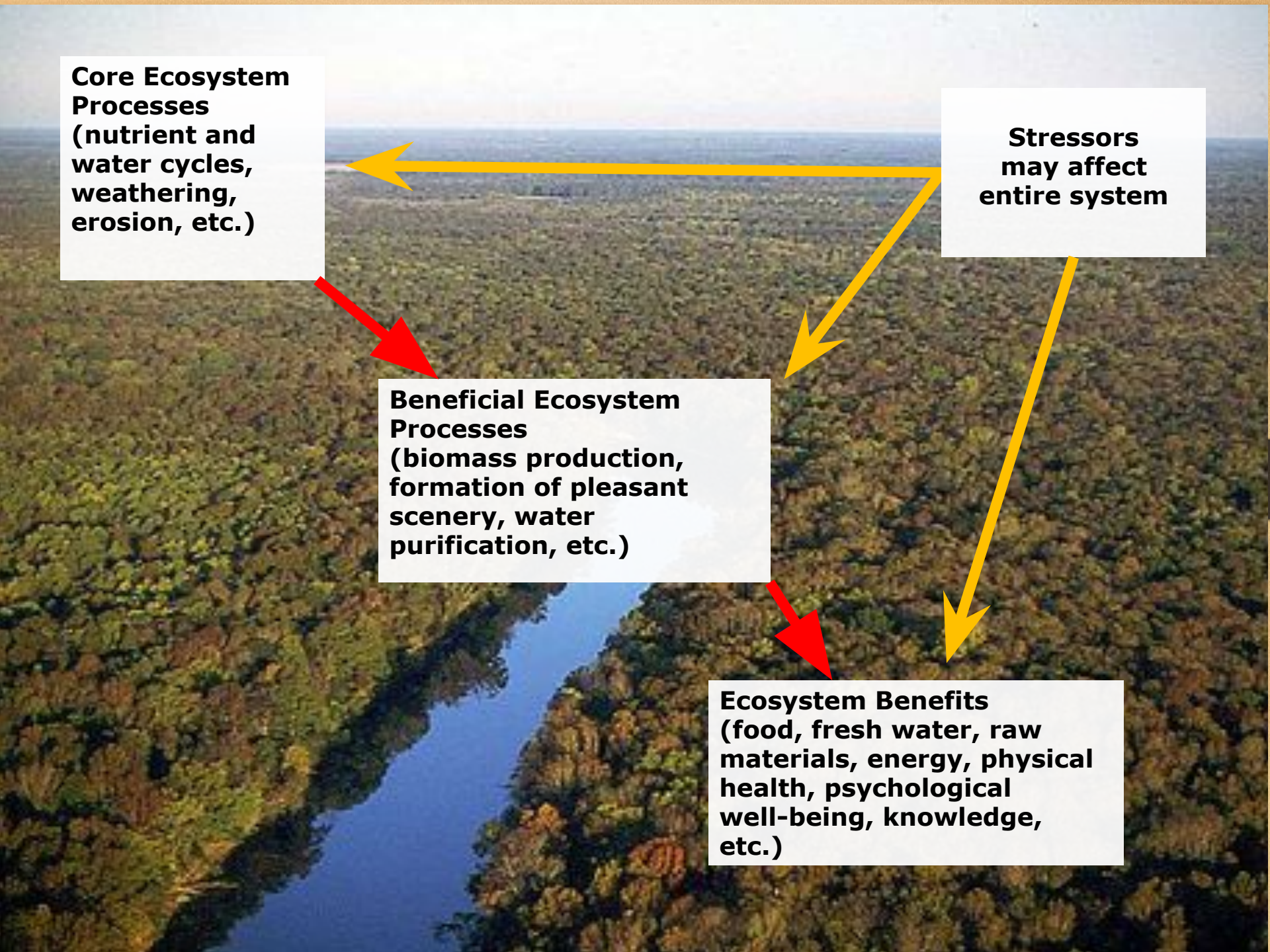
Ecosystem Services Framework

Ecosystem Services are "the effects on human well-being of the flow of benefits from an ecosystem endpoint to a human endpoint at a given extent of space and time (Johnson, et al., 2010)."

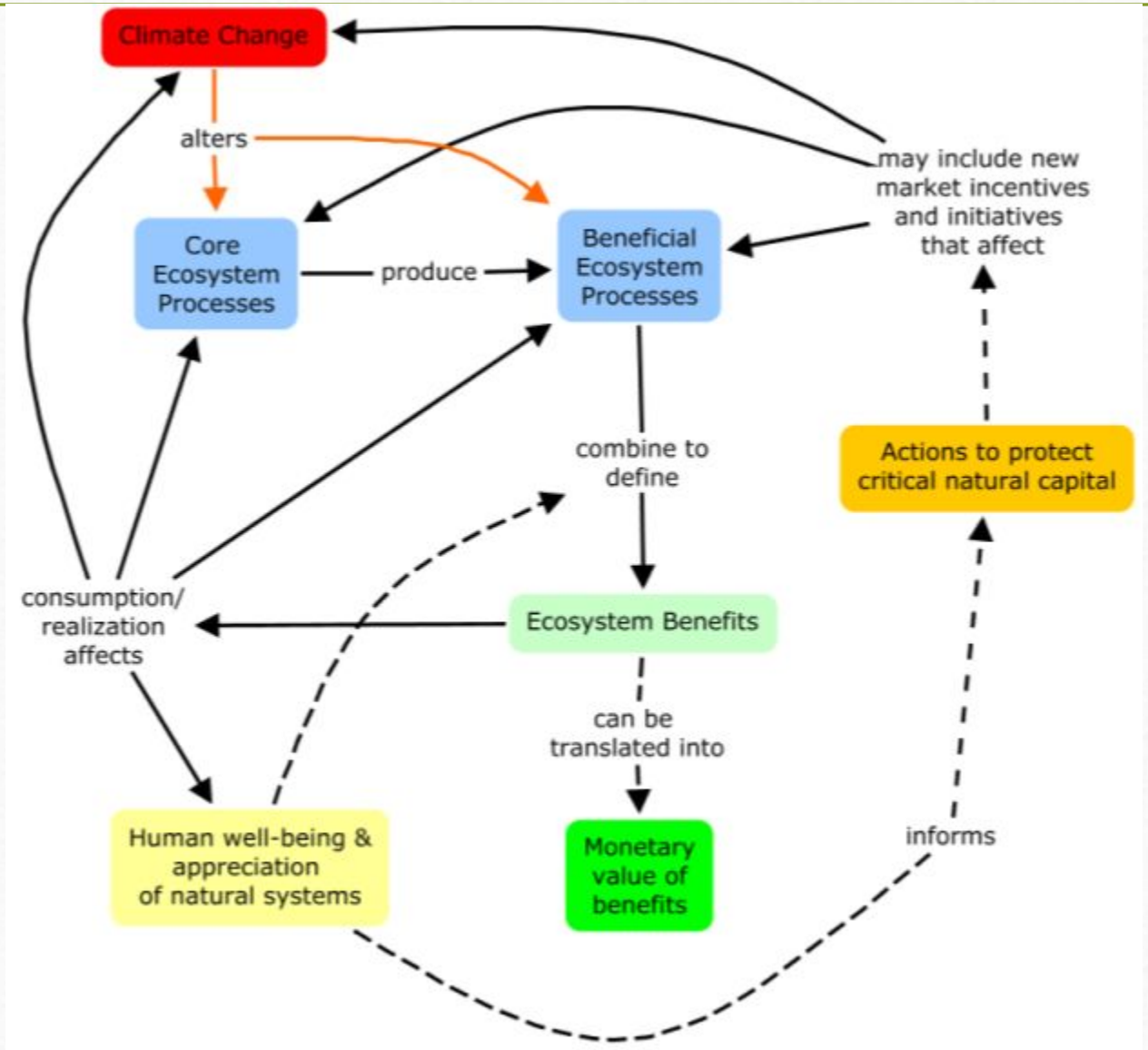
Ecosystem Services Framework

Human-focused, but driven by ecological processes.

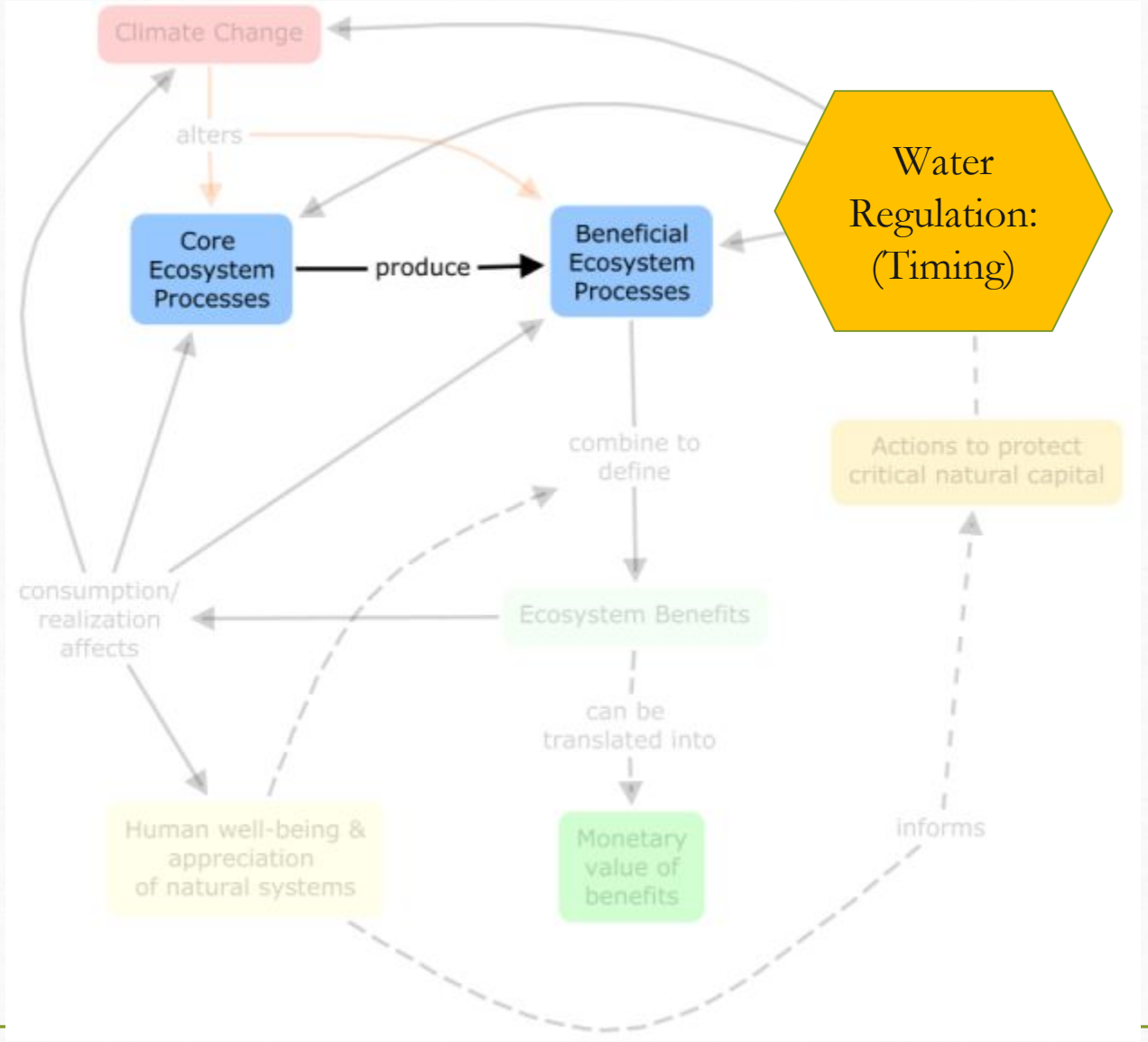
Biophysical quantities
+
Human needs and desires
=
Ecosystem Services


Core Ecosystem Processes (nutrient and water cycles, weathering, erosion, etc.)
Stressors may affect entire system
Beneficial Ecosystem Processes (biomass production, formation of pleasant scenery, water purification, etc.)
Ecosystem Benefits (food, fresh water, raw materials, energy, physical health, psychological well-being, knowledge, etc.)

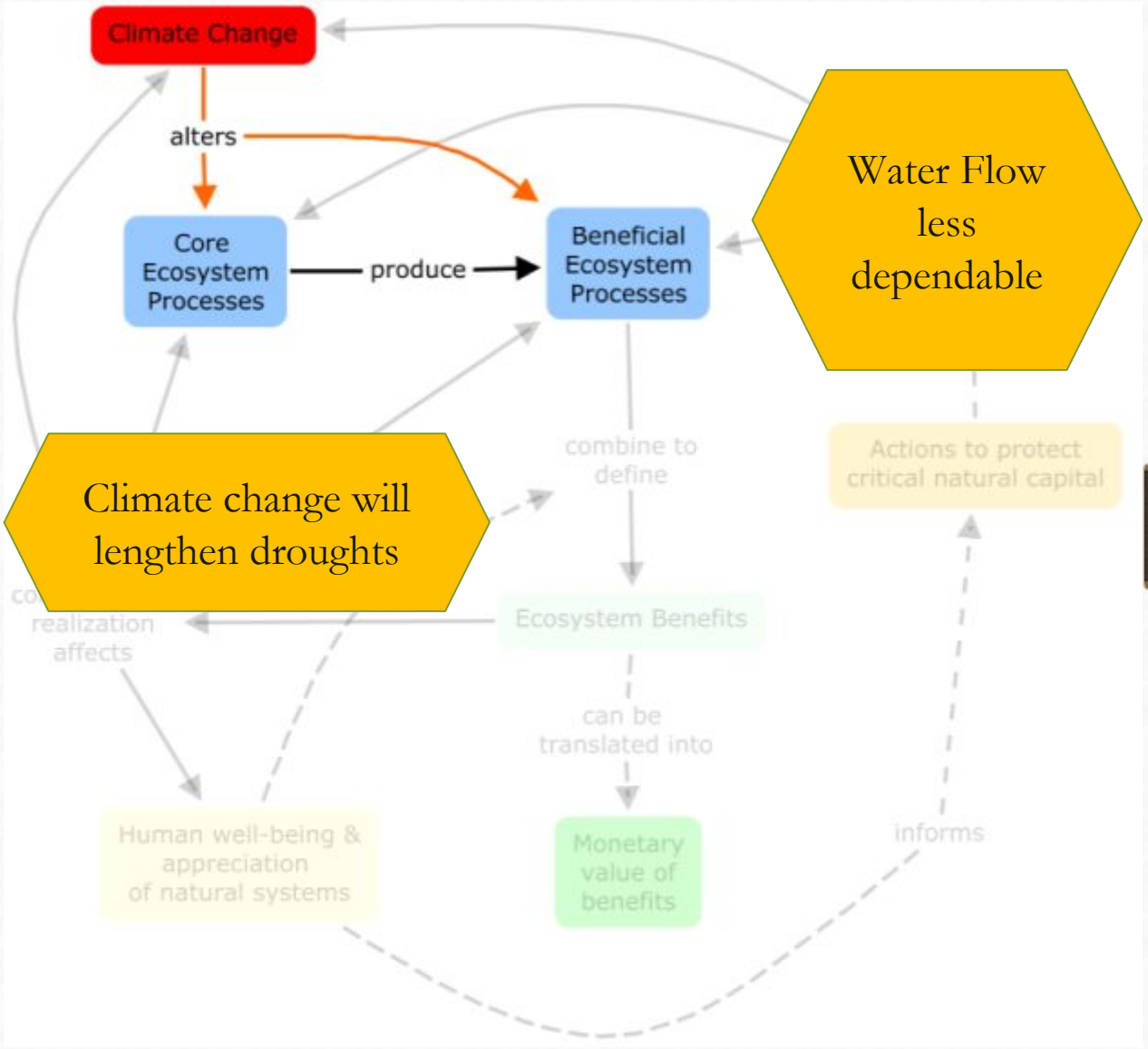
Concept Map (Sample)



Core processes produce beneficial processes.

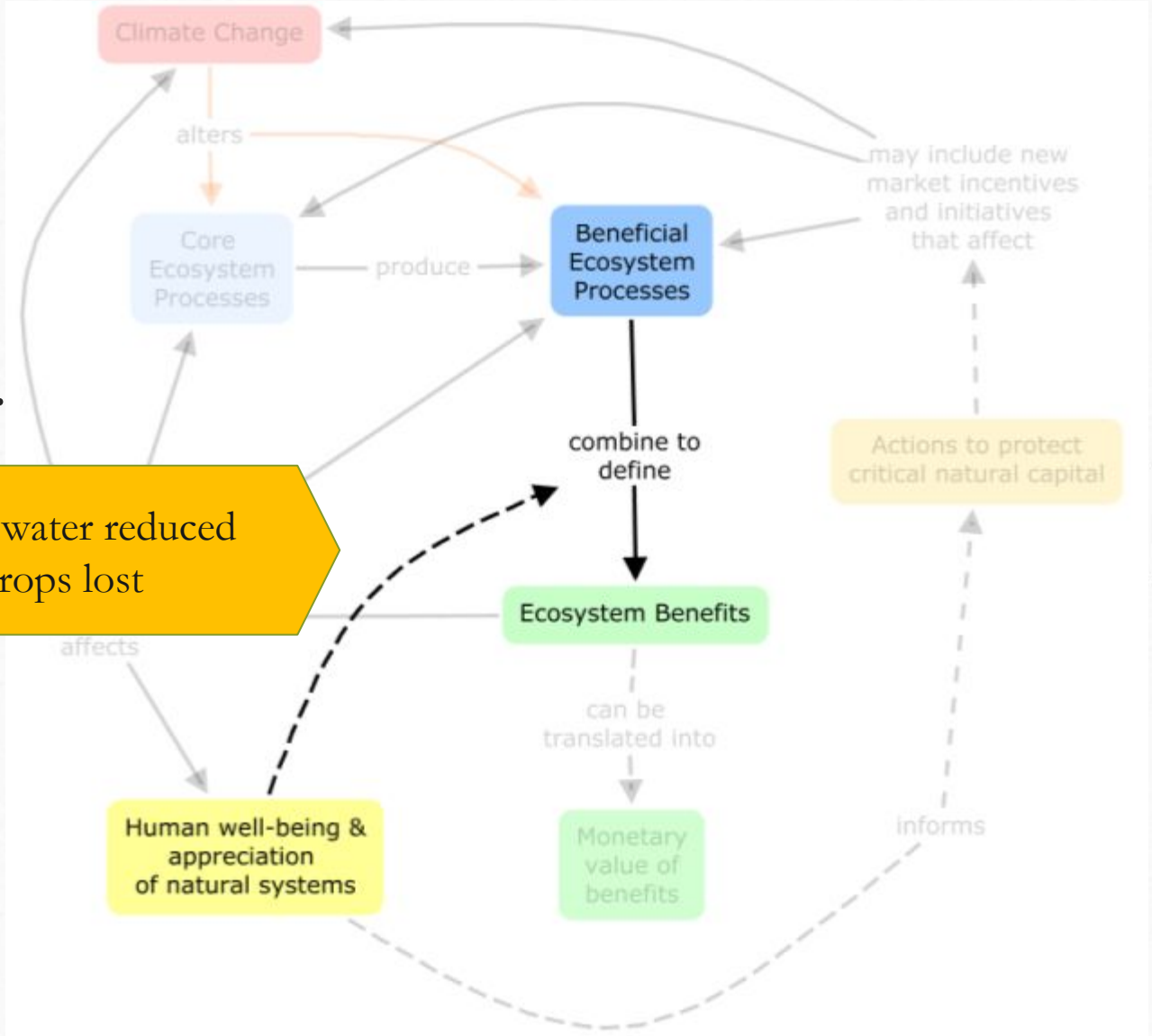


Stressors alter processes.

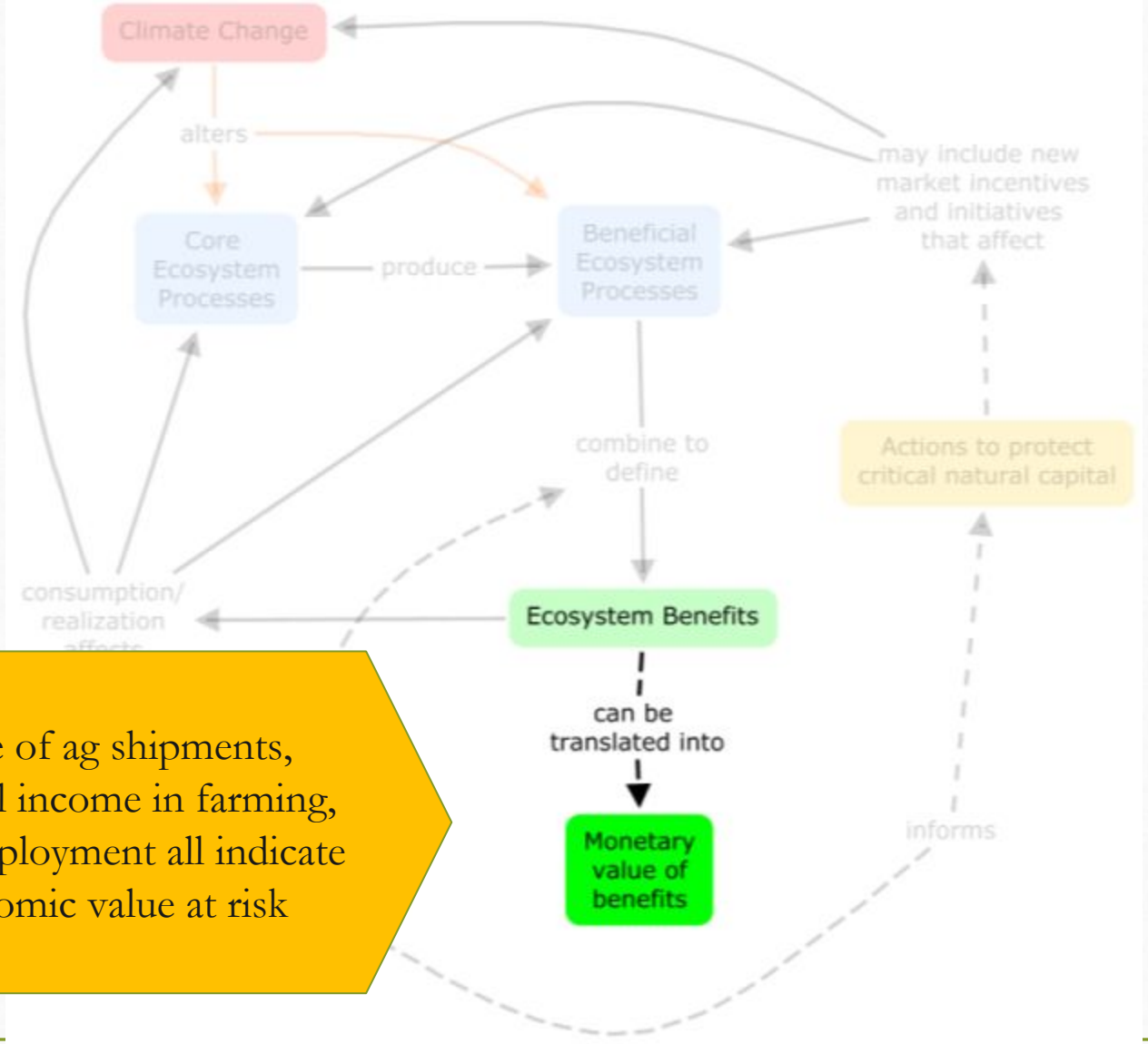


Benefits derive from processes AND appreciation.

Irrigation water reduced -> crops lost

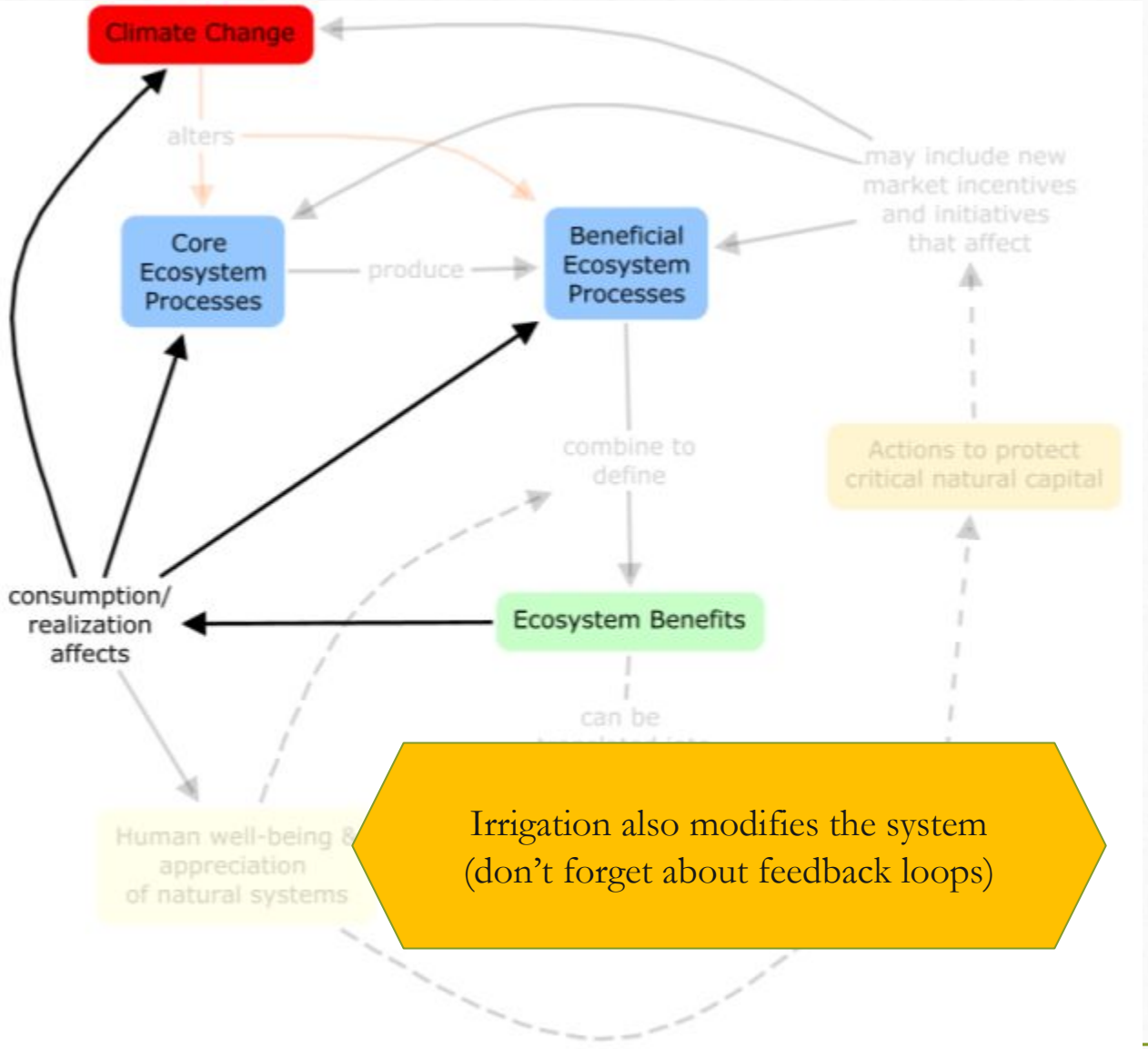


Benefits can be (but do not have to be) expressed in dollars.

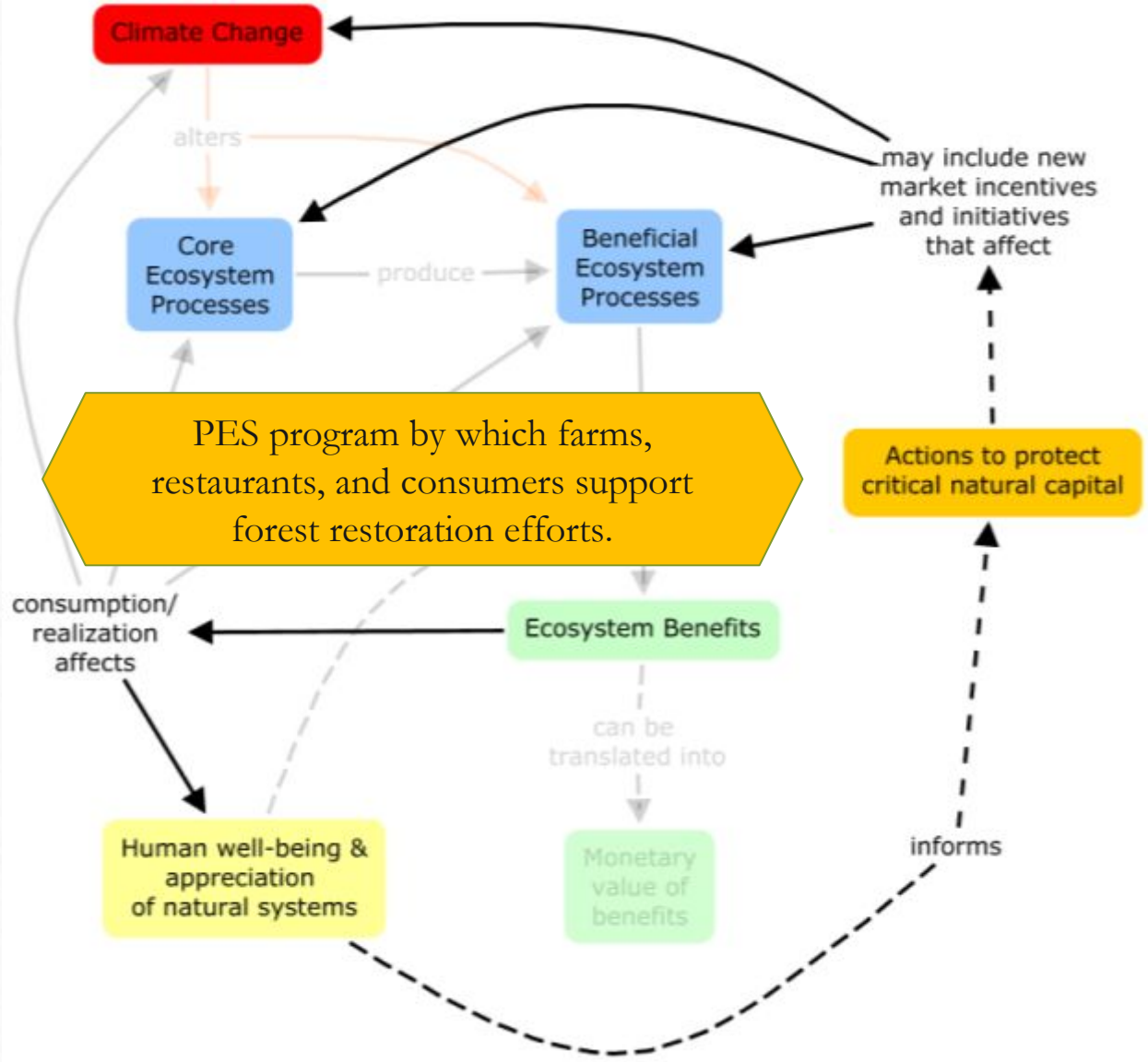


Value of ag shipments, personal income in farming, farm employment all indicate economic value at risk

Using benefits has bio-physical feedbacks.



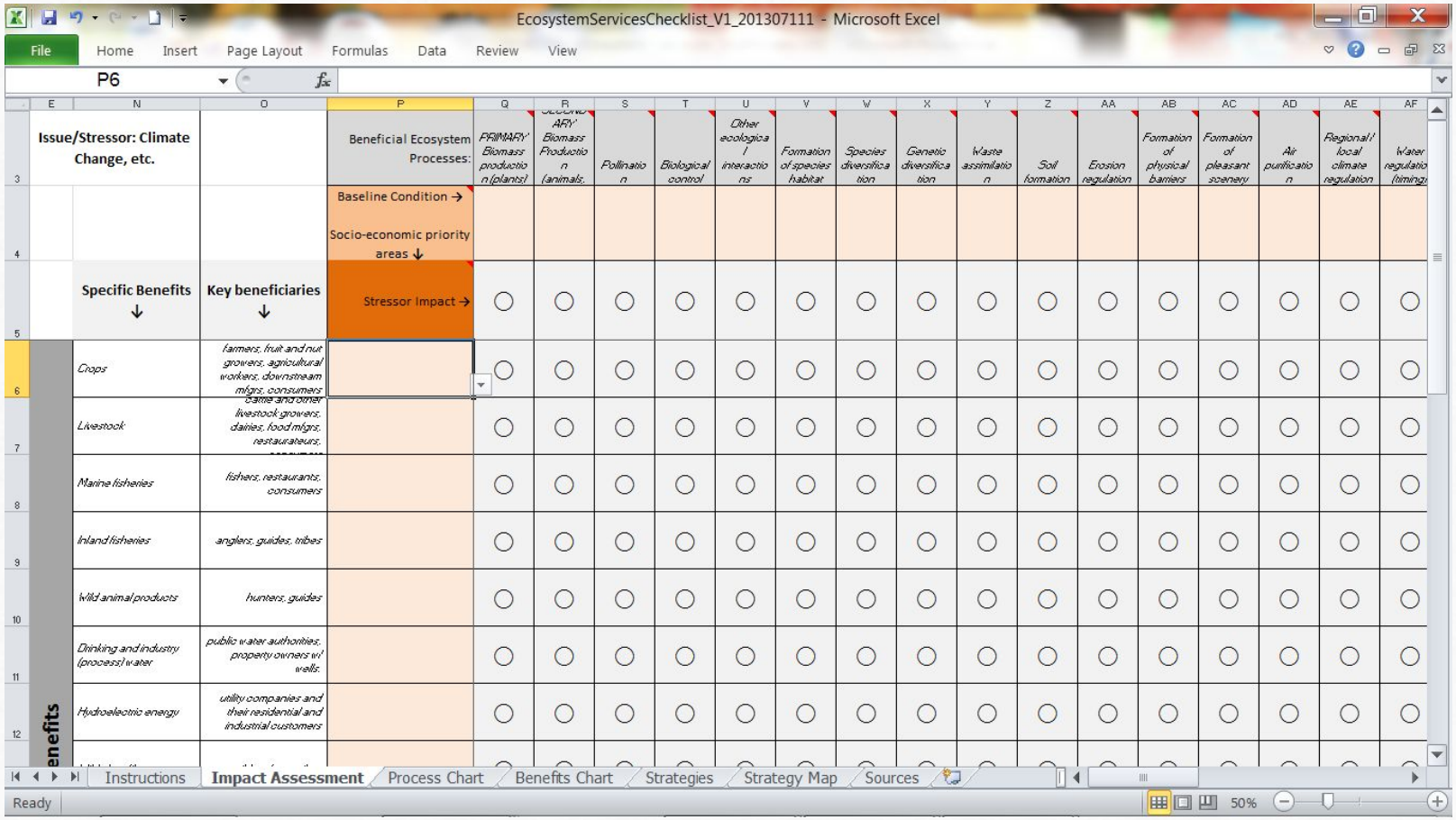
Using benefits also has policy and market feedbacks.



Ecosystem Services Assessment

- To enumerate and, possibly, quantify
  key ecosystem service values and impacts
- To provide a basis for land use management
  that restores, conserves and sustains ecosystem processes and benefits
- To support market-based and other relationships
  that provide resources for adaptation actions
  - Payments for ecosystem services
  - Marketing and other partnerships
  - Revenue / cost sharing
  - Education

The Sandbox


EcosystemServicesChecklist_V1_201307111 - Microsoft Excel
File
Home
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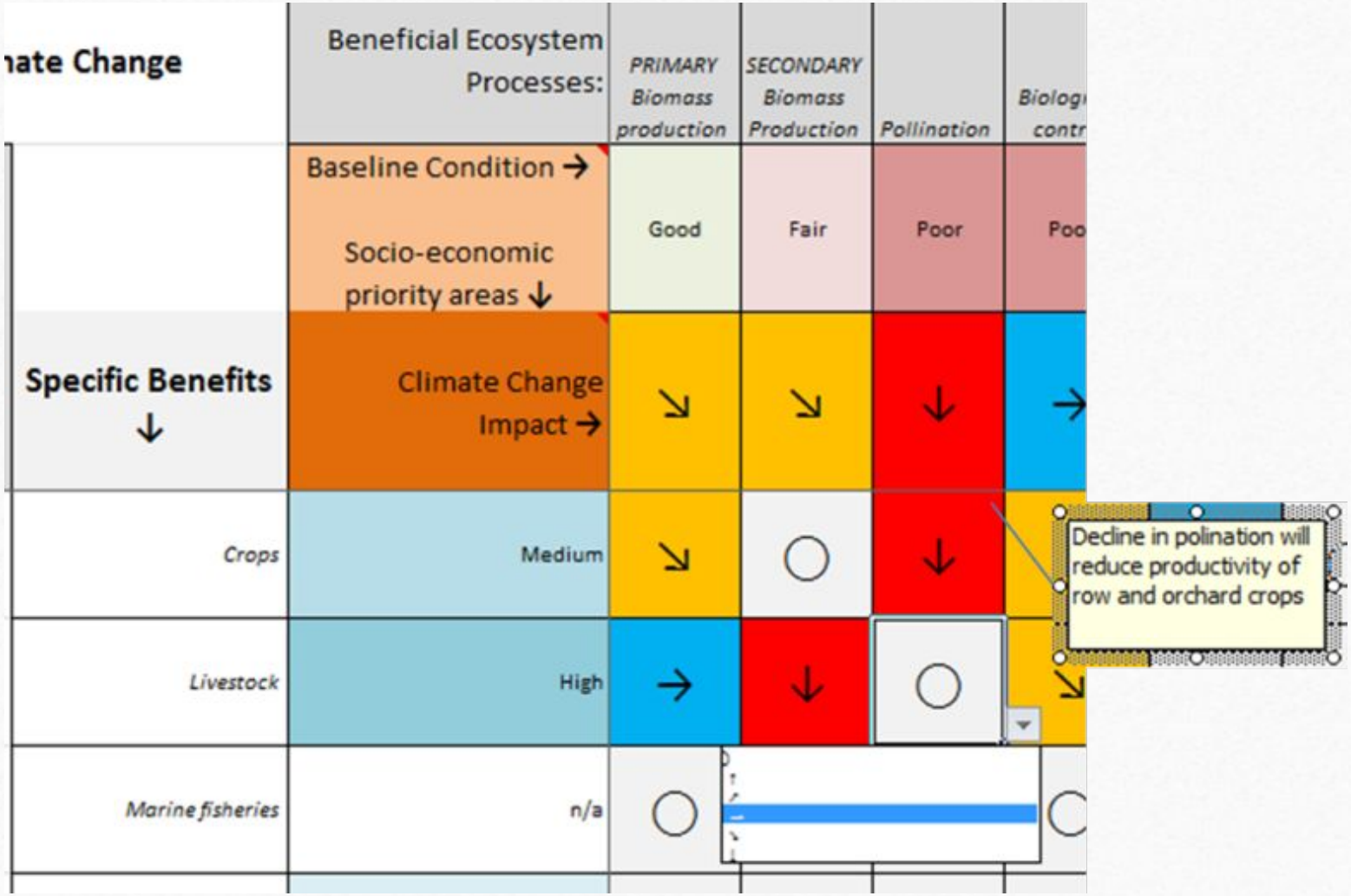
Page Layout
Formulas
Data
Review
View
P6
Issue/Stressor: Climate Change, etc.
Beneficial Ecosystem Processes:
Baseline Condition →
Socio-economic priority areas ↓
Specific Benefits ↓
Key beneficiaries ↓
Stressor Impact →
PRIMARY Biomass production (plants)
SECONDARY Biomass Production (animals)
Pollination
Biological control
Other ecological interactions
Formation of species habitat
Species diversification
Genetic diversification
Waste assimilation
Soil formation
Erosion regulation
Formation of physical barriers
Formation of pleasant scenery
Air purification
Regional/ local climate regulation
Water regulation (timing)
Crops
farmers, fruit and nut growers, agricultural workers, downstream mfgrs, consumers
Livestock
livestock growers, dairies, food mfgrs, restaurateurs,
Marine fisheries
fishers, restaurants, consumers
Inland fisheries
anglers, guides, tribes
Wild animal products
hunters, guides
Drinking and industry (process) water
public water authorities, property owners w/ wells
Hydroelectric energy
utility companies and their residential and industrial customers
Instructions
Impact Assessment
Process Chart
Benefits Chart
Strategies
Strategy Map
Sources
Ready
50%

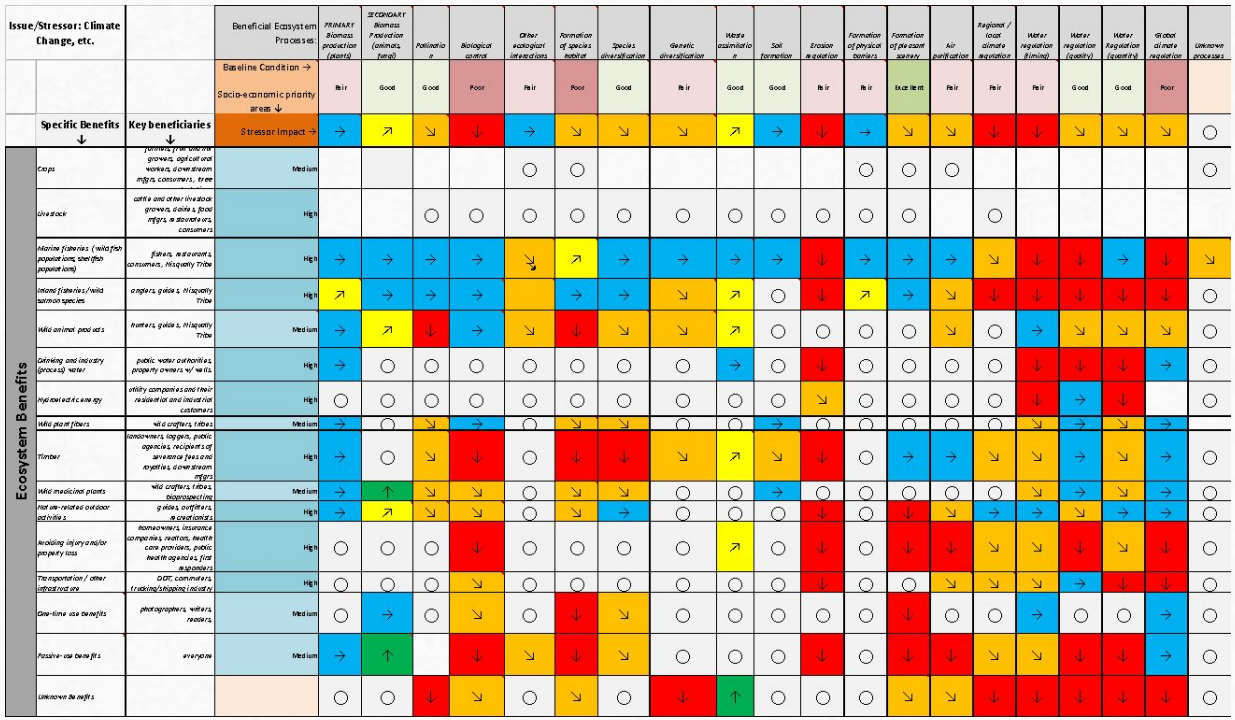
Follow the Benefits "Upstream" (and Back).

- What are some key economic sectors?
- What benefits are they connected to?
- What processes are important to the supply of those benefits?
- What is the condition of each key processes?
- How will climate change affect that condition?
- How will changes in the process' conditions affect benefits?

Judgements are about Relative Change.

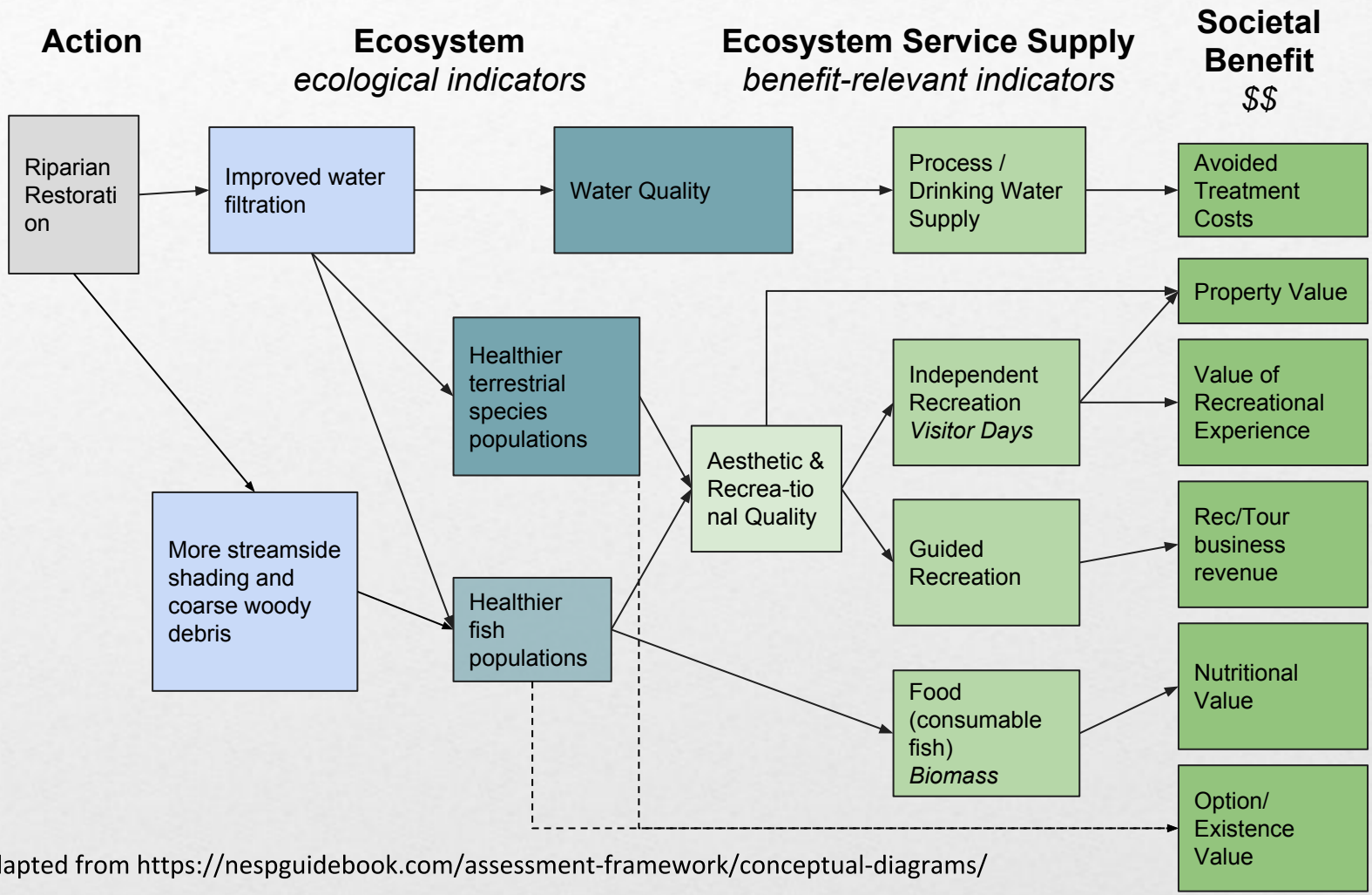


Assessment Tool Sample (Nisqually River Council)



Issue/Stressor: Climate Change, etc.			Beneficial Ecosystem Processes	PRIMARY Biomass production (plants)	SECONDARY Biomass Production (animals, fungi)	Pollination	Biological control	Other ecological interactions	Formation of species habitat	Species diversification	Genetic diversification	Waste assimilation	Soil formation	Erosion regulation	Formation of physical barriers	Formation of pleasant scenery	Air purification	Regional / local climate regulation	Water regulation (timing)	Water regulation (quality)	Water Regulation (quantity)	Global climate regulation	Unknown processes
			Baseline Condition →	Fair	Good	Good	Poor	Fair	Poor	Good	Fair	Good	Good	Fair	Fair	Excellent	Fair	Fair	Fair	Good	Good	Poor	
	Specific Benefits ↓	Key beneficiaries ↓	Socio-economic priority areas ↓																				
			Stressor Impact →	→	↗	↘	↓	→	↘	↘	↘	↗	→	↓	→	↘	↘	↓	↓	↘	↘	↘	○
Ecosystem Benefits	Crops	farmers, private timber growers, agricultural workers, downstream mfgrs, consumers, tree	Medium					○	○						○	○	○						○
	Livestock	cattle and other livestock growers, dairy & goat mfgrs, restaurants, consumers	High			○	○	○	○	○	○	○	○	○	○	○		○					
	Marine fisheries (wild fish population, shellfish population)	fishers, restaurants, consumers, Nisqually Tribe	High	→	→	→	→	↗	↗	→	→	→	→	↓	→	→	→	↗	↓	↓	→	↓	↗
	Inland fisheries/wild salmon species	anglers, guides, Nisqually Tribe	High	↗	→	→	→		→	→	↗	↗	○	↓	↗	→	↗	↓	↓	↓	↓	↓	○
	Wild animal products	hunters, guides, Nisqually Tribe	Medium	→	↗	↓	→	↗	↓	↗	↗	↗	○	○	○	○	↗	○	→	↗	↗	↗	○
	Drinking and industry (process) water	public water authorities, property owners w/ wells	High	→	○	○	○	○	○	○	○	→	○	↓	○	○	○	○	↓	↓	↓	→	○
	Hydroelectric energy	utility companies and their residential and industrial customers	High	○	○	○	○	○	○	○	○	○	○	↗	○	○	○	○	↓	→	↓		○
	Wild plant fibers	wild crafters, tribes	Medium	→	○	↗	→	○	↗	↗	○	○	→	○	○	○	○	○	↗	→	↗	→		
	Timber	landowners, loggers, public agencies, recipients of severance fees and royalties, downstream mfgrs	High	→	○	↗	↓	○	↓	↓	↗	↗	↗	↓	○	→	→	↗	↗	→	↗	→	○
	Wild medicinal plants	wild crafters, tribes, bioprospecting	Medium	→	↑	↗	↗	○	↗	↗	○	○	→	○	○	○	○	○	↗	→	↗	→	○
	Not use-related outdoor activities	guides, outfitters, ecotourists	High	→	↗	↗	↗	○	↗	→	○	○	○	↓	○	↓	↘	→	→	↗	→	→	○
	Avoiding injury and/or property loss	homeowners, insurance companies, realtors, health care providers, public health agencies, first responders	High	○	○	○	↓	○	○	○	○	↗	○	↓	○	↓	↓	↗	↗	↓	↗	↓	○
	Transportation / other infrastructure	ODOT, commuters, trucking/shipping industry	High	○	○	○	↗	○	○	○	○	○	○	↓	○	○	↘	↗	↗	→	↓	↓	○
	One-time use benefits	photographers, writers, readers,	Medium	○	→	○	↗	○	↓	↗	○	○	○	○	○	↓	○	○	→	○	○	→	○
	Passive-use benefits	everyone	Medium	→	↑		↓	↗	↓	↗	○	○	○	↓	○	↓	↓	↗	↗	↓	↓	→	○
	Unknown benefits			○	○	↓	↗	○	↗	○	↓	↑	○	○	○	↗	↗	↓	↓	↓	↓	↓	○

Ecosystem Services Value Chain



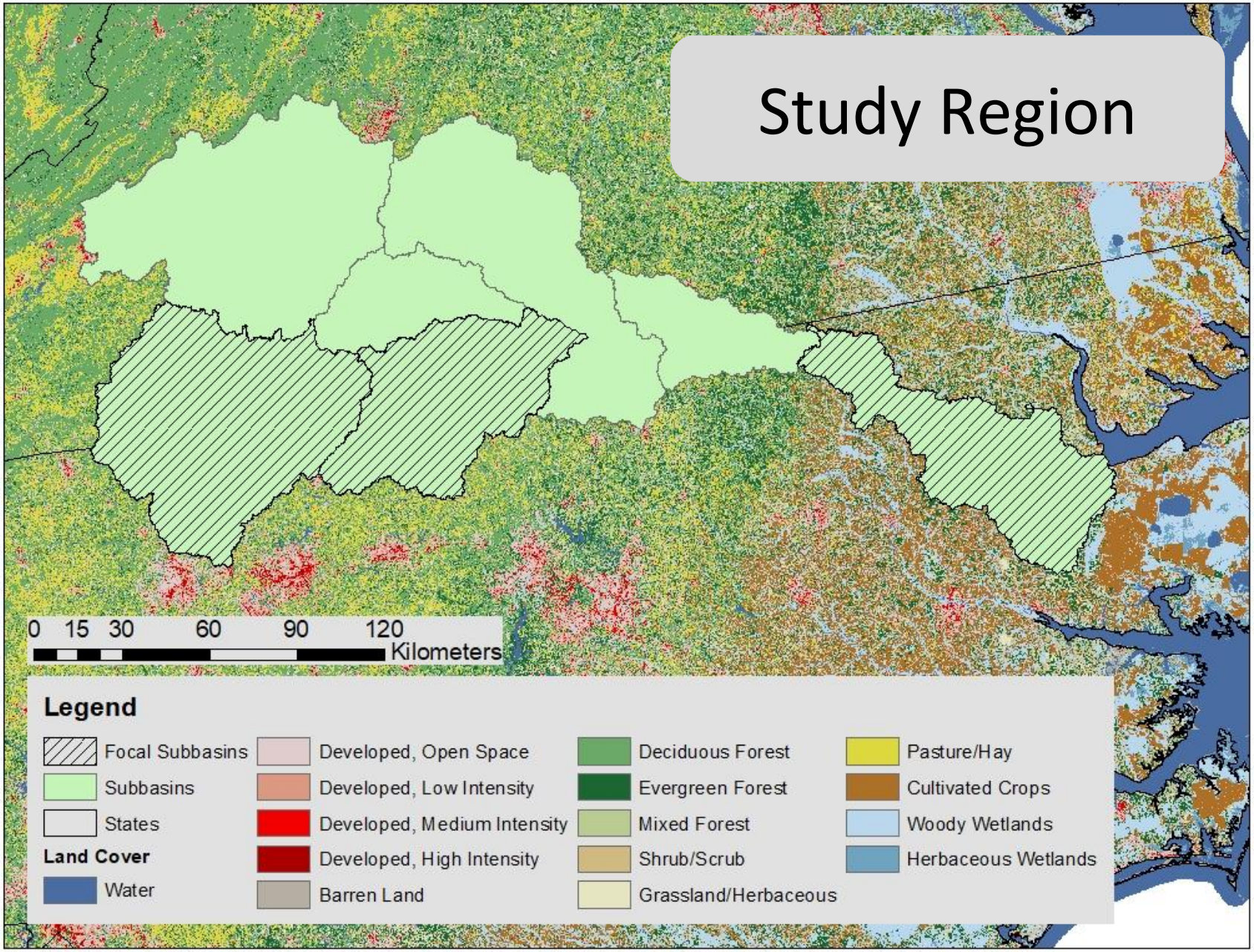
Adapted from https://nespguidebook.com/assessment-framework/conceptual-diagrams/


Break
10
Minutes

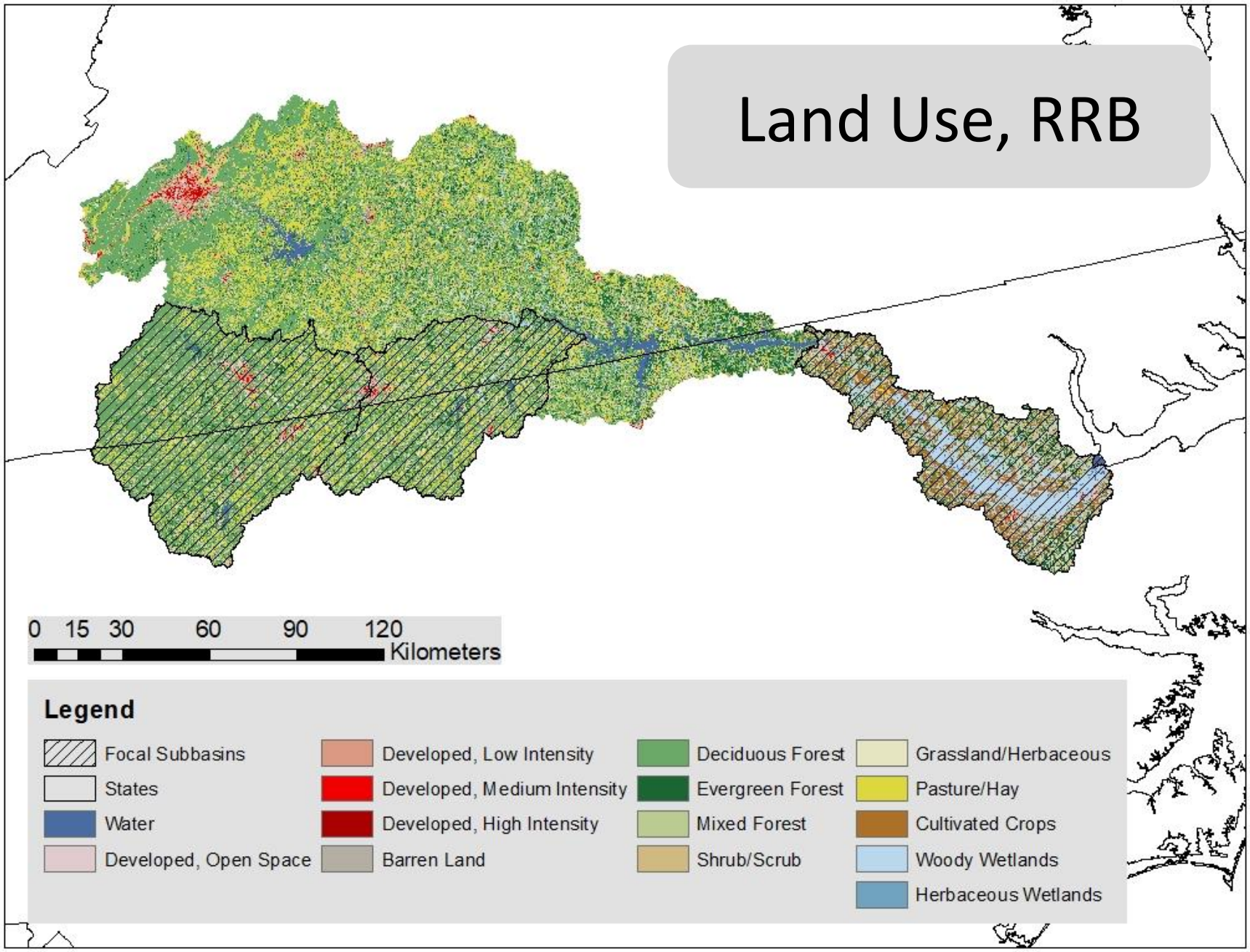
Baseline Estimates

- Land Cover (or Land Use)
  - Area in each land
- Ecosystem Service Productivity
  - $ per unit area per year
  - for a range of ecosystem services (water supply, recreation, aesthetics, raw materials, etc.)
  - Minimum of "candidate values" or "comps" used today
- Area x $/area/year = $/year

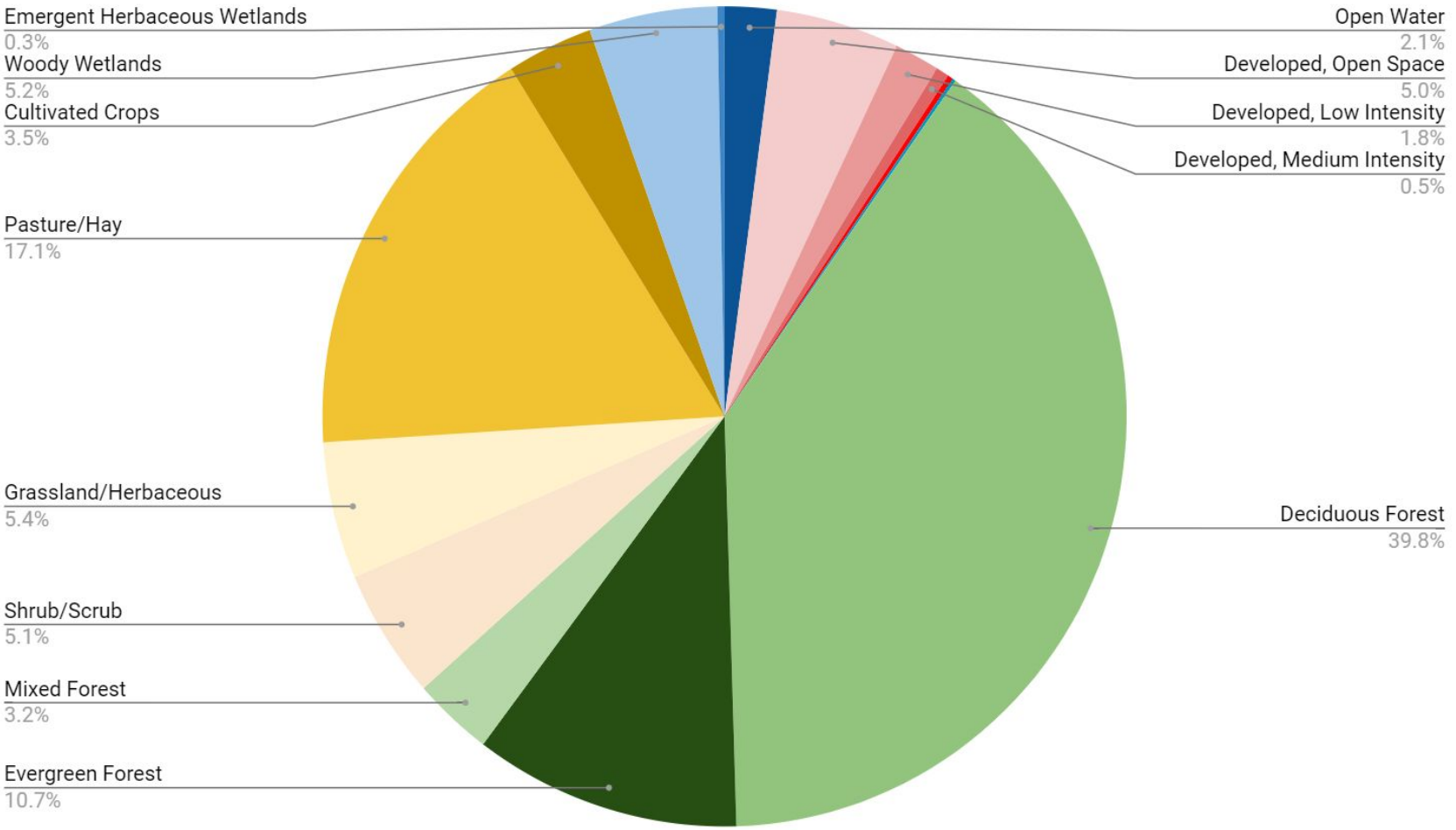
Study Region



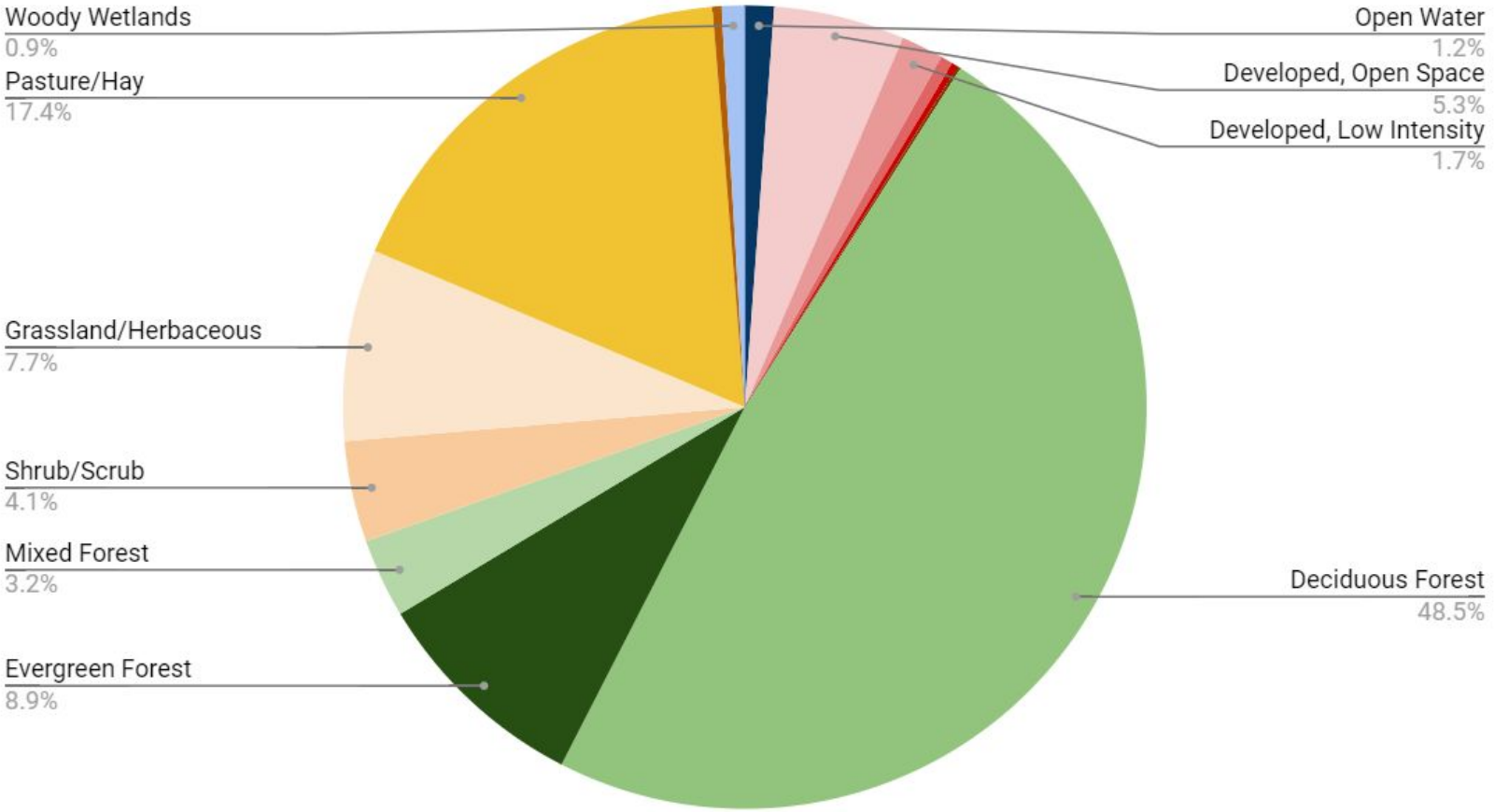
Land Use, RRB


0 15 30 60 90 120
Kilometers
Legend
Focal Subbasins
States
Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Herbaceous Wetlands

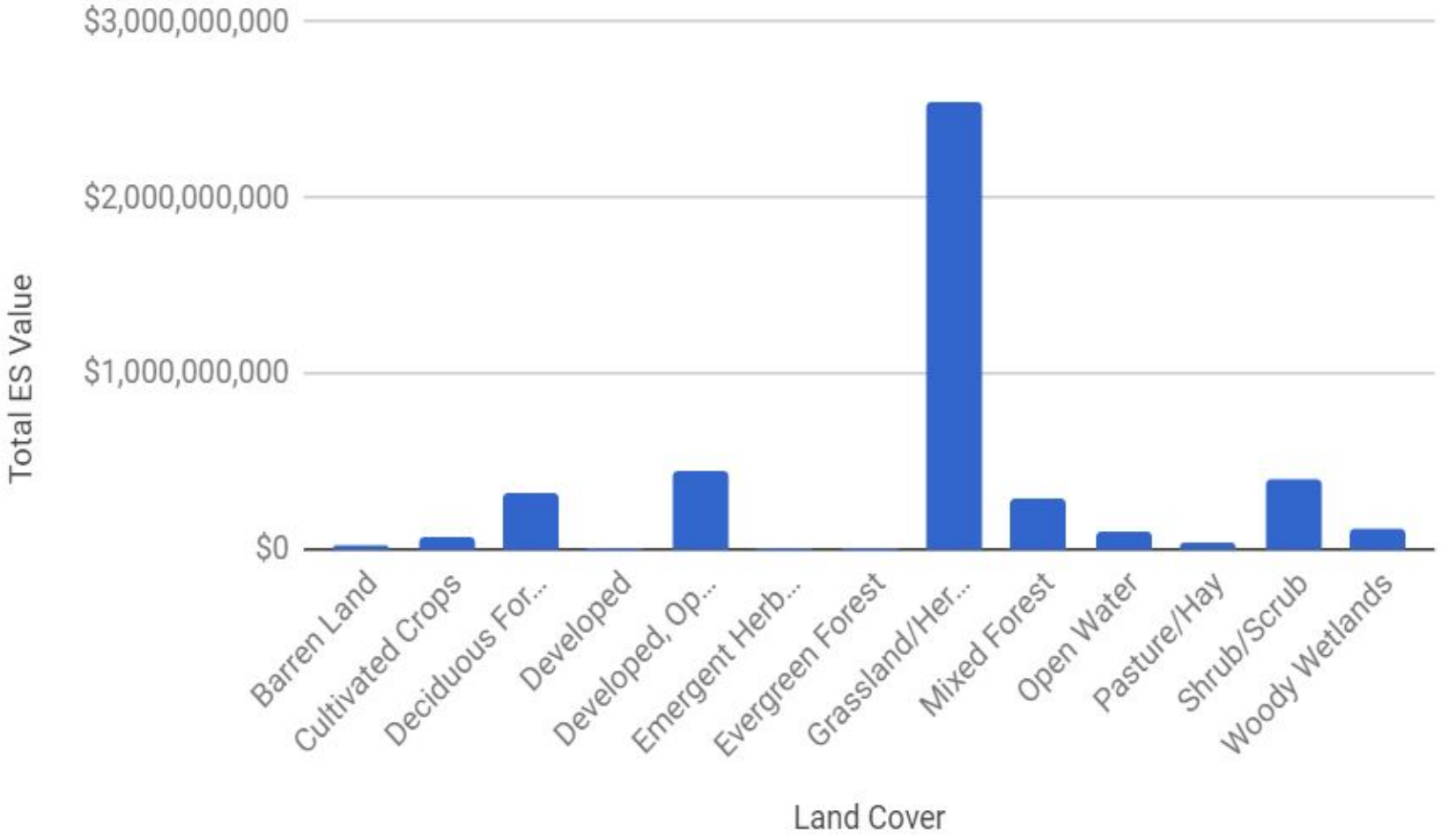
Roanoke River Basin Land Cover Distribution



Dan River Basin Land Cover Distribution

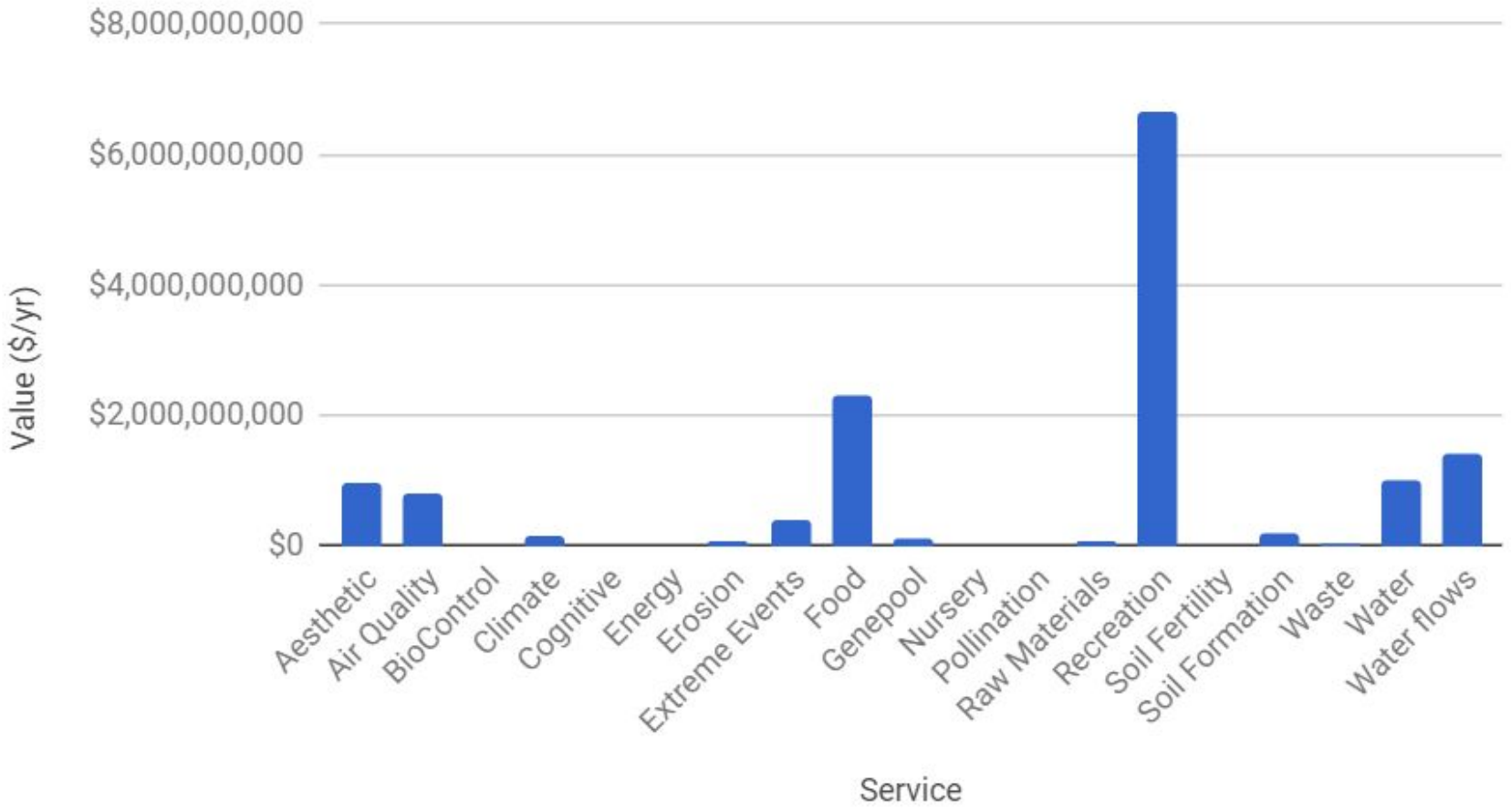


Total ES Value (per year) vs. Land Cover



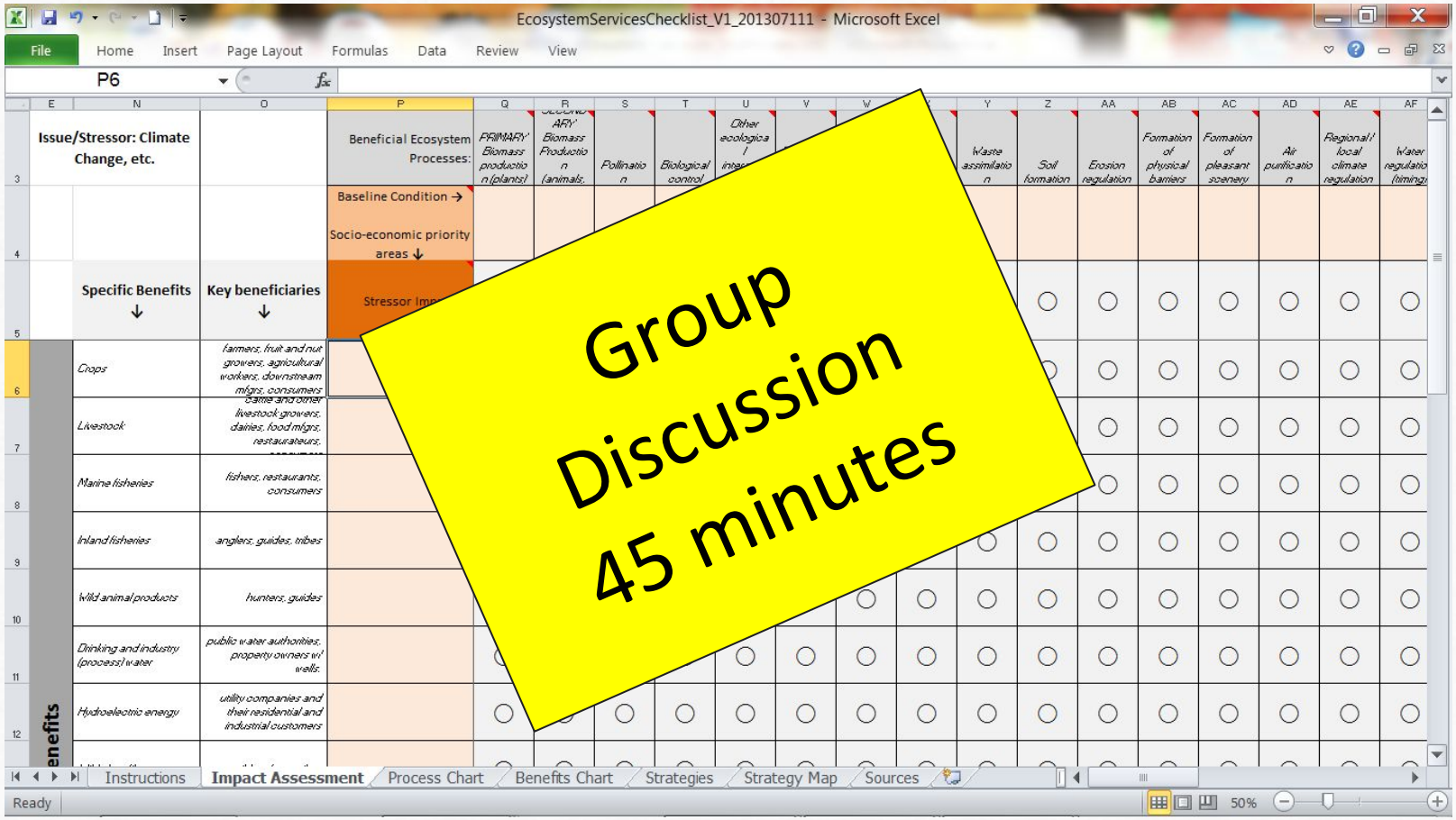
Further ESV Exploration

Ecosystem Service Values in the Roanoke River Basin

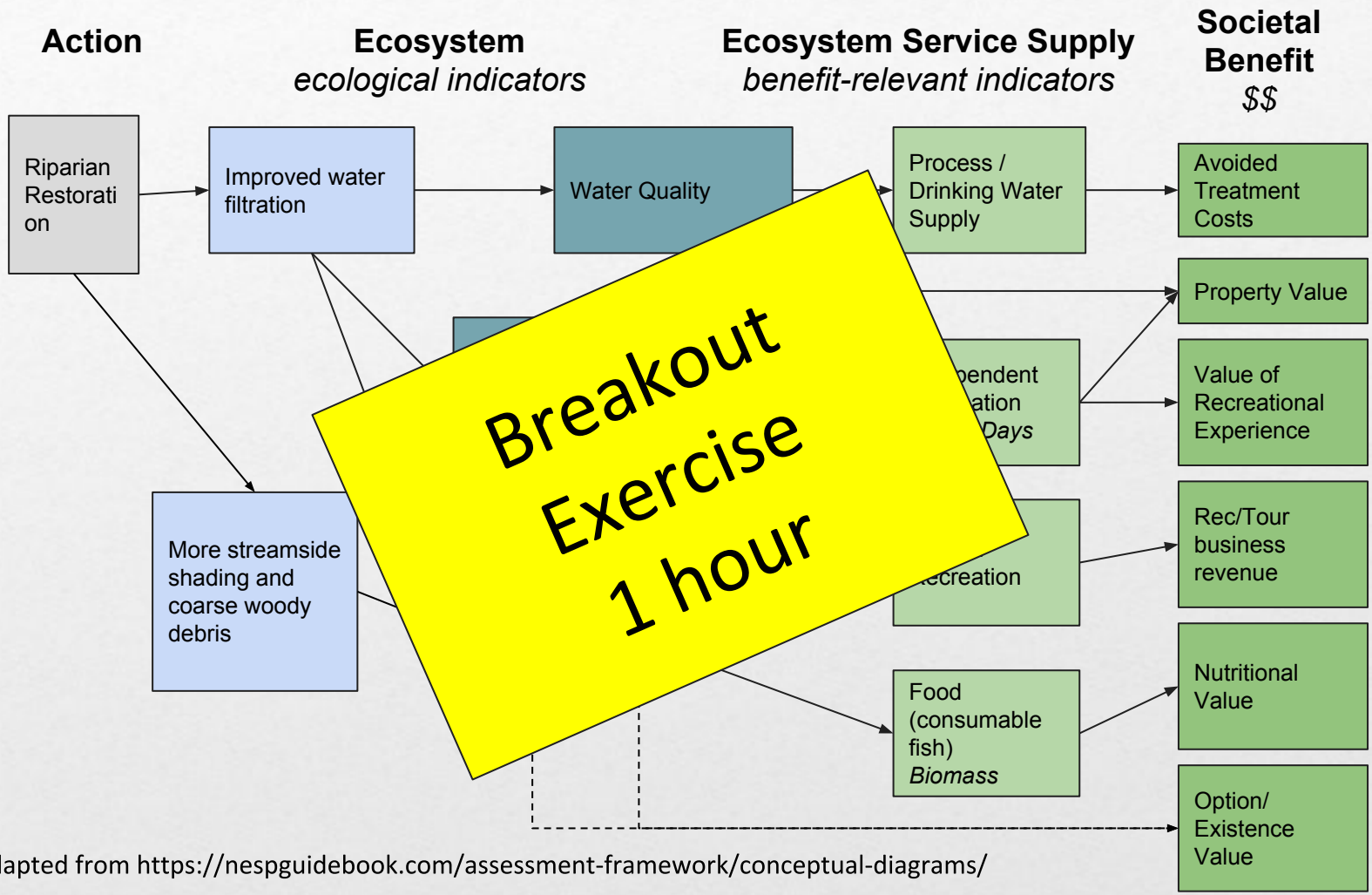



Lunch
45
Minutes

Stressors, Conditions, Benefits



Ecosystem Services Value Chain



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