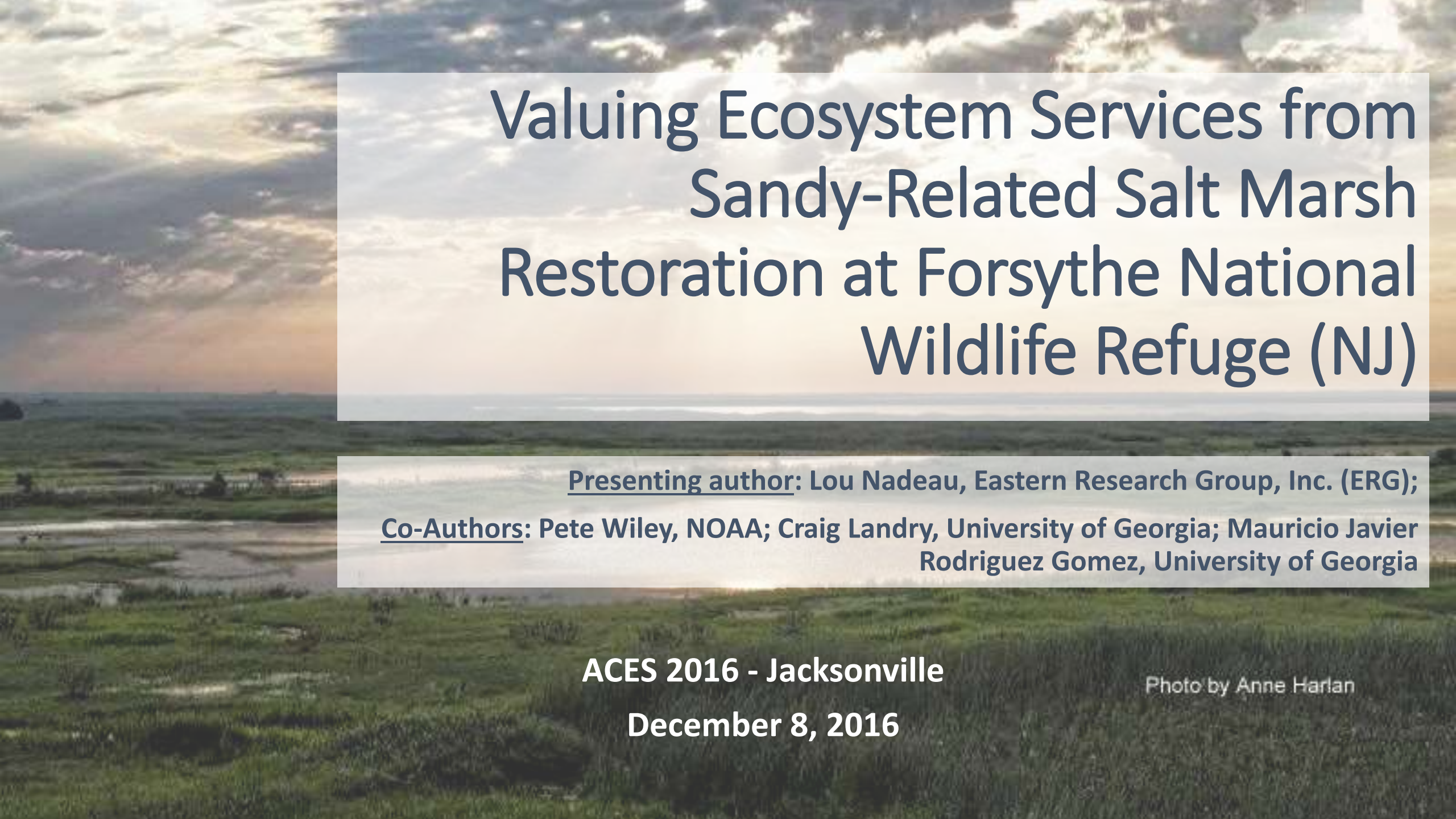


Valuing Ecosystem Services from Sandy-Related Salt Marsh Restoration at Forsythe National Wildlife Refuge (NJ)

Presenting author: Lou Nadeau, Eastern Research Group, Inc. (ERG);

Co-Authors: Pete Wiley, NOAA; Craig Landry, University of Georgia; Mauricio Javier Rodriguez Gomez, University of Georgia

ACES 2016 - Jacksonville

December 8, 2016

Photo by Anne Harlan

Our project

- Estimate values of ecosystem services that can be used in guiding post-Sandy restoration decisions
  - Trade-offs
- Focus on New York and New Jersey area
- Take into account transferability

All project components

- Coastal protection in Jamaica Bay, NYC
- Trade-offs in salt marsh ecosystem services at Forsythe NWR in NJ
- Benefit transfer guidelines (Jamaica Bay)
- Social cost of carbon at Forsythe

Forsythe NWR

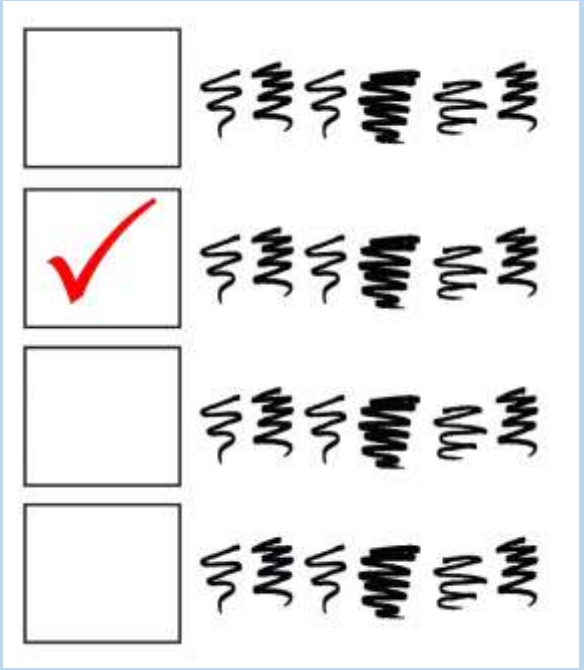
- **Managed by US FWS**
- **50 miles along the NJ coast**
- **Major stop-over for migratory birds**
- **More then 37K acres**
  - **78% is a salt marsh**
- **Significant damage from Sandy**

Forsythe Restoration

- Forsythe NWR restoring 3,000 acres of salt marsh
  - Thin layer placement
  - Tidal flow restoration
  - More than just repairing damage from Sandy
- How do people value trade-offs between ecosystem services?
  - Protection from surge
  - Protection from non-surge flooding
  - Habitat
  - Recreation

Method: Stated Preference

- Contingent valuation
  - Describe a project/scenario and ask people whether they are willing to pay a certain amount or not
  - Vary the cost, but not the project/scenario parameters
- Choice experiment
  - Let's make this more complicated!
  - Vary the cost AND vary the project parameters
  - Assess trade-offs

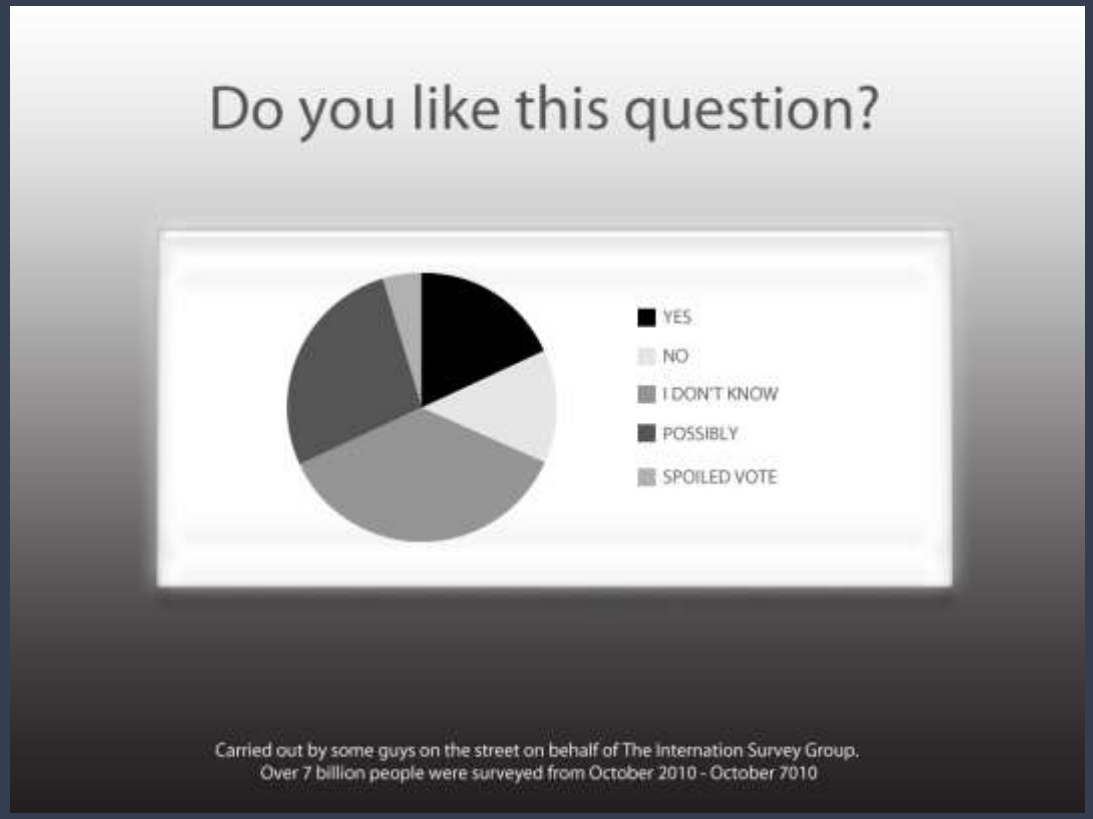


Choice experiment survey

- Respondents are asked to choose between two options and a status quo (choice set)
- Each option has attributes (ecosystem services)
- Each option has a “level” for each attribute and a cost
- Each respondent was asked three valuation questions

Survey sequence/design

- Background/education
- Familiarity/visits to FNWR
- Concern about FNWR
- Impact of Sandy
- Instructions for valuation
- Valuation matrix (3x)
- “Debrief” questions
- Altitudinal questions (CC, future storms, restoration)
- Outdoor activities
- Demographics provided by GfK



Phrasing ecosystem service benefits to respondents

- Habitat and recreation (qualitative)
  - “None”
  - “Minimal” improvements
  - “Significant “improvements
- Surge and non-surge flooding
  - Number of homes protected
- Acres - number

Choice table

Options to choose from

Attributes (ecosystem services)

Category	Status quo	Option A	Option B
Amount of the marsh that is restored	None	**[1K, 3K, 5K]** acres	**[1K, 3K, 5K]** acres
Storm protection	Homes in the coastal area are under increased risk from storm damage.	Protects **[1K, 3K, 6K]** homes and businesses from a 5-foot storm surge (a rise of water generated by a storm that is 5 ft over and above the predicted tide level)	Protects **[1K, 3K, 6K]** homes and businesses from a 5-foot storm surge (a rise of water generated by a storm that is 5 ft over and above the predicted tide level)
Flood protection	Homes in the coastal areas are under increased risk of suffering flood damage.	Protects **[3K, 7K, 10K]** homes and businesses from a 20-year flood (a flood that would occur only once every 20 years)	Protects **[3K, 7K, 10K]** homes and businesses from a 20-year flood (a flood that would occur only once every 20 years)
Habitat	Habitats for migratory birds continue to deteriorate with the marsh; over time fewer birds would visit the marsh.	**["NONE", "MINIMAL", "SIGNIFICANT']**	**["NONE", "MINIMAL", "SIGNIFICANT']**
Recreation	Recreational opportunities decline as the marsh deteriorates; over time there would be fewer places to fish, hunt, and hike trails.	**["NONE", "MINIMAL", "SIGNIFICANT']**	**["NONE", "MINIMAL", "SIGNIFICANT']**
Cost - Increase in your annual income tax	$0	**[$20, $65, $130]**	**[$20, $65, $130]**
Vote	☐	☐	☐

"Levels" of the attributes

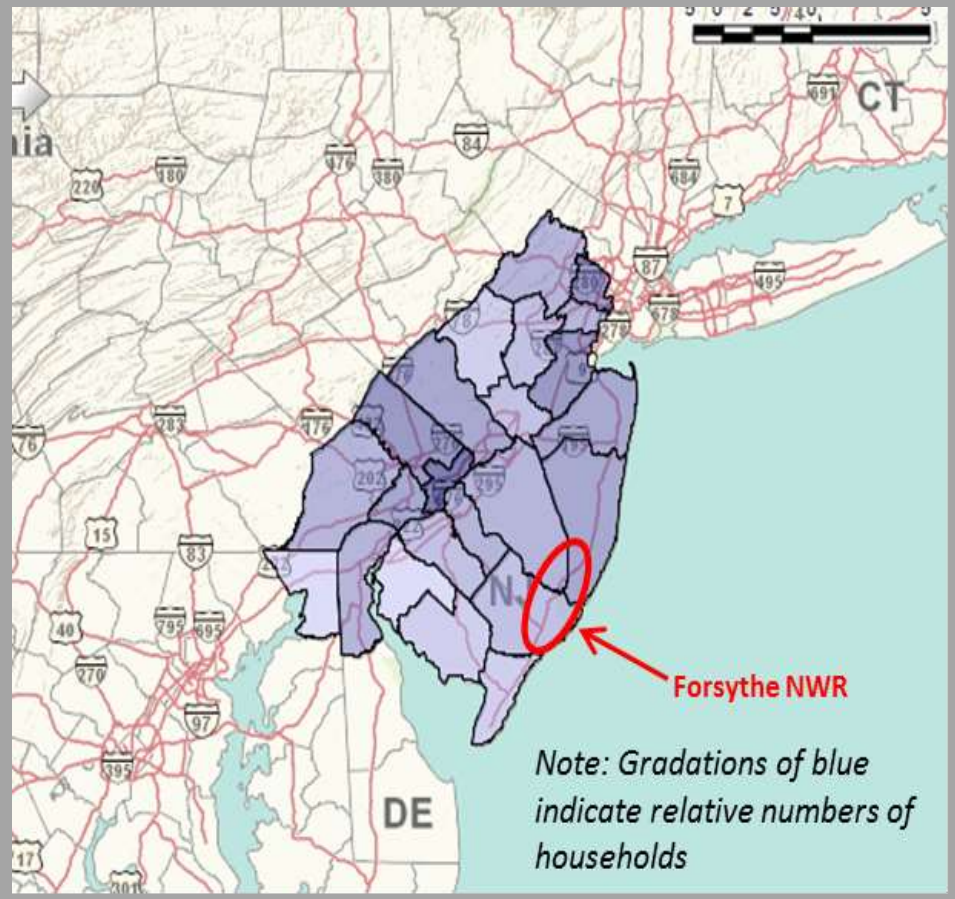
Cost of each one

Check box for respondent to "vote"

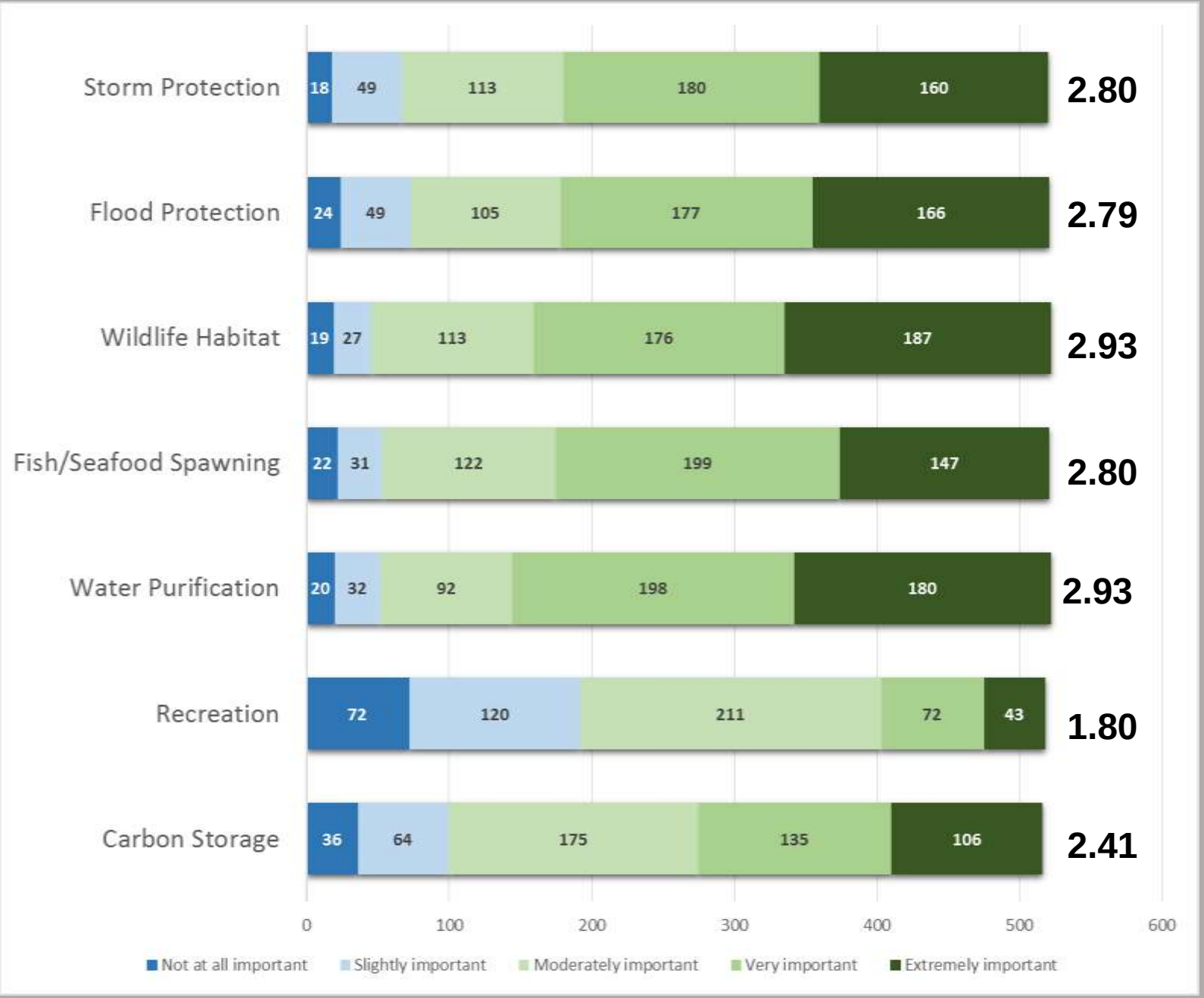
Implementation: GfK Knowledge Network Panel

- Pre-tested in late winter/early Spring of 2015 by ERG and then again by GfK in mid-Summer 2015

- Full implementation: mid-August 2015
  - 541 total responses



Wildlife and water purification were most important to respondents



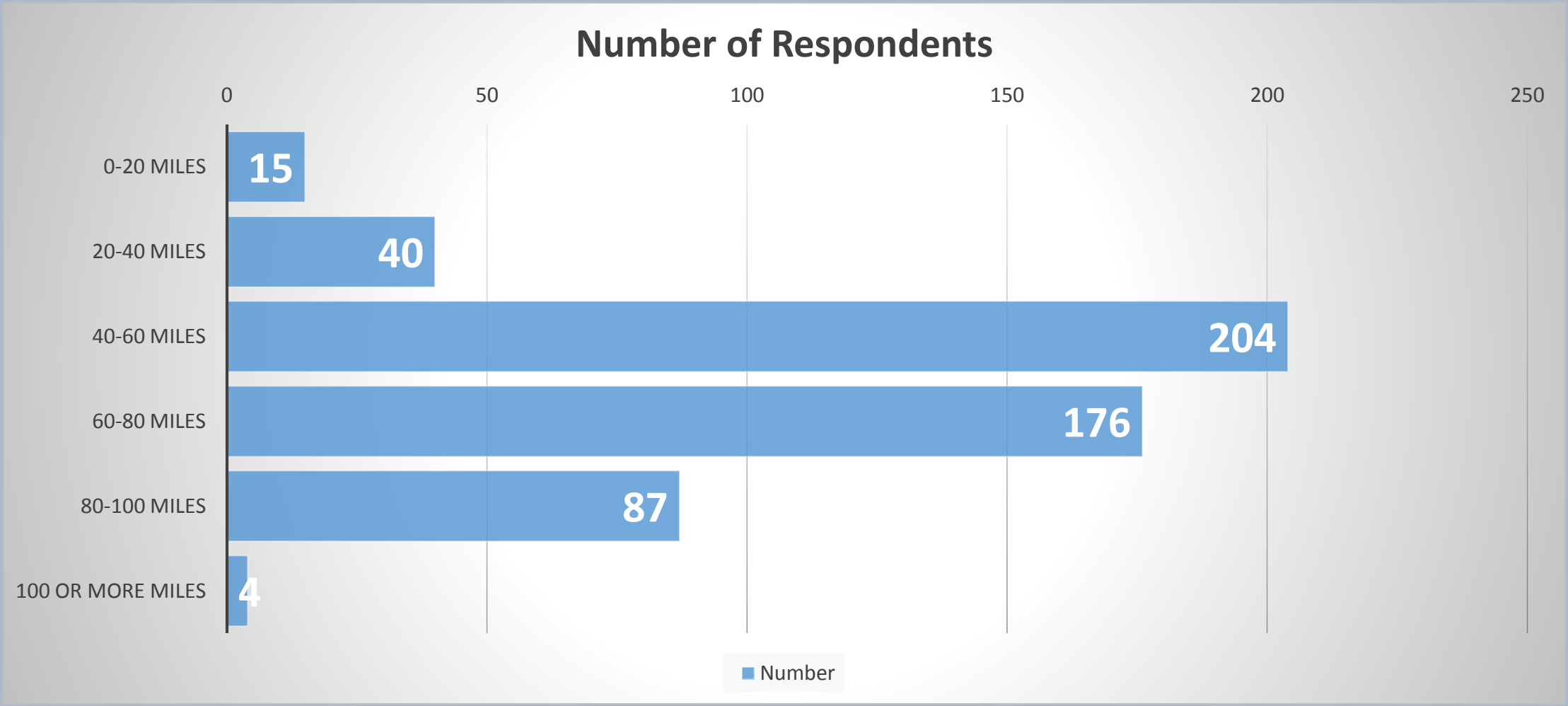
What we can estimate

- Habitat and recreation – qualitative
  - “None” to “minimal”
  - “None” to “significant”
- Flooding – number of homes
  - Combined surge and non-surge
  - Homes – converted to 5K homes
- Acres - number
  - Converted to 1K acres

Willingness to pay (WTP) Estimates

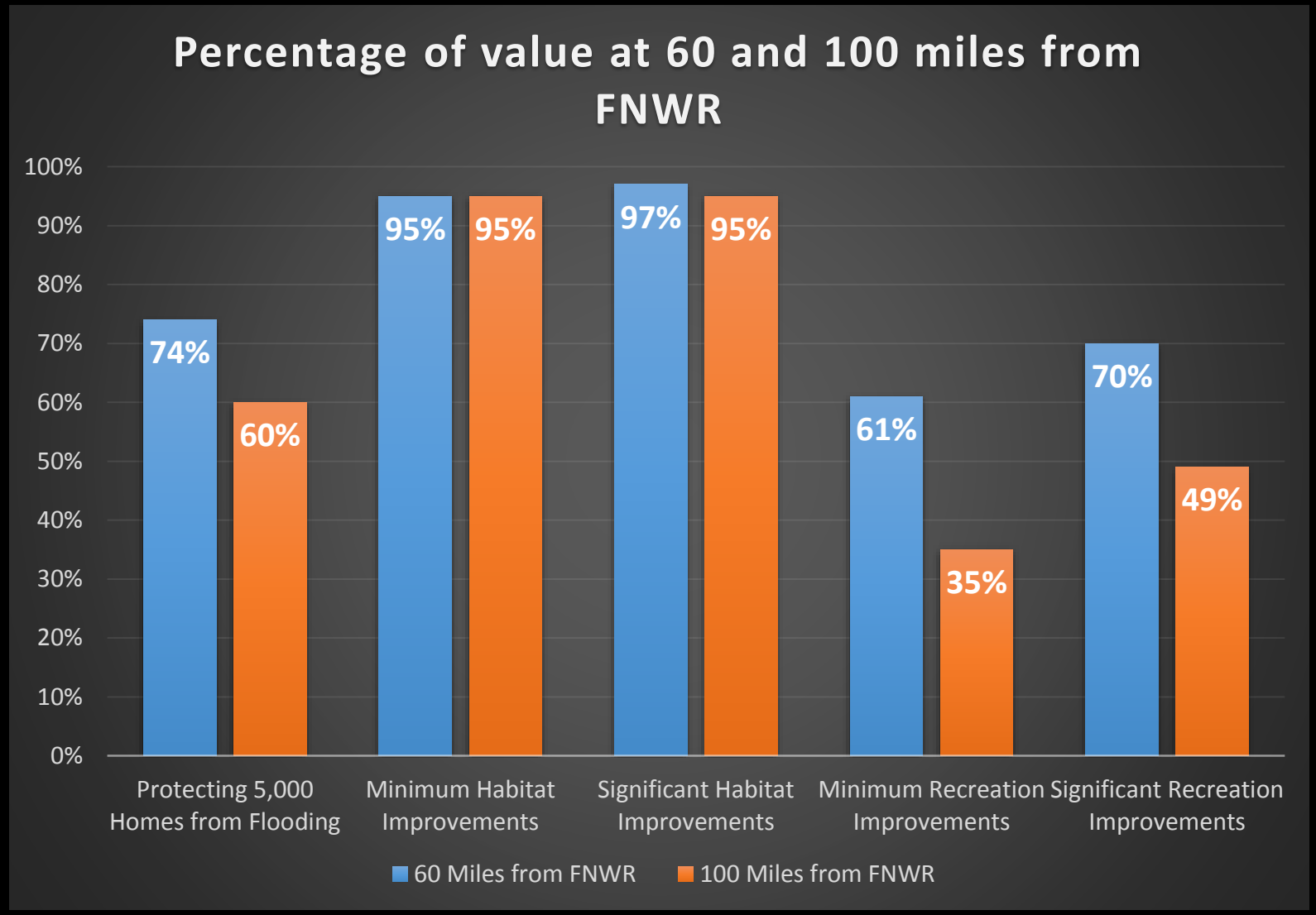
Ecosystem service	Incremental change	Estimated WTP (per HH per year)
Habitat provision	None to minimal improvements	$50.33
	None to significant improvements	$90.95
Recreation	None to minimal improvements	$30.71
	None to significant improvements	$45.35
Protecting homes from surge	5,000 homes	$9.95
Restoring acres of marsh	1,000 acres	$8.96

Distance from Forsythe

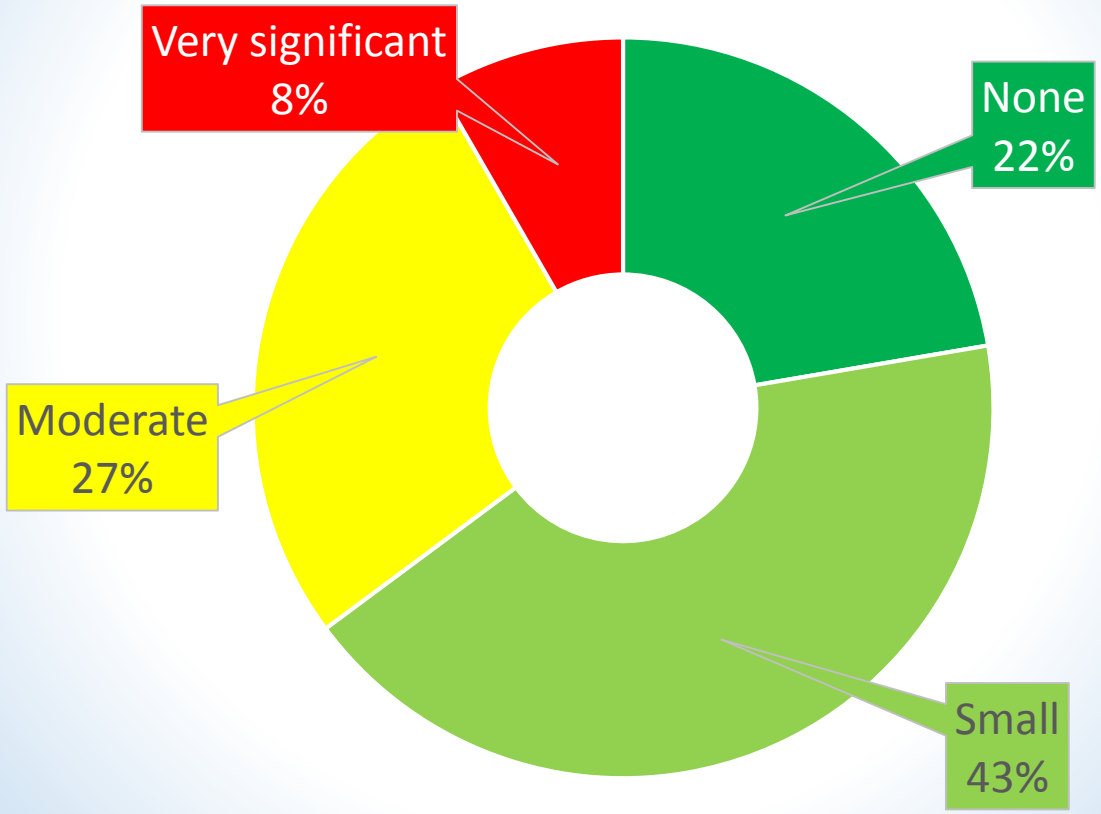


Economic Value and Distance from Forsythe

- Habitat benefits do not decay over distance
- Recreation benefit decay quickly over distance
- Flood protection benefits decay moderately over distance



Self-Reported Impact of Sandy



WTP and reported impact of Sandy

Reported Impact	Protecting 5,000 Homes from Flooding	Minimum Habitat	Significant Habitat	Minimum Recreation	Significant Recreation	Restoring 1,000 acres of salt marsh
None	-$4.43	$27.30	$67.27	$2.07	$17.42	$2.21
Small	$7.65	$46.69	$86.65	$25.56	$40.91	$7.80
Moderate	$19.73	$66.07	$106.04	$49.06	$64.41	$13.39
Very significant	$31.81	$85.46	$125.43	$72.55	$87.90	$18.97
Overall estimate	$9.95	$50.33	$90.95	$30.71	$45.35	$8.96

Trade-offs: ratios between qualitative changes

Ecosystem service	Minimum habitat improvements	Significant habitat improvements	Minimum recreation improvements	Significant recreation improvements
Minimum habitat improvements	-	1.81	0.61	0.90
Significant habitat improvements	0.55	-	0.34	0.50
Minimum recreation improvements	1.64	2.96	-	1.48
Significant recreation improvements	1.11	2.01	0.68	-

Trade-offs between qualitative changes and homes protected

Category	Minimum habitat improvements	Significant habitat improvements	Minimum recreation improvements	Significant recreation improvements
Number of homes protected from flooding	28,078	50,742	17,133	25,303

How do we use those ratios?

- Min habitat improvement project vs. a sig. habitat improvement project (ratio: 1.81)
  - Look at ratio of costs (sig to min)
  - Less than 1.81 → sig. habitat project
- Min recreation project to flood protection project
  - The flood protection project would need to protect at least 17K homes

Contact information

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Willingness to pay over distance

Percentage of value that remains after 60 and 100 miles from Forsythe

Miles from FNWR	Protecting 5,000 Homes from Flooding	Minimum Habitat Improvements	Significant Habitat Improvements	Minimum Recreation Improvements	Significant Recreation Improvements
60	74%	95%	97%	61%	70%
100	60%	95%	95%	35%	49%

Value associated with habitat improvements is stable over distance

Recreation-related values decline rapidly