

Estimation and Implications of Ecosystem Service Values

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Estimation and Implications of Ecosystem Service Values

- ▶ Ecosystem Services and Human Well-being
- ▶ Economic concept of “Value”
- ▶ Linking Ecosystem Services to Values
- ▶ Estimation of ecosystem service values
- ▶ Implications of ecosystem service values

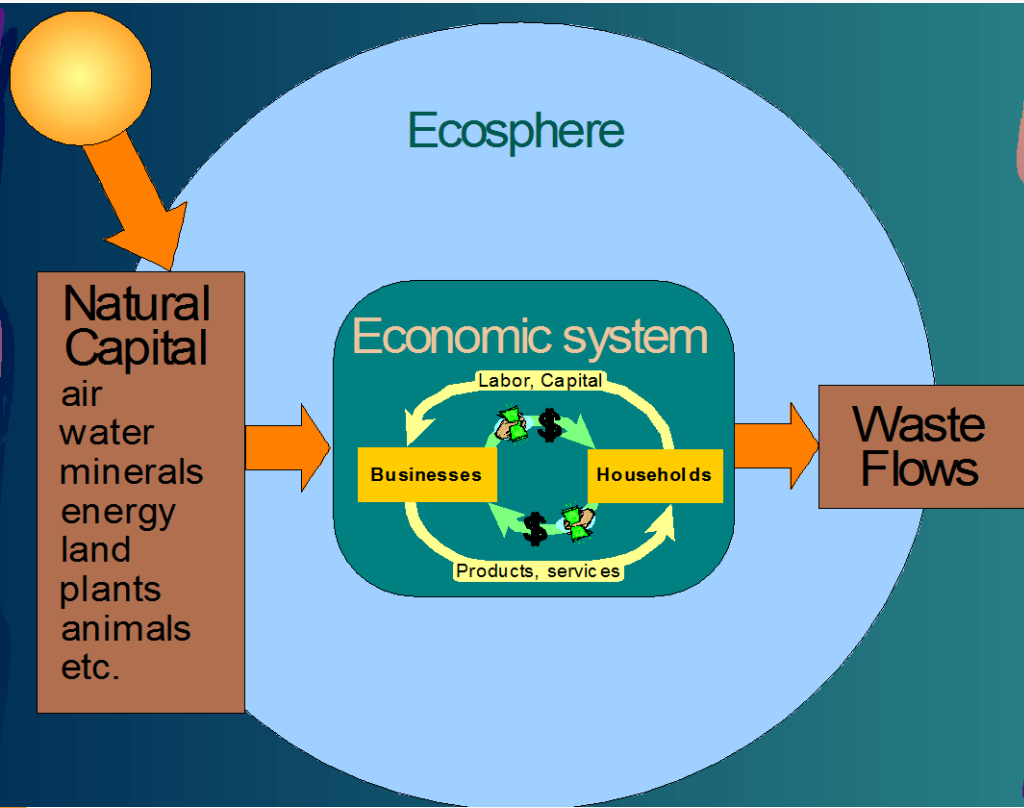


Ecosystem Services and

- ▶ Human Well-being



Ecosystem Services: Benefits Nature Provides to People



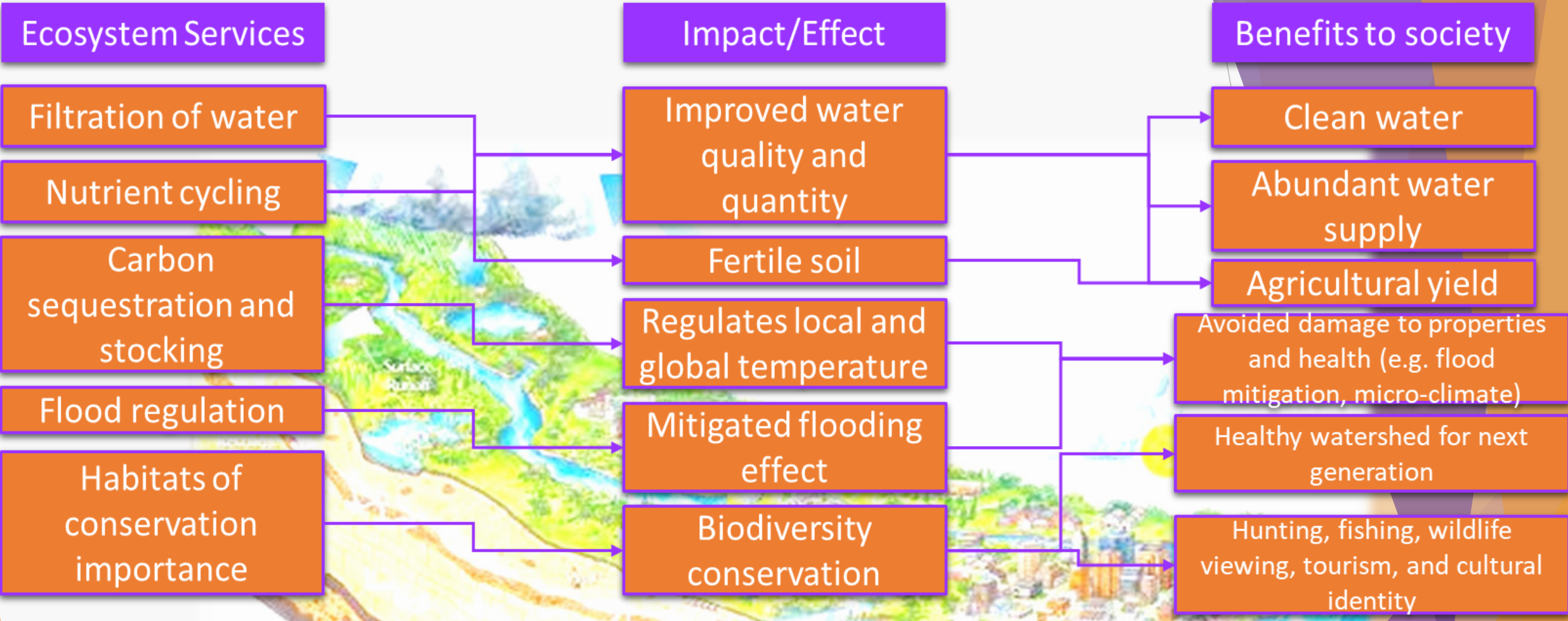
Source: Lupi, F., (undated). Environmental, natural resource and ecological economics, A PowerPoint presentation for fisheries and wildlife economics, Michigan State University.

Provisioning Goods produced or provided by ecosystems	Regulating Benefits from regulation of ecosystem processes	Supporting Ecosystem benefits such as nutrient cycling, pollination, soil formation	Cultural Non-material benefits such as aesthetic, spiritual and recreational
  	 	   	  

Modified from Millennium Ecosystem Assessment, 2005
 Slide adapted from Sandifer, 2017

Image sources:
<https://www.hydroworld.com/articles/2015/12/duke-receives-40-year-ferc-license-for-catawba-wateree-hydropower-project.html>
https://www.postandcourier.com/news/controversial-group-s-study-reports-toxins-pollute-even-safe-drinking/article_9697044e-715c-11e7-ae7d-172d0c264f26.html
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<https://weather.com/news/weather/video/drone-flies-over-flooded-cane-bay-plantation-summerville-south-carolina>
<http://www.southeastdiscovery.com/blog/2012/09/how-safe-are-the-lakes-in-the-southeast-south-carolina-lakes-part-iii/>
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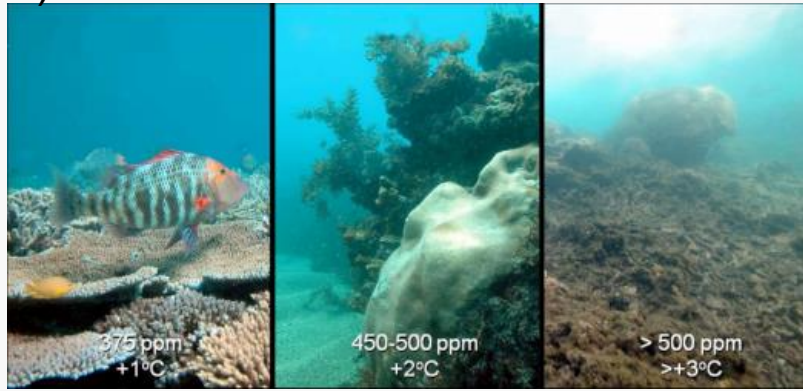




From “ecosystem service”
to
“welfare improvement”



a)



b)



c)



d)

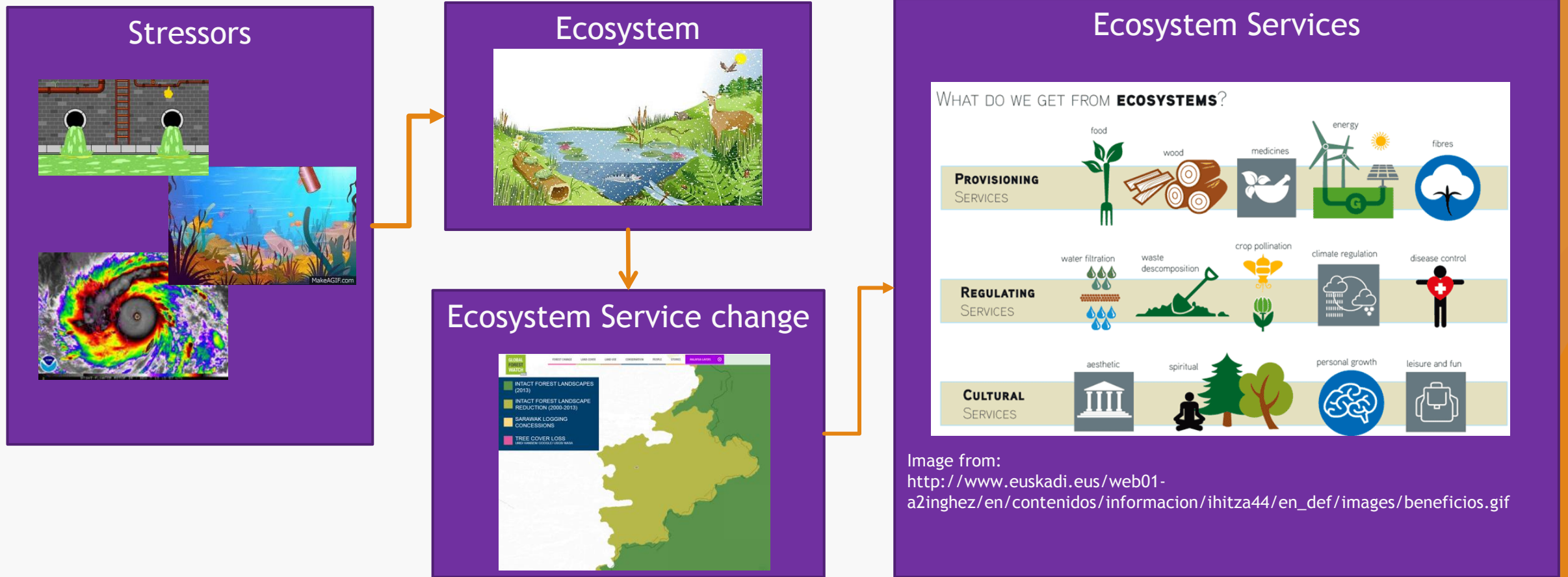


Impacts of stressors
have real effects
and entails **REAL COSTS!!!**

Examples of the impacts of stressors on coastal and marine ecosystems. (a) Impacts of ocean acidification on corals, (b) harmful algal blooms, (c) extreme weather events that lead to flooding and other issues, and (d) fishery and beach closures due to unclear water, toxins, or disease.



Relationships Among Stressors, Ecosystem Services and Human Well-being



Economic concept of

- ▶ “Value”





“Measure” in order to “Manage”,
hence it is important to place a value to the
environment?



Economic Concept of Value



VALUE

- ▶ Price is the amount required as payment.

What is Value?

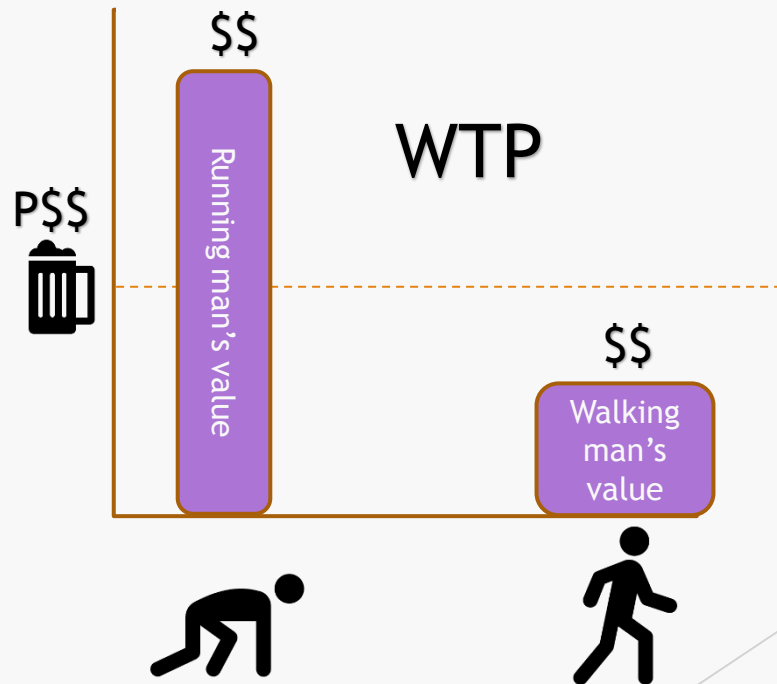
- ▶ Any good or service for which people are willing to make a sacrifice or a **“tradeoff”** has economic value.



Economic Concept of Value

2 ways to define tradeoff

- ▶ maximum amount of Y willing to give up for X (willingness to pay or WTP measure)
- ▶ minimum amount of Y willing to accept as compensation to forego X (willingness to accept or WTA measure)



Any good or service for which people are **willing to make a sacrifice of** has economic value.

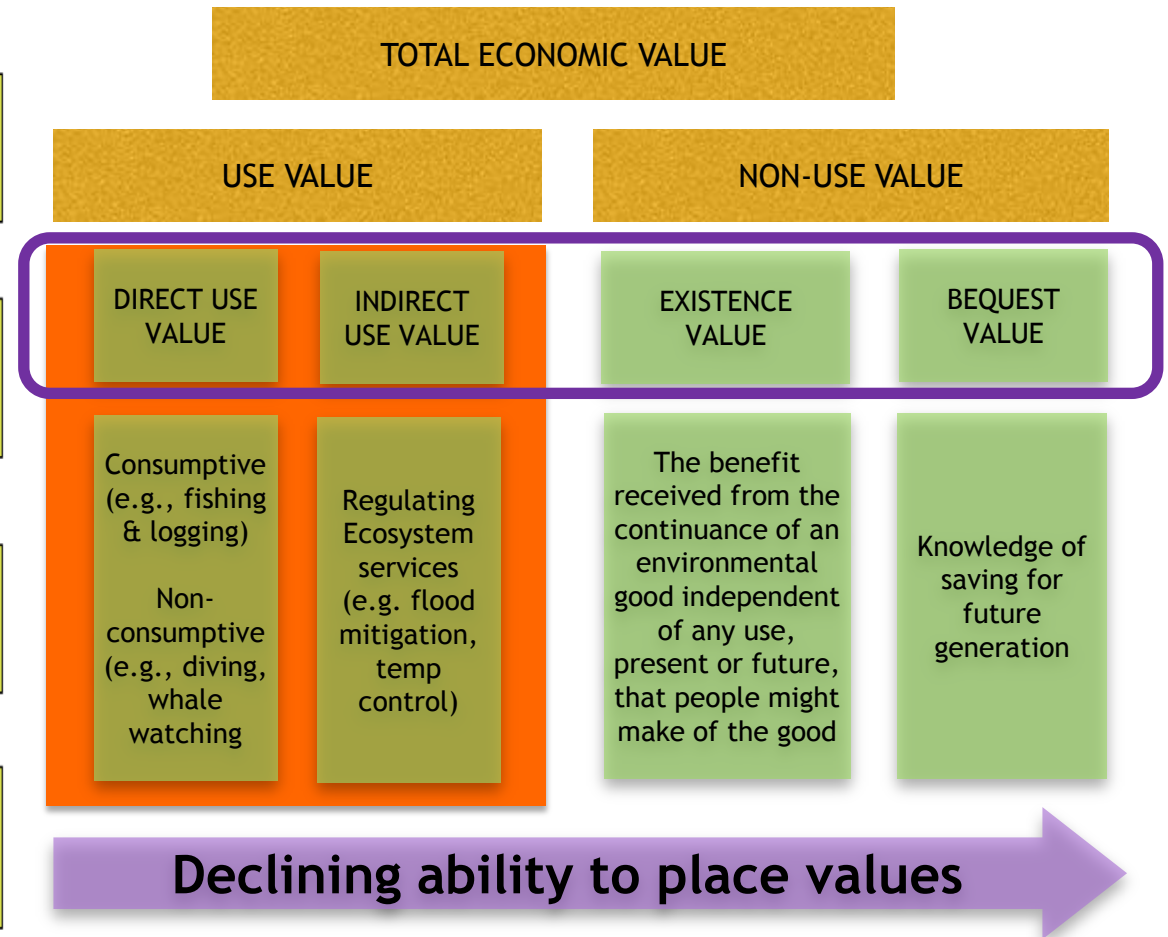
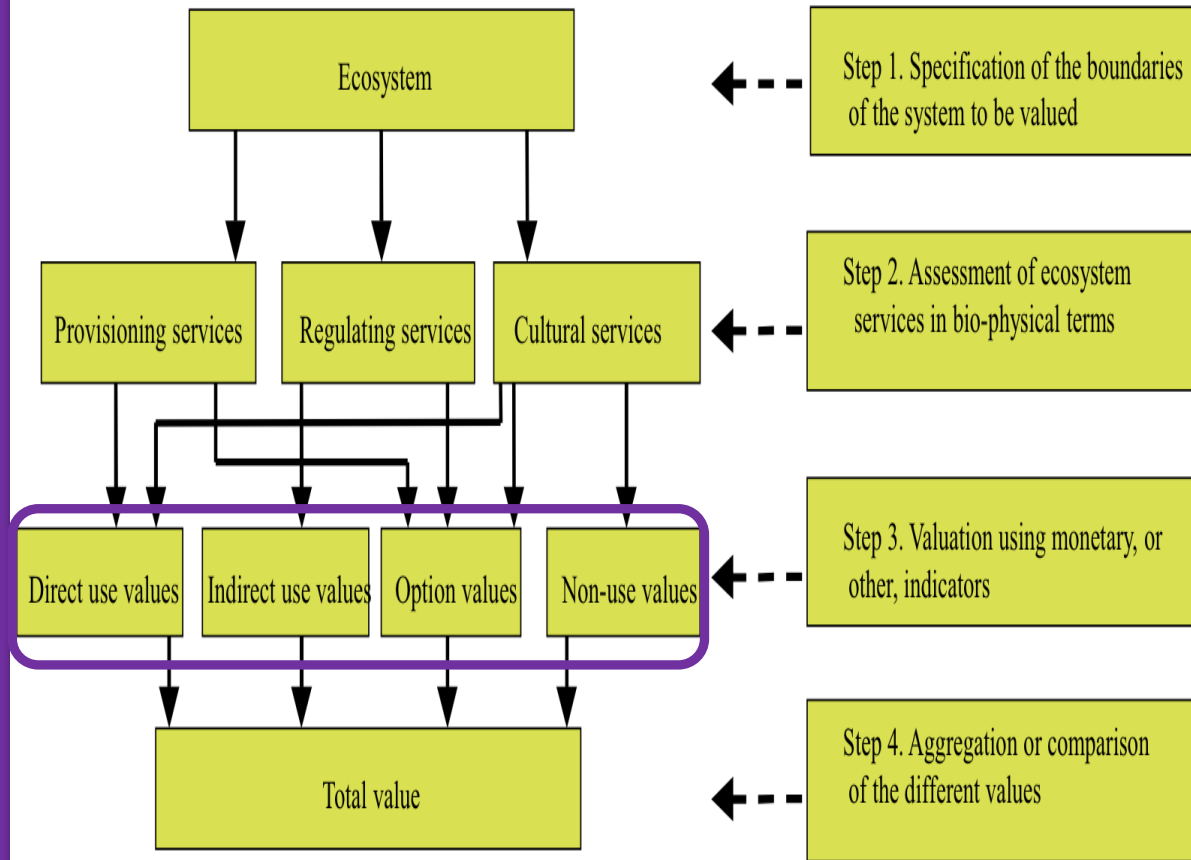
- Economic values not just for goods traded on market
- Not limited to market goods
- Nonmarket valuation seeks to estimate these

What has economic value?



Linking Ecosystem ▶ Services to Values





Examples of Non-Consumptive Use Values: Salt Marsh, Mangrove Forest, Oyster Reefs

Ecosystem services:

Direct use (consumptive):

Food, fuel, other materials

Direct use (non-consumptive):

Aesthetics & recreation

Science & education

Indirect use:

Nursery for many species

Waste assimilation

Nutrient cycling

Shoreline stabilization and protection

Coastal erosion control

- ▶ “The overall annual economic impact of recreational activities from fishing, hunting, and wildlife viewing in South Carolina is \$2.74 billion and 31,958 jobs.”
- ▶ “The Natural resource-based sectors annually contribute \$33.4 billion dollars economic activity and 218,719 jobs to state economy.”

▶ (Willis and Straka, 2016)



Image sources:

▶ <http://www.dnr.sc.gov/marine/NERR/pdf/livingshorelines11-20-15.pdf>

▶ Modified slides from Sandifer, 2017

~ 200 oyster-based living shoreline projects in South Carolina

Estimating Ecosystem

- ▶ Service Values





*A Ridge-to-Reef Ecosystem-based Valuation Approach to Biodiversity Conservation Activities in Mt. Malindang Layawan Watershed.
(Ureta et al, 2016)*



Non-Market valuation using a non-market-based instrument:
Contingent Valuation Method

Context:

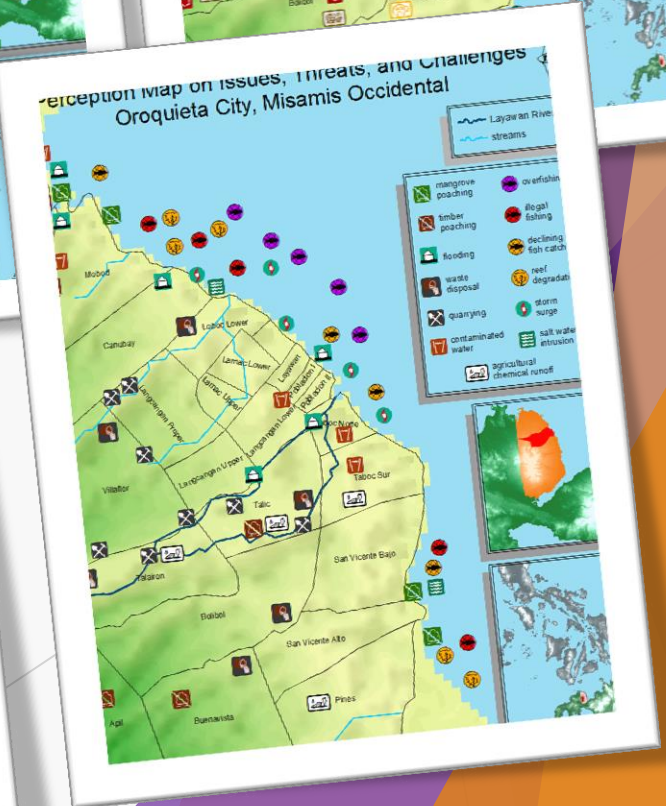
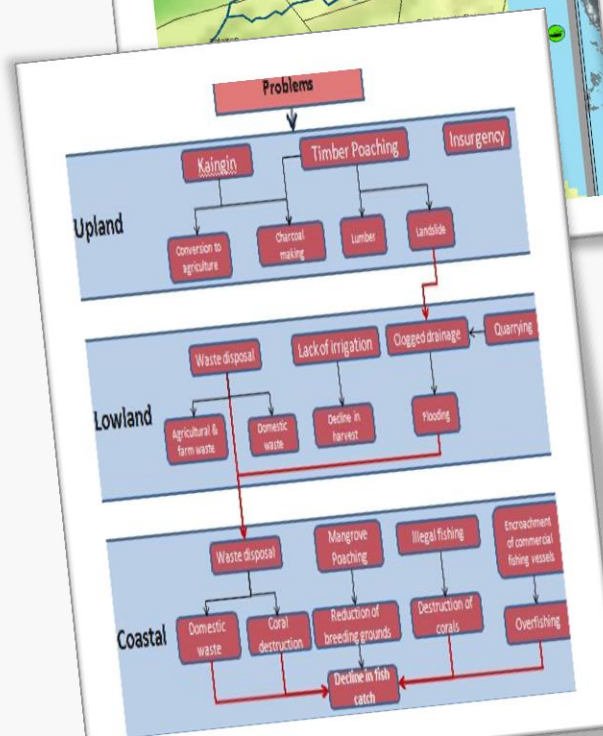
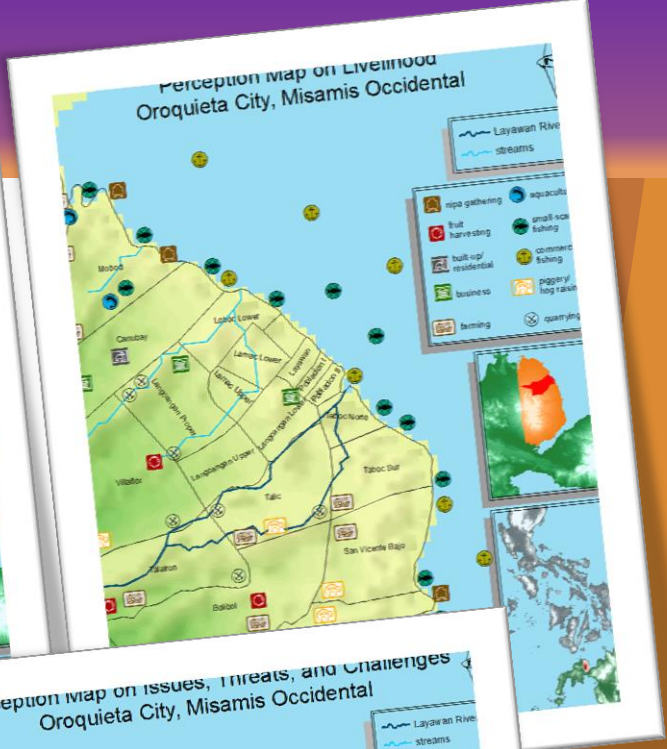
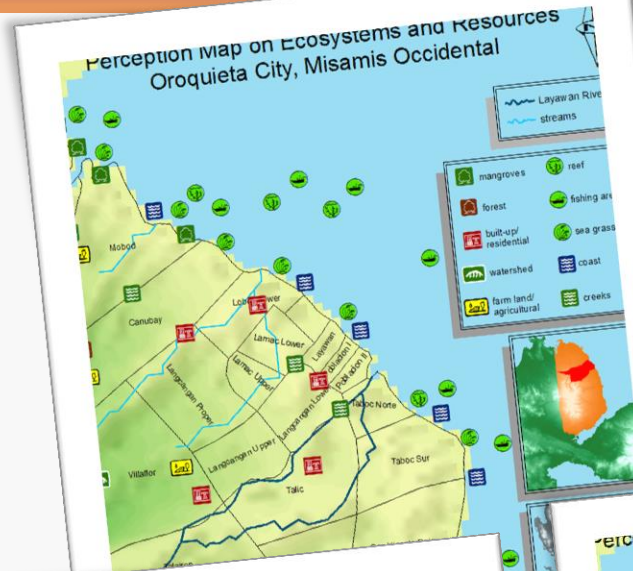
- The watershed is the main source of water, livelihood and has rich biodiversity making it part of an ASEAN Heritage Park.
- The government have insufficient funds to support conservation activities
- An initiative for sustainable financing mechanism through a Payments-For-Ecosystem Services framework were proposed.
- The PES framework involved estimating the non-consumptive use values of the community towards Layawan watershed.



Establishing baseline data

Conduct Focus Group Discussion

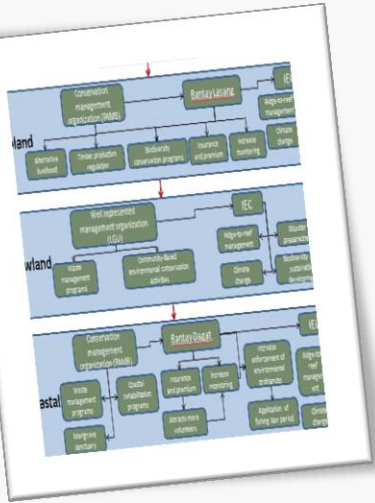
- Participatory Mapping
- Problem Tree Analysis



Identifying target ES and designing valuation scenario

Conduct Focus Group Discussion

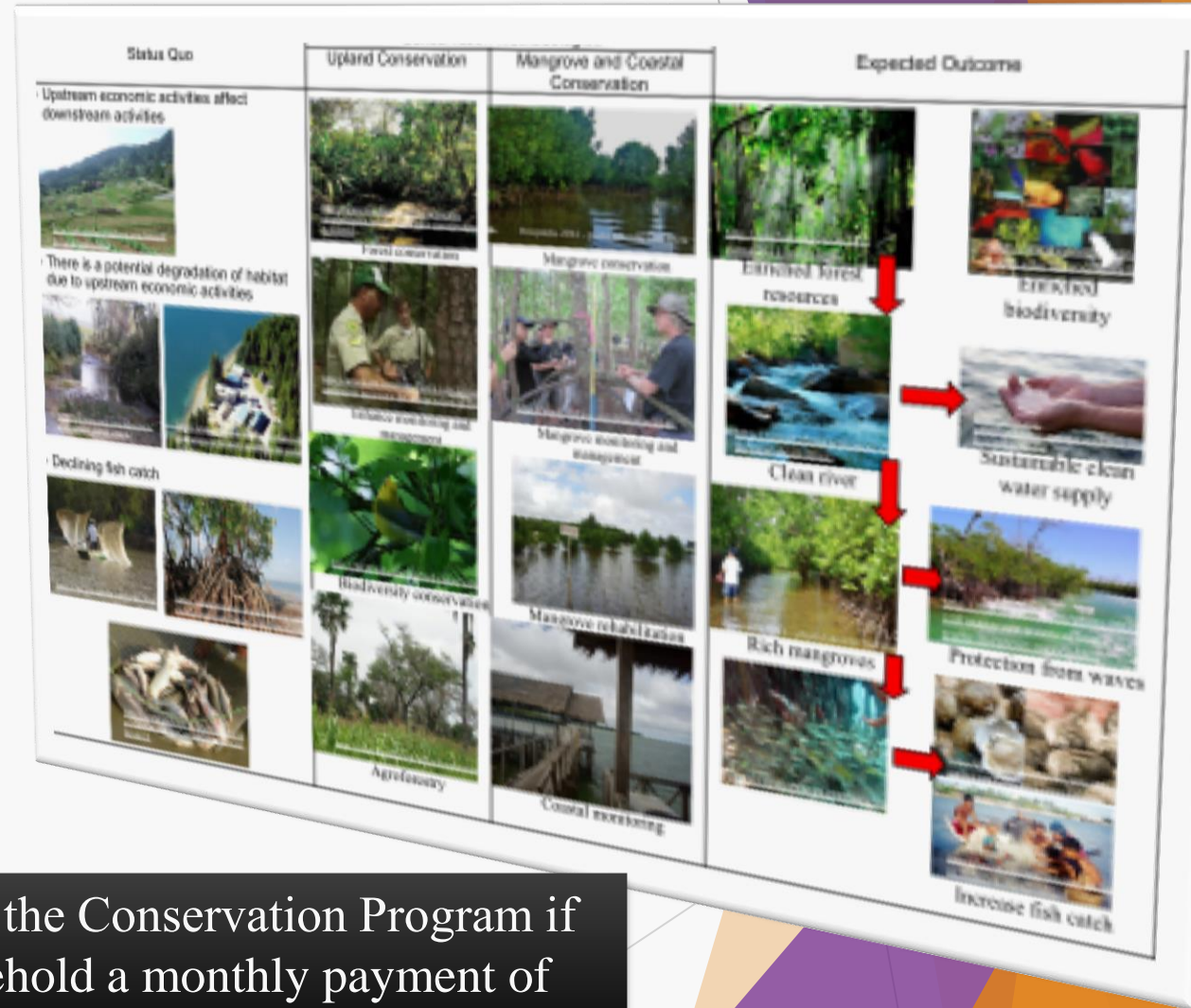
- Solution Tree Analysis



Contingent Valuation Method Survey Question:

Consider that:

- Conservation Fund will be collected to support biodiversity conservation activities of the watershed
- Current average water bill is P250 (\$5) per month



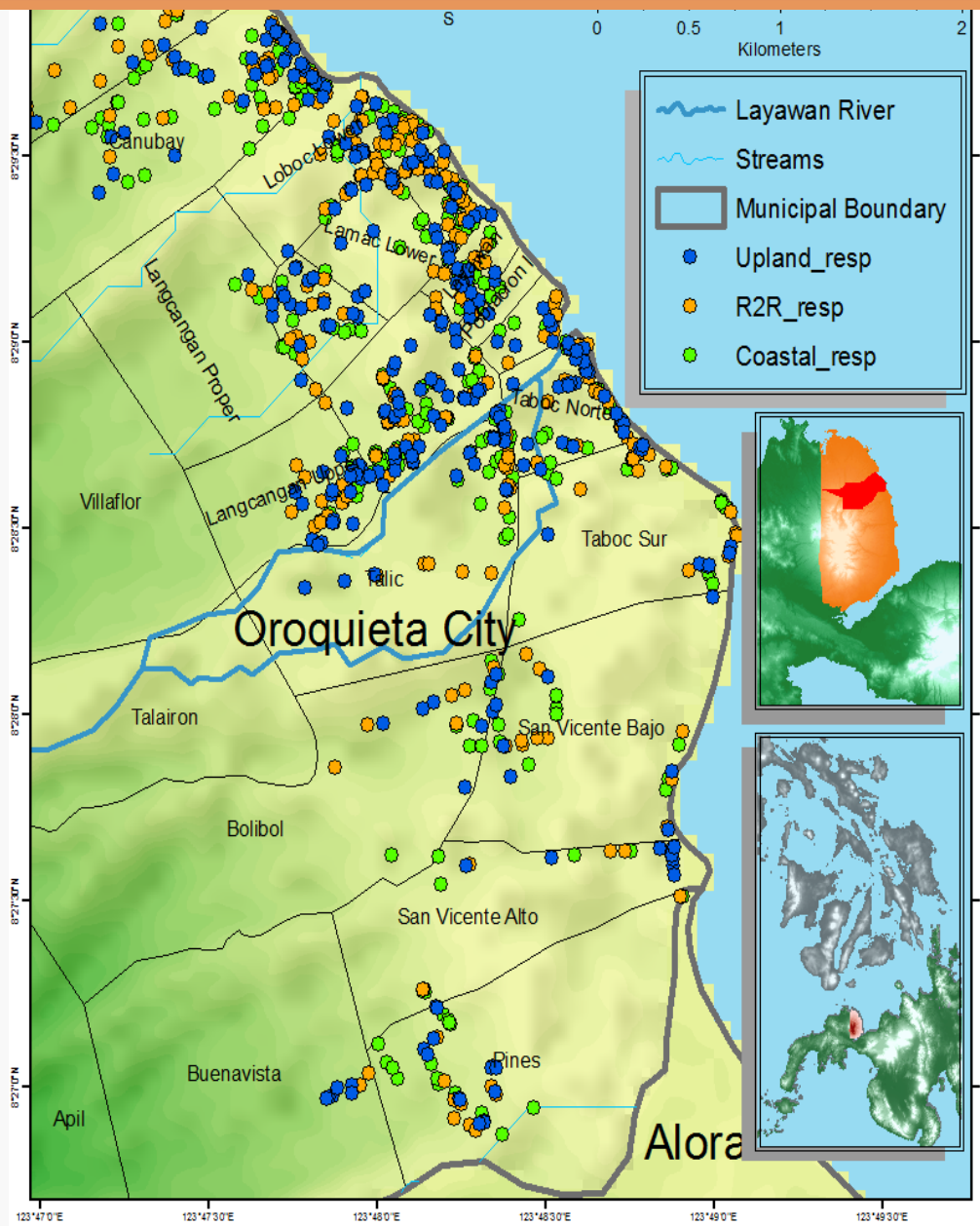
“Would you vote to support the Conservation Program if it will cost an average household a monthly payment of _____ to be added to your water bill over the next 5 years?”



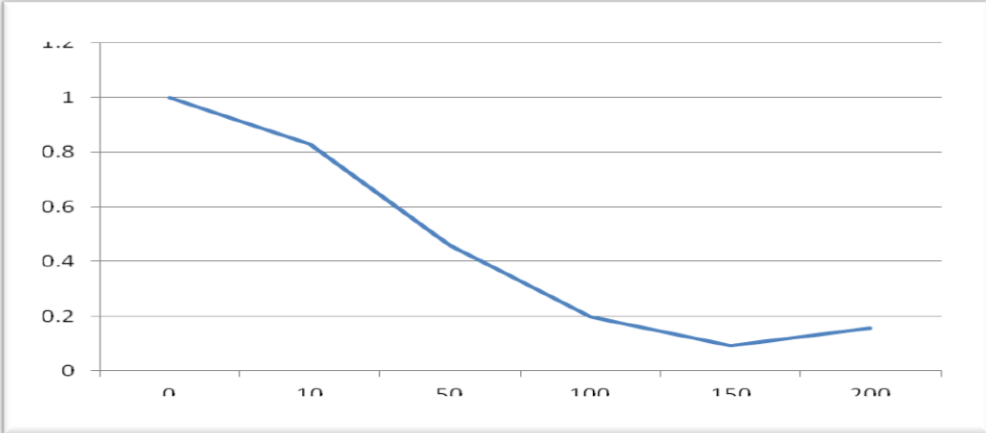
Estimating the values

Survey details:

- 900 respondents
- Mean household head age is 50 years
- Mean household size is 4 members
- Mean household monthly income is PhP 13,000 (\$260)
- Poverty threshold in the region is PhP 16,500 (\$325)
- Food threshold in the region is PhP 11,500 (\$225)
- Average water bill is PhP 250 (\$5)



Estimating the values



Bid Amount	Total Samples	Total number of samples that answered YES	Percentage of YES responses for (%)	Lower Bound Willingness to Pay values	Upper Bound Willingness to Pay
10	47	39	83	1.70	3.72
50	59	27	46	18.61	13.06
100	56	11	20	26.12	10.55
150	44	4	9	15.83	-9.70
200	45	7	16	-12.93	31.11
Total	251	88	--	49.33	48.75
Mean WTP				49.04	

$$\text{logit}(Y^*=1) = -0.6875601 - 0.0190733\text{BidAmount} - 0.9160954\text{Coastal Conservation} - 0.9462545\text{Upland Conservation} + 0.5973739\text{Income}10001_20000 + 0.8053643\text{Income}30001_40000 + 1.477634\text{Income}40001_50000 + 1.52432\text{Income} > 50001 + 0.1741499\text{Educ} + 0.1413143\text{WTPCA} + 0.5689516\text{Certain} + 0.1584564\text{HHsize}$$

$$\text{MWTP} = 1 * [(Y^* - \beta(\text{BidAmount}) * \text{BidAmount}) / \beta(\text{BidAmount})]$$

$$\text{WTP}_x = \text{MWTP} / N_x$$

$$\text{WTPR}_{2R} = 10800.23618 / 251 = 43.03$$



Estimating the values

Program	Parametric Estimation		Non-Parametric Estimation		
	Mean WTP	Max WTP	Min WTP	Max WTP	Mean WTP
R2R	43.03	244.42	48.75	49.33	49.04

- PhP43 (\$0.86) – PhP 49 (\$0.98)
- 19 - 22% increase from the average water bill of PhP 250 (\$5)
- Projected annual total revenue of PhP 17.8 million (\$356,000)

“Despite the low income, due to high regard to the ecosystem service, the value towards the conservation program is still high.”



Implications of Ecosystem

- ▶ Service Values



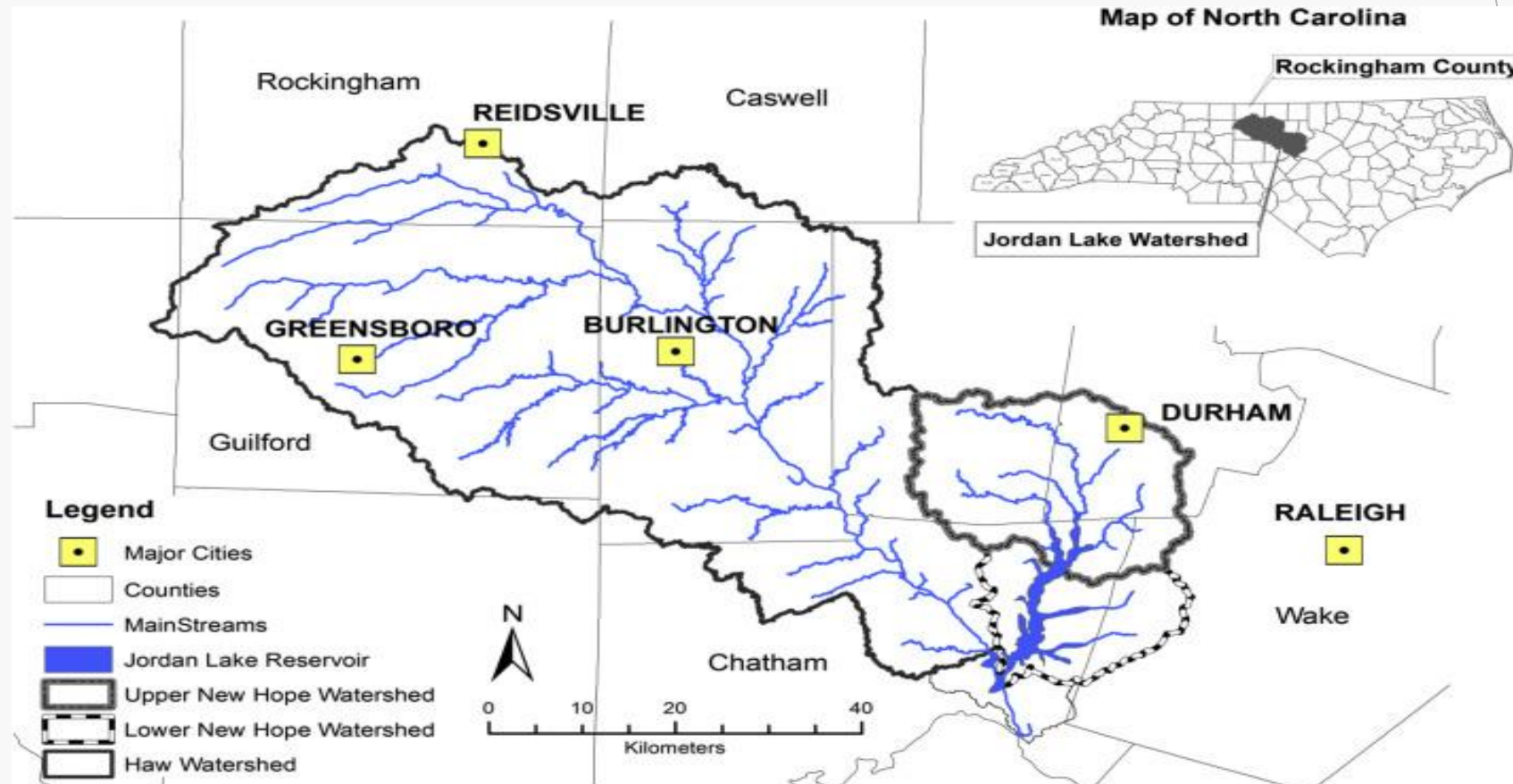
Market Incentives for Provision of Ecosystem Services



Marketable Permit Systems or Trading Programs



Water Quality Trading program in Jordan Lake, NC



Water quality trading market in Jordan Lake, NC

Farm installs best management practice to generate credit



Nitrogen Credit



Permitted source buys credit to meet regulatory requirement



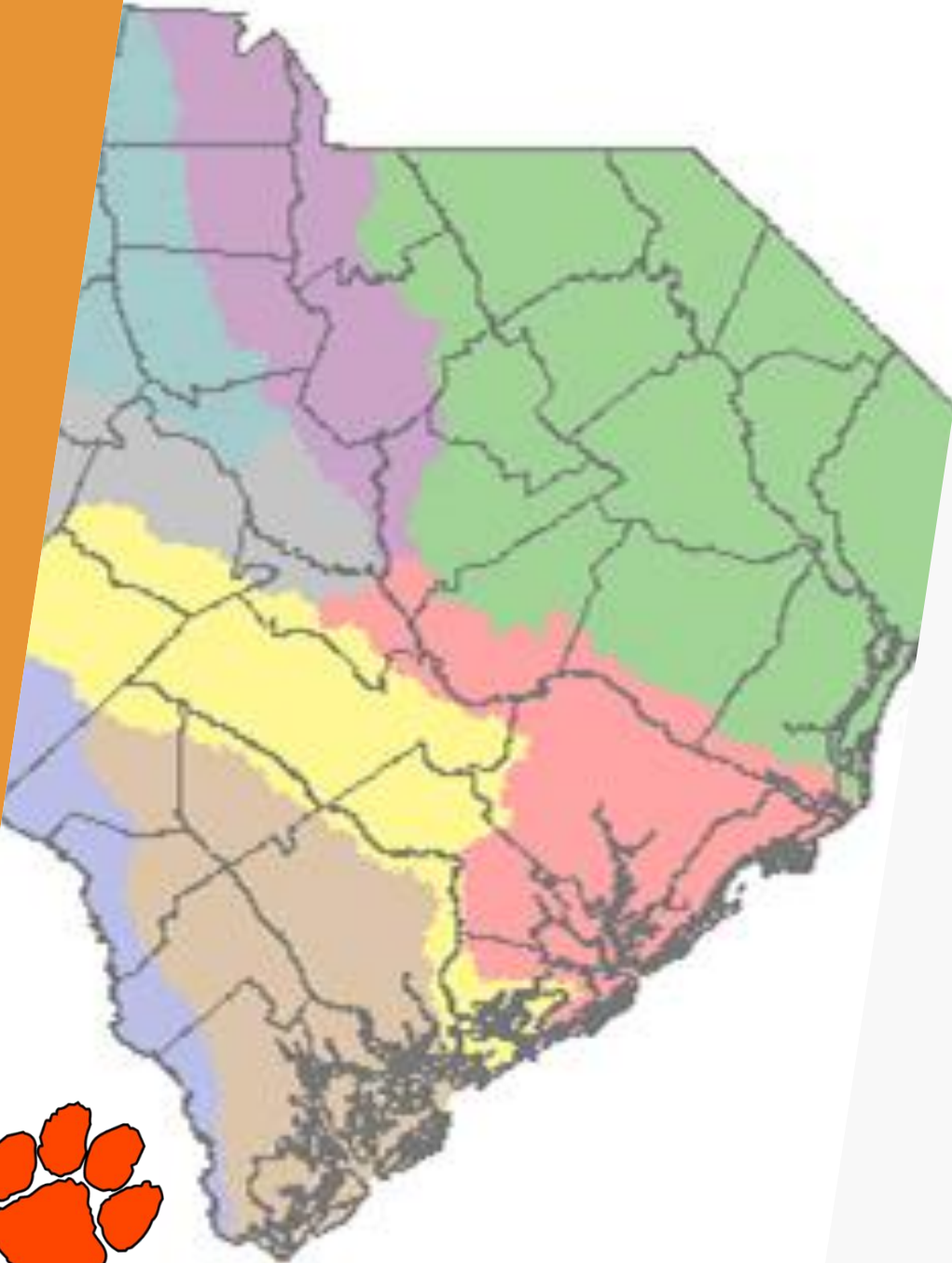
Image: <http://wqt.epri.com/pilot-trades.html>



Payments for Ecosystem Services



Payment for Ecosystem Services in Santee Basin, SC



References

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- ▶ <http://ucanr.edu/sites/RangelandES/PES/>
- ▶ <http://www.dnr.sc.gov/economic/index.html>
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