Decision-Making Processes in Relation to Fertilizer Use, Revenue, and Vegetative Buffer Installation

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Introduction

Agricultural non-point source pollution is of critical concern to water quality:

- 2000 National Water Quality Inventory reported decreased water quality in almost every state
- The second largest source of impairment to wetlands and a major contaminator of surveyed estuaries and ground water (EPA, 2014)

Vegetative buffers are an economically viable and powerful tools in combating agricultural pollution. Adoption of buffer strips could lead to decreases in harmful fertilizer runoff by up to 50% (Vermont Department of Environmental Conservation, 2014).

Many factors influence a producer's decision to adopt a vegetative buffer strip:

- Economic consequences of decisions
- Access to information
- Social norms and pressures

Experimental games offer insight into participant decision making processes.

Hypotheses

- Participants will install vegetative buffers more quickly when provided access to information about the benefits of buffer strip adoption or when offered a monetary incentive.
- Participants who have background knowledge of vegetative buffer strips prior to playing the game will install buffers more quickly.

Methods

Experimental game participants were asked to make decisions in a simulated experimental game environment (coded in R)

Game play

- 7 different scenarios repeated three times for a total of 21 (plus 1 practice session)
- For every scenario, decisions were made each year for 6 years
- Participants were paid in US$ based on their economic returns from all sessions

Data collected during game play: Scenario (Information provide & economic incentives), Adoption Decision and Decision year

Post-play survey

Survey questions examined age, economic status, sex, pre-participation buffer strip knowledge, environmental policy knowledge, agricultural science knowledge.

Decision Year, and survey answers were linearly regressed against Scenario type using R.

Image 1: Effect of excess fertilizer runoff

Image 2: Vegetative buffers are strips of grasses or other close-growing vegetation planted around fields and other drainage ways that filter out nutrients, sediments, and other pollutants before they reach water sources (Vermont Department of Environmental Conservation, 2014).

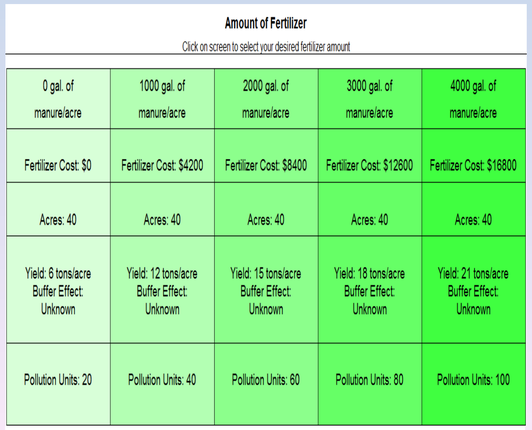

Image 3: Screenshot of actual gameplay

Results and Discussion

To date, 29 individuals have participated in this experimental gaming study. Data collection is currently ongoing. All game play was conducted in the Social Ecological Gaming and Simulation (SEGS) laboratory at the University of Vermont.

Players adopted buffer strips earlier in the session when provided information regarding the benefits of buffer strip adoption or the possibility of a monetary incentive for adoption (Figure 1 & Figure 1 inset). Players adopted buffer strips earlier in the session with increased prior knowledge or awareness of the buffer strip benefits (Figure 2).

Future research should investigate factors such as the influence of social pressure, group incentives or pollution threshold incentives. Additionally, recruitment of participants from the agricultural industry could provide more relevant data and feedback.

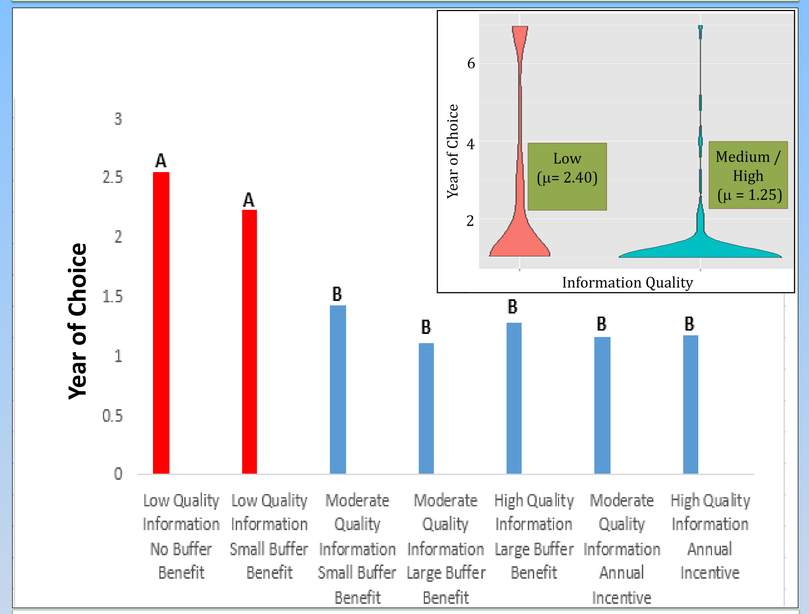

Figure 1. Information quality affects timing of buffer strip adoption. Buffer strip adoption occurred significantly later in Scenarios 1&2 compared to the rest of the scenarios ($p < 0.001$, F-stat = 80.34, df = 1, 607). Figure 1 inset depicts a violin plot describing the effect of Information quality on timing of adoption.

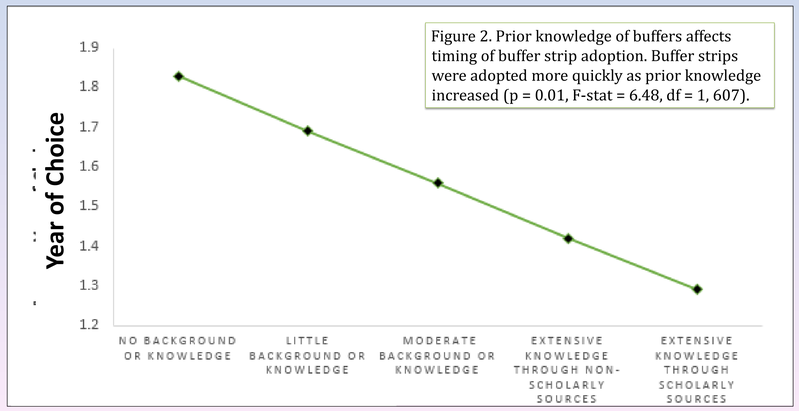

Figure 2. Prior knowledge of buffers affects timing of buffer strip adoption. Buffer strips were adopted more quickly as prior knowledge increased ($p = 0.01$, F-stat = 6.48, df = 1, 607).

Conclusions

Human behavioral decisions to adopt buffer strips can be nudged using economic incentives and by increasing awareness of the benefits of buffer strip instillation. These results provide evidence for the use of interventions that will increase buffer strip awareness or provide economic incentives for buffer strip adoption.

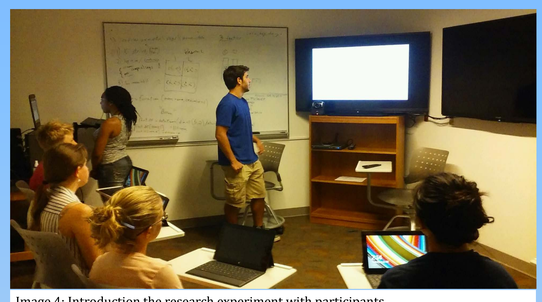

Image 4: Introduction the research experiment with participants

References

- R Development Core Team. 2015. R: A language and environment for statistical computing. R Foundation for Statistical Computing.
- U.S. Environmental Protection Agency. 2014. Agriculture. Water: Polluted Runoff.
- Vermont Department of Environmental Conservation. 2014. Vermont Lake Champlain Phosphorus TMDL Phase I Implementation Plan.
- Image 1: http://assets.bwbx.io/images/iMuQAW7l5DGM/v1/628x-1.jpg
- Image 2: https://www.edf.org/cdn/farfuture/eDujYhs5Frbby1HLT1wGBnhPX5vVGNlbVlJMB5sPAec/mtime:1380306622/sites/default/files/2011-EDF-NitrogenRunoff%23310.jpg

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