



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Analyzing Disparities in WTA to Adopt Climate-Smart Practices: A Decision Tree Approach

Zuyi Wang¹, Anastasia Thayer¹, Michael Vassalos¹, Felipe De Figueiredo Silva¹, Nathan Smith¹, and Man-Keun Kim²

¹ Department of Agricultural Sciences, Clemson University, email: zuyiw@clemson.edu

¹ Department of Agricultural Sciences, Clemson University, email: awthaye@clemson.edu

¹ Department of Agricultural Sciences, Clemson University, email: mvassal@clemson.edu

¹ Department of Agricultural Sciences, Clemson University, email: fdsilva@clemson.edu

¹ Department of Agricultural Sciences, Clemson University, email: nathan5@clemson.edu

² Department of Applied Economics, Utah State University, email: mk.kim@usu.edu

***Selected Poster prepared for presentation at the 2024 Agricultural & Applied Economics Association
Annual Meeting, New Orleans, LA: July 28-30, 2024***

Copyright 2024 by Wang, Tejada, and Kim. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

ANALYZING DISPARITIES IN WTA TO ADOPT CLIMATE-SMART PRACTICES: A DECISION TREE APPROACH



ZUYI WANG¹, ANASTASIA THAYER¹, MICHAEL VASSALOS¹, FELIPE DE FIGUEIREDO SILVA¹, NATHAN SMITH¹, AND MAN-KEUN KIM²

1. DEPARTMENT OF AGRICULTURAL SCIENCES, CLEMSON UNIVERSITY, CLEMSON, SC
2. APPLIED ECONOMICS, UTAH STATE UNIVERSITY, LOGAN, UT



INTRODUCTION

- Adoption of Climate-Smart practices such as **cover crops, mulching, reduced tillage, and prescribed grazing** have gained more attention in due to carbon sequestration and reduced greenhouse gas emissions.
- USDA awarded more than **\$3.1 billion for 141 projects to increase production and markets for climate-smart commodities**. In South Carolina, leafy greens, peanut and beef cattle producers are participating the Climate-Smart Grown in SC project.
- The **objective** of this study is two-fold:
 - Compare the incentive given by the program to their self-reported willingness to accept (WTA) to adopt such practices; and
 - Explain what drives the difference between those values.

DATA

Enrolled Producers Total = 174:

- 103 Beef Cattle, 60 Leafy Greens, and 11 Peanuts (See Table 1. for a description by practice, and Figure 1 for producers enrolled).
- Targeted Underserved Producers defined by NRCS.
- Producers can receive incentive from more than one practice.

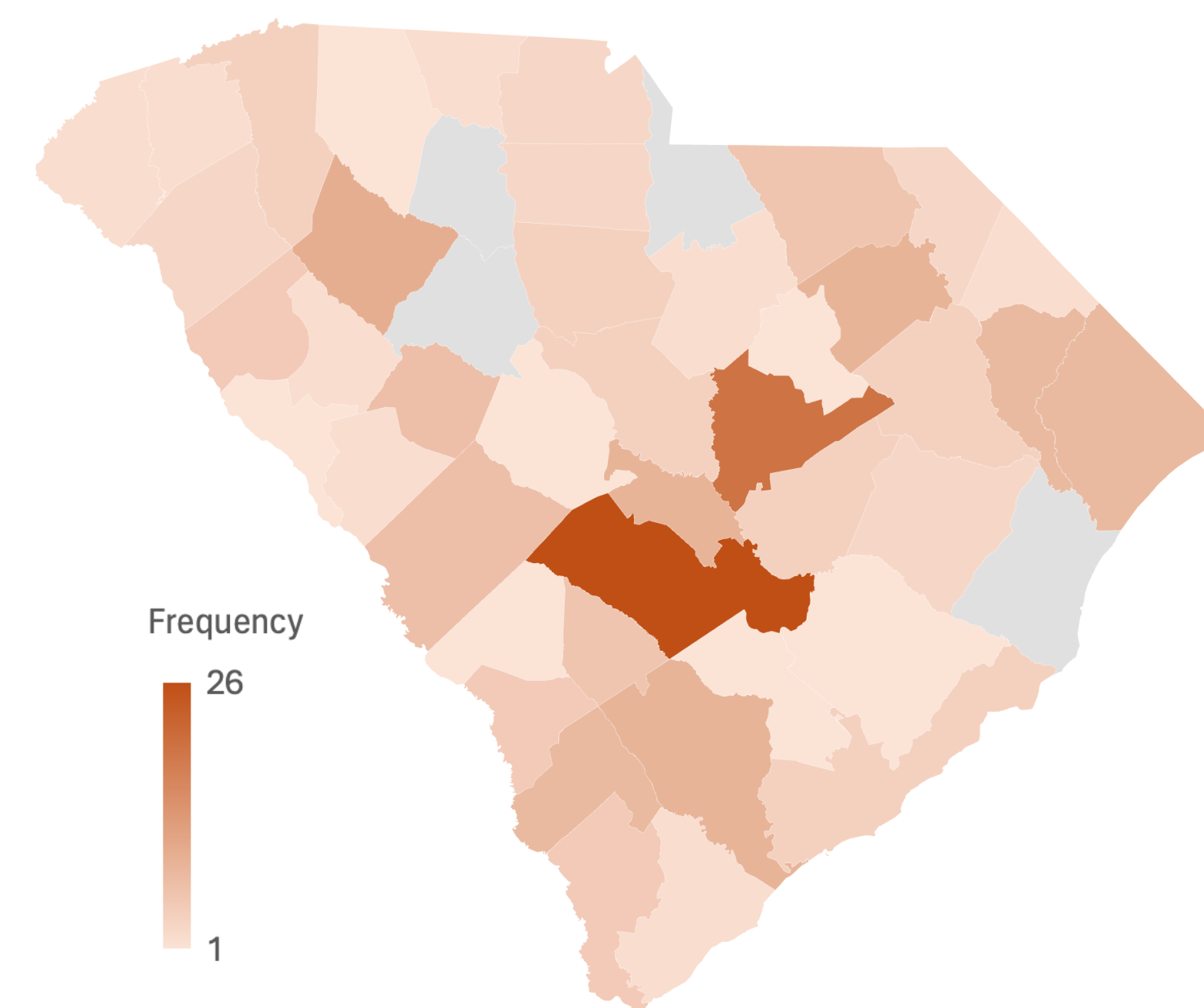


Figure 1. State coverage-producers enrolled in the program

Table 1. Difference between producer WTA and incentive received through the Climate-Smart project by commodity and practice

		Enrolled Number	Higher WTA Count	Incentive payment (\$)	Diff. in payment and WTA
Peanut	Cover crop	11	2	100	3
	Reduced tillage	10	7	50	-28
Beef cattle	Forage	90	21	250	51
	Prescribed grazing	83	67	50	-88
	Nutrition management	86	80	80	-79
Leafy green	Cover crop	55	9	1500	49
	Reduced tillage	43	10	1500	70
	Mulching	36	17	1500	-74

METHOD

- We use **Machine Learning (ML)** techniques, specifically, the Decision trees method to capture relationship between variables and outcomes (Lantz, 2013; Chiu, 2015; Therneau et al., 2022).
- The survey contains more than 200 potential explanatory variables, posing a challenge in selecting the most relevant ones for a regression model. To address this complexity, we utilize ML techniques
- The variable of interest is the difference between producer WTA and government payments (i.e., WTA minus incentive payment). We used Entropy to measure **impurity**.
- Eleven of the most frequently** occurring variables were selected for node splitting are shown in Figure 2.

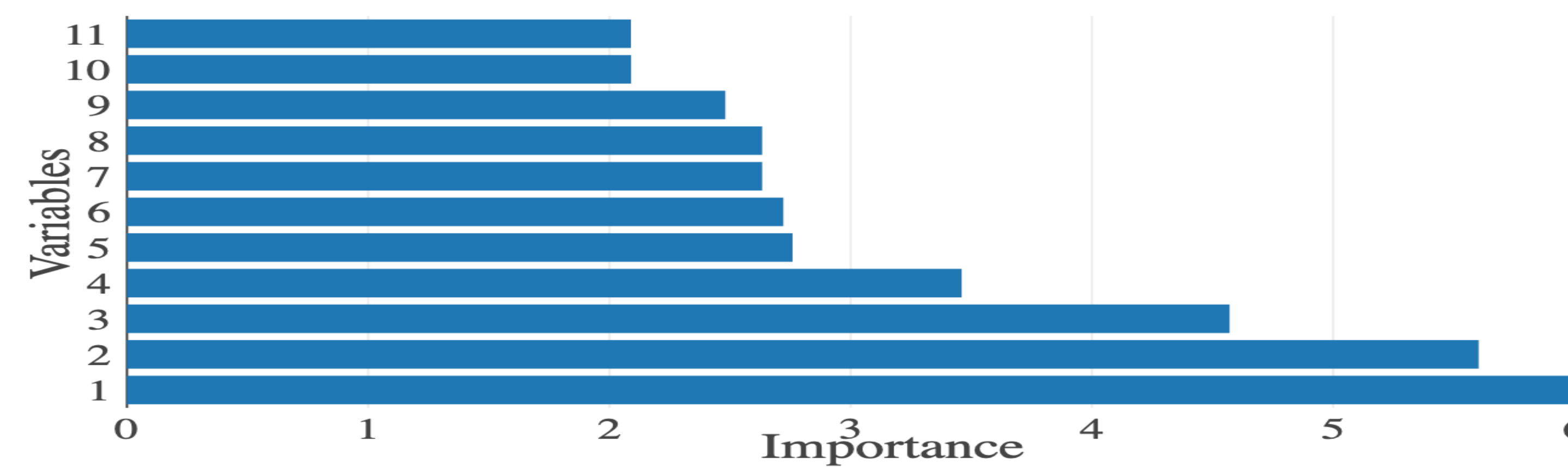


Figure 2. Important variables building Decision tree

Four variables relating to concerns about:

- Increased fluctuation in temperature from year to year (*variable 1*)
- Changes in input costs (*variable 2*)
- Water availability fluctuations due to increased wet/dry years (*variable 3*)
- Change in price (*variable 10*)

Three variables relating to awareness of:

- Market incentives of climate-smart agriculture (*variable 6*)
- Federal funds of climate-smart agriculture (*variable 7*)
- Non-profit fund of climate-smart agriculture (*variable 8*)

Three variables relating to operation information

- Years of farming experience (*variable 4*)
- Taxable household income (*variable 9*)
- I am currently practicing USDA-certified organic (*variable 11*)

How do you agree with the statement

- The media exaggerates environmental issues from agricultural activities (*variable 5*)

RESULTS

- In Figure 3, the root node bifurcates based on the criterion *no concerns about yearly input costs*.
 - 78% of producer indicate incentives are **not** enough (**No** in the bifurcation)
 - 22% of producer indicate incentives are enough (**Yes** in the bifurcation)

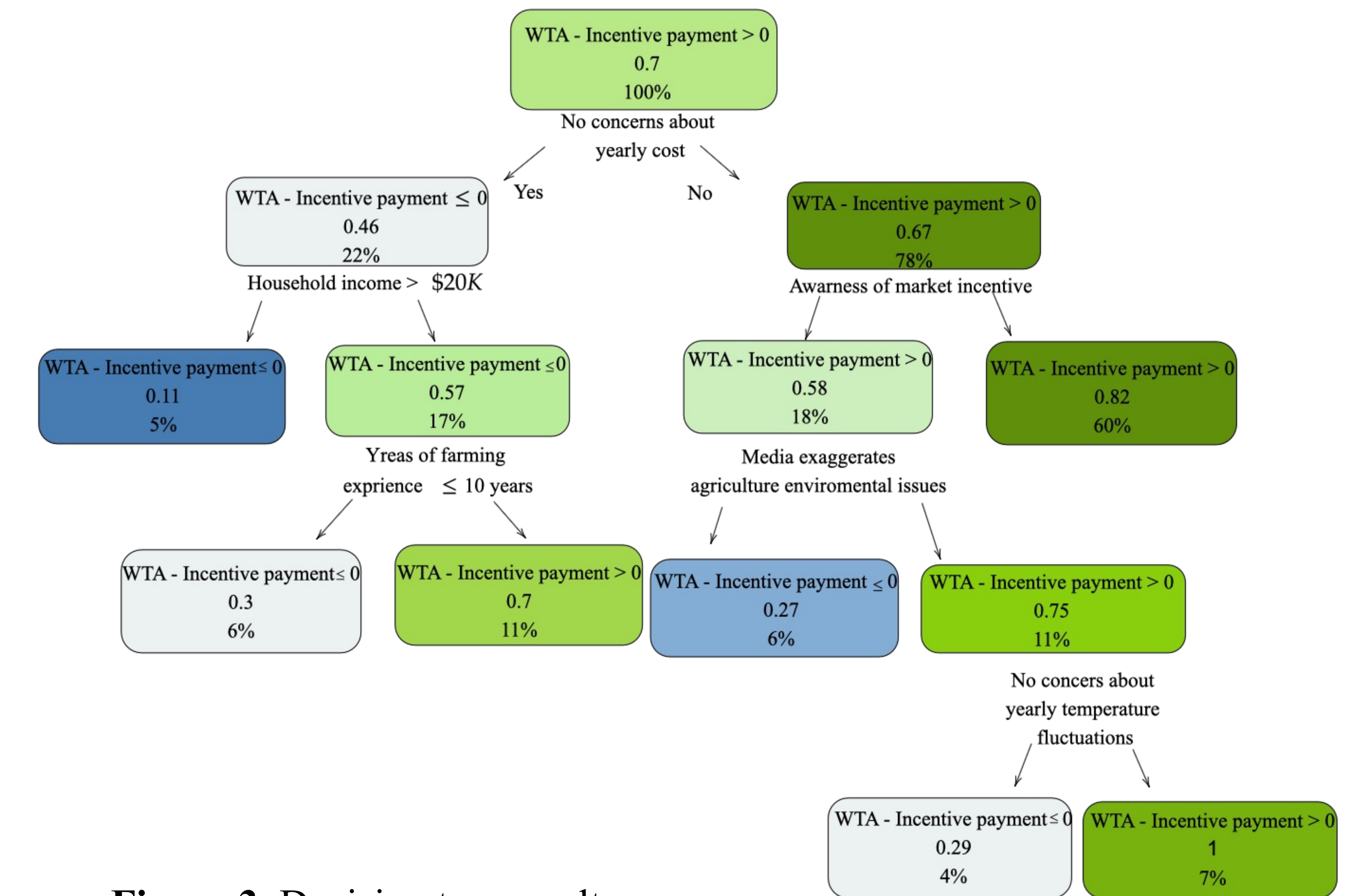


Figure 3. Decision tree results

- The results suggest that producers in South Carolina may be willing to accept a lower amount if they perceive the incentive payment as a safeguard against possible future risks, including input cost.
- Other significant factors contributing to the partitioning of producers include **Taxable household income, farming experience, awareness of market incentives, agreement with media exaggeration of agricultural environmental issues, and concerns about yearly temperature fluctuations**, among many potential attributes in the survey (Figure 3).
- Overall, these results indicate several factors driving farmers to reduce their WTA and adopt climate-smart practices for incentive payments. **Among these, uncertainty about the future stands out as a pivotal factor among others, underscoring its importance in shaping decision trees.**

ACKNOWLEDGEMENT

Funding provided by USDA-NRCS Partnerships for Climate-Smart Commodities award titled Building Partnerships for Climate-Smart Commodities in South Carolina, award number NR2338750004G049