

**Citation:** Hovis, M., F. Cabbage, G. Smith, A. Zuniga-Teran, R. Varady, T. Shear, S. Chizmar, M. Lupek, M. Baldwin, A. Fox, A. Sand, T. Potter, M. Lovejoy, K. Larick, and B. Evans. 2023. Estimating landowners' willingness to accept payments for nature-based solutions in eastern North Carolina for flood hazard mitigation using the contingent valuation method. *Journal of Soil and Water Conservation* 78(6):500-514. doi:10.2489/jswc.2023.00131.

**Estimating landowners' willingness to accept payments for nature-based solutions in eastern North Carolina for flood hazard mitigation using the contingent valuation method**

**Appendices**

Appendix A: Survey booklet

Appendix B: Theoretical Model Variables and Expected Relationships

Appendix C: Robeson County Farm Landowner Survey Descriptive Statistics

Supplemental Tables

# ROBESON COUNTY FLOODWISE FARM OWNER/OPERATOR SURVEY



## Description

Flooding is the most frequent natural disaster globally and one of the most devastating in both lives lost and economic damage. Many of North Carolina's agricultural and urban communities have been hit hard by intense hurricanes, especially since 2015. Alternative mitigation practices that reduce flood damage should be further explored.

We are asking you to complete a brief survey on your experiences with flooding and preferences regarding flood mitigation program design. We have termed this research and outreach effort *FloodWise* to reflect the need for farmers and communities to adopt new natural flood management practices, financial incentives, and community governance methods for program delivery.

This survey is part of a project about flooding and farm conservation program development conducted by a study team at North Carolina State University, NC Farm Bureau, NC Association of Soil and Water Conservation Districts, and NC Foundation for Soil & Water Conservation.

**The survey should not take more than 20 minutes of your time.**

Your participation is voluntary, and your responses will remain confidential. You may withdraw from participation at any time even after providing consent to participate. By filling out this survey, you consent to having a researcher include your responses in their analysis. **A separate consent form is on the back of this booklet.**

If you have any questions, please contact Meredith Hovis, graduate student, at [mehovis@ncsu.edu](mailto:mehovis@ncsu.edu), or Dr. Fred Cabbage at [cabbage@ncsu.edu](mailto:cabbage@ncsu.edu) or phone at 919-515-7789.

Please fill it out only once. When you are done, please fold the survey in the return envelope provided in your packet and place it in the return envelope provided in your packet and mail it back. Or you may take the survey online:



**SCAN QR CODE WITH SMARTPHONE  
CAMERA OR GO TO  
[GO.NCSU.EDU/FLOODWISE2021](http://GO.NCSU.EDU/FLOODWISE2021)**

## Section A: Landowner Experience with Flooding

1. Do you own or operate farm or forestland in **Robeson County, N.C.**?

(Please check which ones apply)

	Own	Operate
Yes		
No		

If you checked no to both → you have finished the survey → **please return it**

2. How many total acres do you own or operate in Robeson County by land use? (Please fill in the blanks with your best estimate)

	Own	Operate
Total Area (acres)		
Crops (acres)		
Pasture/Fields (acres)		
Forest (acres)		
Other:		

3. How close do you live to the land you farm in Robeson County? (Circle the **best letter** estimate)

- a. On or near the land      c. Elsewhere in North Carolina  
 b. Within 50 miles      d. Out of state

4. How many years have you (or your family) owned of farmed these tract(s) in Robeson County? (Circle the **best letter** estimate)

- a. 0 - 5 years      c. 11 - 20 years      e. 31 - 40 years  
 b. 6 - 10 years      d. 21 - 30 years      f. 40+ years

5. Did any of these storms cause major flooding that damaged crops or fields on any part of your tract(s) in Robeson County? (Circle **all** that apply)

Hurricane Florence, 2018  
 Hurricane Matthew, 2016

Hurricane Floyd, 1999  
 Hurricane Fran, 1996

6. **On average**, how many times have storm events caused major flooding that damaged your crops or fields in Robeson County?  
(Circle **best letter** choice)
- a. Never
  - b. Every 25 years
  - c. Every 15 years
  - d. Every 10 years
  - e. Every 7 years
  - f. Every 5 years
  - g. Every 2 years
  - h. Every year

7. Since 2015, have you ever received crop insurance payments because of flooding on your tract(s) in Robeson County?
- No.     Yes. How many times?\_\_\_\_     I don't know.

8. Excluding Hurricanes Florence and Matthew, because of flooding, approximately what percentage of your expected annual agricultural revenues were lost because of flooding since 2015?
- a. 5% or less
  - b. 10%
  - c. 20%
  - d. 30%
  - e. 40%
  - f. 50%
  - g. 60%
  - h. 70%
  - i. 80%
  - j. 90%
  - k. 100%
  - l. 0% -no major flooding

9. Please circle (1 to 5) the extent to which you strongly disagree (SD), disagree (D), have no opinion (N) agree (A) or strongly agree (SA) with each statement.

Statement	SD	D	N	A	SA
I worry about my farmland flooding after a major rainfall.	1	2	3	4	5
I worry that floods may harm my crop, tree, or livestock yields.	1	2	3	4	5
I already use practices to reduce flooding on my property.	1	2	3	4	5
I worry that flooding may harm water quality.	1	2	3	4	5

10. Which of the following actions have you taken in response to a flood event?
- a. Avoided planting crops in areas prone to flooding
  - b. Planted trees or other vegetation in areas prone to flooding
  - c. Built or enhanced tiling
  - d. Built or enhanced ditches and canals
  - e. Built or enhanced other water control structures
  - f. Switched to different crops in flood-affected areas
  - g. Practiced no-till
  - h. Planted cover crops
  - i. Other (please specify): \_\_\_\_\_
  - j. No actions taken

## Section B: Knowledge of Conservation Practices

11. In the past 5 years, have you participated in a program that paid you for land conservation?
- No – **{{if “No”, continue to Question 12}}**
  - Yes - If “Yes”, which program(s)? (Circle all that apply)
    - a. Conservation Reserve Program (CRP)
    - b. Conservation Reserve Enhancement Program (CREP)
    - c. Environmental Quality Incentive Program (EQIP)
    - d. Forest Land Enhancement Program (FLEP)
    - e. Partners for Fish and Wildlife Program
    - f. Wetland Reserve Program (WRP)
    - g. Wildlife Habitat Incentives Program (WHIP)
    - h. A conservation or mitigation banking program
    - i. A state agricultural cost share program for soil and water
    - j. A state forestry cost share program
    - k. A conservation easement with a land trust
    - l. Other (please specify) \_\_\_\_\_
    - m. I have participated in a program, but don’t know which program

# NATURE-BASED SOLUTIONS

12. Before this survey, have you heard or read about the terms "Nature-Based Solutions (NBS)" or "Natural Infrastructure"?

- Yes       No       I don't know

We define nature-based solutions (NBS), also known as "natural infrastructure", as practices that work with nature or mimic nature to address natural hazards like flooding to benefit both human well-being and biodiversity. Specifically, NBS involve the protection, restoration, or management of natural and semi-natural ecosystems. Examples of nature-based flood control practices may include:

- (a) Common or modified **farm conservation practices**, including no-till, cover crops, hardpan breakup, forest planting, agroforestry.
- (b) Various land and hydrology **structural NBS water management practices** such as tiling, drainage, wetland or stream restoration, temporary water storage on fields (Figure A on page 6) or constructed wetland water catchments/basins (Figure B on page 6).

13. Have you ever used nature-based solutions on your property?

- Yes       No       I don't know

If yes, please describe the ways that you have used nature-based solutions:

---

---

---

---

---

---

---

---

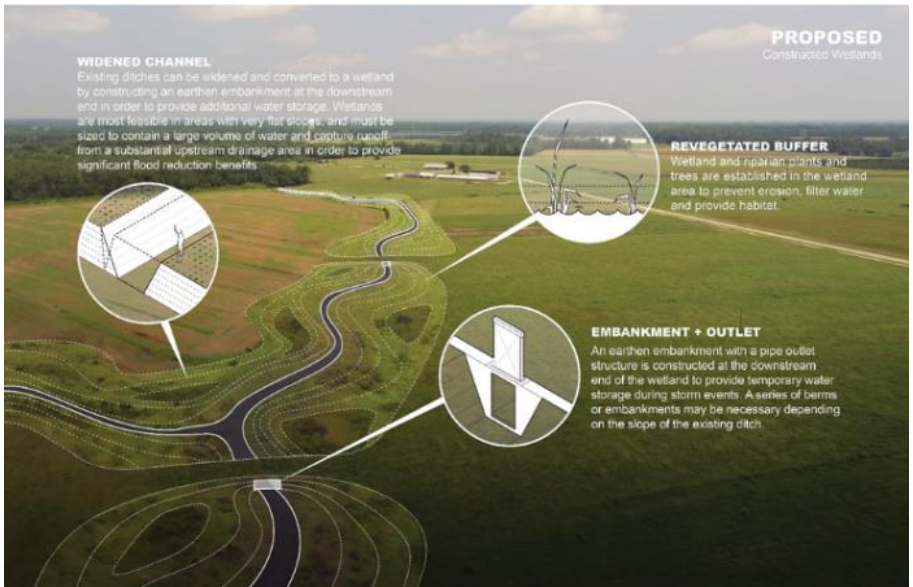
---

---

# POTENTIAL NEW WATER STORAGE PRACTICES



## A. Proposed Temporary Field Flooding – Water Farming



## B. Proposed Wetland Water Catchment Basin, Dams, and Risers

Reference Concepts Courtesy of B. Doll, NCSU Biological and Agricultural Engineering



14. Please circle (1 to 5) the extent to which you strongly disagree (SD), disagree (D), have no opinion (N) agree (A) or strongly agree (SA) with each statement.

<b>Statement</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>
I believe that nature-based solutions (NBS) could reduce flooding risk on my property.	1	2	3	4	5
I believe that NBS could reduce flood risk to communities downstream.	1	2	3	4	5
I feel confident that I could perform certain NBS on my property.	1	2	3	4	5
I would require payments to install and maintain NBS.	1	2	3	4	5
I would require payments to cover the costs of any crops or pastures lost during flooding caused by NBS.	1	2	3	4	5
I might participate in a NBS flood reduction program if I received help to implement and maintain them.	1	2	3	4	5
Implementing NBS flood reduction practices are too costly even with landowner or operator incentives.	1	2	3	4	5
Implementing NBS flood reduction practices would be too time consuming, reducing other farm activities.	1	2	3	4	5
It is my responsibility as a property owner/operator to incorporate flood reduction practices.	1	2	3	4	5
I would not implement nature-based flood reduction practices for reasons other than costs.	1	2	3	4	5

15. Please indicate to what extent you are familiar with the following farm conservation and nature-based solutions. Check **one** box per line.

<b>Practice</b>	<b>Not familiar</b>	<b>Slightly familiar</b>	<b>Moderately familiar</b>	<b>Very familiar</b>	<b>Extremely familiar</b>
<b>Common Farm Conservation Practices</b>					
Cover crops					
No-till cropping					
Hardpan Breakup					
Planting pines					
Planting hardwoods					
Agroforestry/silvopasture					
<b>Structural NBS Water Management Practices</b>					
Tiling with Water Storage Berms					
Stream Restoration					
Forest Wetland Restoration/Banks					
Field ditching/Control/Drainage Districts					
Temporary Field Flooding (see "A" on page 6)					
Wetland Water Catch Basins (see "B" on page 6)					

## Section C: Program Preferences

Assume that installing NBS practices might flood your farm fields or forests for periods of up to one week after a major storm event to prevent flooding elsewhere on the farm or downstream. Federal, state, or local programs could pay you to store this water temporarily. Assume that:

- (a) You could install common agricultural **farm conservation practices** (no-till, cover crops, hardpan breakup, forest planting, agroforestry) for partial cost-share payments, like farm conservation programs, and
- (b) Technical experts and full incentives will be paid to cover the costs for establishing **structural NBS water management practices** (tiling with water storage berms, stream and wetland restoration, field ditching and draining, temporary managed field flooding (Figure A on cover), wetland water catchment basins (Figure B on cover)).

16. Would you be willing to accept payments to install a farm conservation or structural NBS water management practices on any of the following type of farm fields (Circle **all letters** that apply).

- a. Productive crop lands
- b. Marginal crop lands
- c. Productive pasture and grazing land
- d. Marginal pasture and grazing land
- e. Brushy and grown-up fields
- f. Forest land
- g. Other: \_\_\_\_\_
- h. None of the above

17. If adequate funding were provided, which of the following farm conservation and structural nature-based practices would you consider implementing to prevent future flooding? (Circle **all** letters that apply)

- a. Cover crops
- b. No till cropping
- c. Hardpan breakup
- d. Planting pines
- e. Planting hardwoods
- f. Agroforestry
- g. Tiling with berms
- h. Stream restoration
- i. Forested wetland restoration
- j. Field ditching/drainage districts
- k. Managed field flooding/water farming
- l. Wetland water catchment basins
- m. Other: \_\_\_\_\_
- n. None of the above

Assume there were a FloodWise program to assist with implementing **common farm conservation practices** of no-till, cover crops, hardpan breakup, forest planting, agroforestry/silvopasture on your property, circle the contract term length that you would require. (Circle **one** letter)

- a. 5-year contract with annual payments
- b. 10-year contract with annual payments
- c. 20-year contract with annual payments
- d. 30-year contract, annual payments
- e. More than 30 years, annual payments
- f. Permanent land easement
- g. None of the above. I would not participate

18. If you enrolled in these **common farm conservation practices** programs to reduce floods for the contract duration above, assume you would get paid at similar rates for existing farm conservation programs.

a. What cost-share rate would you require to establish the preceding farm conservation practices? (Circle the best **one** choice)

- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%
- None, I would not participate

- b. What is the **minimum** payment per acre per year you would accept to participate in and maintain the above farm conservation practices? (Circle the best **one** choice)

\$40      \$70      \$110      \$140      \$170  
\$50      \$80      \$120      \$150      \$180  
\$60      \$90      \$130      \$160      \$190  
None, I would not participate

19. Assume that due to the higher costs, a FloodWise program that would pay for the establishment and annual management costs for implementing **structural water management practices** of tiling with water storage berms, stream and wetland restoration, field ditching and draining, temporary managed field flooding (Figure A, page 2), wetland water catchment basins (Figure B, page 3), circle the contract term length that you would accept. (Circle the best **one letter** choice)

- a. 5-year contract with annual payments
- b. 10-year contract with annual payments
- c. 20-year contract with annual payments
- d. 30-year contract, annual payments
- e. More than 30 years, annual payments
- f. Permanent land easement
- g. None of the above. I would not wish to participate.

20. If you enrolled in a FloodWise program to reduce floods for the contract duration you selected in question 20, assume that you would get paid: (1) 100% of the costs to establish the practices and compensation when crops are lost due to the practice, (2) annual payments for keeping these practices for the term of the contract, and (3) payment for any crop losses.

What is the **minimum** payment per acre per year you would accept to participate in and maintain the **structural NBS water management practices**—e.g., let the program “lease” your land for the designated practice and time period? (Circle the best **one** choice)

\$40      \$70      \$110      \$140      \$170  
\$50      \$80      \$120      \$150      \$180  
\$60      \$90      \$130      \$160      \$190  
None, I would not participate

21. Please indicate the extent to which you agree that each of the following organizations would be most appropriate to oversee a flood reduction type of conservation contract on private property. Please circle (1 to 5) the extent to which you strongly disagree (SD), disagree (D), have no opinion (N) agree (A) or strongly agree (SA) with each statement, **one** per line.

<b>Organization</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>
NC Cooperative Extension Service (County Agents)	1	2	3	4	5
NC Farm Bureau	1	2	3	4	5
NC Dept. of Agriculture Services	1	2	3	4	5
NC Soil and Water Conservation Districts	1	2	3	4	5
NC Water Drainage Districts	1	2	3	4	5
NC Wildlife Resources Commission	1	2	3	4	5
A nonprofit land conservancy or environmental organization	1	2	3	4	5
USDA Farm Services Agency	1	2	3	4	5
US Federal Emergency Management Agency (FEMA)	1	2	3	4	5
US Fish and Wildlife Service	1	2	3	4	5
USDA Natural Resource Conservation Service (NRCS)	1	2	3	4	5
Other(s) (Please specify): _____	1	2	3	4	5

## Section D: Demographic Questions

In order to more fully understand your responses to the previous questions, we need to know a few things about your background. Remember that your responses are ***completely confidential***. Neither your name nor your address will be linked to your responses in any way. Please circle the best letter choices.

22. What is your gender?      a. male      b. female
23. What is the highest level of schooling/education you have completed?
- a. High school or GED
  - b. Vocational, technical, trade school or certificate program
  - c. Associates degree (2-year degree)
  - d. Bachelors degree (4-year degree)
  - e. Graduate degree
  - f. Professional degree
  - g. Other (please specify):  
\_\_\_\_\_
24. What is your age in years?
- a. Less than 30      c. 46-60      e. 76 or more
  - b. 31-45      d. 61-75
25. What is your race/ethnicity?
- a. White/Caucasian      d. Hispanic/Latino
  - b. Black/African American      e. Asian
  - c. Native American/Indigenous      f. Other (please specify):  
\_\_\_\_\_

26. What was your approximate total household income (AGI) in 2020?

- a. less than \$24,999
- b. \$25,000 - \$49,999
- c. \$50,000 - \$74,999
- d. \$75,000 - \$99,999
- e. \$100,000 - \$149,999
- f. \$150,000 or more

**-end of survey-**

THANK YOU for your participation! Please share any additional comments:

---

---

---

---

---

---

---





# Consent Form

Title of Study: FloodWise: Flood Reduction for Farms and  
Communities in Eastern North Carolina

Principal Investigator: Dr. Fred Cabbage

Funding Source: NC Department of Justice

Point of Contact: Fred Cabbage, 919.515.7789, [cabbage@ncsu.edu](mailto:cabbage@ncsu.edu)

- You are being asked to complete a survey about farm conservation program development. Completing this survey is voluntary. You can stop at any time and do not need to return the survey.
- You must be 18 years of age and reside in the United States to participate in this survey. There are minimal risks associated with your participation in this survey. You will not receive compensation for completing this survey.
- If you have any questions about the survey, how it is implemented, or survey compensation, please contact Dr. Fred Cabbage (see contact info above). If you have questions about your rights as a participant or are concerned with your treatment throughout the research process, please contact the NC State University Institutional Review Board at IRB-Director@ncsu.edu or 919.515.8754 for help.

**If you consent to complete this survey, please return it in the provided stamped envelope to the following address. Please do not include personal information such as your address or name. All surveys sent out and returned are anonymous.**

**Fred Cabbage**

**Department of Forestry and Environmental Resources**

**Box 8008, North Carolina State University, Raleigh, NC 27695-8008**

Appendix B: Theoretical Model Variables and Expected Relationships

<b>Variable</b>	<b>Variable Type</b>	<b>Description</b>	<b>Expected Sign (+, -, ?)</b>	<b>Source</b>
<b>Dependent Variables</b>				
<i>Farm_WTA</i>	Binary	Equals 1 when WTA, and 0 for not WTA	N/A	N/A
<i>NBS_WTA</i>	Binary	Equals 1 when WTA, and 0 for not WTA	N/A	N/A
<i>WTA_payment</i>	Categorical	Equals category 1 when WTA payment is between \$40 and \$50, category 2 is \$60 to \$70, category 3 is \$80 to \$90, category 4 is \$100 to \$110, category 5 is \$120 to \$130, category 6 is \$140 to \$150, category 7 is \$160 to \$170, an category 8 is \$180 to \$190	N/A	N/A
<b>Independent Variables</b>				
<i>Total_Ac_Own</i>	Continuous	Total acreage of land that is owned by respondent	+	Arriagada et al., 2015 Arriagada et al., 2018 Bremer et al., 2014 Jiang et al., 2018 Pattanayak et al., 2003 Villanueva et al., 2016

<i>Manage_Land</i>	Binary	Equals 1 when manages land, and 0 for does not manage or leases land	+	Kang et al., 2019 Lindhjem and Mitani, 2012
<i>Total_Ac_Oper</i>	Continuous	Total acreage of all land that is operated or managed by the landowner?	?	Cubbage et al., 2003 Gutierrez-Castillo et al., 2022 Jiang et al., 2018 Kang et al., 2019 Ma et al., 2012 Nyongesa et al., 2016 Pattanayak et al., 2003 Rabotyagov and Lin, 2013 Wang et al., 2016
<i>Crop_Ac_Own</i>	Continuous	Total acreage of crop land that is owned	+	Arriagada et al., 2015 Arriagada et al., 2018 Bremer et al., 2014 Jiang et al., 2018 Pattanayak et al., 2003 Villanueva et al., 2016
<i>Pasture_Ac_Own</i>	Continuous	Total acreage of pasture or grass land that is owned	+	Arriagada et al., 2015 Arriagada et al., 2018 Bremer et al., 2014 Jiang et al., 2018 Pattanayak et al., 2003

				Villanueva et al., 2016
<i>Forest_Ac_Own</i>	Continuous	Total acreage of forest land that is owned	+	Arriagada et al., 2015 Arriagada et al., 2018 Bremer et al., 2014 Jiang et al., 2018 Pattanayak et al., 2003 Villanueva et al., 2016
<i>Flood_Times</i>	Categorical	Equals zero when flooding has never occurred, 1 when flooding occurs every 25 years, 2 when flooding occurs every 15 years, 3 when flooding occurs every 10 years, 4 when flooding occurs every 7 years, 5 when flooding occurs every 5 years, 6 when flooding occurs every 2 years, and 7 when flooding occurs every year	+	Brouwer and Schaafsma et al., (2013) Bubeck et al., 2017 Pattanayak et al., 2003 Rambonilaza and Brahic, 2016 Rogers, 1975 Jayalath et al., 2021 Rogers, 1983 Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>Revenue_Loss</i>	Continuous	Percent of annual agriculture or forest revenue loss	+	Brouwer and Schaafsma et al., 2013 Bubeck et al., 2017

				Jiang et al., 2018 Lupek, 2014 Pattanayak et al., 2003 Jayalath et al., 2021 Rogers, 1983 Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>Worry_Wquality</i>	Ordinal	<i>I worry that harm may harm water quality</i> Equals 1 when strongly disagrees with the above statement, 2 when disagrees with the above statement, 3 when has no opinion/neutral with the above statement, 4 when agrees with the above statement, 5 when strongly agrees with the above statement	+	Bubeck et al., 2017 Dyer et al., 2015 Ernst and Wallace, 2008 Kreye et al., 2016 Lupek, 2014 Rogers, 1983 Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>Worry_Yields</i>	Ordinal	<i>I worry that floods will harm my crop, tree, or livestock yields</i> Equals 1 when strongly disagrees with the above statement, 2 when disagrees with the above statement, 3 when has no opinion/neutral with the above statement, 4 when agrees with the above	+	Bubeck et al., 2017 Ernst and Wallace, 2008 Lupek, 2014 Ouvrard et al., 2020 Rambonilaza and Brahic, 2016 Rogers, 1983

		statement, 5 when strongly agrees with the above statement		Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>Worry_flood</i>	Ordinal	<i>I worry about my land flooding after a major rainfall</i> Equals 1 when strongly disagrees with the above statement, 2 when disagrees with the above statement, 3 when has no opinion/neutral with the above statement, 4 when agrees with the above statement, 5 when strongly agrees with the above statement	+	Brouwer and Schaafsma et al. (2013) Bubeck et al., 2017 Rambonilaza and Brahic, 2016 Rogers, 1983 Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>Program</i>	Binary	Equals 1 when participated in previous conservation cost-share program, and 0 for has not participated in previous conservation cost-share program	+	Cubbage et al., 2003 Dyer et al., 2015 Gutierrez-Castillo et al., 2022 Pattanayak et al., 2003 Jayalath et al., 2021
<i>Farm_avg_know</i>	Ordinal	Equals 1 when not familiar with common farm practices, 2 when slightly familiar with common farm practices, 3 when moderately familiar with common farm practices, 4 when very familiar with common	+	Bubeck et al., 2017 Jiang et al., 2018 Lupek, 2014 Pattanayak et al., 2003 Rogers, 1983

		farm practices, 5 when extremely familiar with common farm practices		Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>Farm_Contract_Term</i>	Categorical	Equals 1 if landowner prefers 5-year contract for a farm conservation program, 2 for a 10-year contract, 3 for a 20-year contract, 4 for a 30-year contract, 5 for a contract for more than 31 years, 6 for a permanent land easement, and 0 for landowner would not participate in a farm conservation program	?	Kabii and Horwitz, 2006 Kreye et al., 2017 Lupek, 2014
<i>NBS_avg_know</i>	Ordinal	Equals 1 when not familiar with structural NBS, 2 when slightly familiar with structural NBS, 3 when moderately familiar with structural NBS, 4 when very familiar with structural NBS, 5 when extremely familiar with structural NBS	+	Bubeck et al., 2017 Jiang et al., 2018 Lupek, 2014 Pattanayak et al., 2003 Rogers, 1983 Rogers and Prentice-Dunn, 1997 Truelove et al., 2015
<i>NBS_Contract_Term</i>	Categorical	Equals 1 if landowner prefers 5-year contract for a structural NBS program, 2 for a 10-year contract, 3 for a 20-year	?	Kabii and Horwitz, 2006 Kreye et al., 2017 Lupek 2014

		contract, 4 for a 30-year contract, 5 for a contract for more than 31 years, 6 for a permanent land easement, and 0 for landowner would not participate in an NBS program		
<i>Responsible</i>	Ordinal	<i>It is my responsibility as a property landowner/operator to incorporate flood reduction practices</i> Equals 1 when strongly disagrees with the above statement, 2 when disagrees with the above statement, 3 when has no opinion/neutral with the above statement, 4 when agrees with the above statement, 5 when strongly agrees with the above statement	+	Bubeck et al., 2017 Lupek, 2014 Mishra et al., 2021 Rogers, 1983 Rogers and Prentice-Dunn, 1997
<i>Income</i>	Categorical	Equals 1 when annual household income is less than \$2,499, 2 when annual household income is between \$25,000-\$49,999, 3 when annual household income is between \$50,000-\$74,999, 4 when annual household income is between \$75,000-\$99,999, 5 when annual household income is between \$100,000-\$149,999, and 6 when annual household income is \$150,000 or more	?	Cubbage et al., 2003 Jiang et al., 2018 Joshi and Mehmood, 2011 Kreye and Adams, 2016 Pattanayak et al., 2003 Jayalath et al., 2021 Wei et al., 2016



<i>Age</i>	Categorical	Equals 1 when landowners' age is less than 30 years, 2 when age is between 31-45 years, 3 when age is between 46-60 years, 4 when age is between 61-75 years, and 5 when age is 76 years or more	?	Jiang et al., 2018 Kazcan et al., 2013 Kreye and Adams, 2016 Pattanayak et al., 2003 Jayalath et al., 2021
<i>Educ</i>	Categorical	Equals 1 when landowners' highest education completed is high school/GED, 2 for vocational/ technical certificate, 3 for associates, 4 for Bachelors, 5 for Graduate, 6 for professional, and 7 for other	+	Jiang et al., 2018 Kreye et al., 2016 Ma et al., 2012 Nyongesa et al., 2016 Pattanayak et al., 2003 Wolde et al., 2016
<i>Gender</i>	Binary	Equals 1 when landowner gender is male, and 0 for female	?	Kazcan et al., 2013 Kreye and Adams, 2016 Nyongesa et al., 2016 Pattanayak et al., 2003
<i>Proximity</i>	Categorical	Equals 1 when landowner lives on or near the land, 2 when landowner lives within 50 miles, 3 when landowner lives elsewhere in NC and outside of 50 miles, and 4 when landowner lives out of state	+	Conway et al., 2003 Gutierrez-Castillo et al., 2022 Kang et al., 2019 Kendra and Hull, 2005

Appendix C: Robeson County Farm Landowner Survey Descriptive Statistics

<i>Variable</i>	Obs	Mean	Median	Std. dev.	Min	Max
<i>Total_Ac_Own</i>	172	291.70	121.5	535.211	19.8	3900
<i>Manage_Land</i>	198	.35	0	.4792	0	1
<i>Total_Ac_Oper</i>	161	173.58	0	590.81	0	6000
<i>Crop_Ac_Own</i>	162	147.41	50	327.14	0	2500
<i>Pasture_Ac_Own</i>	165	11.73	0	38.57	0	400
<i>Forest_Ac_Own</i>	164	127.39	37.5	400.52	0	3480
<i>Flood_Times</i>	162	3.07	3	2.42	0	7
<i>Revenue_Loss</i>	153	11.39	5	15.58	0	80
<i>Worry_flood</i>	170	3.04	3	1.31	1	5
<i>Worry_Yields</i>	170	3.26	4	1.27	1	5
<i>Worry_Wquality</i>	170	3.21	3	1.25	1	5
<i>Program</i>	177	.23	0	.46	0	1
<i>Farm_know_avg</i>	165	2.74	2.67	1.09	1	5
<i>NBS_know_avg</i>	163	1.99	1.67	.94	1	5
<i>Farm_Contract_Term</i>	120	1.87	2	.99	1	6
<i>NBS_Contract_Term</i>	108	2.09	2	1.23	1	6
<i>Farm_WTA</i>	146	.72	1	.45	0	1
<i>NBS_WTA</i>	145	.69	1	.46	0	1
<i>Combined_WTA</i>	142	.67	1	.47	0	1
<i>Farm_Payment</i>	106	128.21	120	46.20	40	190
<i>NBS_Payment</i>	101	131.98	130	46.22	40	190
<i>Income</i>	144	4.03	4	1.53	1	6

<i>Age</i>	165	3.98	4	.80	1	6
<i>Educ</i>	165	3.53	4	1.58	1	7
<i>Gender</i>	165	.73	1	.44	0	1
<i>Responsible</i>	158	3.29	3	1.02	1	5
<i>Proximity</i>	177	1.69	1	.97	1	6

\*Note: For the continuous variables, the median was less than the mean, indicating that there were some large farms that increased the averages

## References

- Arriagada, R.A., E.O. Sills, P.J. Ferraro, and S.K. Pattanayak. 2015. Do payments pay off? Evidence from participation in Costa Rica's PES program. *PLOS ONE* 10(7):e0131544. doi:10.1371/journal.pone.0131544.
- Arriagada, R., A. Villaseñor, E. Rubiano, D. Cotacachi, and J. Morrison. 2018. Analysing the impacts of PES programmes beyond economic rationale: Perceptions of ecosystem services provision associated to the Mexican case. *Ecosystem Services* 29:116–127. doi:10.1016/j.ecoser.2017.12.007.
- Bremer, L.L., K.A. Farley, and D. Lopez-carr. 2014. What factors influence participation in payment for ecosystem services programs? An evaluation of Ecuador's SocioParamo program. *Land Use Policy* 36:122–133. doi.org/10.1016/j.landusepol.2013.08.002.
- Conway, M.C., G.S. Amacher, J. Sullivan, and D. Wear. 2003. Decision non-industrial forest landowners make: An empirical examination. *Journal of Forest Economics* 9(3):181–203.
- Dyer, J., B. Barlow, K. Kush, W. Morse, L. Teeter, and G. Kever. 2015. Factors affecting Alabama landowner interest in harvesting pine straw and willingness to accept prices. *Agroforest Systems* 89:829–839. doi:10.1007/s10457-015-9816-8.
- Ernst, T., and G.N. Wallace. 2008. Characteristics, motivations, and management actions of landowners engaged in private land conservation in Larimer County, Colorado. *Natural Areas Journal* 28(2):109-120.
- Kendra, A., and R.B. Hull. 2005. Motivations and behaviors of new forest owners in Virginia. *Forest Science* 51(2):142–154.
- Kreye, M., D. Adams, F. Escobedo, and J. Soto. 2016. Does policy process influence public values for forest-water resource protection in Florida? *Ecological Economics* 129:122–131.
- Mishra, B., R. Will, and O. Joshi. 2021. Attitudes and Intentions of Landowners Towards Active Management for Deer Hunting in the Forested Grassland Transitional Ecoregion of the South-central USA. ISFRE 2021 Annual Conference, May18-19, 2021 [Oral Presentation].
- Ouvrard, B., J. Abildtrup, and A. Stenger. 2020. Nudging acceptability for wood ash recycling in forests: A choice experiment. *Ecological Economics* 177:106748. <https://doi.org/10.1016/j.ecolecon.2020.106748>.
- Rambonilaza, T., and E. Brahic. 2016. Non-market values of forest biodiversity and the impact of informing the general public: Insights from generalized multinomial logit estimations. *Environmental Science and Policy* 64:93–100. <https://doi.org/10.1016/j.envsci.2016.06.008>.

# Supplemental Tables

**Table S1: Multinomial Logit Model 1, WTA Payments for Farm Conservation Practices**

						Number of obs = 77
						Waldchi2(42) = 1354.47
Log Pseudolikelihood = -121.25118						Pseudo R2 = 0.1747
<i>WTA_FarmPayment</i>	Coefficient	Robust std. err.	z	P> z	95% Confidence Interval	
<b>1</b>						
<i>Manage_Land</i>	-.0420348	1.216609	-3.53	<b>0.000***</b>	0.000	-1.909249
<i>Total_Ac_Oper</i>	.0028325	.0013176	2.15	<b>0.032**</b>	.0002501	.0054149
<i>Flood_Times</i>	.1859453	.3533975	0.53	0.599	-.5067011	.8785917
<i>Worry_flood</i>	.7402397	.6022997	1.23	0.219	-.4402459	1.920725
<i>Farm_Contract</i>	.0837945	.4231023	0.20	0.843	-.7454708	.9130599
<i>Income</i>	-.2097646	.4651791	-0.45	0.652	-1.121499	.7019697
<b>2</b>						
<i>Manage_Land</i>	1.017564	1.43905	0.71	0.479	-1.802923	3.83805
<i>Total_Ac_Oper</i>	.002011	.0012519	1.61	<b>0.108<sup>a</sup></b>	-.0004427	.0044648
<i>Flood_Times</i>	.068353	.2208255	0.31	0.757	-.3644571	.5011631
<i>Worry_flood</i>	-.1867265	.5729301	-0.33	0.744	-1.309649	.9361659
<i>Farm_Contract</i>	-.32811	1.078481	-0.30	0.761	-2.441893	1.785673
<i>Income</i>	.2270662	.3714875	.61	0.541	-.5010359	.9551683
<b>3</b>						
<i>Manage_Land</i>	-.0420348	1.299937	-0.03	0.974	-2.589864	-2.505795
<i>Total_Ac_Oper</i>	-.0129325	.0058879	-2.20	<b>0.028**</b>	-.0244725	-.0013924
<i>Flood_Times</i>	.0670905	.1901765	0.35	0.724	-.3056485	.4398295
<i>Worry_flood</i>	-.2389634	.391629	-0.61	0.542	-1.006542	.5286154
<i>Farm_Contract</i>	-.181361	.4175908	-0.43	0.664	-.9998238	.6371019
<i>Income</i>	-.1264368	.2653526	-0.48	0.634	-.6465183	.3936448

<b>4 (base outcome)</b>	-	-	-	-	-	-
<b>5</b>						
<i>Manage_Land</i>	-1.495384	1.313536	-1.14	0.255	-4.069868	1.0791
<i>Total_Ac_Oper</i>	-.0014081	.0014369	-0.98	<b>.0327**</b>	-.0042243	.0014081
<i>Flood_Times</i>	-.0594296	.2016198	-0.29	0.768	-.4545872	.335738
<i>Worry_flood</i>	.2167924	.4213475	0.51	0.607	-.6090335	1.042618
<i>Farm_Contract</i>	-.1399454	.4704565	-0.30	0.766	-1.062023	.7821324
<i>Income</i>	.1386447	.3083907	0.45	0.653	-.4657901	.7430794
<b>6</b>						
<i>Manage_Land</i>	.6067244	1.06574	0.57	0.569	-1.482088	2.695536
<i>Total_Ac_Oper</i>	.0015846	.0013061	1.21	0.225	-.0009753	.0041444
<i>Flood_Times</i>	-.0556523	.2144113	-0.26	0.795	-.4758907	.3645861
<i>Worry_flood</i>	-.1414129	.4619467	-0.31	0.760	-1.046812	.763986
<i>Farm_Contract</i>	.0521043	.3298675	0.16	0.874	-.5944241	.6986327
<i>Income</i>	.2023555	.2999255	0.67	0.500	-.3854878	.7901987
<b>7</b>						
<i>Manage_Land</i>	-25.10852	4.377779	-5.74	<b>0.000***</b>	-33.68881	-16.52823
<i>Total_Ac_Oper</i>	.003713	.0014409	2.58	<b>0.010***</b>	.0008889	.0065371
<i>Flood_Times</i>	-.0819304	.4648202	-0.18	0.860	-.9929614	.8291005
<i>Worry_flood</i>	.2398256	.8072975	0.30	0.766	-1.342448	1.8221
<i>Farm_Contract</i>	3.041263	.9466856	3.21	<b>0.001***</b>	1.185793	4.896733
<i>Income</i>	-1.331631	.5873996	-2.27	0.023	-2.482913	-1.1803486

<b>8</b>							
<i>Manage_Land</i>	1.536634	.975371	.58	<b>0.115</b> <sup>a</sup>	-.3750778	3.448326	
<i>Total_Ac_Oper</i>	.0017661	.0012561	1.41	0.160	-.0006957	.0042279	
<i>Flood_Times</i>	.1301742	.2077399	0.63	0.531	-.2769885	.5373369	
<i>Worry_flood</i>	-.4248334	.3739518	-1.14	0.256	-1.157765	.3080986	
<i>Farm_Contract</i>	.0544809	.3589386	0.15	0.879	-.649026	.7579877	
<i>Income</i>	.4842279	.2885226	1.68	<b>0.093</b> *	-.081266	1.049722	

\*\*\*Significant at 1%; \*\* Significant at 5%; \* Significant at 10%; <sup>a</sup> Significant at 15%

**Table S2: Multinomial Logit Model 2, WTA Payments for Structural NBS Practices**

		Number of obs = 85				
		Waldchi2(35) = 2163.79				
Log Psuedolikelihood = -132.38537		Pseudo R2 = 0.1801				
<i>WTA_NBSPaymen</i> <i>t</i>	Coefficient	Robust std. err.	z	P> z	95% Confidence Interval	
<b>1</b>						
<i>Manage_Land</i>	-17.33129	.770045	-22.51	<b>0.000***</b>	-18.84055	-15.82203
<i>Revenue_Loss</i>	-.0049851	.0267197	-0.19	0.852	-.0573549	.0473846
<i>NBS_Contract</i>	-.4640303	.488769	-0.95	0.342	-1.422	.4939394
<i>Age</i>	.618093	.654392	0.94	0.345	-.6642755	1.900894
<i>Worry_flood</i>	.0238185	.49611	0.06	0.955	-.9441727	1.000543
<b>2</b>						
<i>Manage_Land</i>	1.985866	1.173127	1.69	<b>0.090*</b>	-.3134205	4.285152
<i>Revenue_Loss</i>	-.0613088	.0362296	-1.60	<b>0.091*</b>	-.1323176	.0097
<i>NBS_Contract</i>	-1.465331	.6972174	-2.10	<b>0.036**</b>	-2.831852	-.0988104
<i>Age</i>	.8048166	.6160738	1.31	0.191	-.4026659	2.012299
<i>Worry_flood</i>	.140664	.3995531	0.35	0.725	-.6424458	.9237737
<b>3</b>						
<i>Manage_Land</i>	-16.05206	1.073325	-14.96	<b>0.000***</b>	-18.15574	-13.94839
<i>Revenue_Loss</i>	.0268845	.0268349	1.00	0.316	-.0257109	.0794799
<i>NBS_Contract</i>	.4244211	.6043534	0.70	0.483	-.7600899	1.608932
<i>Age</i>	-.3661388	.6877994	-0.53	0.594	-1.714201	.9819234
<i>Worry_flood</i>	-.5028108	.5079839	-0.99	0.322	-1.498441	.4928193
<b>4</b>						
<i>Manage_Land</i>	-1.059276	.7478638	-0.14	0.887	-1.571714	1.359858
<i>Revenue_Loss</i>	-.0003397	.0217644	-0.02	0.988	-.0429971	.0423177

<i>NBS_Contract</i>	-.0521525	.3067338	-0.17	0.865	-.6533398	.5490348
<i>Age</i>	.9369524	.5715965	1.64	<b>0.101*</b>	-.1833562	2.057261
<i>Worry_flood</i>	-.2385289	2.356177	-1.21	0.225	-7.47445	1.761594
<b>5</b>						
<i>Manage_Land</i>	-.3645149	.8187107	-0.45	0.656	-1.969158	1.240129
<i>Revenue_Loss</i>	-0.528463	.0375305	-1.41	0.159	-.1264048	.0207122
<i>NBS_Contract</i>	.3077179	.3688813	0.83	0.404	-.4152761	1.030712
<i>Age</i>	1.584533	.607373	2.61	<b>0.009***</b>	.3941038	2.774962
<i>Worry_flood</i>	.1963899	.3464093	0.57	0.571	-.4825598	.8753396
<b>6</b>						
<i>Manage_Land</i>	-.04757	.8242843	-0.06	0.954	-1.663138	1.567998
<i>Revenue_Loss</i>	-.0505687	.0316989	-1.60	<b>0.111<sup>a</sup></b>	-.1126974	.0115601
<i>NBS_Contract</i>	-0.340731	.3616876	-0.09	0.925	-.7429678	.6748216
<i>Age</i>	.0461478	.462075	0.10	0.920	-.8595025	.951798
<i>Worry_flood</i>	.3388965	.3573964	-0.95	0.343	-.3615876	1.039381
<b>7</b>						
<i>Manage_Land</i>	-17.2021	1.319602	-13.04	<b>0.000***</b>	-19.78848	-14.61573
<i>Revenue_Loss</i>	-.0472694	.0353946	-1.34	0.182	-.1166416	.0221028
<i>NBS_Contract</i>	.3581405	.7101224	0.50	0.614	-1.033674	1.749955
<i>Age</i>	-.5483974	1.343842	-0.41	0.683	-3.182279	2.085484
<i>Worry_flood</i>	-.4199653	.7855248	-0.53	0.593	-1.959566	1.119635
<b>8 (base outcome)</b>	-	-	-	-	-	-

\*\*\*Significant at 1%; \*\* Significant at 5%; \* Significant at 10%; <sup>a</sup> Significant at 15%