

# Applying Behavioral Economics to Improve Environmental Programs



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STAC CBP

Johns Hopkins University





Johns Hopkins Bloomberg Distinguished Professor Paul Ferraro

<https://youtu.be/ZEzjyADdhd4>

Ecologist ----->

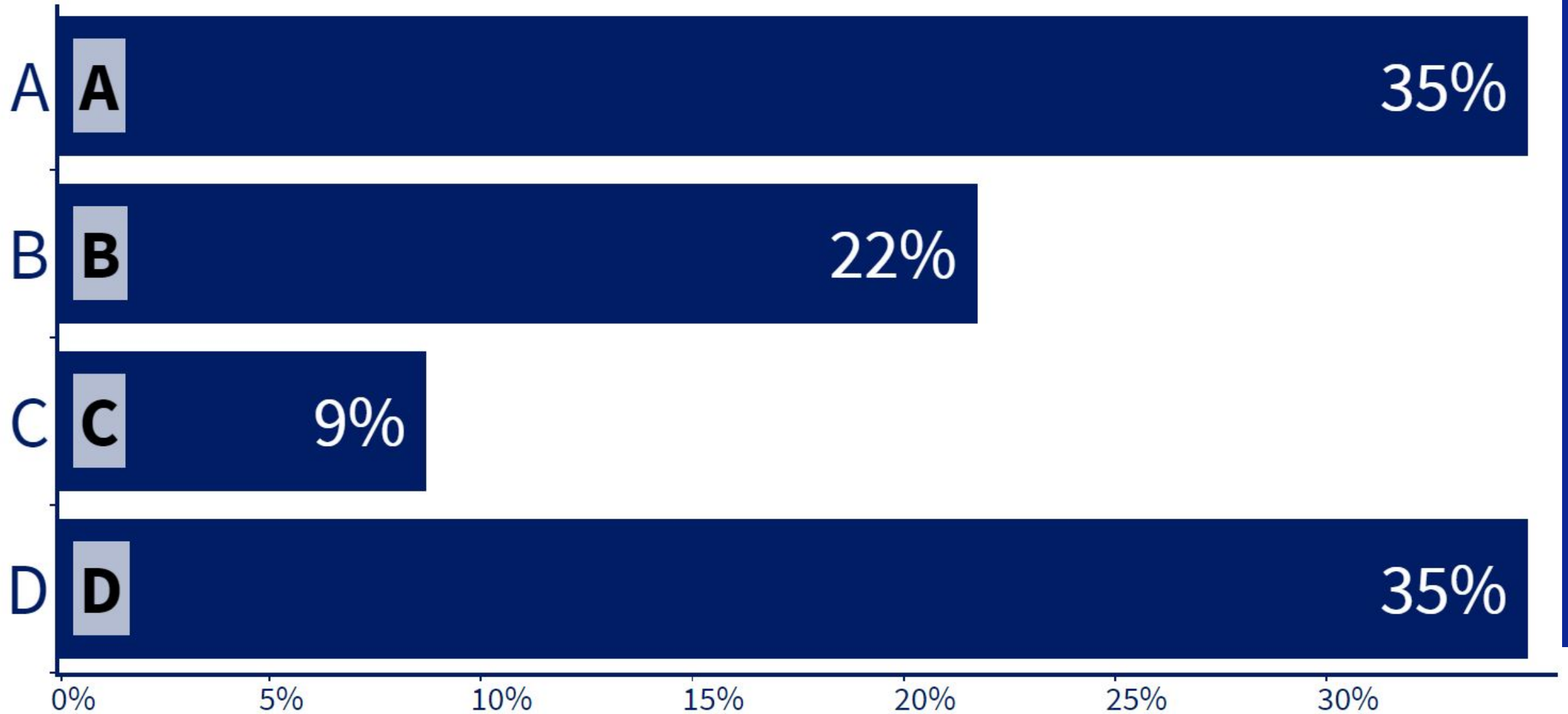
Economist ----->

Behavioral  
Scientist and  
Applied  
Statistician

Imagine that your country is preparing for an outbreak of an unusual disease that is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Scientific estimates of the consequences of the programs are on your sheet of paper:

## Which Program do You Prefer?

Respond at [Pollevo.com/ferraro68](https://www.pollevo.com/ferraro68) Text **FERRARO68** to **22333** once to join, then **A, B, C, or D**



Imagine that your country is preparing for an outbreak of an unusual disease that is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Scientific estimates of the consequences of the programs are on your sheet of paper:

### Positive Framing

If Program A is adopted, exactly 200 people will be saved.

If Program B is adopted, there is a 1 in 3 probability that all 600 people will be saved and a 2 in 3 probability that no one will be saved.

$$A = C \quad \text{and} \quad B = D$$

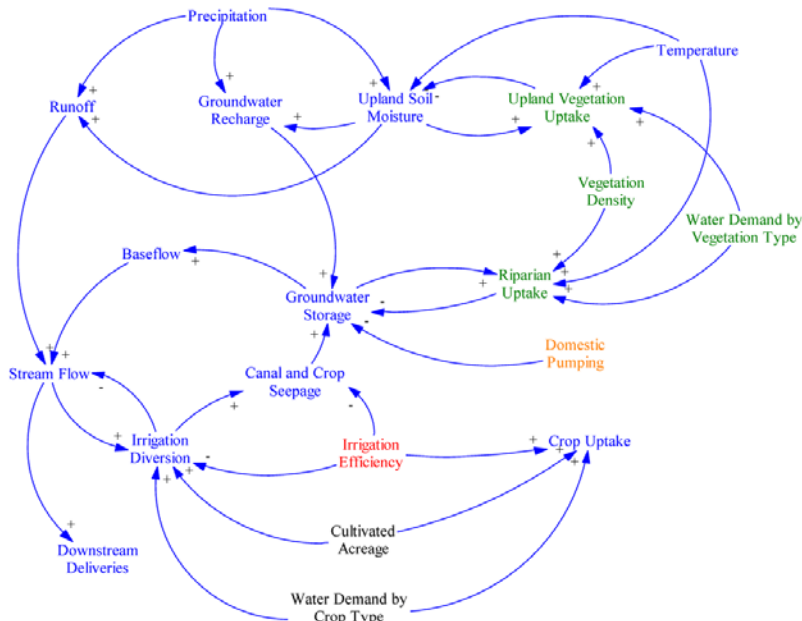
### Negative Framing

If Program C is adopted, exactly 400 people will die.

If Program D is adopted, there is a 1 in 3 probability that no one will die and a 2 in 3 probability that all 600 will die.

# Human Behavior, Policies & Programs

Environmental problems are human problems. Changing environmental outcomes is about changing human behavior



# Changing Environmental Outcomes is about Changing Human Behavior



The Center for  
Behavioral and Experimental  
Agri-Environmental Research

# CBEAR Goals

Bring insights from the behavioral sciences to agri-environmental programs

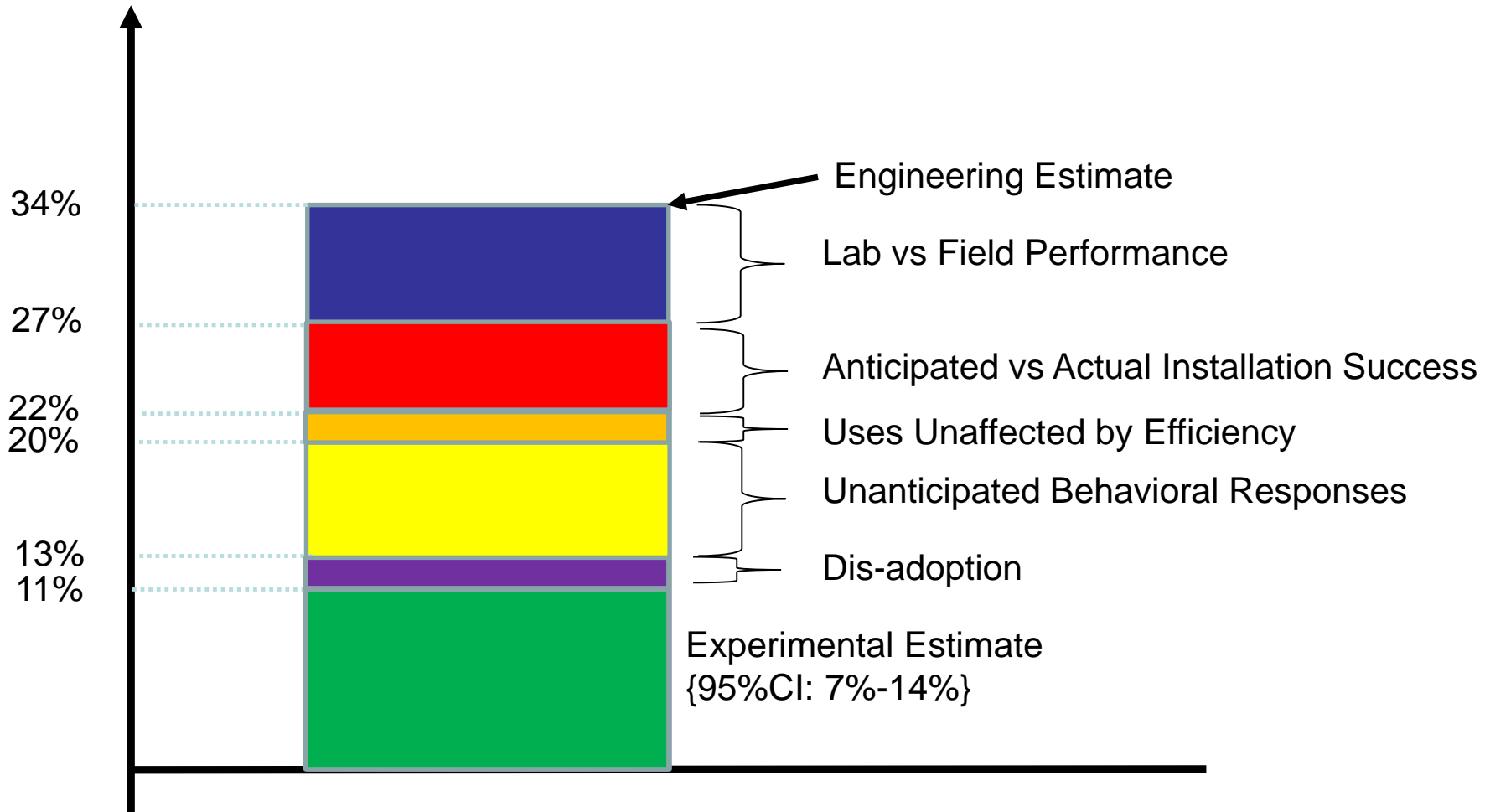


Create a culture of experimentation in agri-environmental programs

# Ongoing Field Experiments

- Citizen willingness to act politically and financially for environmental goals
- Farmer willingness to accept conservation practices
- Adoption of more efficient technology to reduce input use
- Community monitoring and reporting to improve environmental indicators
- Announced vs surprise regulatory inspections to improve LT compliance
- Social comparisons to reduce point source pollution

Percent Reduction in Monthly Water Use  
(4 months after intervention)



Alpizar, Bernedo, and Ferraro, unpublished

# Greater irrigation efficiency = 20% reduction?

## Agriculture Drought Relief Program.

### Agricultural Drought Relief Program

Although the drought of 2008 may only be a bad memory, impacts still linger on. In order to reduce the impacts and reduce the costs of future droughts and to conserve water; the Henderson County Soil and Water Conservation District has some grant funds to assist local producers. Please note that these funds Retrofitting existing irrigation systems to Conservation Irrigation and Micro Irrigation. These practices are intended to:

-convert center-pivot and lateral move irrigation systems to employ drop nozzles or low-pressure spray nozzles. This practice can also be used to convert an existing traveling gun system to a center-pivot or lateral move system using drop nozzles or low-pressure spray. The practice can also be used to equip existing irrigation equipment with end-gun shutoff devices.



**AGRICULTURAL WATER RESOURCES ASSISTANCE PROGRAM**  
**§ 139-60**  
**FISCAL YEAR 2012 ANNUAL REPORT**  
**January 2013**

# Greater efficiency = more water used

Adoption of drop-nozzle irrigation increased groundwater extraction. Why?



Farmers expanded area irrigated and changed crops.

Pfeiffer & Lin, 2013



CONTROL GROUP

OUT OF CONTROL GROUP.

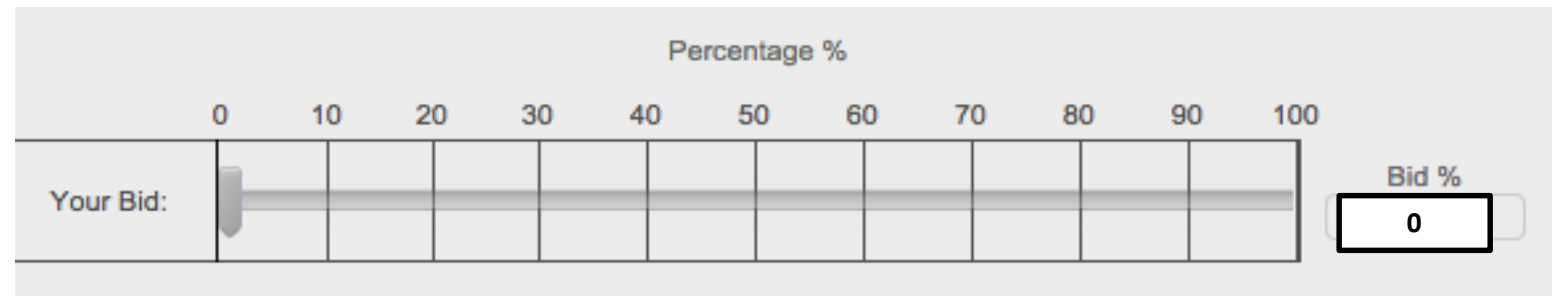
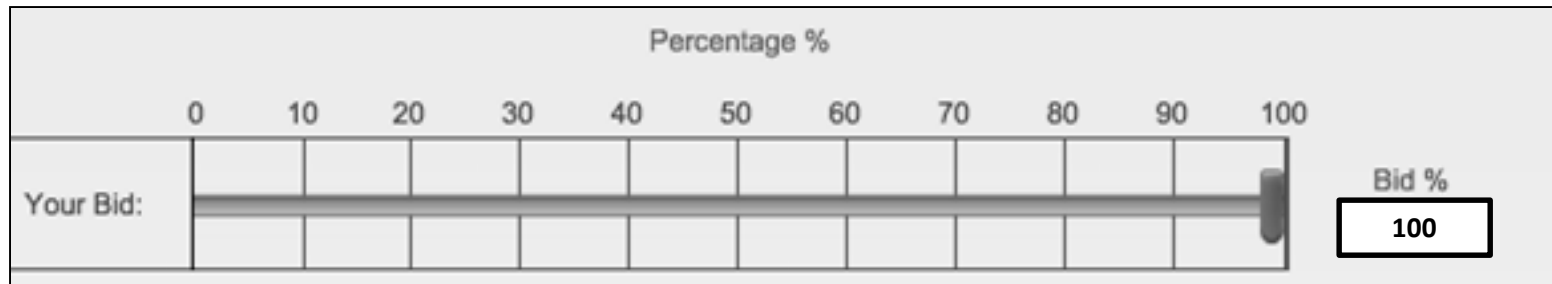
We run 1000s  
of uncontrolled  
experiments  
every year.

# MINDSPACE

<b>Messenger</b>	we are heavily influenced by who communicates information
<b>Incentives</b>	our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses
<b>Norms</b>	we are strongly influenced by what others do
<b>Defaults</b>	we 'go with the flow' of pre-set options
<b>Salience</b>	our attention is drawn to what is novel and seems relevant to us
<b>Priming</b>	our acts are often influenced by sub-conscious cues
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# Default Starting Bid in Auction

Farm operators bidding on conservation contracts (e.g., riparian buffers, remove abandoned poultry houses, feral hog trapping systems)

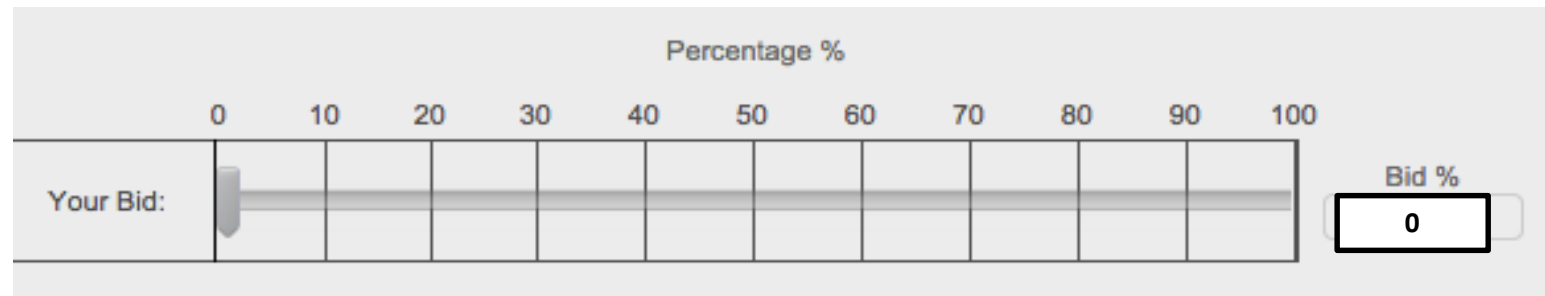
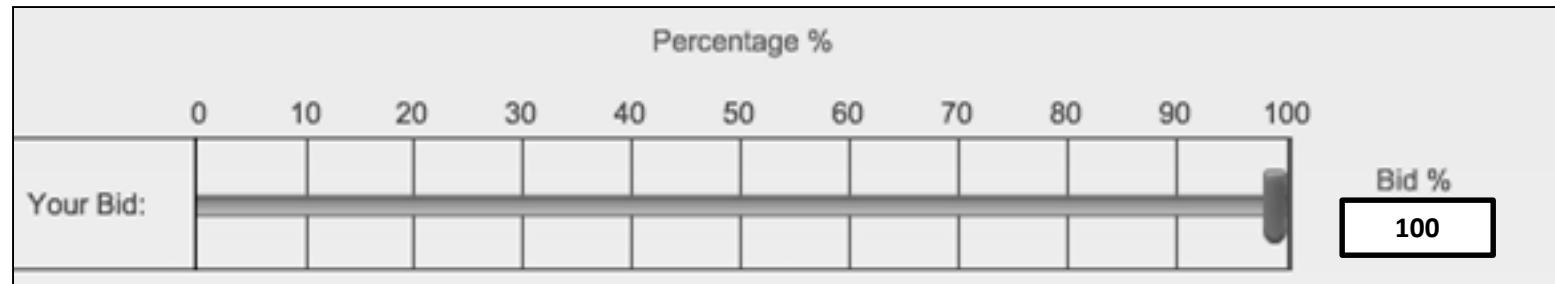


(Ferraro and Messer, unpublished)

# Default Starting Bid in Auction

Bids 10 percentage points higher if assigned 100% starting bid.

Equivalent to forgoing ~USD 1400



(Ferraro and Messer, unpublished)

# Incentives: how they are presented matters

Up to 50 actions you can perform.

- Gain-Frame Contract: "Start with \$0. For every action you perform, you receive \$100."
- Loss-Frame Contract: "Start with \$5000. For every action you do not perform, you lose \$100."

If losses are weighed more heavily than equivalent gains by many people, then Loss-Frame Contract will induce greater total effort.

# Incentives: how they are presented matters

Randomized controlled trials imply:

- People exert more effort with loss-frame contracts (1%-6% more effort).
- They exert more effort even when they know that the loss-frame contract induces more effort in people, on average.

# Incentives: how they are presented matters

(1) People respond less to a sales tax reduction or rebate than equal reduction in offered price



(2) People discount tax credits and rebates because they must apply for them (28% of California PHEV/BEV buyers failed to apply for rebate in first four years of market).

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## Water Run Off from our Lawns and Gardens Causes Problems Downstream

The Delaware River watershed, where you are sitting right now, provides drinking water to 17 million people—roughly 6% of the population of the United States.

Scientists have designated over 8,000 miles of streams in the watershed as "impaired." Their water quality is so poor you cannot safely drink from them, fish or swim in them, or even use them for agriculture or industrial uses. A substantial part of this damage is caused by water running off our lawns, gardens and streets.

The runoff carries with it nutrients, like nitrogen and phosphorous. While these nutrients can help plants grow in our yards, nutrient-rich runoff can make drinking water unsafe and causes enormous algae growth in our lakes, streams and bays. These algae block the light for aquatic plants, which then die and literally remove oxygen from the water. Without oxygen, fish, crabs, oysters, and other aquatic animals die.

By using bay friendly landscaping products, you can reduce the nutrient runoff from your property that harms our aquatic plants and wildlife.

Sources: Delaware River Basin Commission, Delaware Online, National Oceanic and Atmospheric Administration, Philadelphia Water Department.



[Go back](#)

[Continue](#)

## Water Run Off from our Lawns and Gardens Causes Problems Downstream

Jerome Rodio was a Navy and police officer, as well as a business owner and chamber of commerce president. In his spare time, Jerome helped the homeless and the Oxford SILO (Serving Inspiring Loving Others) project. Many expected Jerome to become the Mayor of Oxford, PA, just 13 miles from Delaware.

But Jerome died last summer from the flesh-eating *Vibrio* bacteria, which he received after being scratched by a crab trap and washing it out with bay water. According to the Chesapeake Bay Foundation, *Vibrio* grows from a "combination of warmer waters, nutrient pollution, and other factors". Nutrient pollution comes from water running off of our lawns, gardens and streets.

USA Today reports that the survival rate for an infection from *Vibrio* is only about 50%. Despite Jerome's treatment at a Veterans Affairs clinic, local hospital and the University of Maryland Medical Center, he died just three days after getting his original scratch.

By using bay friendly landscaping products, you can reduce nutrient runoff from your property.

Sources: Chester County Press, USA Today



Go back

Continue

# Behavioral Insights: The Knowns

- A credible, growing evidence base: interventions inspired by behavioral sciences can change policy-relevant behaviors.
- Often inexpensive implementation, which implies that even if their behavioral impacts are small, they can be cost-effective.
- Often no new legislation or rules needed.
- Often easy to pilot in inexpensive randomized controlled trials, which makes it much easier to evaluate effectiveness and thus build a solid evidence base regarding what works and under what conditions.

*Revealed preferences, rational inattention and costly information acquisition.....Government policy and time-inconsistent voters.....Behavioral economics and public policy: a pragmatic perspective.....Twenty years of present bias.....Behavioral economics and neuroeconomics.....Behavioral economics in the classroom*

*Behavioural Insights Team (UK)*

*Behavioural Insights Unit (New South Wales)*

*Social and Behavioral Sciences Team (US)*

*Washington DC, NYC, Chicago....and more every month*



At any given moment, a given Facebook user is participating in 10 RCTs

**Perfectly human: Behavioral economists target natural instincts to eradicate poverty**



**Economic regulation**

**Nudge nudge, think think**



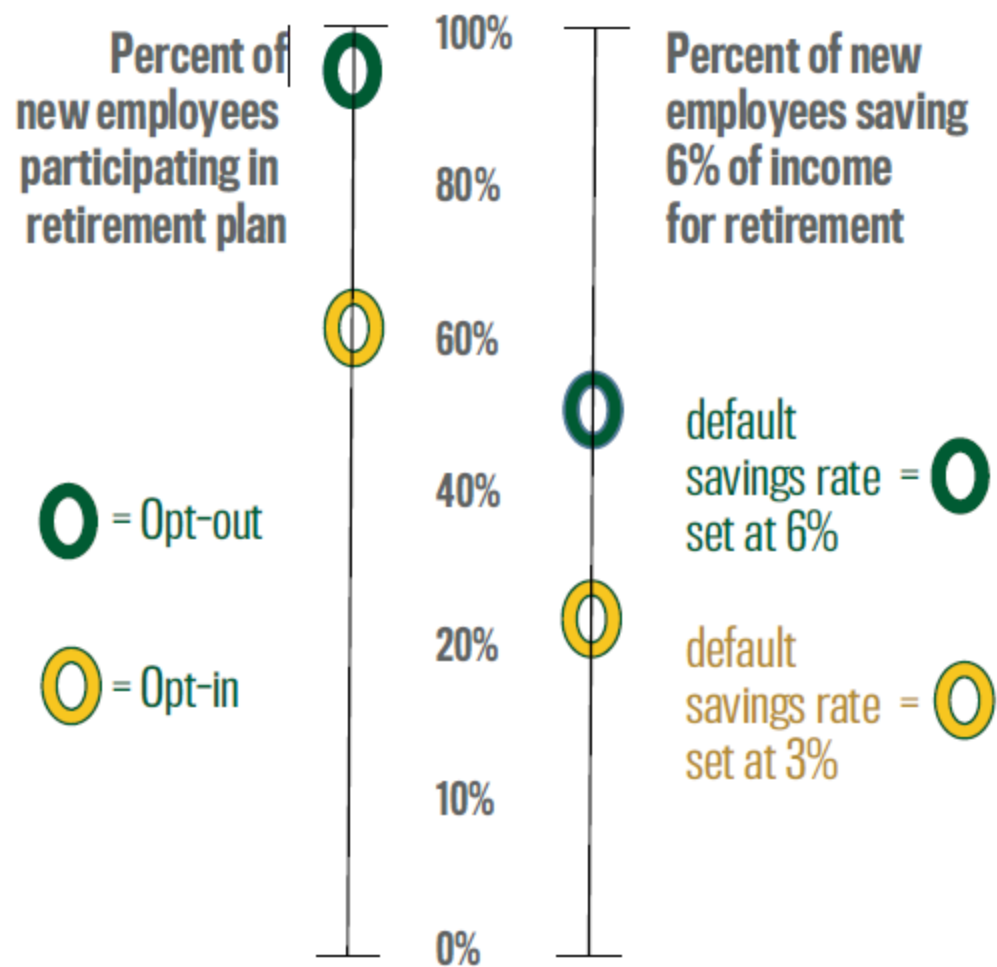
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# Defaults Choices Matter

- Defaults: settings or choices that apply to individuals who do not take active steps to change them.
- People are more likely to choose a default than if the same option had to be actively chosen.
- Attraction of defaults: They can affect behavior while maintaining freedom of choice and hence respect for different preferences.

# Defaults Matter: Retirement Savings Plan



# Do Defaults Choices Matter for Ecosystem Service Provisioning?

- More and better practices implemented if the default starting value is set of all conservation practices for which a parcel is eligible, with producers removing practices they did not want from the list?
- Recommend an acreage enrollment (e.g., 75% of eligible acres) instead of asking “how many acres would you like to sign up?”



# Social Comparisons: people care about others' actions

## Do polluters?

To: {Contact-Name}¶  
 ¶  
 From: Dietrich Earnhart, Professor, [University of Kansas](#)¶  
 ¶  
 {contact-name}¶  
 {facility-name}¶  
 {Address}¶  
 {City} {State} {Zip}¶  
 ¶

### Why am I getting this letter?¶

Your municipal wastewater treatment facility, {Facility-Name}, is regulated under the Clean Water Act by the Kansas Department of Environment and Health (KDHE), in concert with the Environmental Protection Agency (EPA). The KDHE lists you as the facility's contact person for the National Pollutant Discharge Elimination System (NPDES).¶



Peer Comparisons of Compliance among Kansas Municipal Dischargers¶

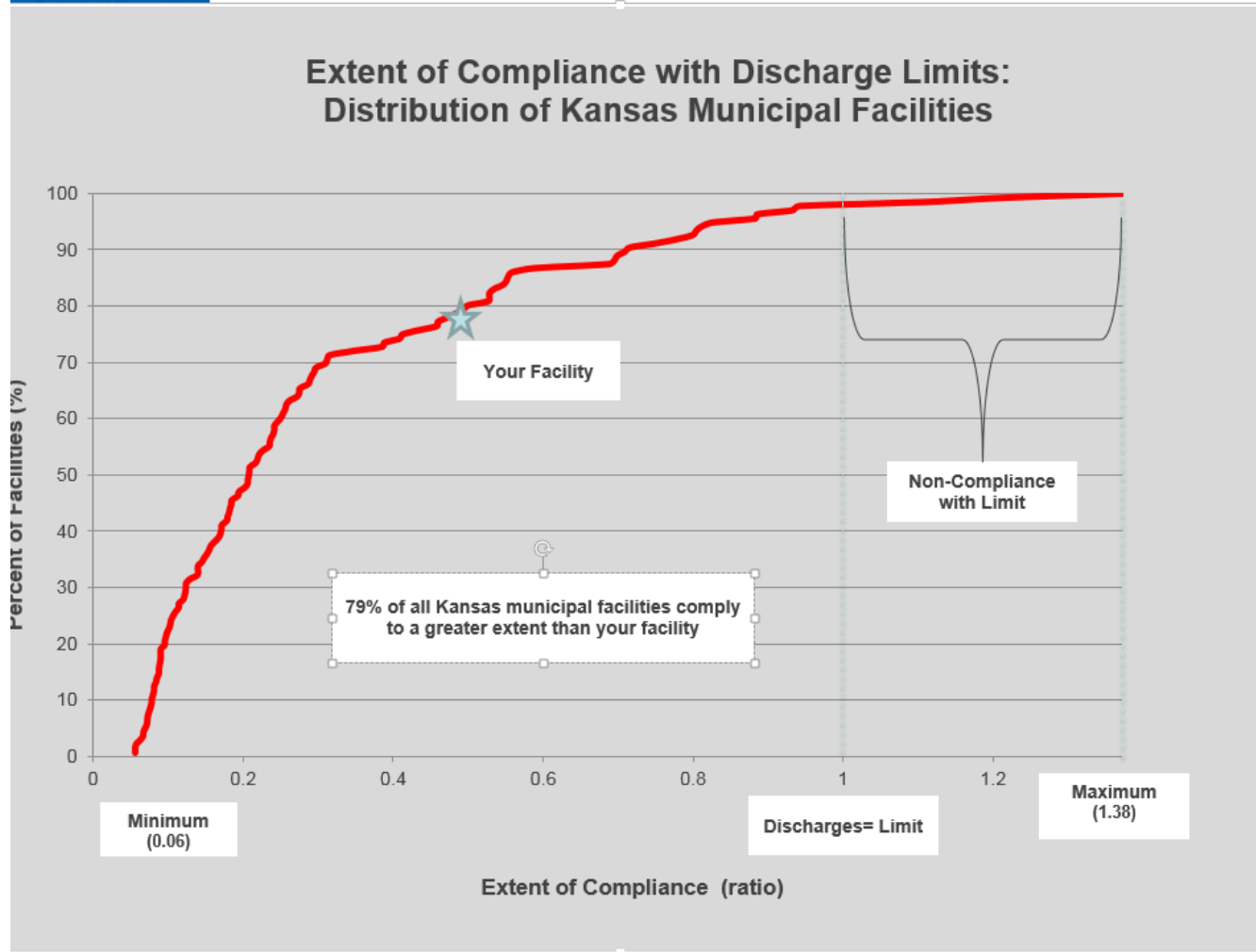
In our conversations with Kansas treatment facility managers, people have told us that they were not sure how their compliance performance differed from their Kansas peers. We have created a pilot initiative that aims to provide this information.¶

We hope you find it useful!¶

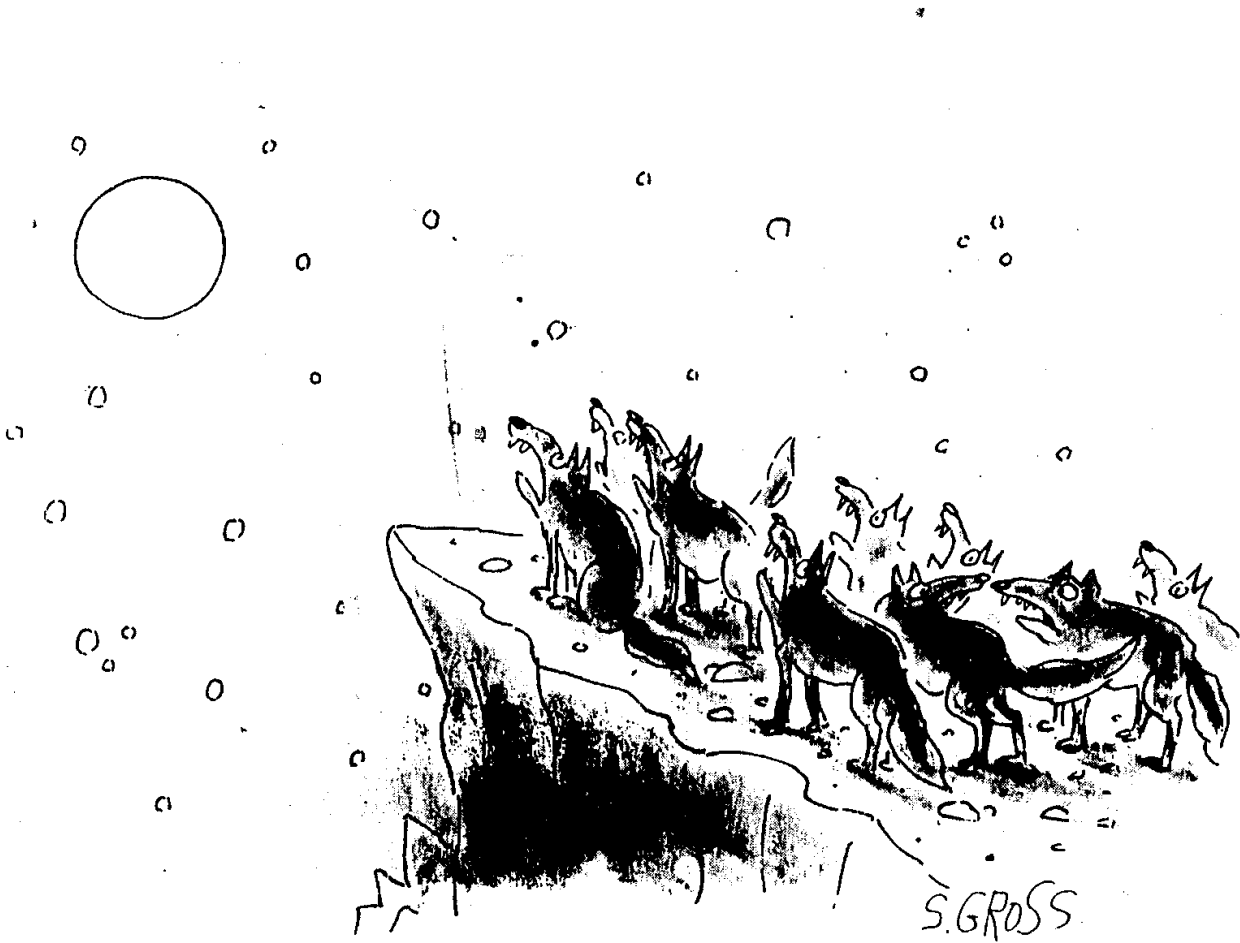
### What is a compliance ratio and why should I care?¶

To give you some sense of how your compliance with your NPDES discharge limits compares to your Kansas peers' compliance, we have extracted publicly available data from the EPA Integrated Compliance Information System (ICIS) database and assembled these data in a more easily understood

**Discharge-to-compliance Ratio.** Wastewater discharges are recorded as a concentration, in milligrams of pollutant per liter of water discharged (mg/L). Say Facility A's discharge limit for a pollutant is 30 mg/L and it discharges 15 mg/L. Its *discharge-to-limit ratio* then equals 0.50. If the facility's discharge limit changes from 30 mg/L in the winter to 12 mg/L in the summer, when stream flow is lower, then its discharge-to-limit ratio



# Questions?



*“My question is: Are we making an impact?”*

# MINDSPACE

<b>Messenger</b>	we are heavily influenced by who communicates information
<b>Survey 1300 Iowa farmers (Arbuckle et al. 2013)</b> <b>% “Somewhat or Strongly Trust” as Source of Info on Climate Change</b>	
Scientists: 45%	[strongly distrust: 6 %]
Farm Groups: 40%	[strongly distrust: 4%]
Government agencies: 23%	[strongly distrust: 18%]
Environmental NGOs: 18%	[strongly distrust: 29%]
News media: 9%	[strongly distrust: 30%]
<b>Affect</b>	our emotional associations can powerfully shape our actions
<b>Commitments</b>	we seek to be consistent with our public promises, and reciprocate acts
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# Climate change outreach mitigation experiment

## Experimental Design

Producers in Great Lakes region with farms on histosol soils are randomized into six outreach groups

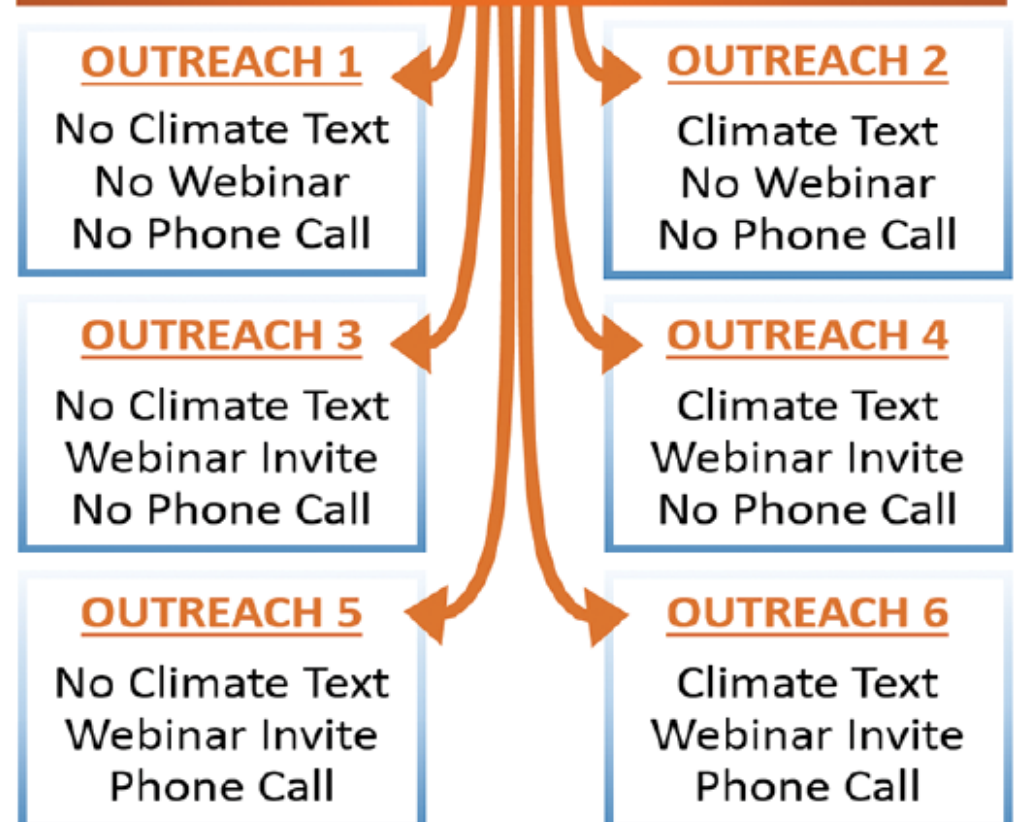
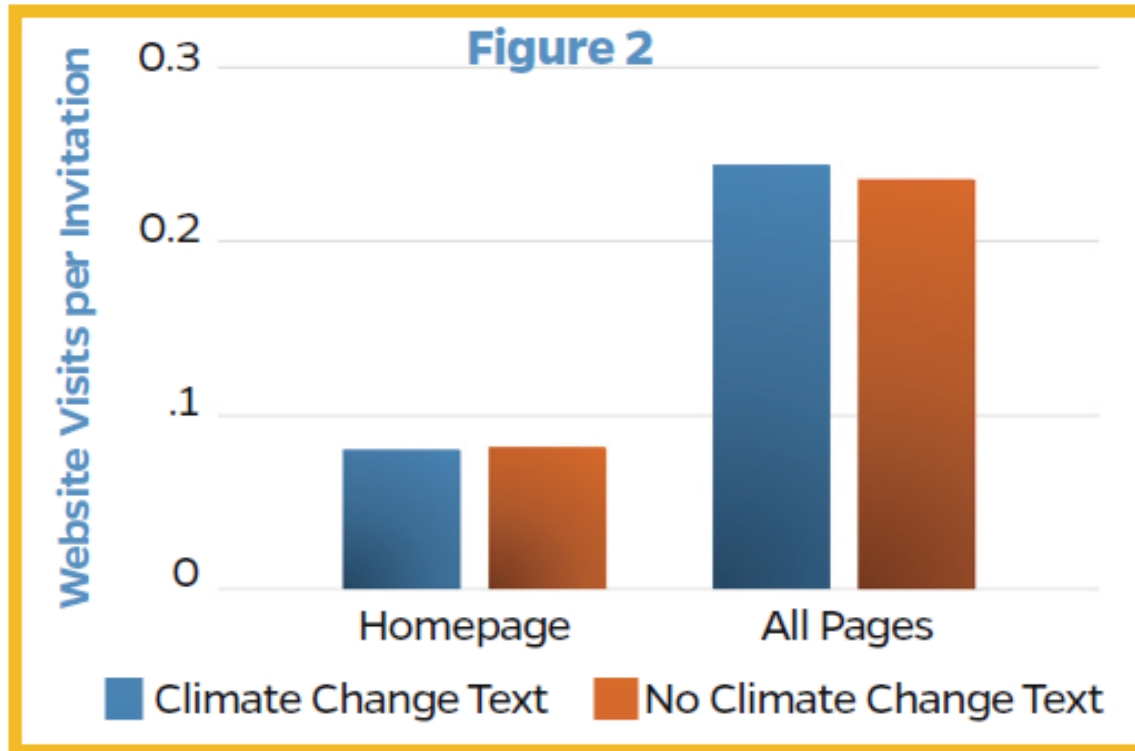


Figure 1

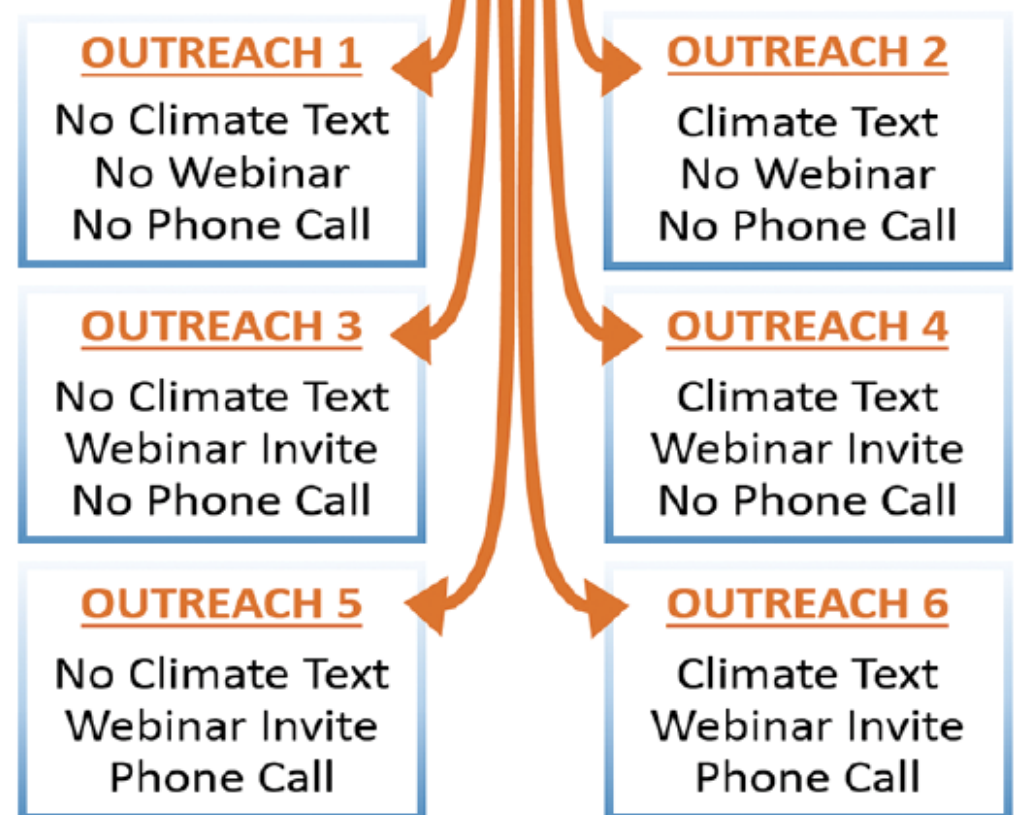
# Climate change outreach mitigation experiment

## Climate Change Text Impact



## Experimental Design

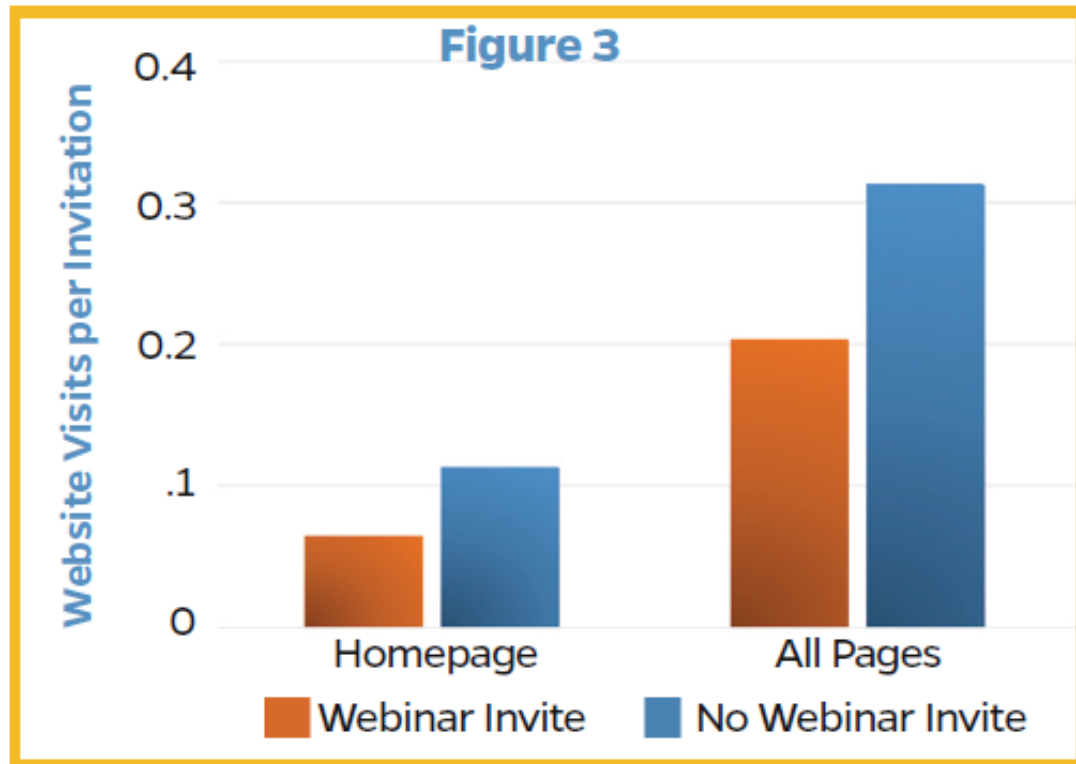
Producers in Great Lakes region with farms on histosol soils are randomized into six outreach groups



**Figure 1**

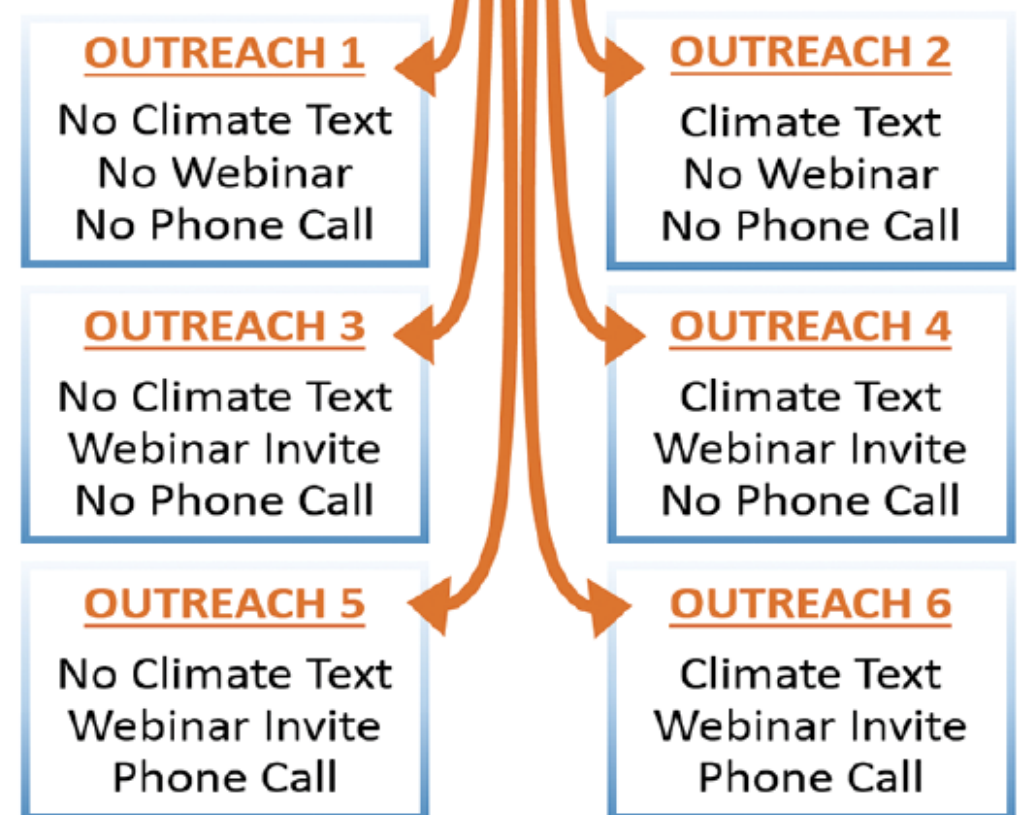
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## Webinar Invite Impact



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Producers in Great Lakes region with farms on histosol soils are randomized into six outreach groups



**Figure 1**