Do extreme events cause a shift in climate change beliefs? A study of the 2012 Midwestern U.S. drought and agriculture

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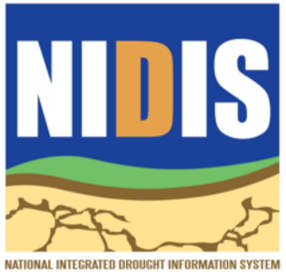
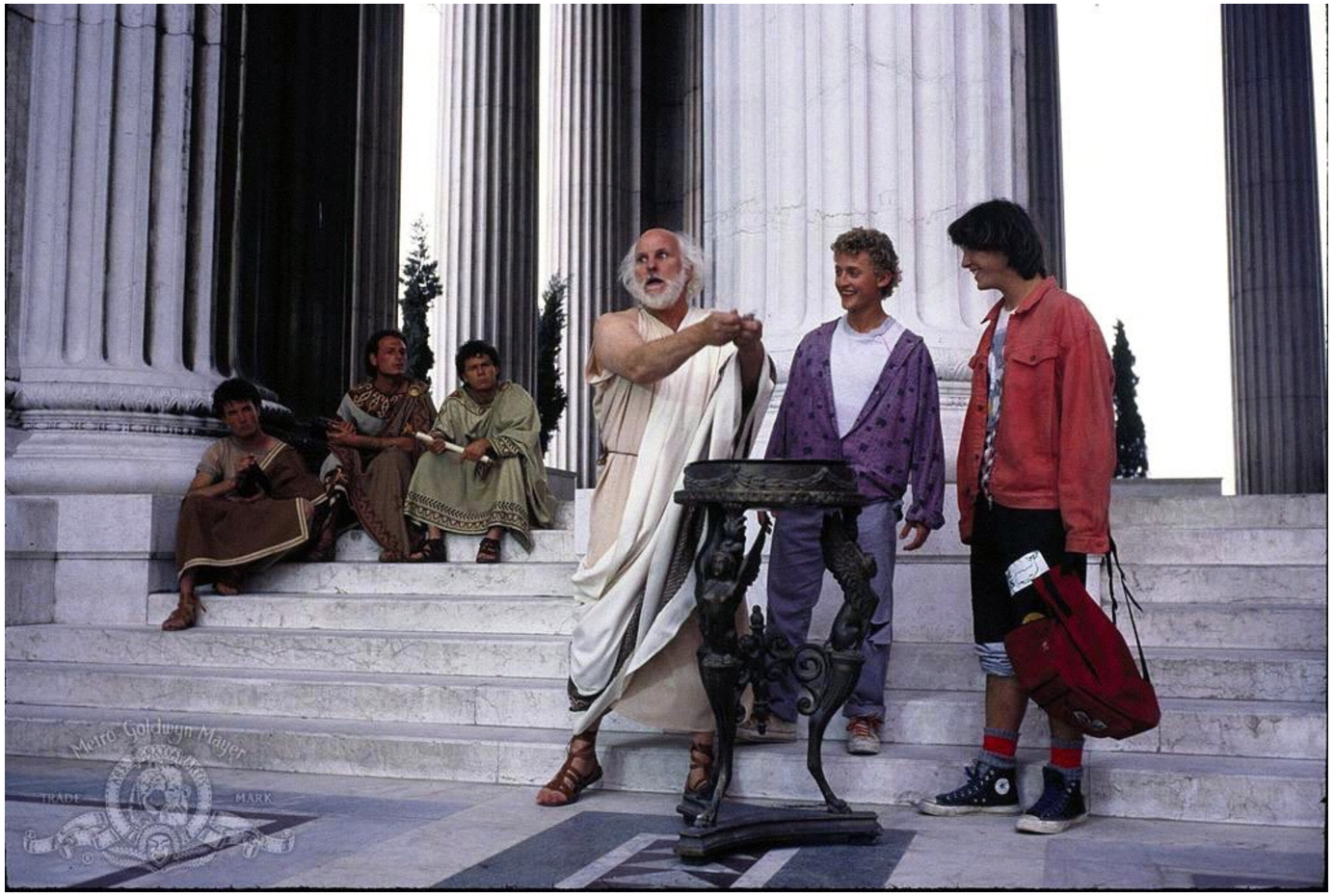


Meta-webinar stuff

Illustration: Wikimedia Commons

This ain’t ancient Greece.



Feel free to speak up, but there will be question breaks.

Illustration: Wikimedia Commons

Any unanswered questions:

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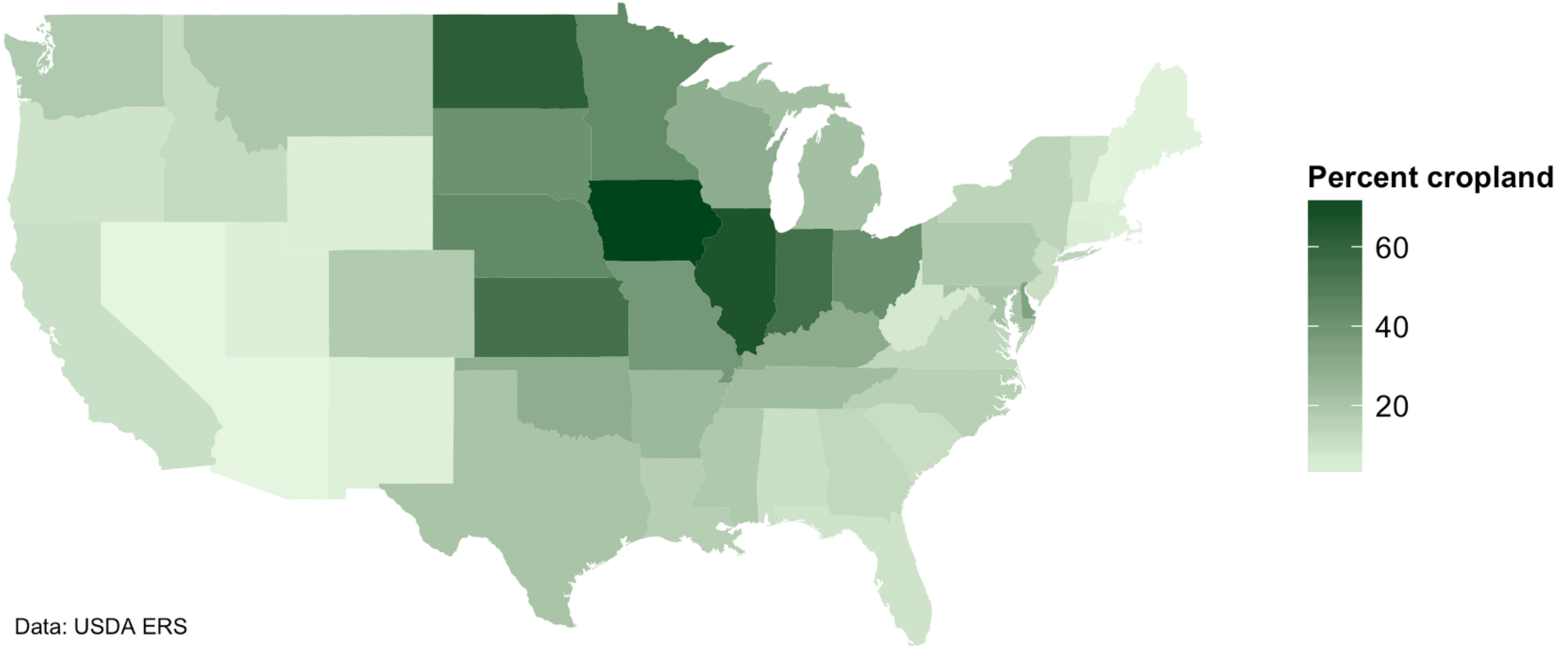
2

things about agriculture that make it worth studying.

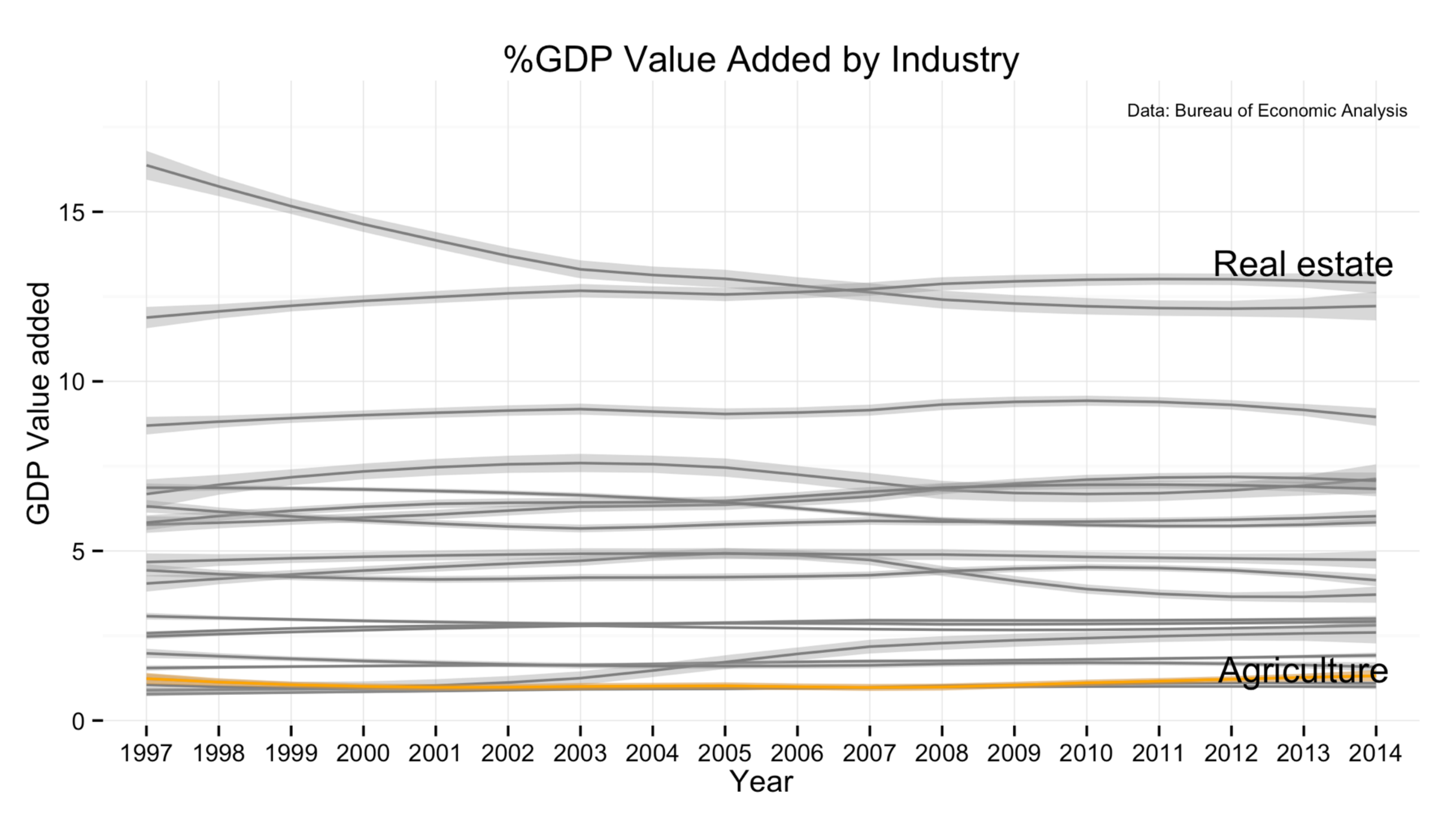
Photo: SDCorn.org

1. Agriculture is huge

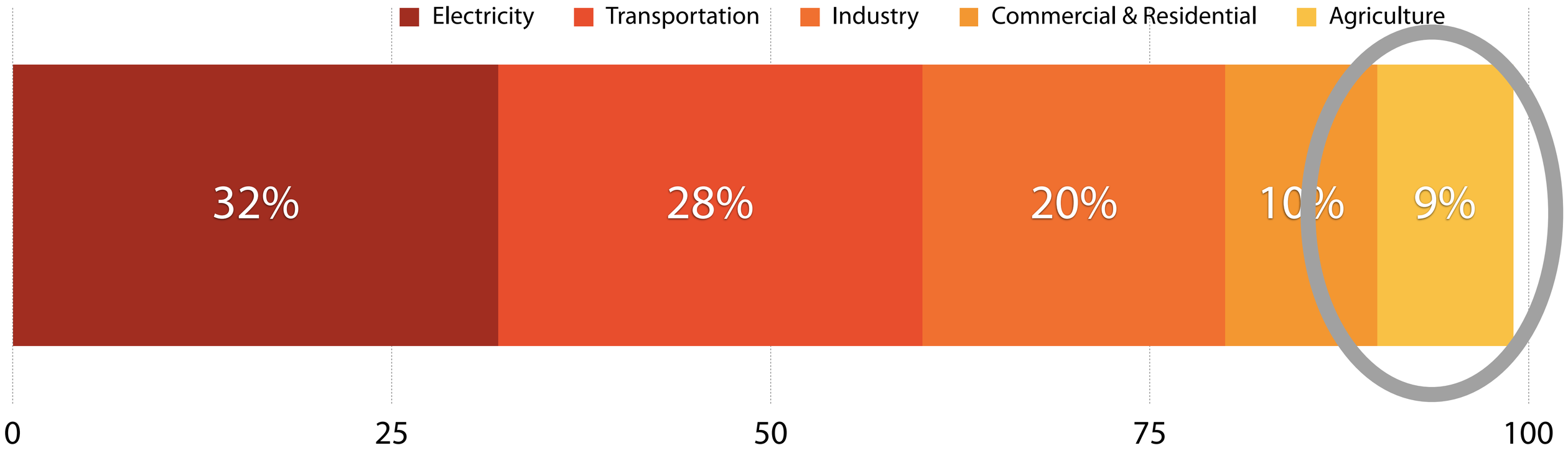
Cropland as a percent of total land, 2007



Data: USDA ERS


%GDP Value Added by Industry
Data: Bureau of Economic Analysis
Real estate
Agriculture
GDP Value added
0
5
10
15
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

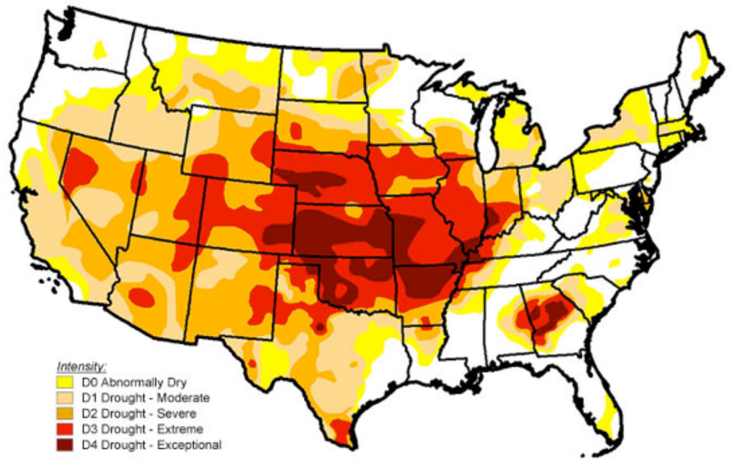
2. Agriculture emits.



% of US GHG Emissions

Data: EPA

The effects of the 2012 Midwestern US drought on climate change beliefs



Useful 2 Usable

State climatologists, Crop modelers, Agronomists,
Economists, Social scientists, RCC staff

PURDUE UNIVERSITY

IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

MICHIGAN STATE UNIVERSITY

ILLINOIS

SDSU

MICHIGAN

MU

UNIVERSITY OF Nebraska Lincoln

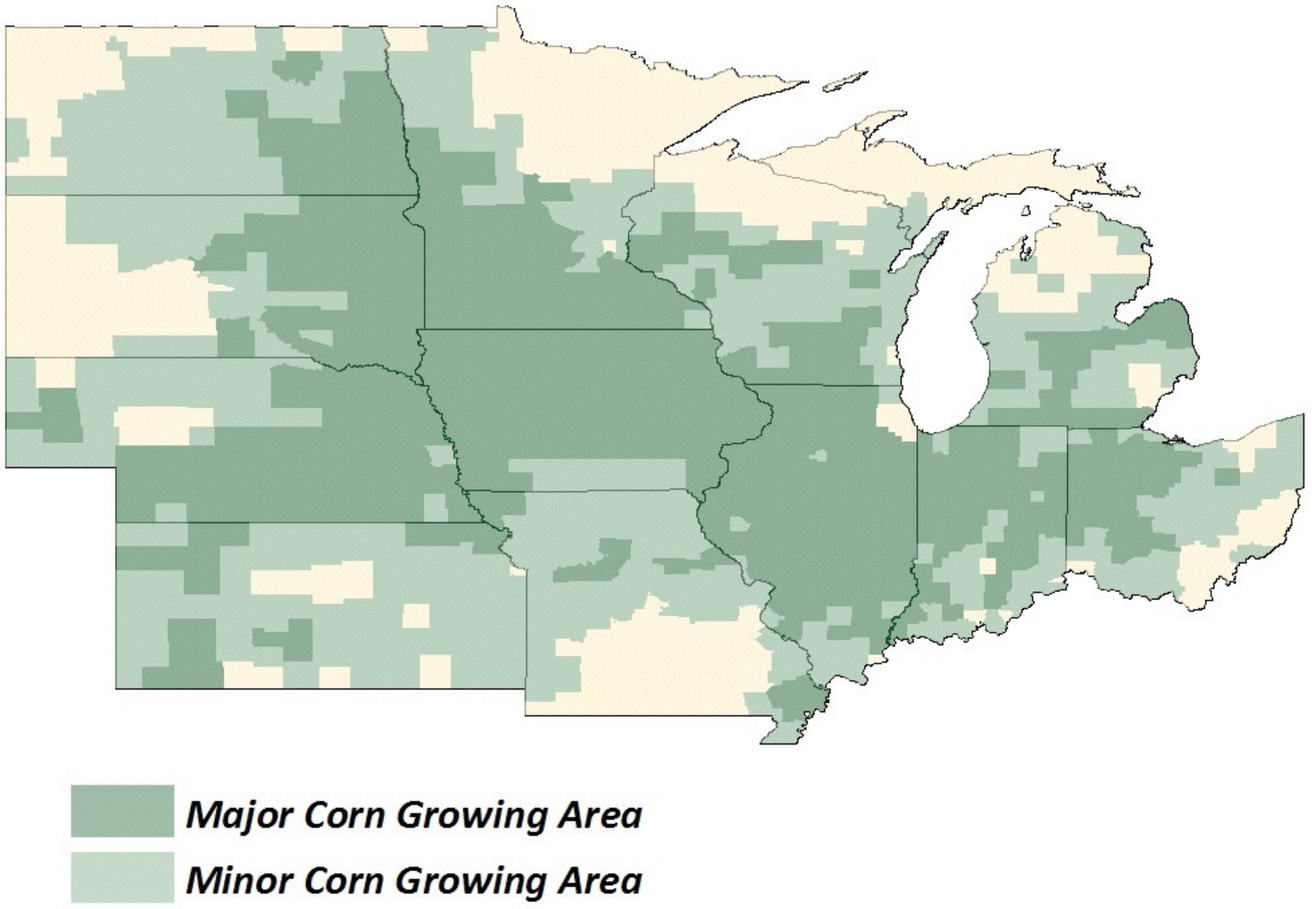
UW Extension Cooperative Extension

HIGH PLAINS REGIONAL CLIMATE CENTER

MRCC Midwestern Regional Climate Center

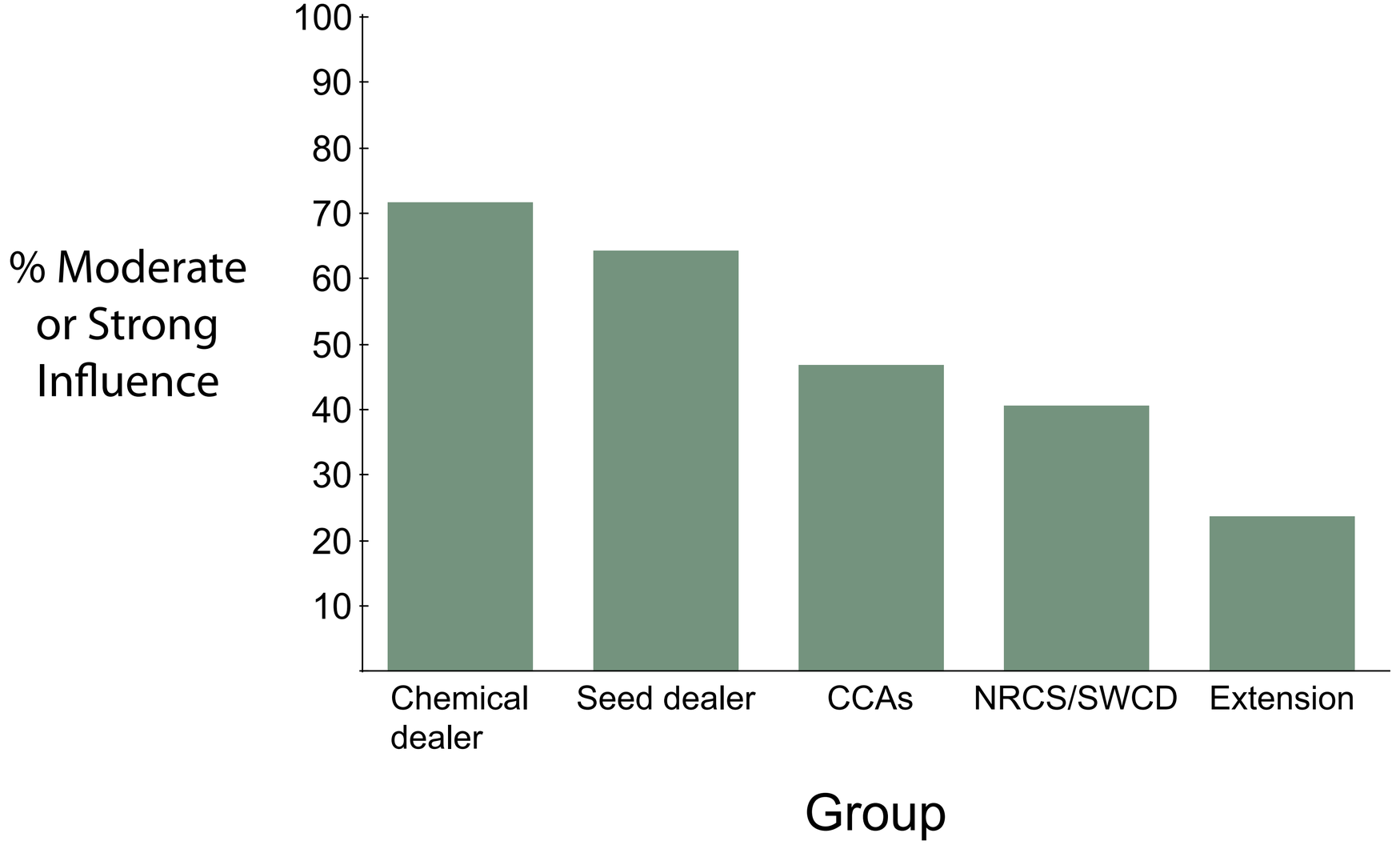
National Drought Mitigation Center

U2U Study Region



- Nearly one-third of global supply
- Over $50B to US economy

Agricultural Advisors: key players in the corn industry

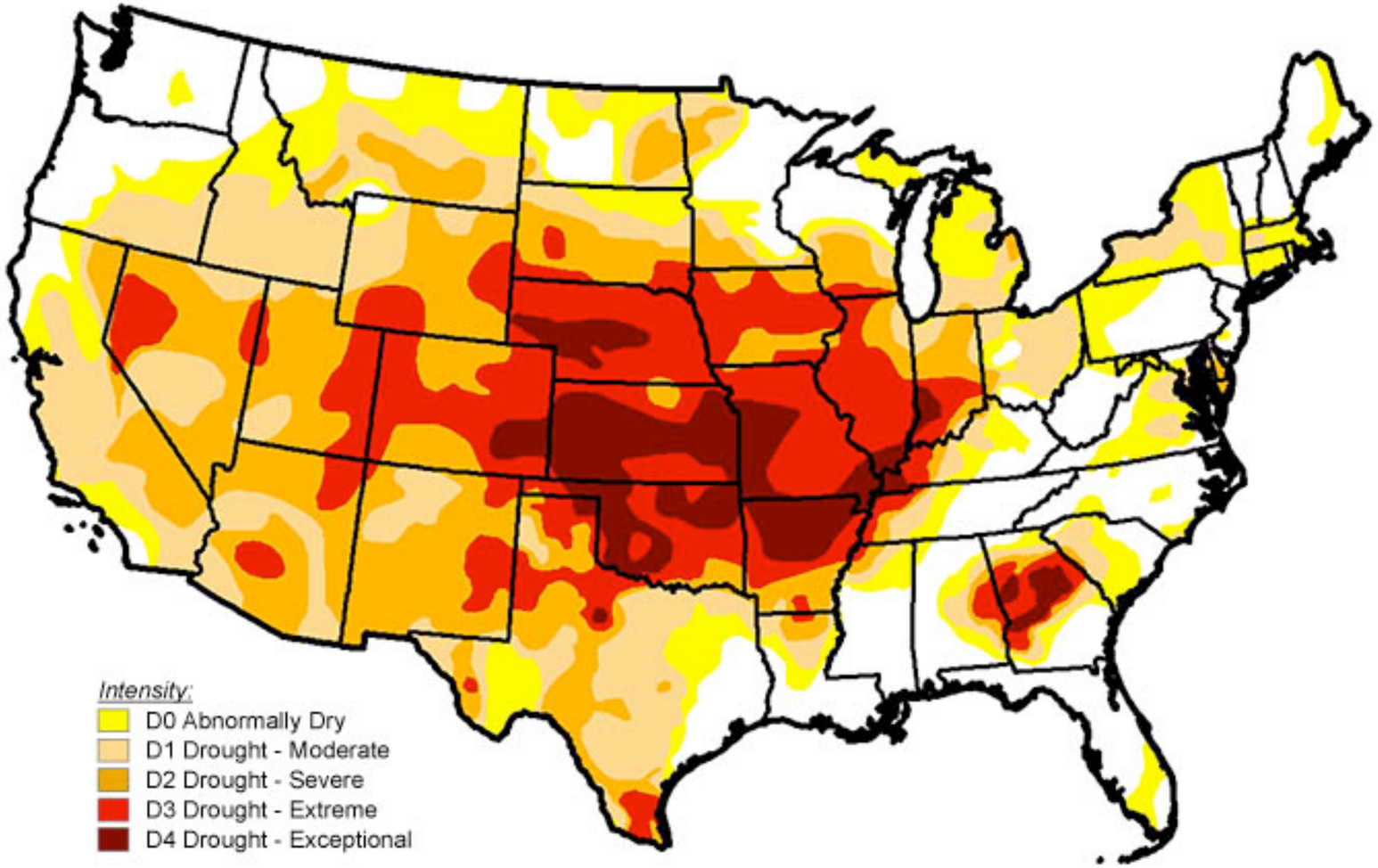


Source: Prokopy et al. unpublished data

2012 Advisor Survey:

- Climate Change Beliefs
- Risk Perceptions
- Attitudes toward climate adaptation

The 2012 drought: a research opportunity



Credit: NDMC August 2012

The worst drought in 50+ years

Credit: Purdue University

Credit: NDJMom

Credit: UCAR

Did this extreme event change climate beliefs?

Credit: UCAR

What is the role of experience?

Credit: UCAR

L. Whitmarsh. 2007. *Journal of Risk Research* 11: 351–374

Journal of Risk Research
Vol. 11, No. 3, April 2008, 351–374

Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response

Lorraine Whitmarsh*

Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich, UK

Climate change is a threat to human health and life, both now and in the future. Despite this, studies show that the public typically do not consider the issue a priority concern or a direct, personal threat. Furthermore, few are taking any preventive or protective action. Previous studies identify direct experience as a major influence on risk perception, learning and action. Drawing on such evidence, this paper focuses on the intangibility of climate change as a key impediment to personal engagement and explores whether relevant experiences of flooding and air pollution influence individuals' knowledge, attitudes, risk perception and behavioural responses to climate change. Perhaps surprisingly, interviews and a survey conducted in the south of England indicate flood victims differ very little from other participants in their understanding of and responses to climate change, but that experience of air pollution does significantly affect perceptions of and behavioural responses to climate change. Air pollution victims are no more likely to cite pollution as a cause of climate change than non-victims; but they do have higher pro-environmental values. Respondents with these values are significantly more likely to consider climate change a salient risk and to take action in response to it. Therefore the relationship between air pollution experience and responses to climate change may be indirect and mediated by environmental values. The paper concludes by highlighting implications of this research for developing climate change policies and strategies for public engagement.

Keywords: climate change; risk perception; experience; flooding; air pollution

Introduction

Mounting scientific evidence suggests climate change[1] is a significant threat both to humans and to the wider environment. Although there may be some benefits, most studies suggest impacts – such as increasingly extreme weather events, rising sea levels, flooding and droughts – will threaten human health and life (IPCC 2001a). Whilst developing countries may be more vulnerable to climate change, many severe impacts are likely to be experienced in Europe (Giorgi 2006). Furthermore, the threat of climate change is not only a future risk. Recent biological and climatic trends suggest human-induced climate change is already threatening both human and non-human life (e.g., Parmesan and Yohe 2003). In the UK, for example, both temperatures and periods of intense daily rainfall have been increasing over the past century, with recent flooding affecting many areas which have never been threatened before (Environment Agency 2001b).

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Journal of Risk Research
Vol. 11, No. 3, April 2008, 351–374

Routledge
Taylor & Francis Group

Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response

Contrary to expectations, the research found that flood victims differ very little from other participants in their understanding of and response to climate change… Although flood victims are more likely to feel that climate change is an issue of personal importance, they are no more knowledgeable, concerned or active in relation to climate change than people without flooding experience.

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nature climate change

LETTERS

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Perceptions of climate change and willingness to save energy related to flood experience

A. Spence[1]*, W. Poortinga[2], C. Butler[3] and N. F. Pidgeon[3]*

One of the reasons that people may not take action to mitigate climate change is that they lack first-hand experience of its potential consequences. From this perspective, individuals who have direct experience of phenomena that may be linked to climate change would be more likely to be concerned by the issue and thus more inclined to undertake sustainable behaviours. So far, the evidence available to test this hypothesis is limited, and in part contradictory[1–4]. Here we use national survey data collected from 1,822 individuals across the UK in 2010, to examine the links between direct flooding experience, perceptions of climate change and preparedness to reduce energy use. We show that those who report experience of flooding express more concern over climate change, see it as less uncertain and feel more confident that their actions will have an effect on climate change. Importantly, these perceptual differences also translate into a greater willingness to save energy to mitigate climate change. Highlighting links between local weather events and climate change is therefore likely to be a useful strategy for increasing concern and action.

Climate change targets for reductions in greenhouse-gas emissions have now been instituted across many developed and developing nations. Research demonstrates that these targets are unlikely to be met without major changes in societal structures that will necessarily require engagement of the wider public, for example to achieve more efficient or reduced energy use[5,6]. Although for many years a majority of individuals have expressed concern about climate change in the UK, as elsewhere, an examination of polling data in recent years actually reveals a small decline in concern, alongside an increase in scepticism regarding its seriousness and anthropogenic causes[7–9]. Indeed, public perceptions typically reflect a much lower concern about climate change than is expressed by climate scientists, potentially owing, in part, to the public's lack of personal experience with climate impacts[10,11]. Psychological research indicates that one reason for a lack of concern about climate change may be the perception that it is a distant issue. Lay people tend to perceive areas that are vulnerable to climate change impacts as geographically distant—at least in Western countries[12,13]. This relates to research within the domain of embodied social cognition that links distance, and in particular spatial distance, with the dampening of reactions and judgements[14].

These observations logically lead to the idea that highlighting the links between local events and climate change may encourage people to engage with the issue[15] and to take action to mitigate potential impacts. Indeed, personal experience is thought to be a key driver of risk perceptions, and the perceived likelihood of a risk is found to increase if it has recently been experienced or can readily be imagined[16]. Relating local events to climate change may also have perceptual and behavioural impacts to the extent that these help to make the issues less distant and more tangible. It might be expected that experiencing some kind of (generally negative) event that could be attributed to climate change would leave people feeling helpless. However, goal-setting theory[17] highlights the benefits of setting concrete, specific goals in increasing instrumentality (that is, an individual's belief that actions will lead to outcomes) and the likelihood of subsequent action being taken. In line with this, if people are better able to relate to the potential consequences of climate change impacts, they may also be more likely to feel that their behaviour can lead to changes in these impacts.

Climate change itself is not directly observable by individuals, it being a reference to average climate conditions over a long period of time rather than that observed on a daily or seasonal basis, and is perhaps really understood only through mathematical models and scientific measurement[18]. However, given that seasonal events and the weather are the primary means by which individuals can experience and observe the climate, it is understandable that this is a means by which people may judge climate change. Note that phenological research (the recording of seasonal events), for example the early arrival of swifts in summer in the UK, and indigenous observations within key areas, for example reduction in numbers of seals within Arctic regions, have proved useful in verifying, clarifying and documenting impacts of climate change[19].

Major extremes in weather, and ecosystem changes, are already being experienced across multiple geographical regions (for example, droughts in Uganda and Sudan) and are expected to increase in frequency and severity as a result of climate change[20]. In particular, for many places including the UK, it is observed that periods of intense rainfall have increased in frequency over the past 40–60 years, resulting in a greater number of floods, and indeed recent research has explicitly linked anthropogenic greenhouse-gas emissions to an increase in flood risk in England and Wales[21]. It is important to acknowledge that climate change predictions highlight the increasing risk of particular weather patterns and events[22]. Hence, attributing any one event to climate change is highly complex, and as a consequence it is particularly difficult for communicators or the public to link actual experiences with the more abstract notions of risk derived from climate science. On this issue, some commentators have suggested that the substantial changes to the composition of the world's atmosphere mean that it is perhaps now more appropriate to discuss weather events in terms of hybrid weather; that is, as the result of a new co-produced natural–cultural climate system[23].

Existing research indicates that environmental views and perceptions of climate change can be related to individuals' physical surroundings and experiences. People who inhabit places recognized as physically vulnerable to climate change impacts in certain overt ways, for example living in low-lying coastal areas,

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Myers et al. 2012. *Nature Climate Change* 3: 343–47.

nature climate change

LETTERS

PUBLISHED ONLINE: 2 DECEMBER 2012 | DOI: 10.1038/NCLIMATE1754

The relationship between personal experience and belief in the reality of global warming

Teresa A. Myers[1]*, Edward W. Maibach[1], Connie Roser-Renouf[1], Karen Akerlof[1] and Anthony A. Leiserowitz[2]

In this paper, we address the chicken-or-egg question posed by two alternative explanations for the relationship between perceived personal experience of global warming and belief certainty that global warming is happening: Do observable climate impacts create opportunities for people to become more certain of the reality of global warming, or does prior belief certainty shape people's perceptions of impacts through a process of motivated reasoning[1]? We use data from a nationally representative sample of Americans surveyed first in 2008 and again in 2011; these longitudinal data allow us to evaluate the causal relationships between belief certainty and perceived experience, assessing the impact of each on the other over time[2]. Among the full survey sample, we found that both processes occurred: 'experiential learning', where perceived personal experience of global warming led to increased belief certainty, and 'motivated reasoning', where high belief certainty influenced perceptions of personal experience. We then tested and confirmed the hypothesis that motivated reasoning occurs primarily among people who are already highly engaged in the issue whereas experiential learning occurs primarily among people who are less engaged in the issue, which is particularly important given that approximately 75% of American adults currently have low levels of engagement[3,4].

Climate change is affecting every region by increasing the frequency and/or intensity of heat waves, droughts, precipitation, floods, hurricanes, and forest fires, and through impacts on ecosystems and species, including human health[5]. Yet, most Americans perceive climate change as a problem distant in time and space, and do not recognize its indicators and impacts in their own localities[4,6]. Moreover, despite widespread agreement among climate scientists that human-caused climate change is occurring[7] only two-thirds (66%) of Americans adults correctly understand that 'global warming is happening', and nearly half of these are only 'somewhat sure' (42%) or 'not at all sure' (5%) of their answer; moreover, only a third believe that they or their families will be harmed[4]. Low levels of belief certainty and perceived threat, in turn, indicate low levels of engagement with the issue, which is strongly associated with reduced levels of support for taking action to address the problem[8].

One possible explanation for these low levels of belief certainty—and perceptions of the threat as distant—is that climate change is difficult to perceive directly; 'climate' itself is a statistical abstraction, even though its impacts can be quite tangible[9]. Current theories of cognitive science suggest that learning about abstractions requires analytical information processing, which involves cognitive effort—a scarce commodity, which people expend sparingly[10]. Both low motivation to think about climate change and low ability to comprehend scientific information[11] can impede people's processing of the charts, graphs and models in the climate scientist's toolkit.

By contrast, experiential processing—learning through experience—is much more likely to occur: it happens automatically, effortlessly and instantly, and has strength and immediacy that analytical information lacks. Peoples' impressions of climate change are probably shaped in large measure by their strong propensity for experiential processing, yet information about climate change is often presented in abstract analytical terms that are hard for people to process and connect to their own lives[12]. Common in both scientific and media reports[13], abstractions make for pallid education, and are less convincing than the vividness of personal experience.

Indeed, people who say they have personally experienced global warming are far more likely to be engaged with the issue than people who say they have not[1,14,15]. More than a quarter of the American public believe they have personally experienced the effects of global warming[4], and that belief is strongly associated with higher global warming risk perceptions[16], worry[17], and response motivation[18]. This pattern of relationships suggests the possibility that as individuals experience the effects of global warming, they become more certain that global warming is occurring.

However, a rival hypothesis suggests that perceptions of personal experience stem from prior beliefs through a process of motivated reasoning rather than from impartially detecting changes in their local environment. The literature on motivated reasoning in general—and cultural cognition in particular[19]—has demonstrated that people's prior beliefs about climate change can strongly influence how they interpret changes in environmental conditions (see also literature on Bayesian updating for a competing perspective[20]).

People tend to seek (or avoid) and process information—often using mental shortcuts—in a manner that is favourable to their preferred conclusions[21]. Evidence that is consistent with the desired attitude is accepted at face value, while conflicting evidence is ignored, dismissed, or subjected to critical review[22]. Value-inconsistent information can lead to 'boomerang' effects (that is, strengthening prior beliefs)[23], and can be avoided, forgotten, or distorted[24], particularly in situations where an individual feels powerless to reduce a potential threat[22].

There is considerable evidence that motivated reasoning influences some people's global warming beliefs. Political ideology, egalitarianism, and individualism, for example, are strongly associated

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nature climate change

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What gives?

Photo: Joe Philipson

2012 Advisor Survey:

- Climate Change Beliefs
- Risk Perceptions
- Attitudes toward climate adaptation

Photo: Joe Philipson

Unprecedented baseline data.

So let’s do it again.

2013 Advisor Survey:

- Climate change beliefs
- Risk perceptions
- Attitudes toward climate adaptation
- *Experience with the drought*

3 hypotheses (based on SARF and RAA):

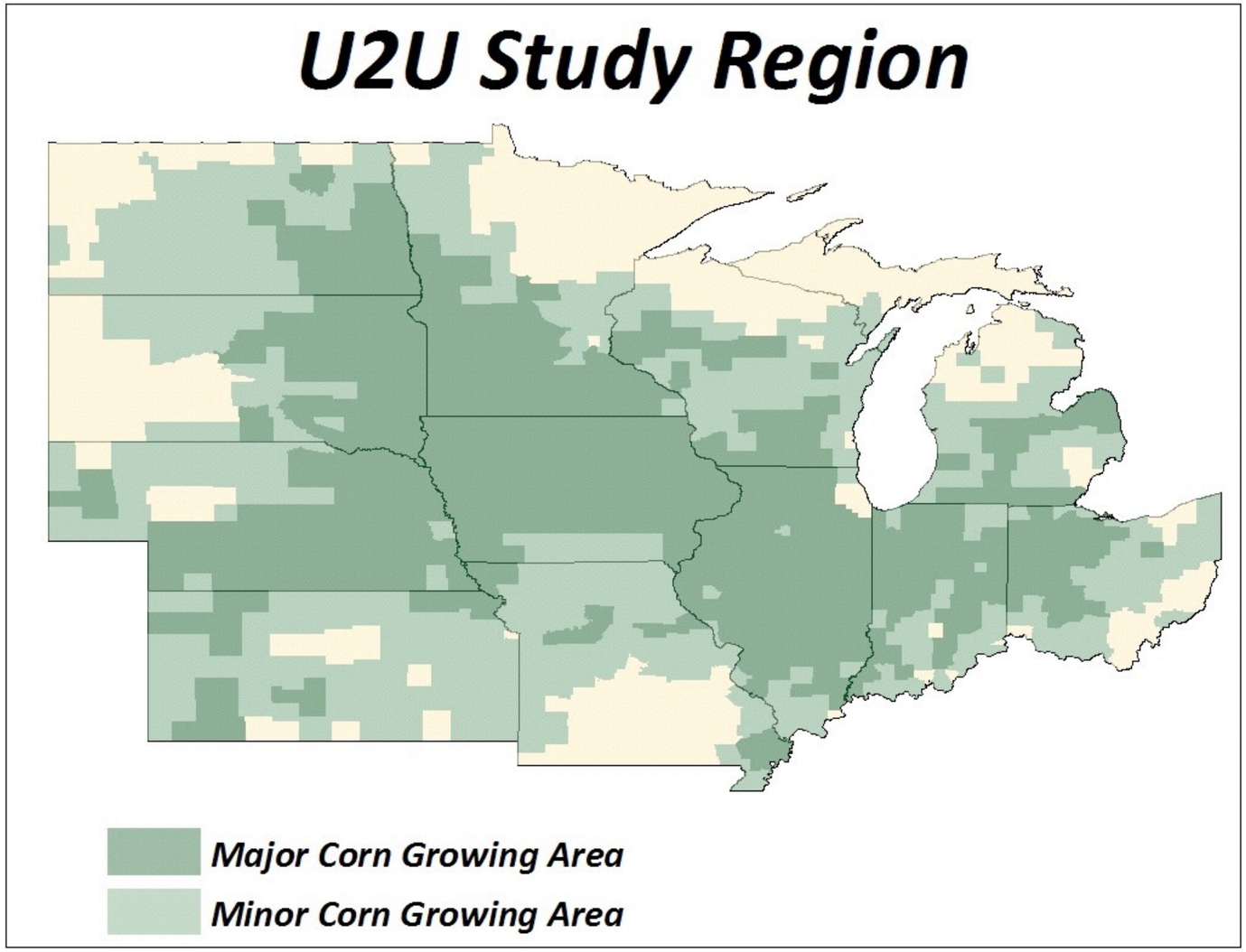
H1: Belief in climate change will have increased

H2: Risk perceptions will have increased

H3: Willingness to use climate information will have increased

2013 Advisor Survey:

- Administered electronically to ~7500 advisors
- ~25% response rate
- 864 repeat respondents



Survey administered in Indiana, Nebraska, Michigan, Iowa

H1: Belief in climate change will have increased.

H2: Belief in climate change will have increased.

H1: Belief in climate change will have increased.

H2: Risk perceptions associated with climate change will have increased.

H3: Attitudes toward climate change adaptation will have become more favorable.

- Climate change is occurring, and it is **caused mostly by natural changes** in the environment
- Climate change is occurring, and it is **caused mostly by human activities**
- Climate change is occurring, and it is **caused equally by natural** changes in the environment and human activities
- Climate change is **not occurring**
- **There is not sufficient evidence** to know with certainty if climate change is occurring or not

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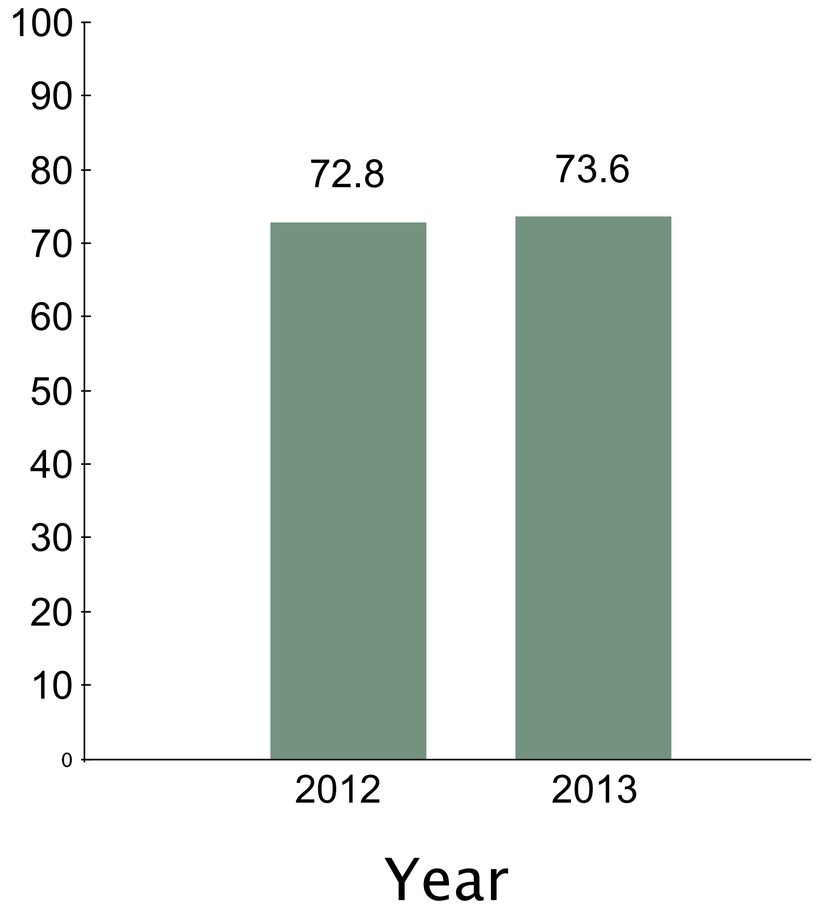
Results: Climate change belief

% Belief in climate change



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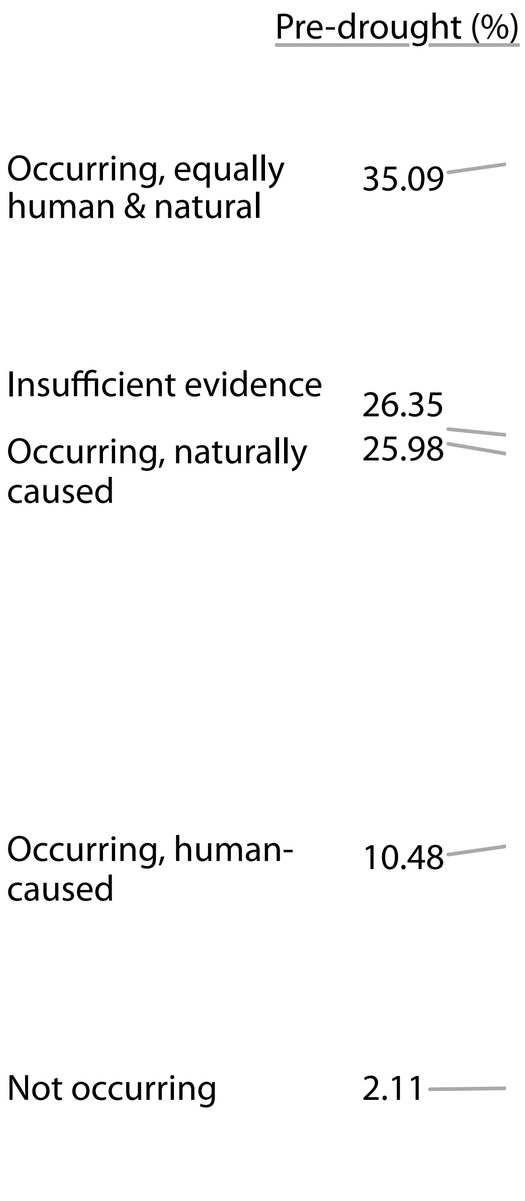
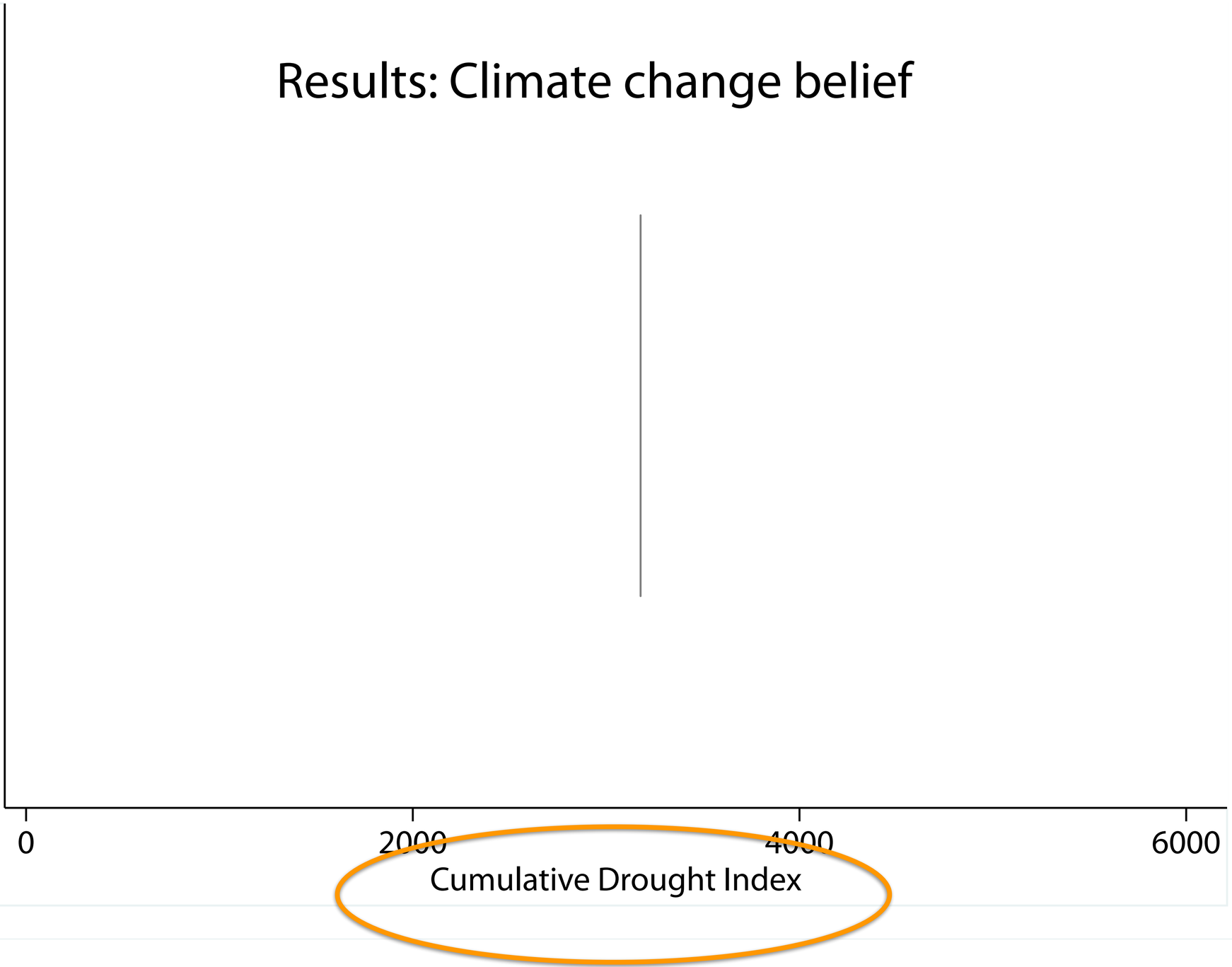
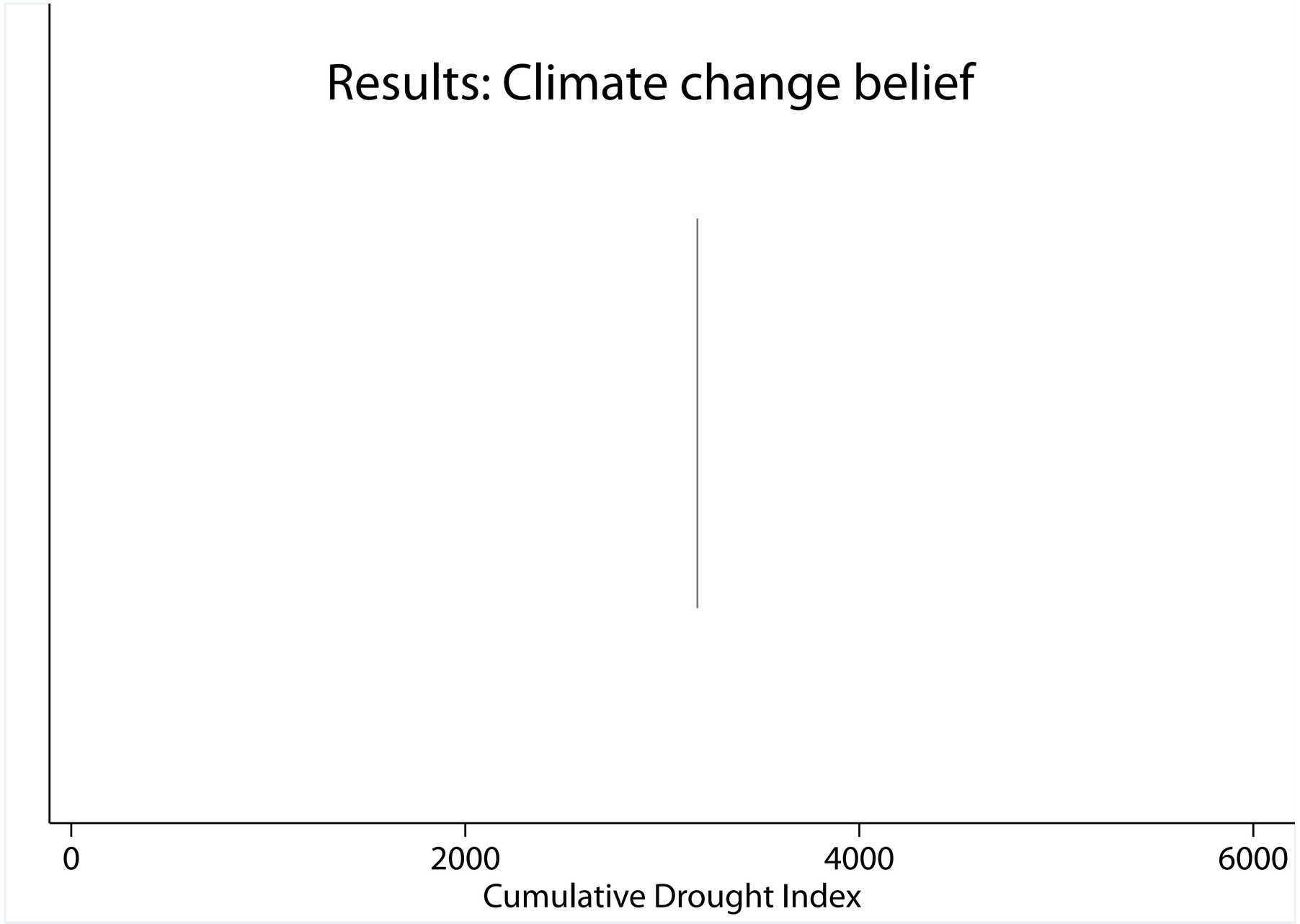
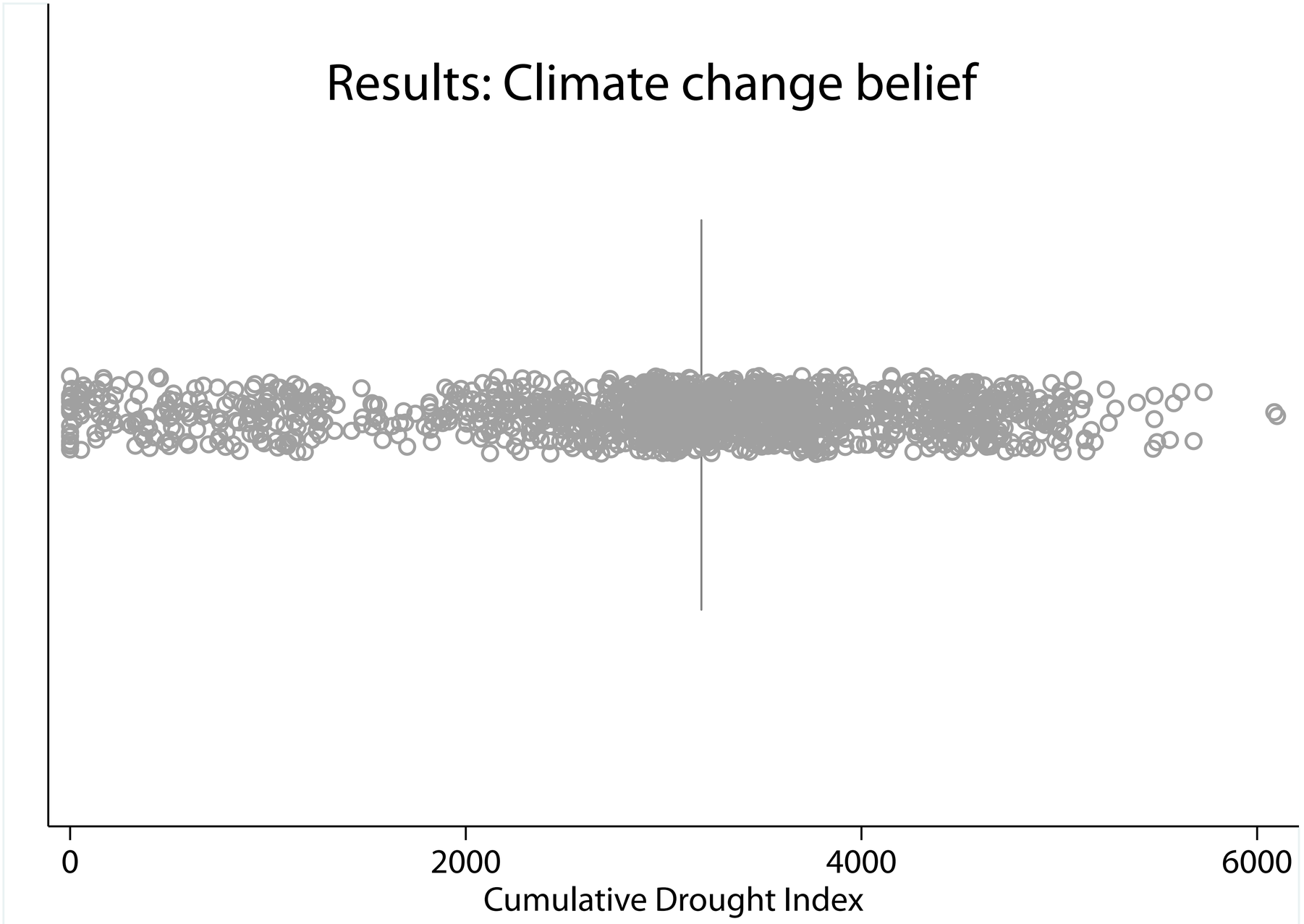


Results: Climate change belief

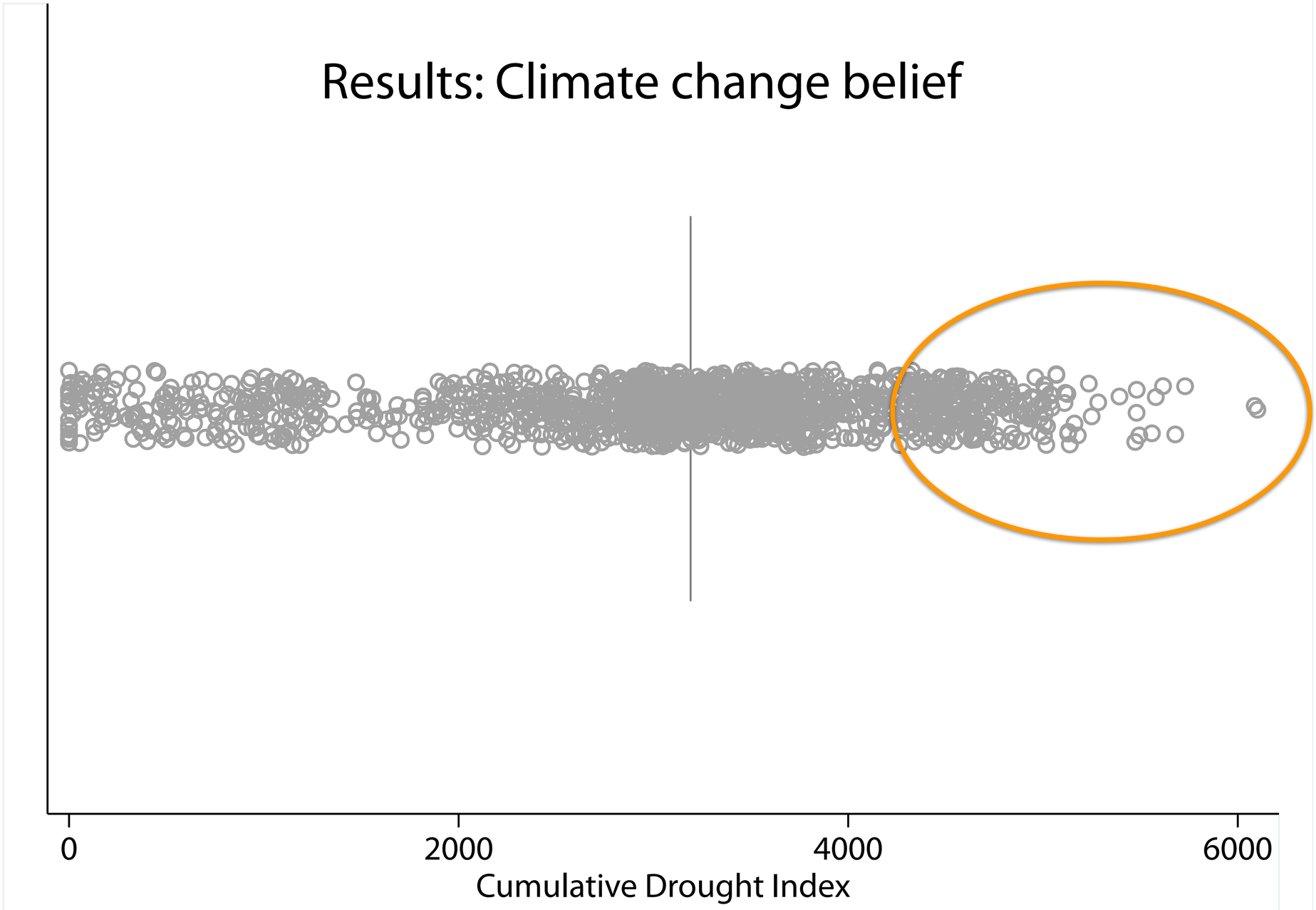



Results: Climate change belief
0
2000
4000
6000
Cumulative Drought Index

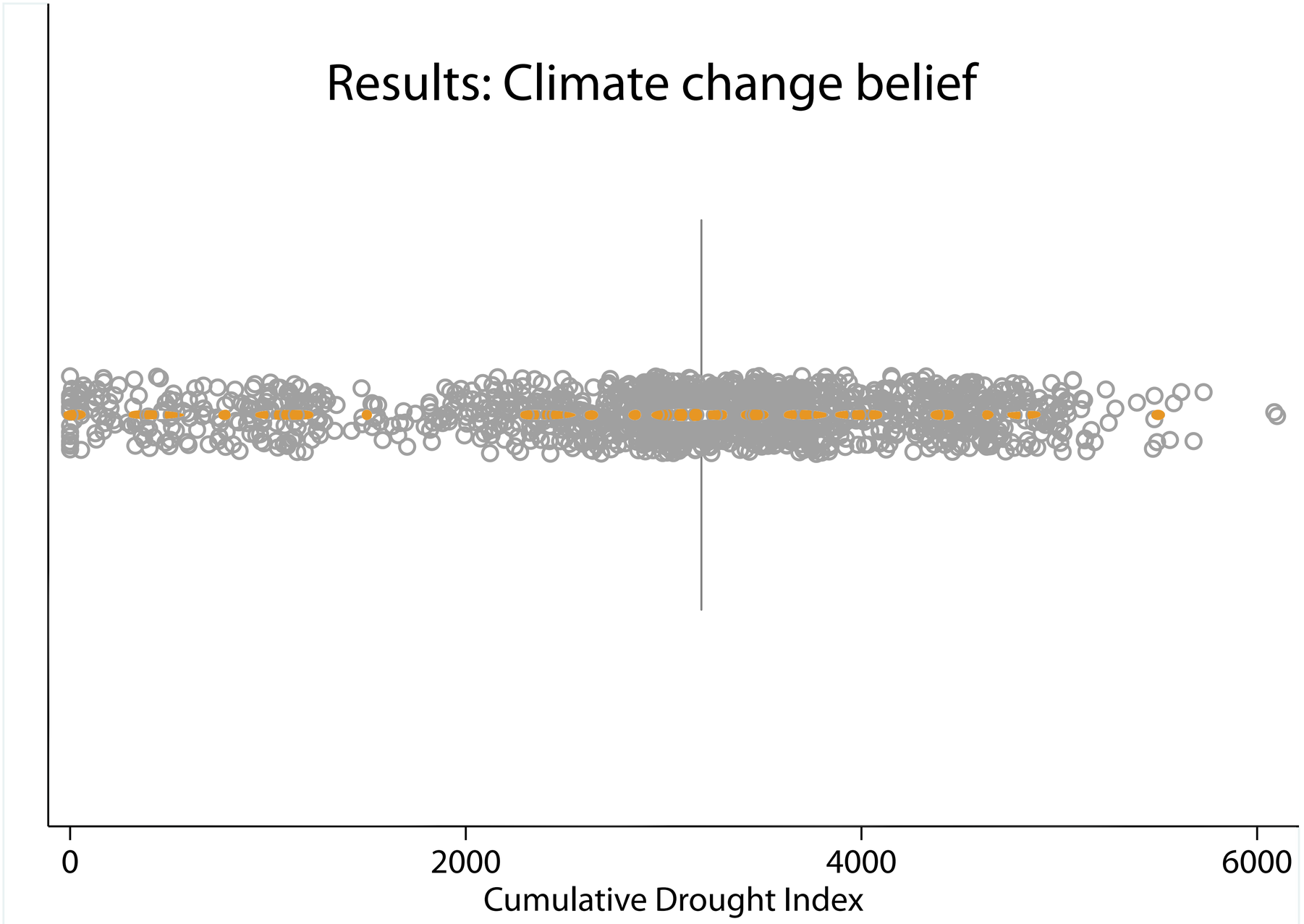
Results: Climate change belief

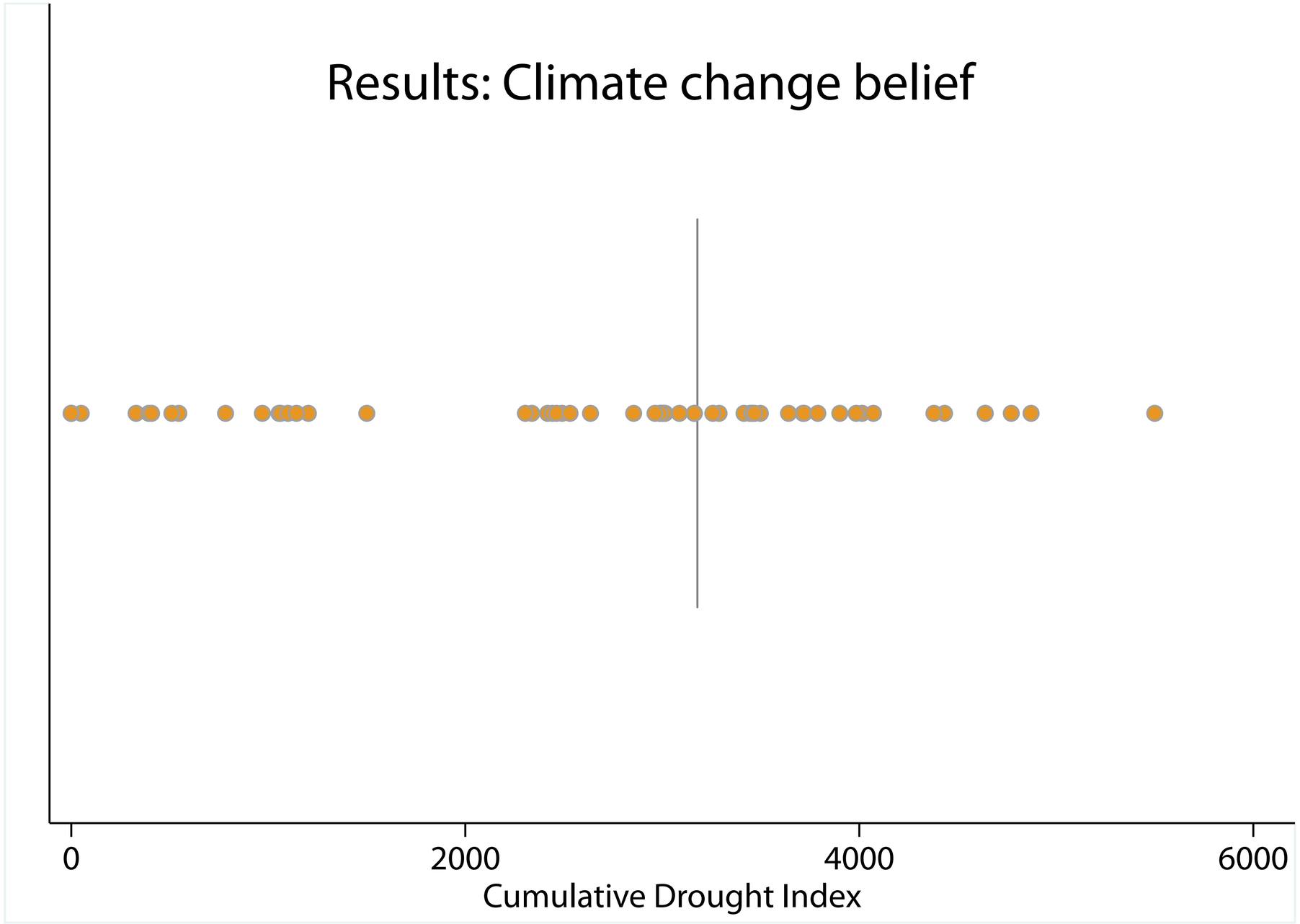


Results: Climate change belief



Results: Climate change belief




Results: Climate change belief
0
2000
4000
6000
Cumulative Drought Index

H1: Belief in climate change will have increased.

H1: Belief in climate change did not increase.

H2: Risk perceptions associated with climate change will have increased.

Wet Risks

floods
rain
ponding
nutrient runoff

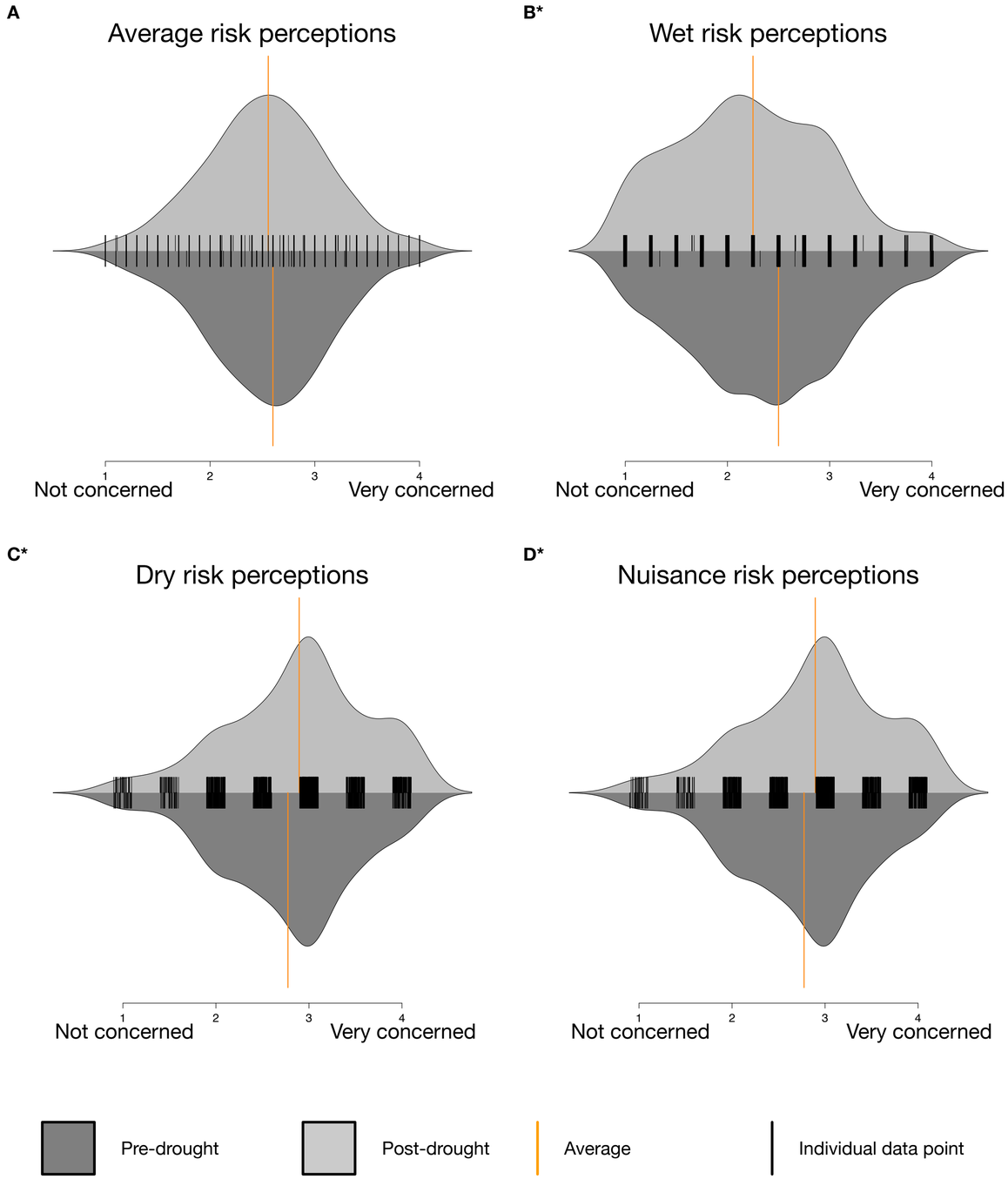
Dry Risks

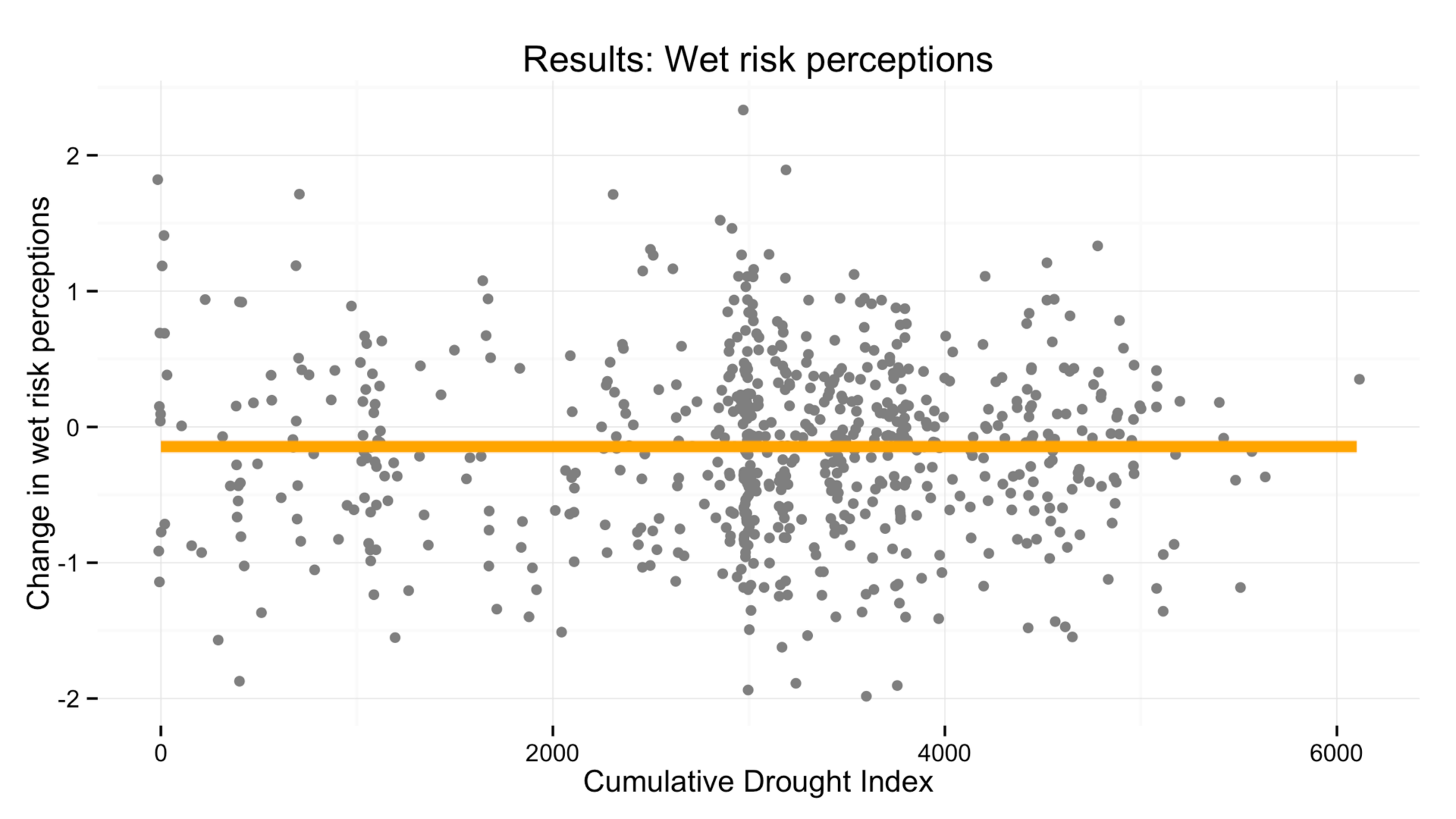
drought
heat

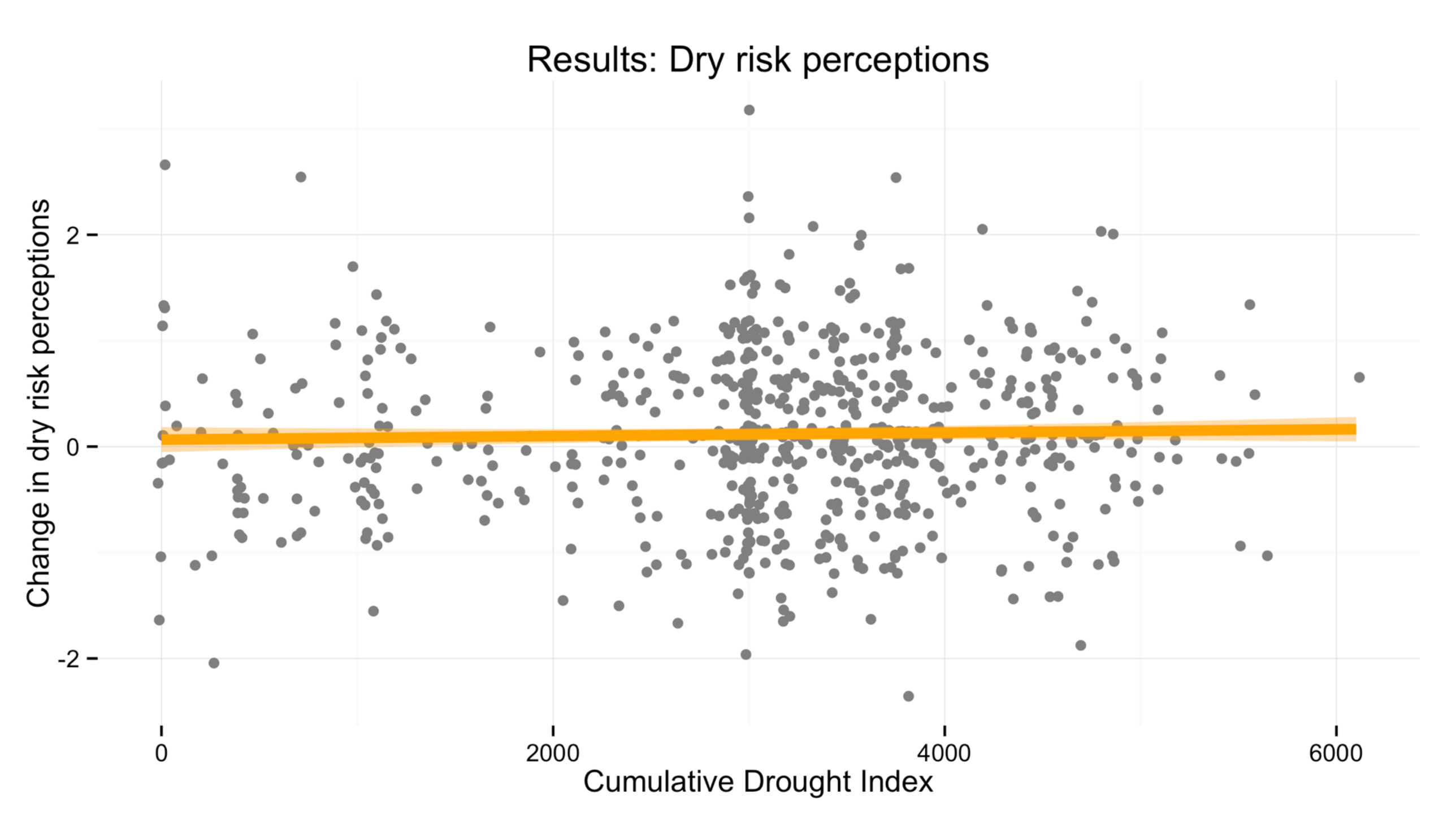
Nuisance Risks

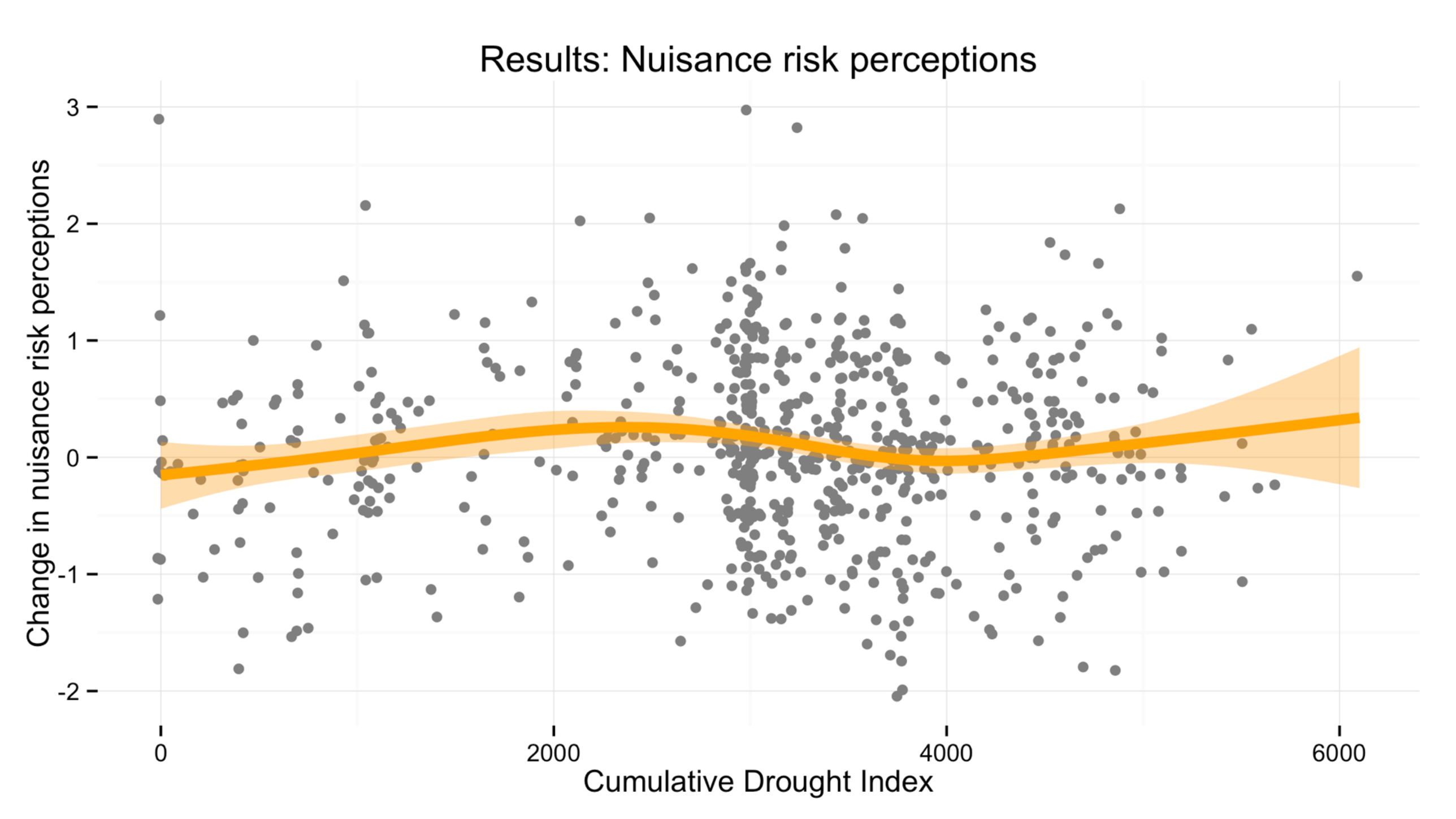
weeds
insects
disease

Results: Risk perceptions




Results: Wet risk perceptions
Change in wet risk perceptions
2
1
0
-1
-2
0
2000
4000
6000
Cumulative Drought Index


Results: Dry risk perceptions
Change in dry risk perceptions
2
0
-2
0
2000
4000
6000
Cumulative Drought Index

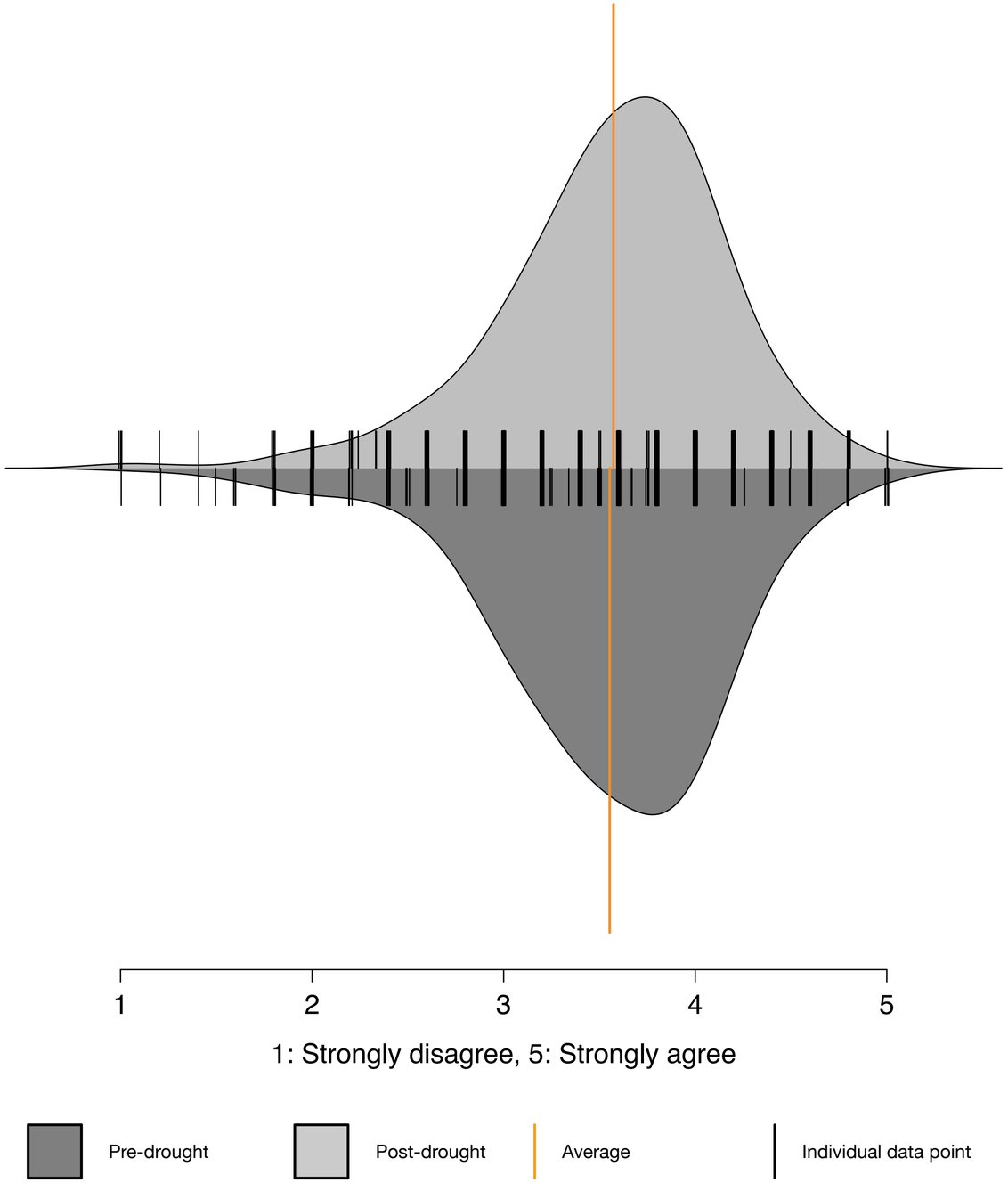

Results: Nuisance risk perceptions
Change in nuisance risk perceptions
3
2
1
0
-1
-2
0
2000
4000
6000
Cumulative Drought Index

H2: Risk perceptions associated with climate change will have increased.

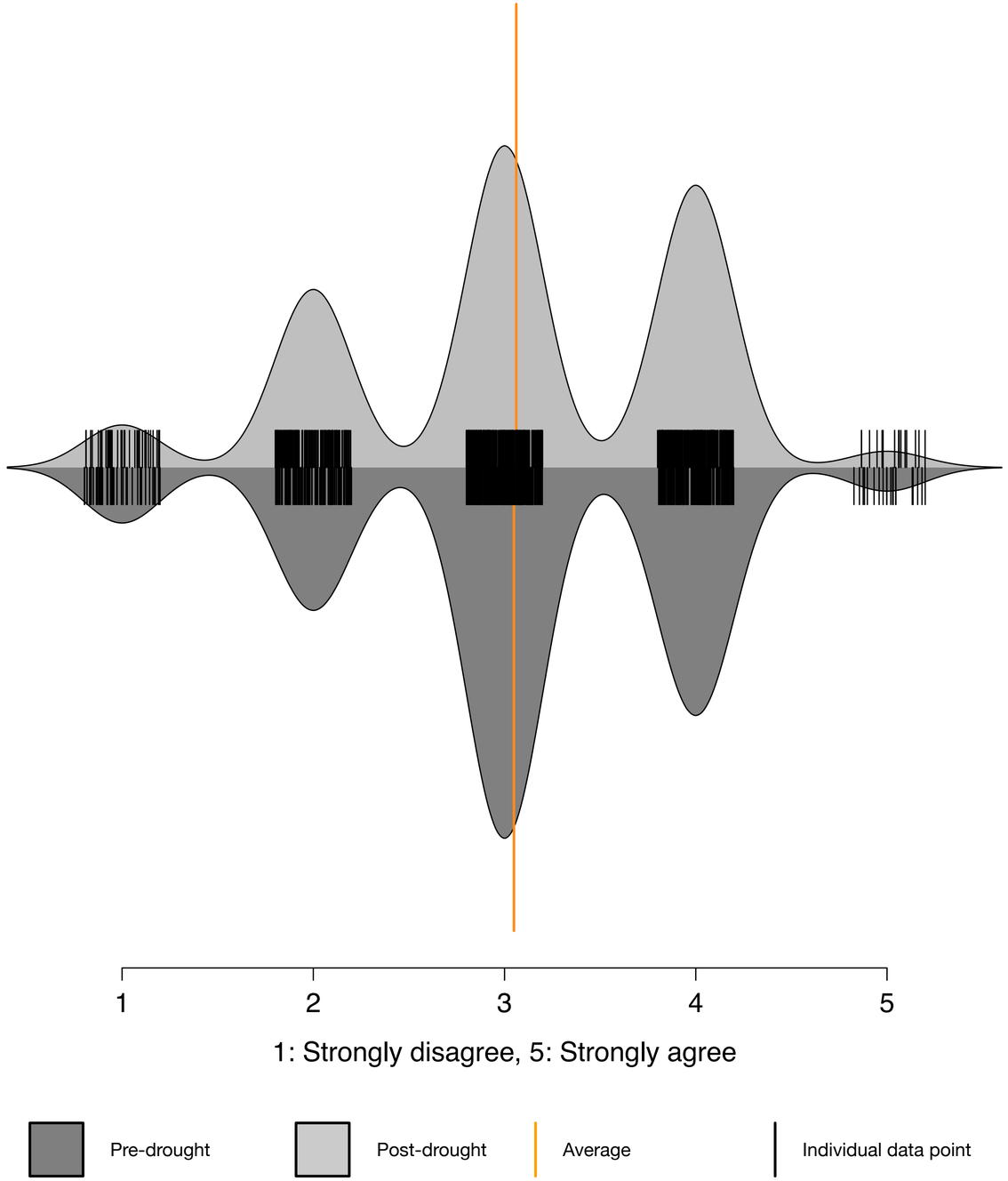
H2: Risk perceptions associated with climate change shifted.

H3: Attitudes toward climate change adaptation will have become more favorable.

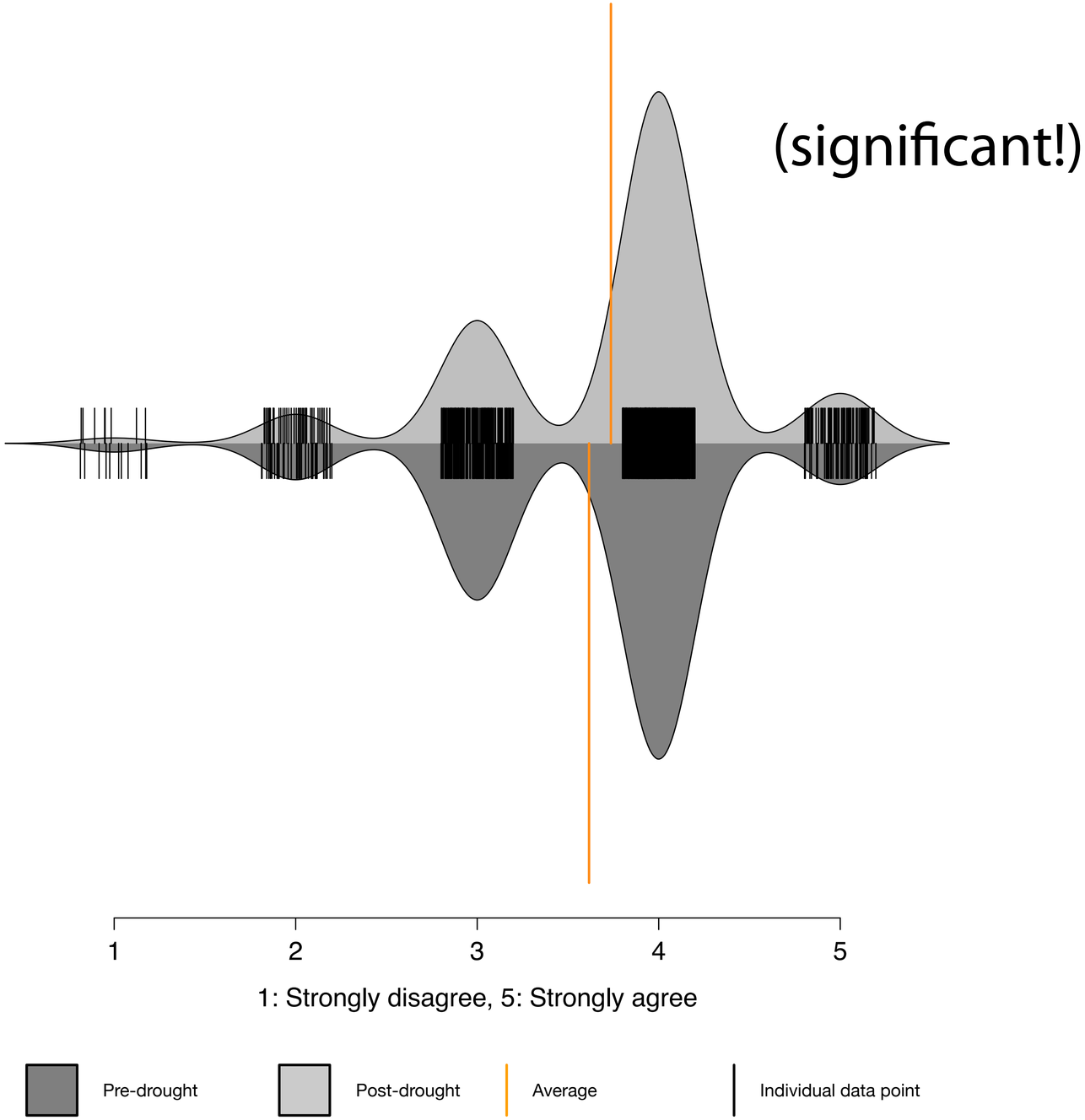
Results: Average adaptation attitude



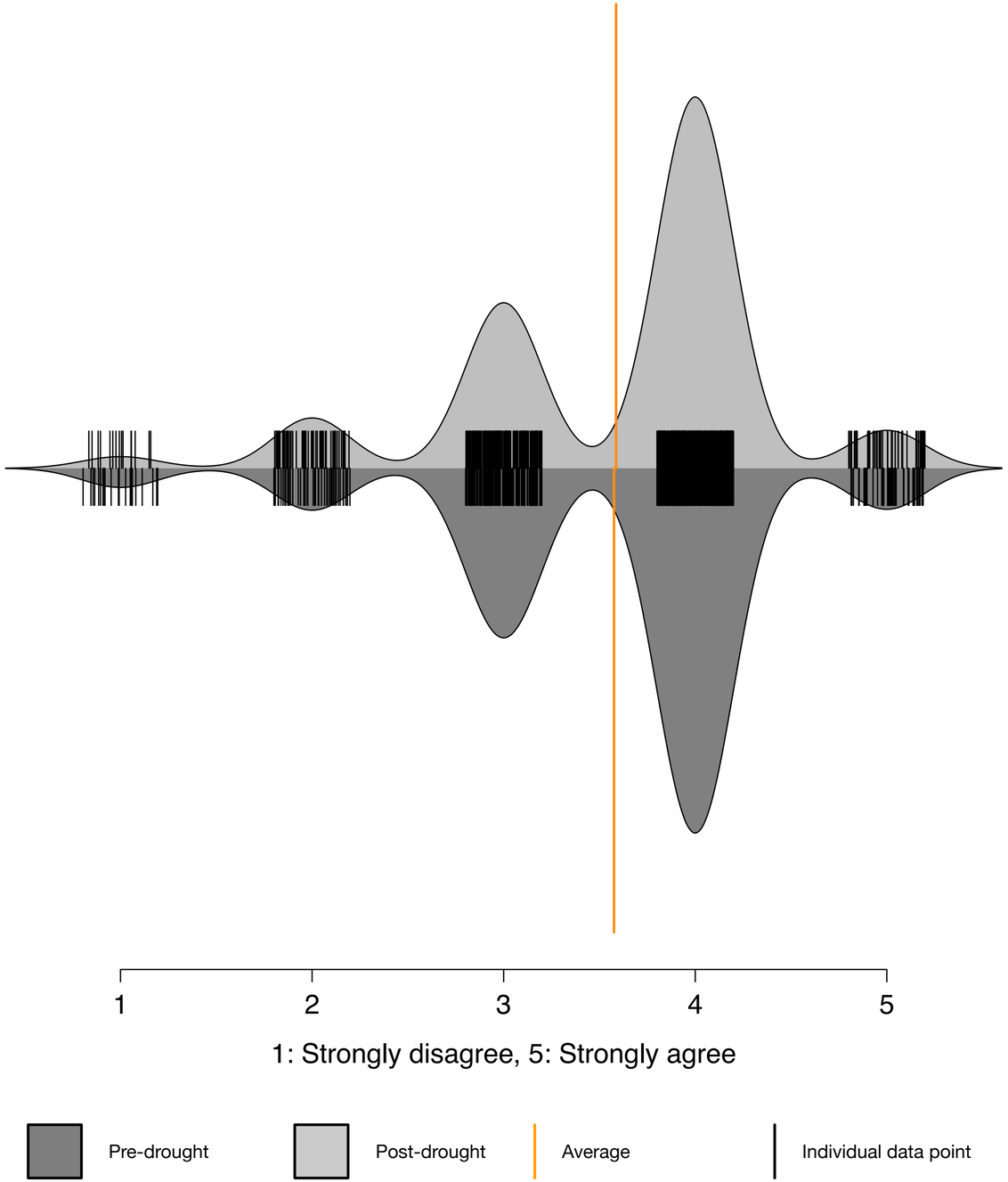
Results: “I would like to provide advice based on climate forecasts.”



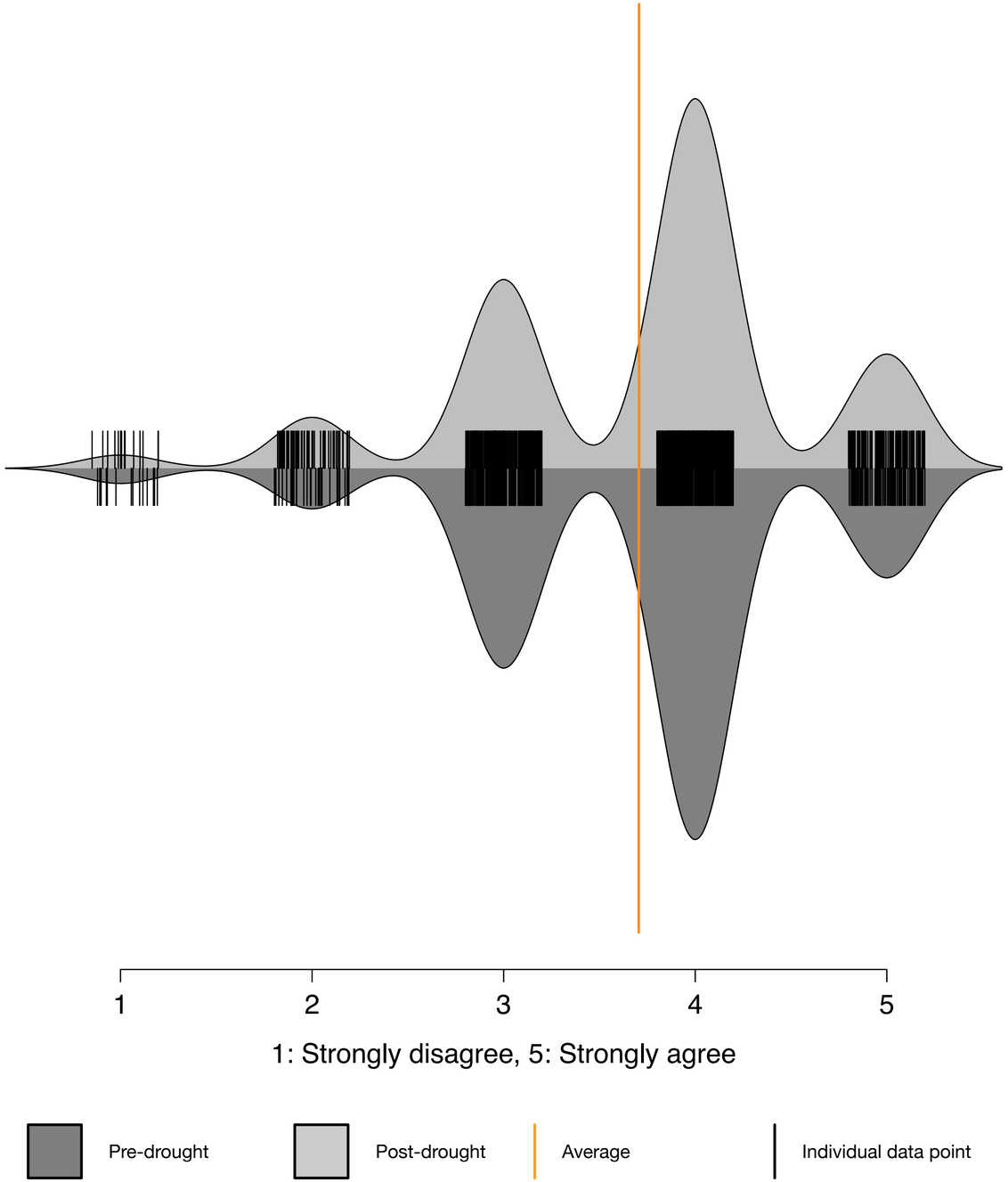
Results: “Farmers should take additional steps to protect farmland from increased weather variability.”



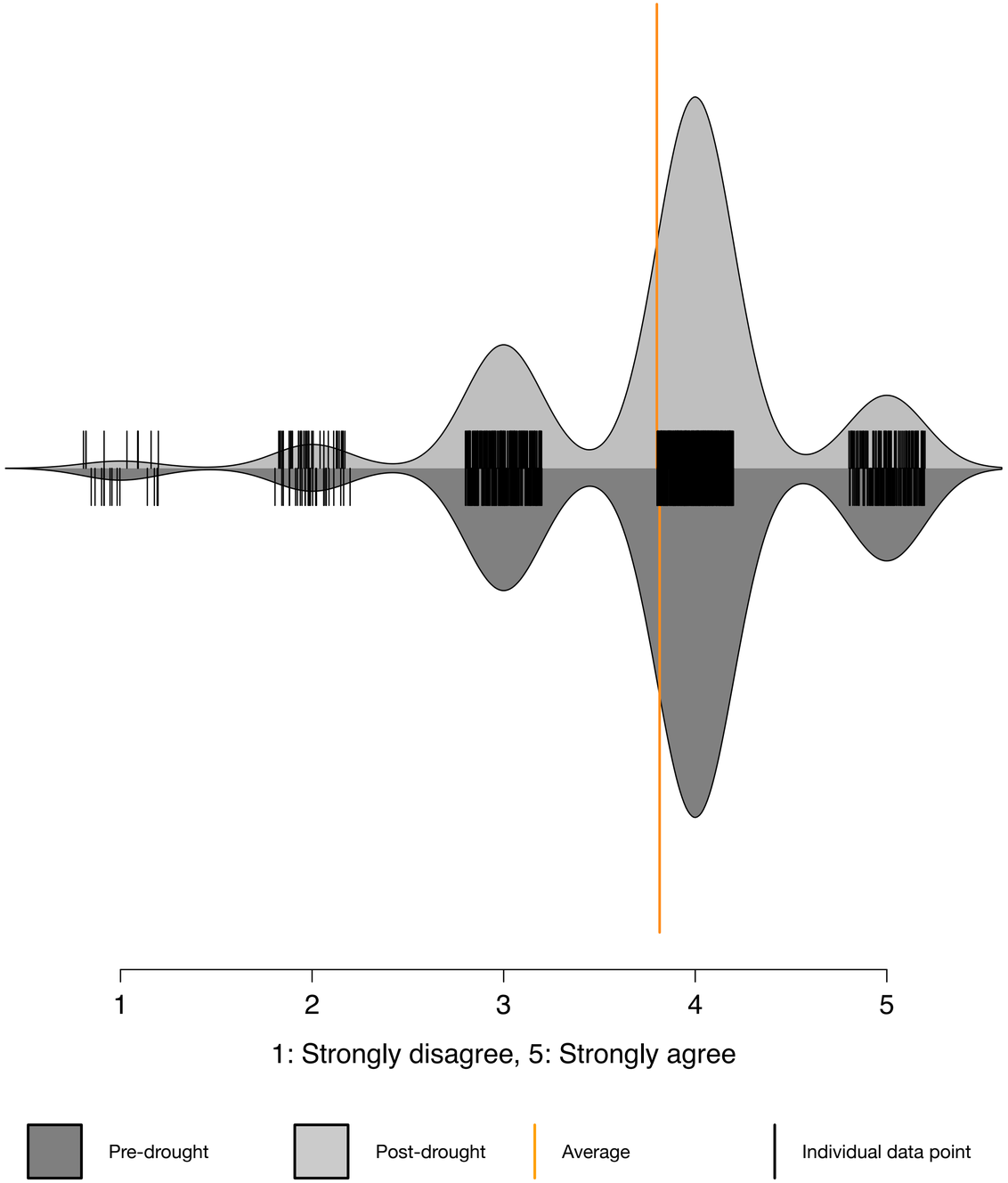
Results: “In my role as advisor, I should help farmers prepare for increased weather variability.”



Results: “Changing practices to cope with increasing climate variability is important to the long-term success of the farmers I advise.”



Results: “It is important for farmers to adapt to climate change to ensure the long-term success of U.S. agriculture.”



H3: Attitudes toward climate change adaptation will have become more favorable.

H3: Attitudes toward climate change adaptation did not change.

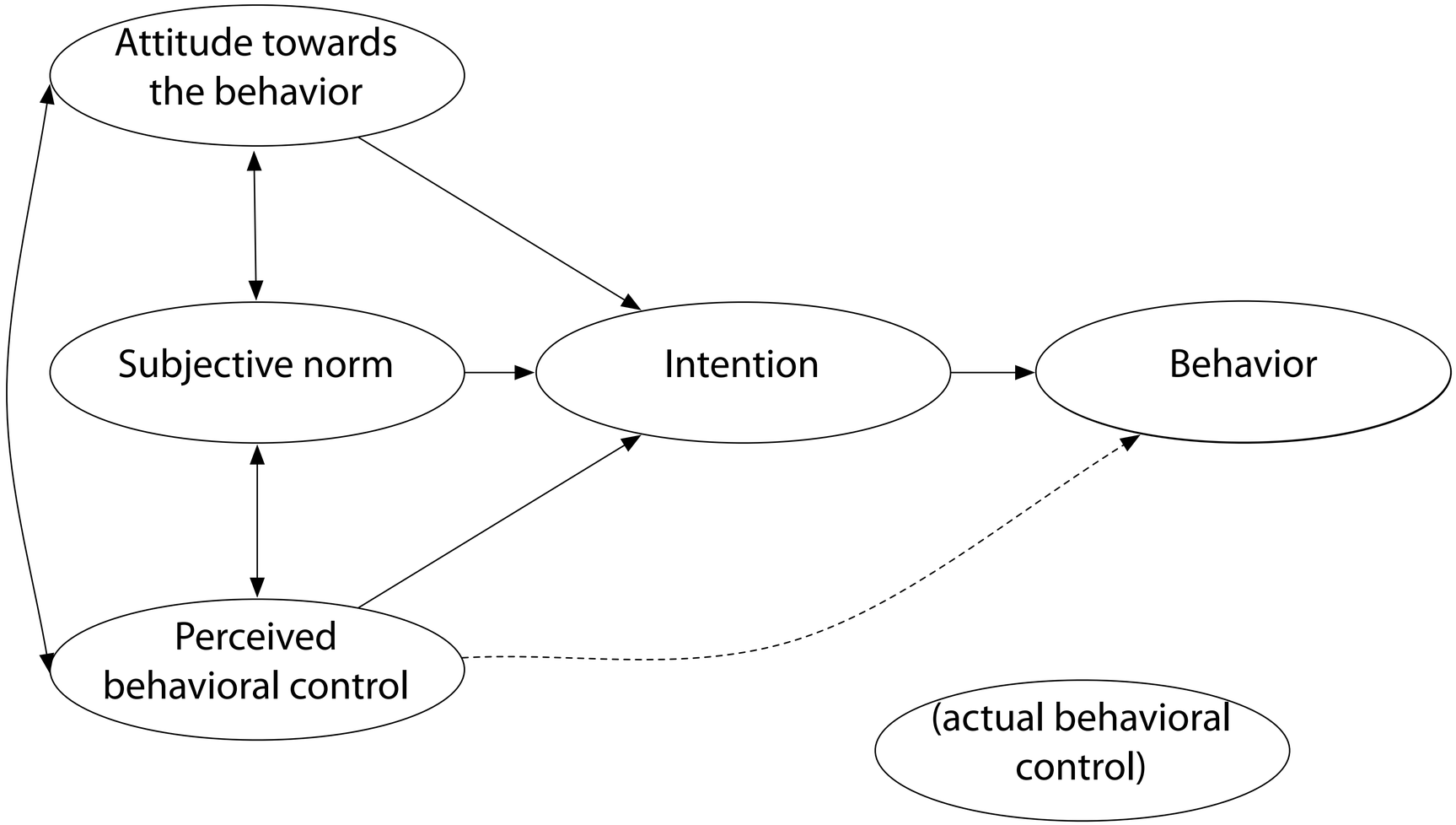
H1: Belief in climate change will have did not change.

H2: Risk perceptions associated with climate change shifted.

H3: Attitudes toward climate change adaptation did not change.

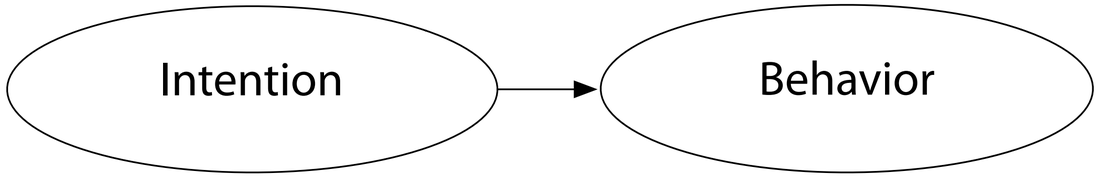
H3: Attitudes toward climate change adaptation did not change.

Icek Ajzen & Martin Fishbein: The Reasoned Action Model

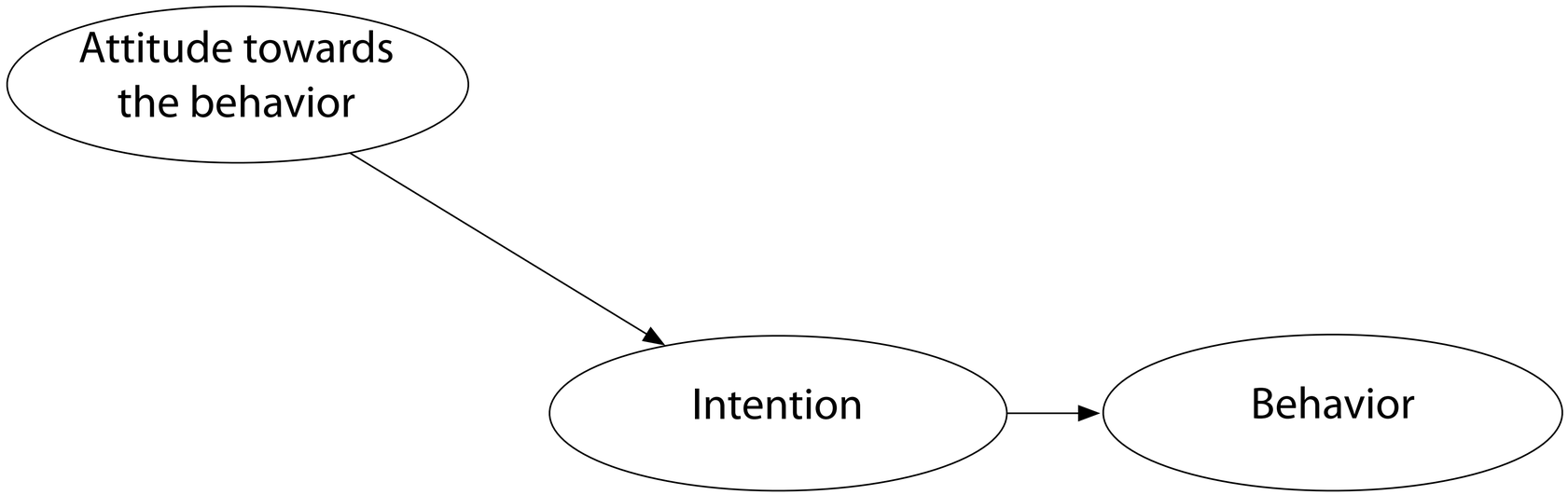


The Reasoned Action Model

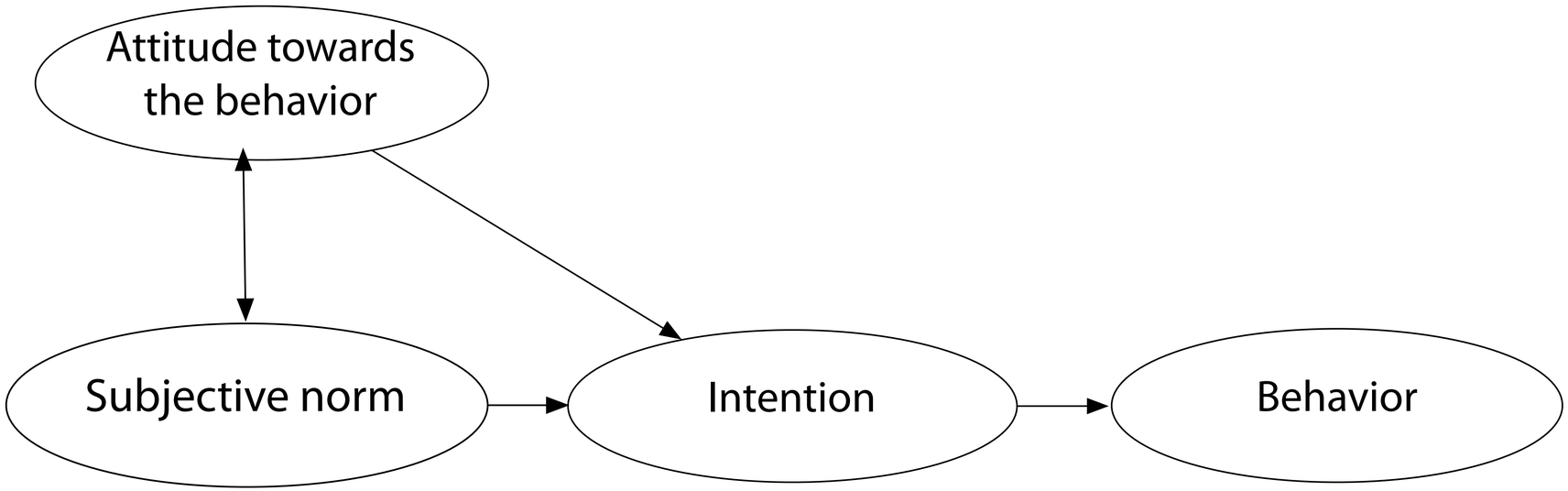
The Reasoned Action Model



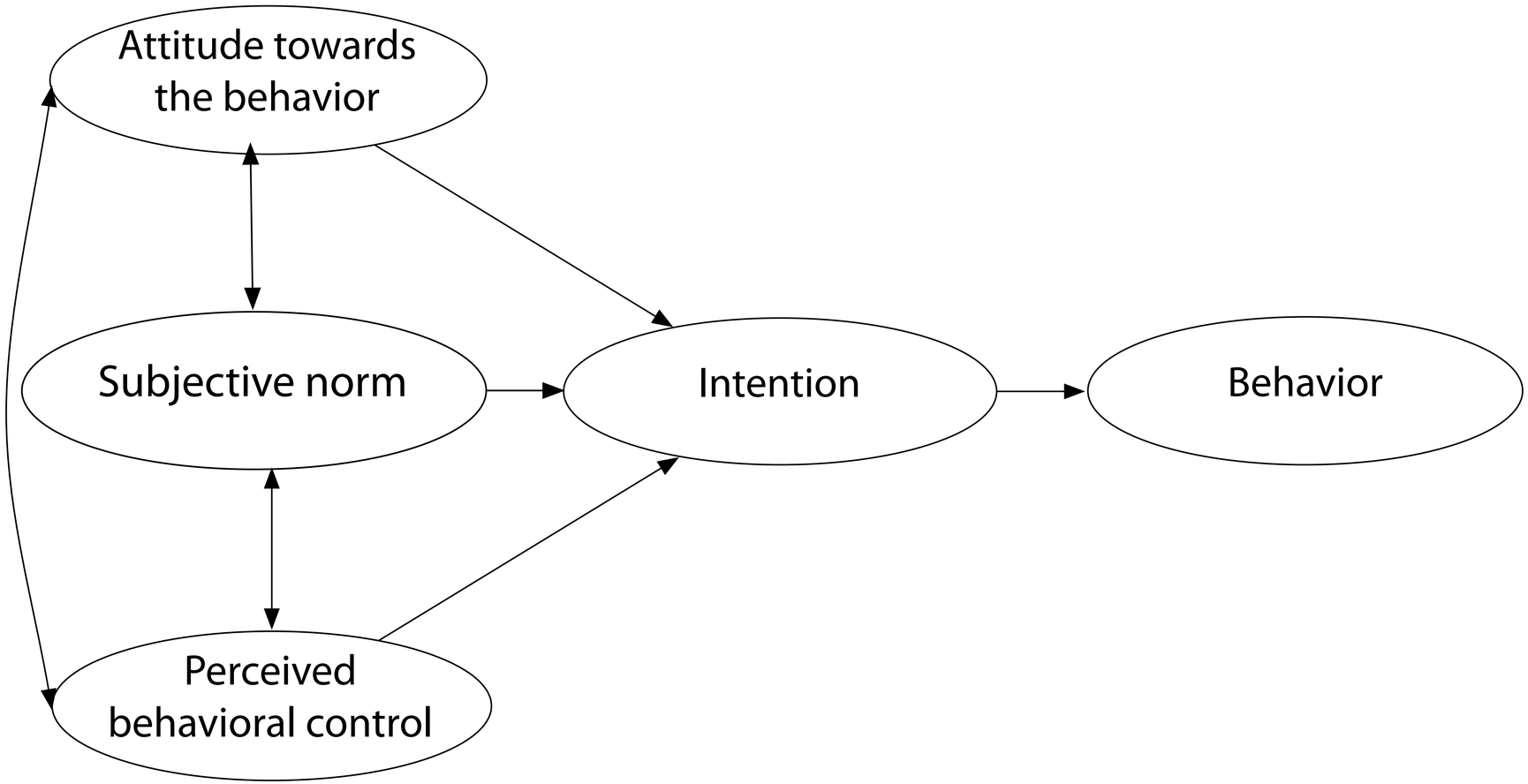
The Reasoned Action Model



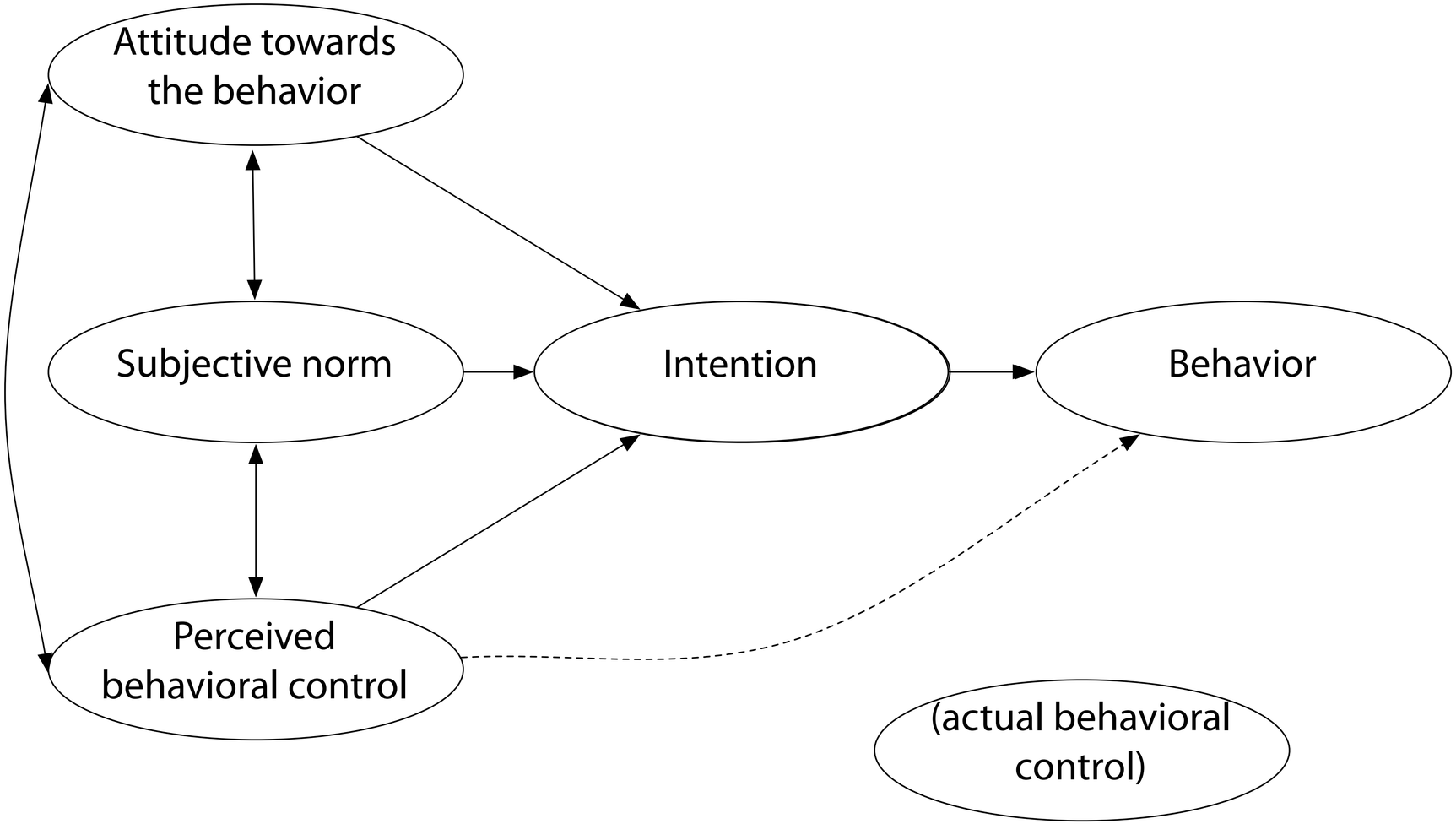
The Reasoned Action Model



The Reasoned Action Model

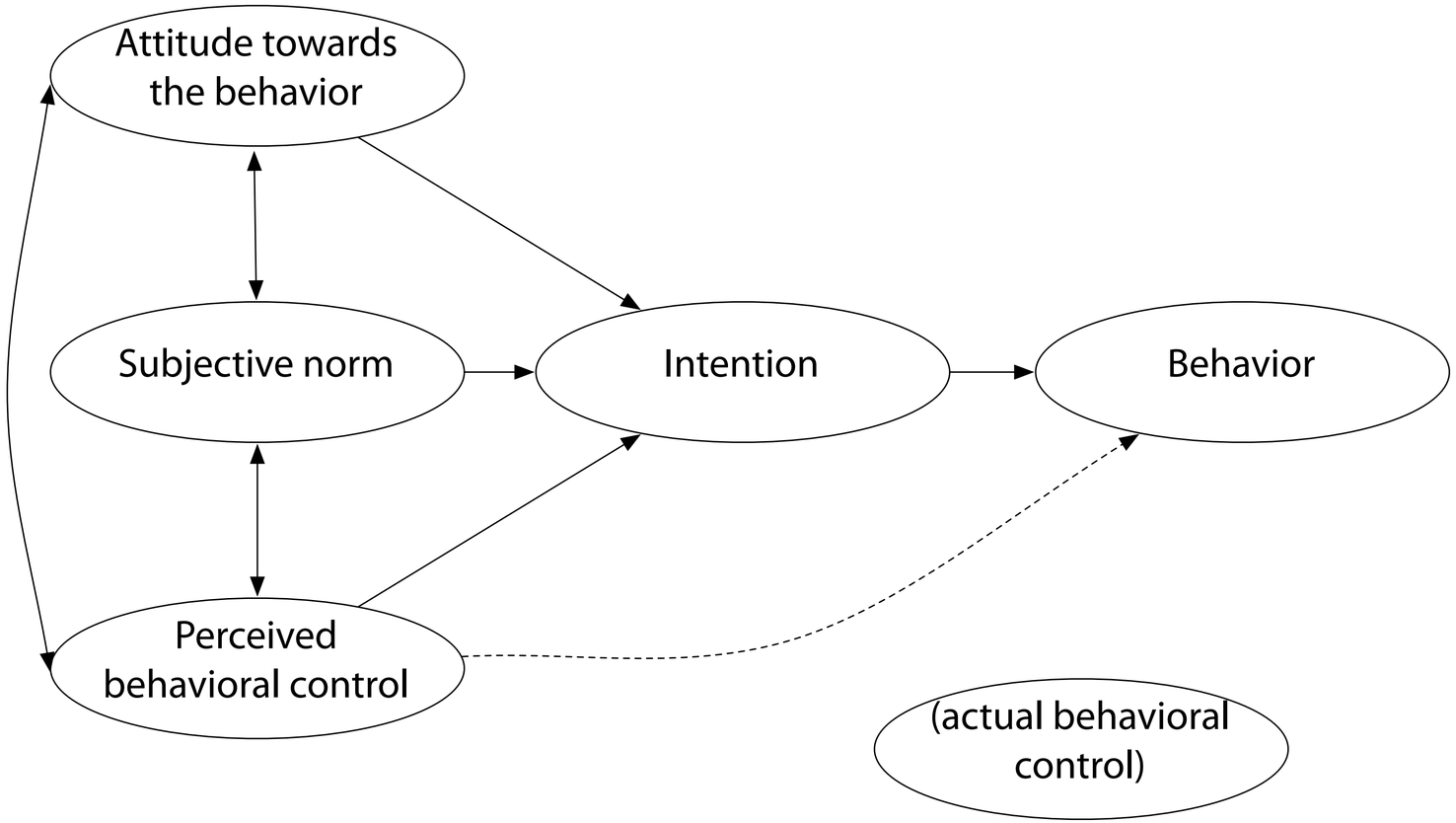


The Reasoned Action Model



The Reasoned Action Model

H3a: Desire to use climate information will be influenced by perceived behavioral control, attitudes, and perceived norms as indicated by the Reasoned Action Approach



Perceived behavioral control: perceived ability to use climate information (2-question construct)

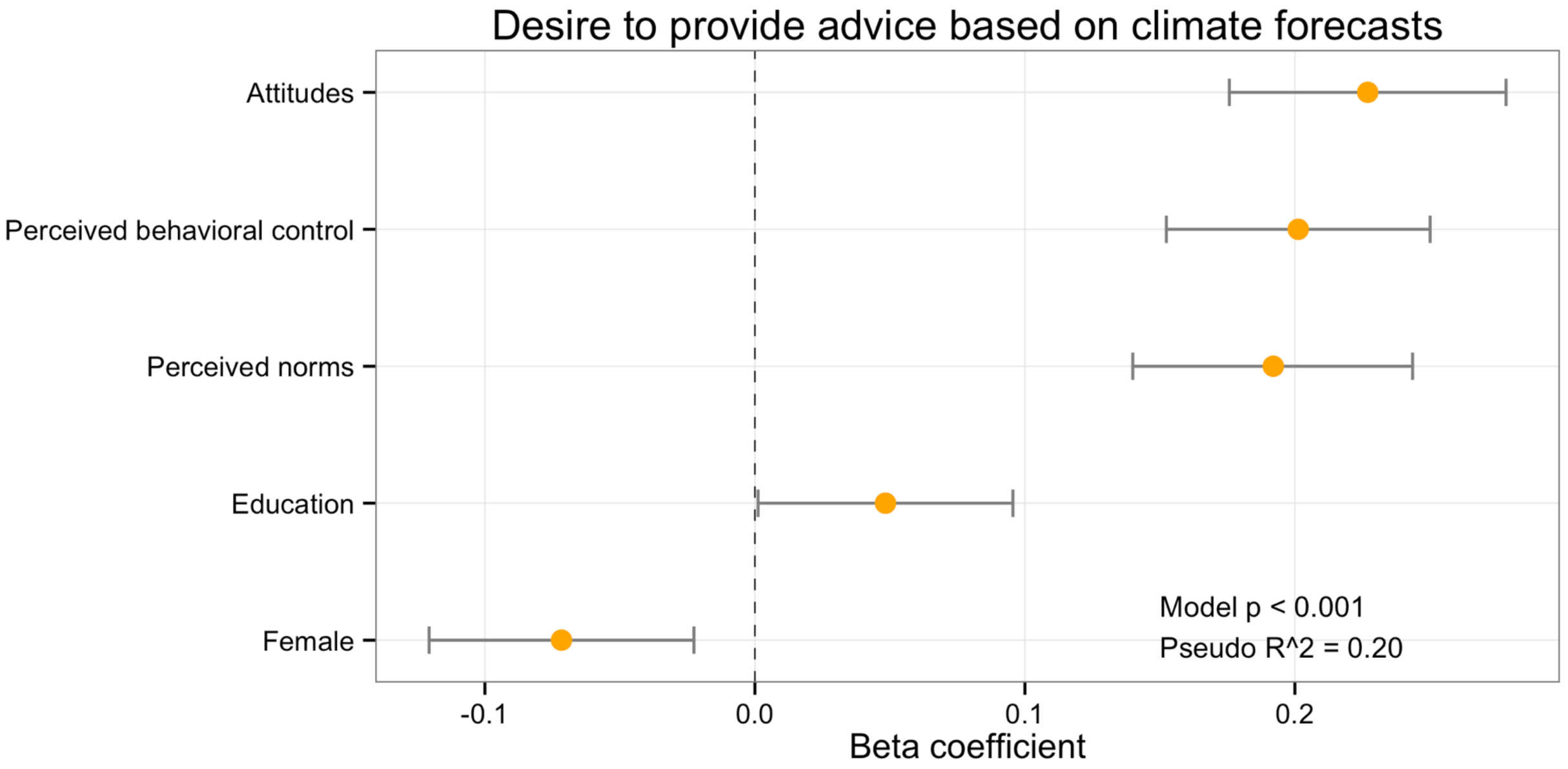
Attitudes: positive/negative feelings toward using climate information (3-question construct)

Perceived norms: influence of peers (2-question construct)

Model

Dependent variable: willingness to use climate information when providing advice to farmers.

Independent variables: attitudes, perceived behavioral control, perceived norms, education, gender


Desire to provide advice based on climate forecasts
Attitudes
Perceived behavioral control
Perceived norms
Education
Female
Model p < 0.001
Pseudo R^2 = 0.20
-0.1
0.0
0.1
0.2
Beta coefficient

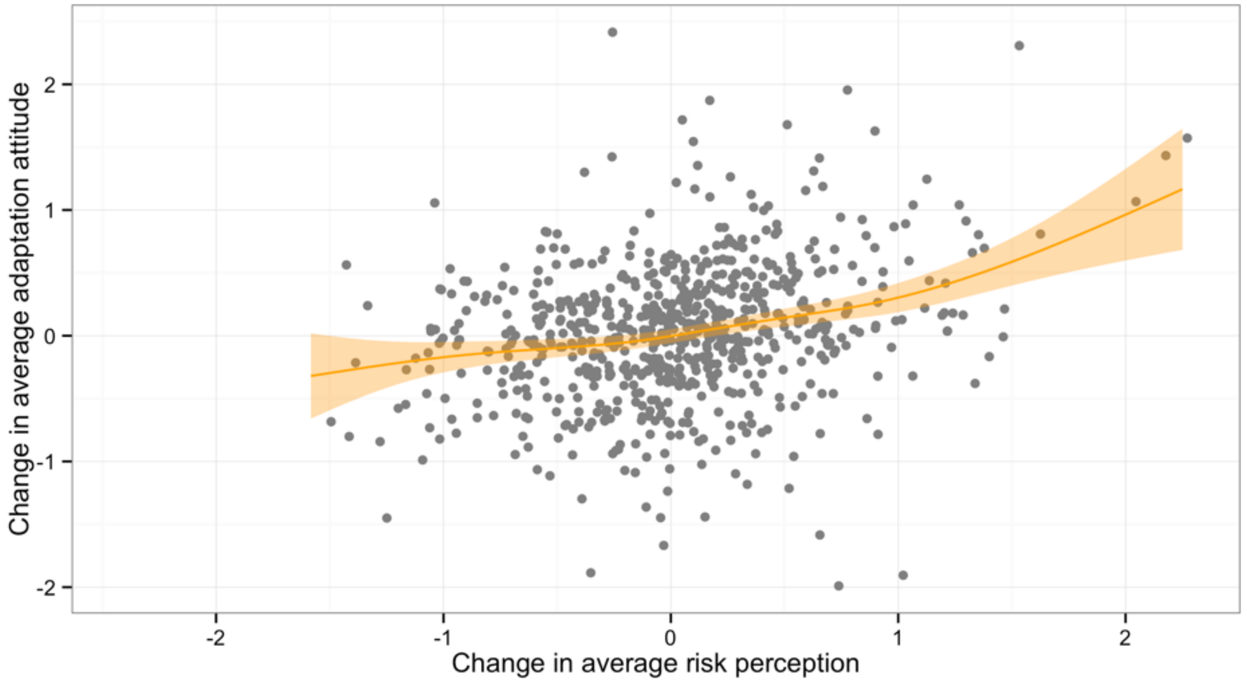
H1: Belief in climate change will have did not change.

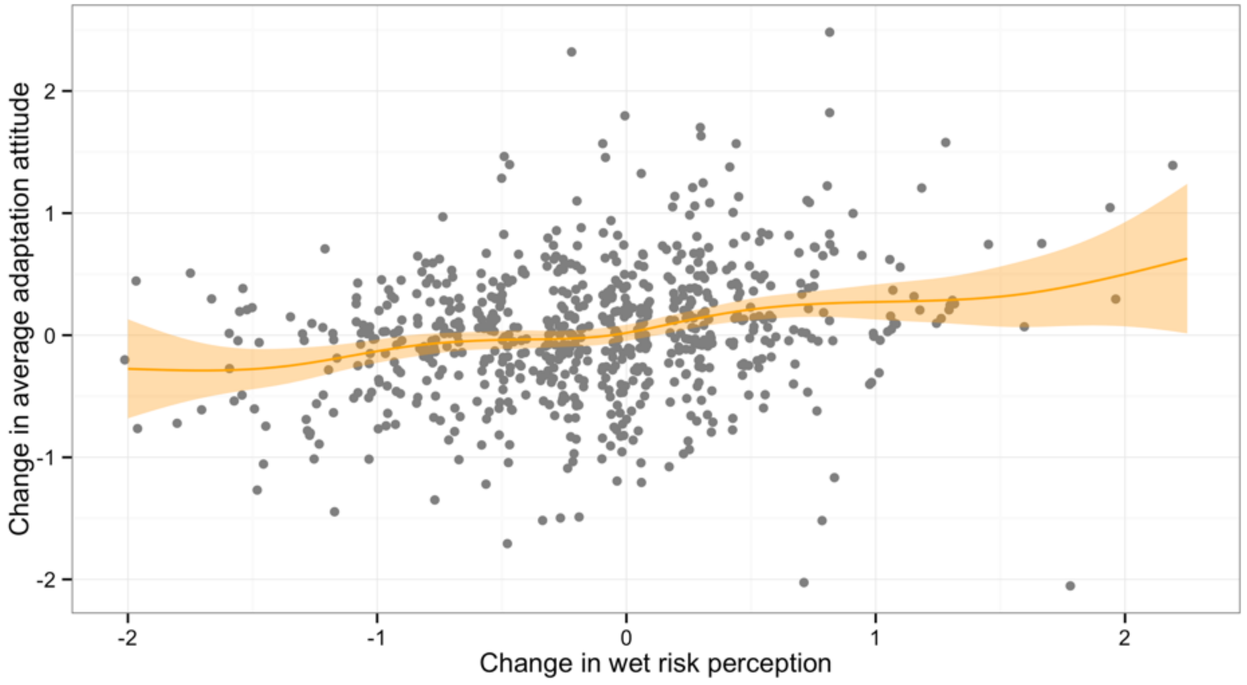
H2: Risk perceptions associated with climate change shifted.

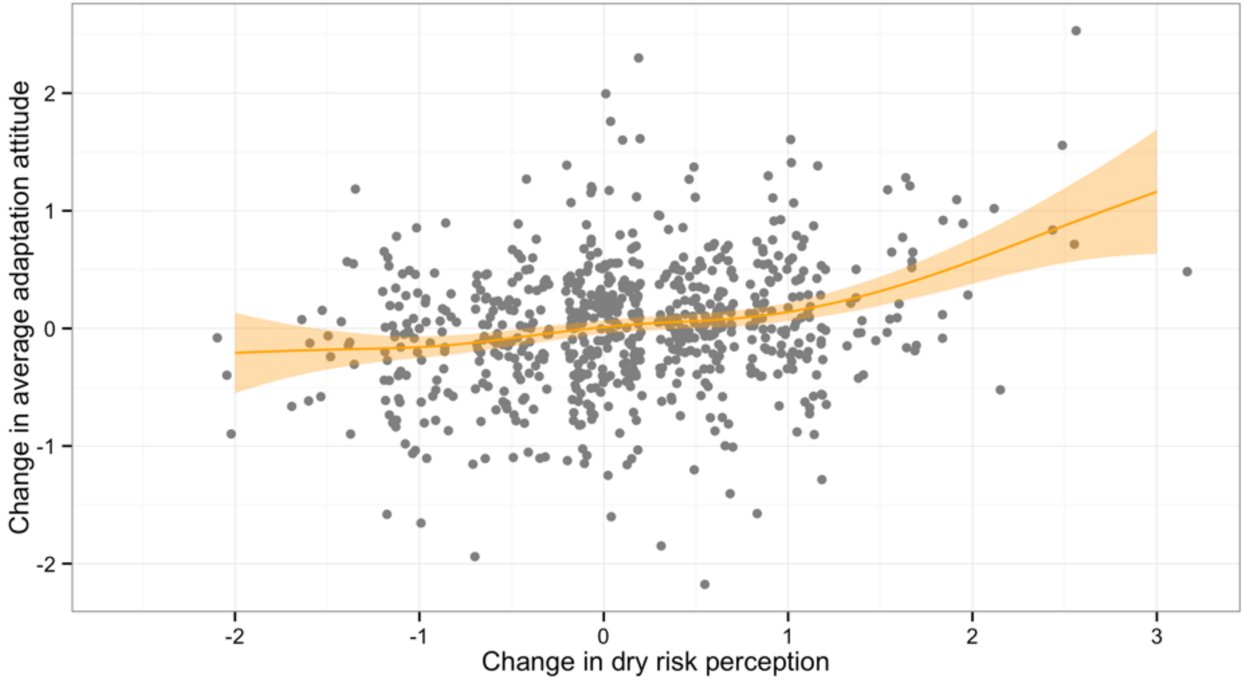
H3: Attitudes toward climate change adaptation did not change.

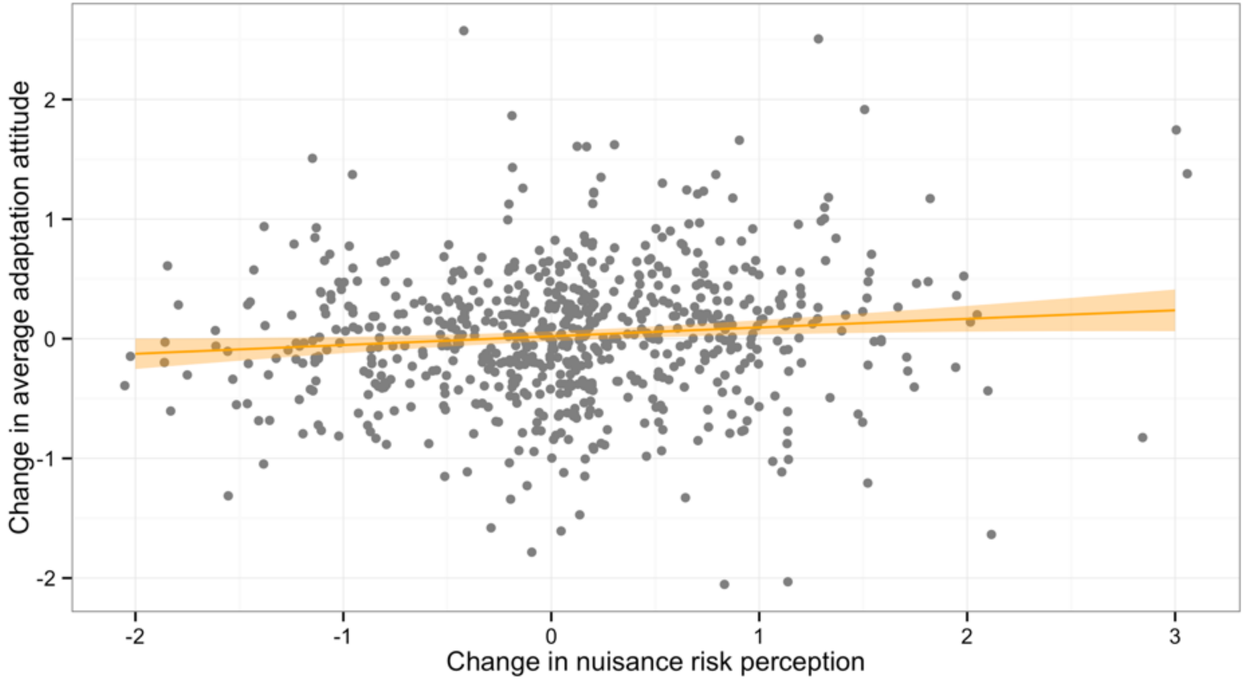
H3a: Attitudes toward climate change adaptation were predicted by the reasoned action model.

Reason for optimism?


Change in average adaptation attitude
Change in average risk perception
2
1
0
-1
-2


Change in average adaptation attitude
Change in wet risk perception
2
1
0
-1
-2


Change in average adaptation attitude
Change in dry risk perception
3
2
1
0
-1
-2


Change in average adaptation attitude
Change in nuisance risk perception
3
2
1
0
-1
-2

Critiques & complaints

Critiques & complaints

This is a population of relative elites.

Critiques & complaints

This is a population that is used to dealing with weather cycles.

Critiques & complaints

This is a population that is buffered from the effects of drought by crop insurance.

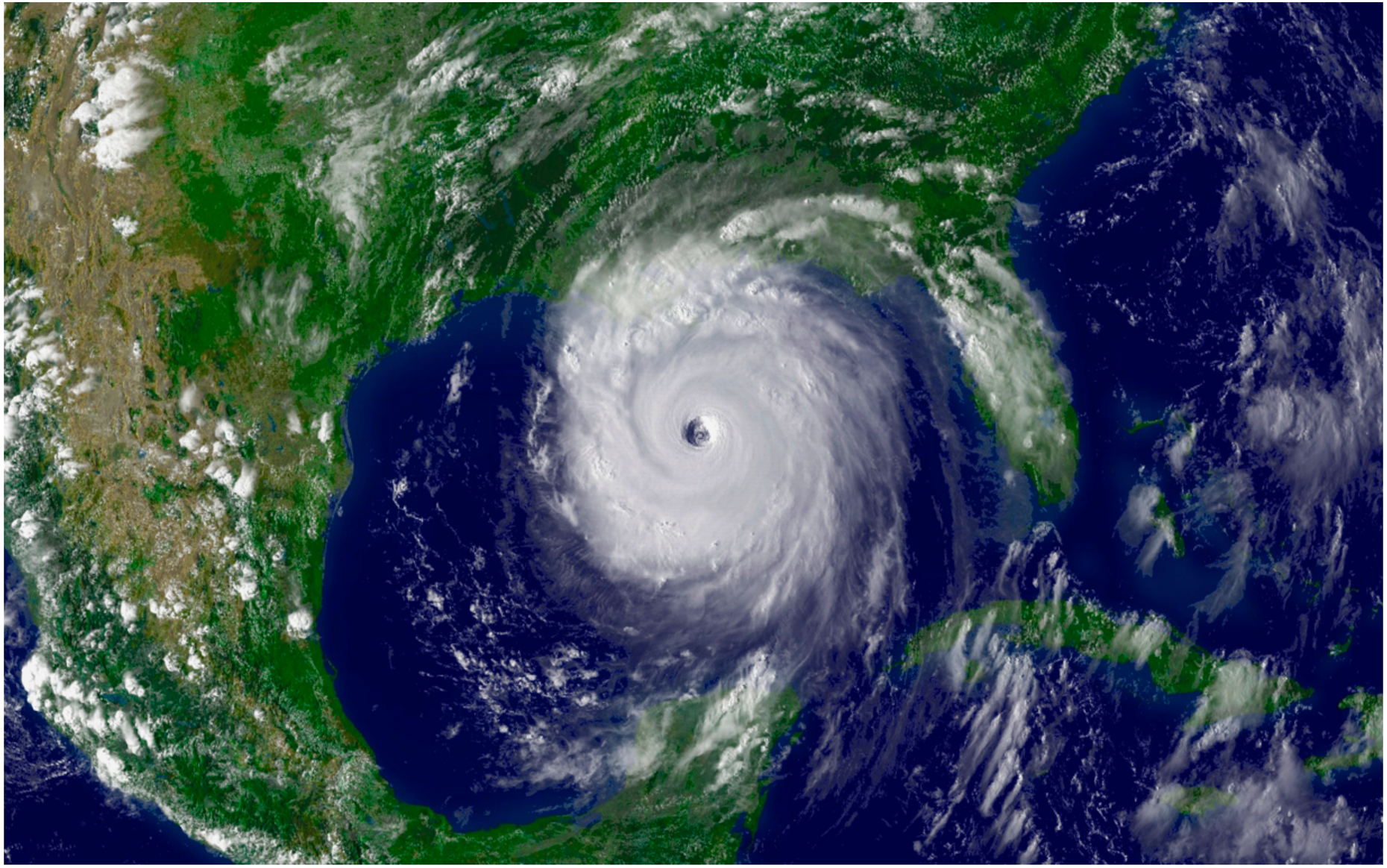
Critiques & complaints

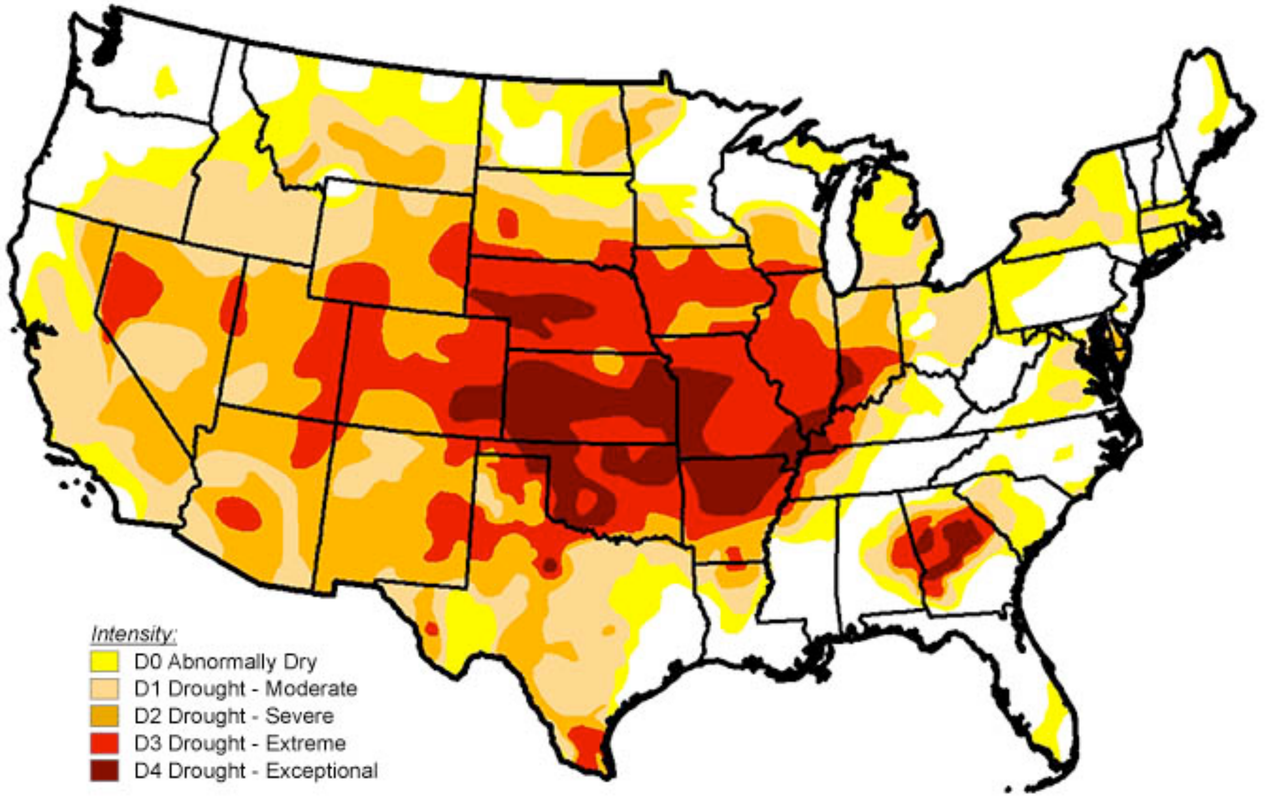
This drought was only one year.

Unprecedented baseline data.

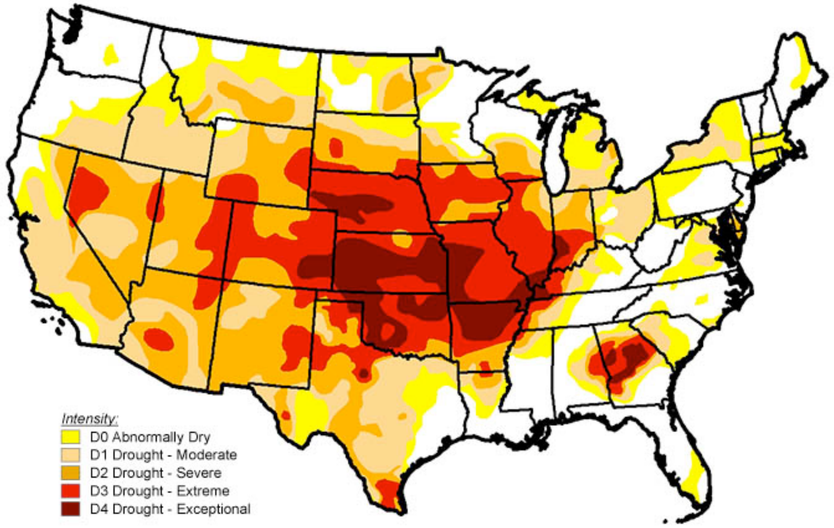
Conclusions

What are the effects of extreme events on perceptions of climate change?




Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional

Conclusions



Extreme events **may not change people's views** on climate change.

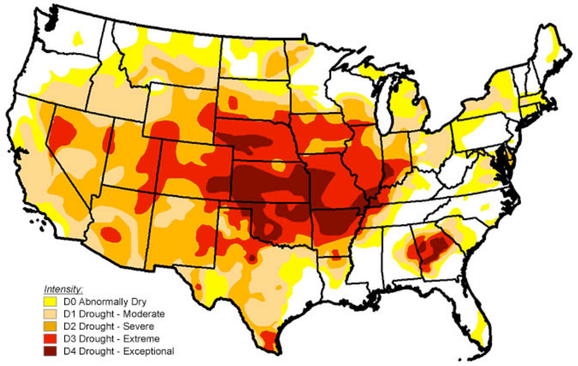
Conclusions

Risk Perceptions: an opportunity for framing?

Conclusions

Climate information: Is it useful? Is it usable?

The effects of the 2012 Midwestern US drought on climate change beliefs



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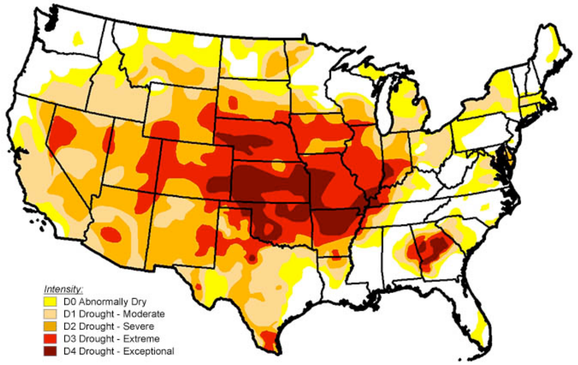
U2U Project
Linda Prokopy, Director
www.AgClimate4U.org

Questions?



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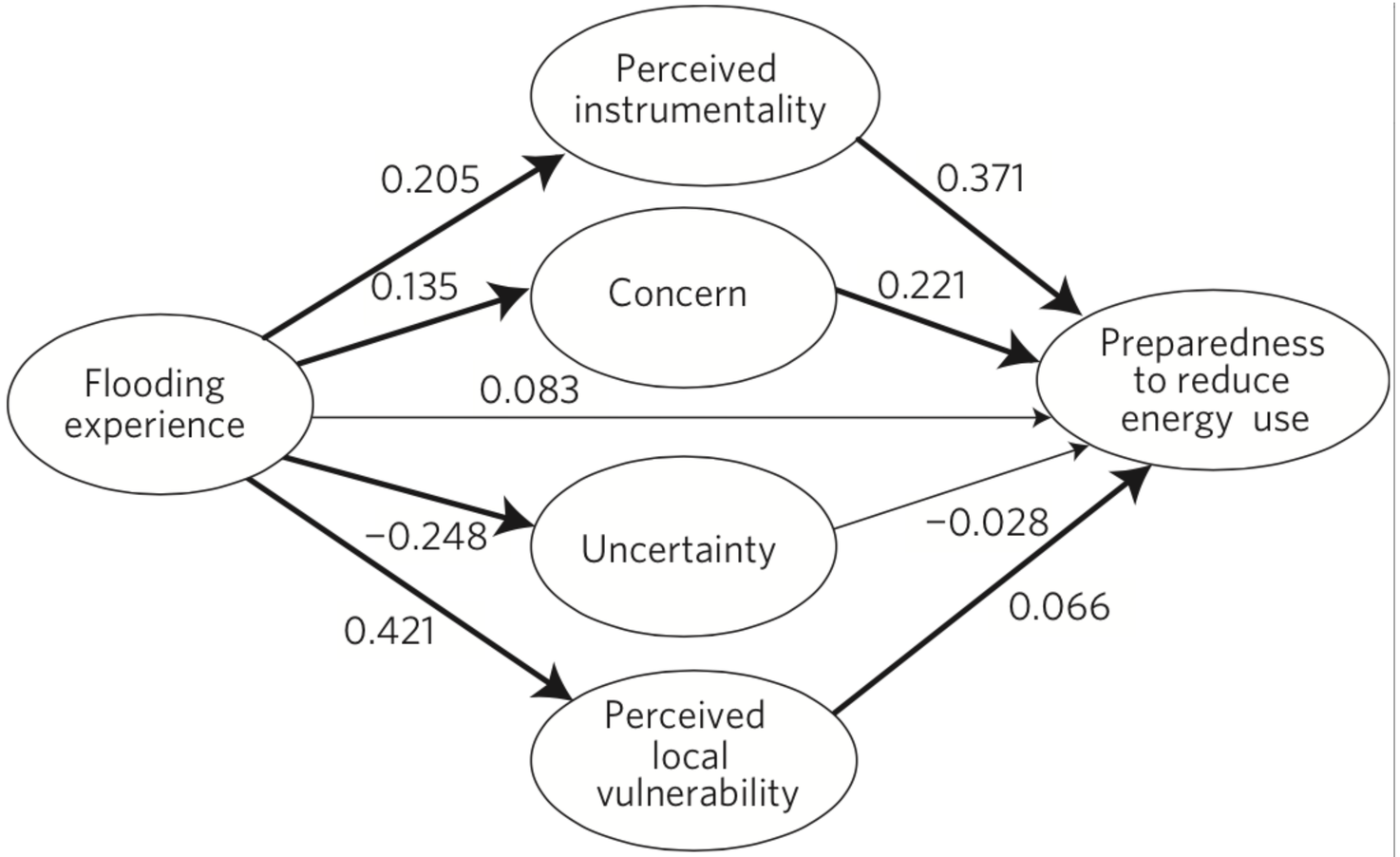
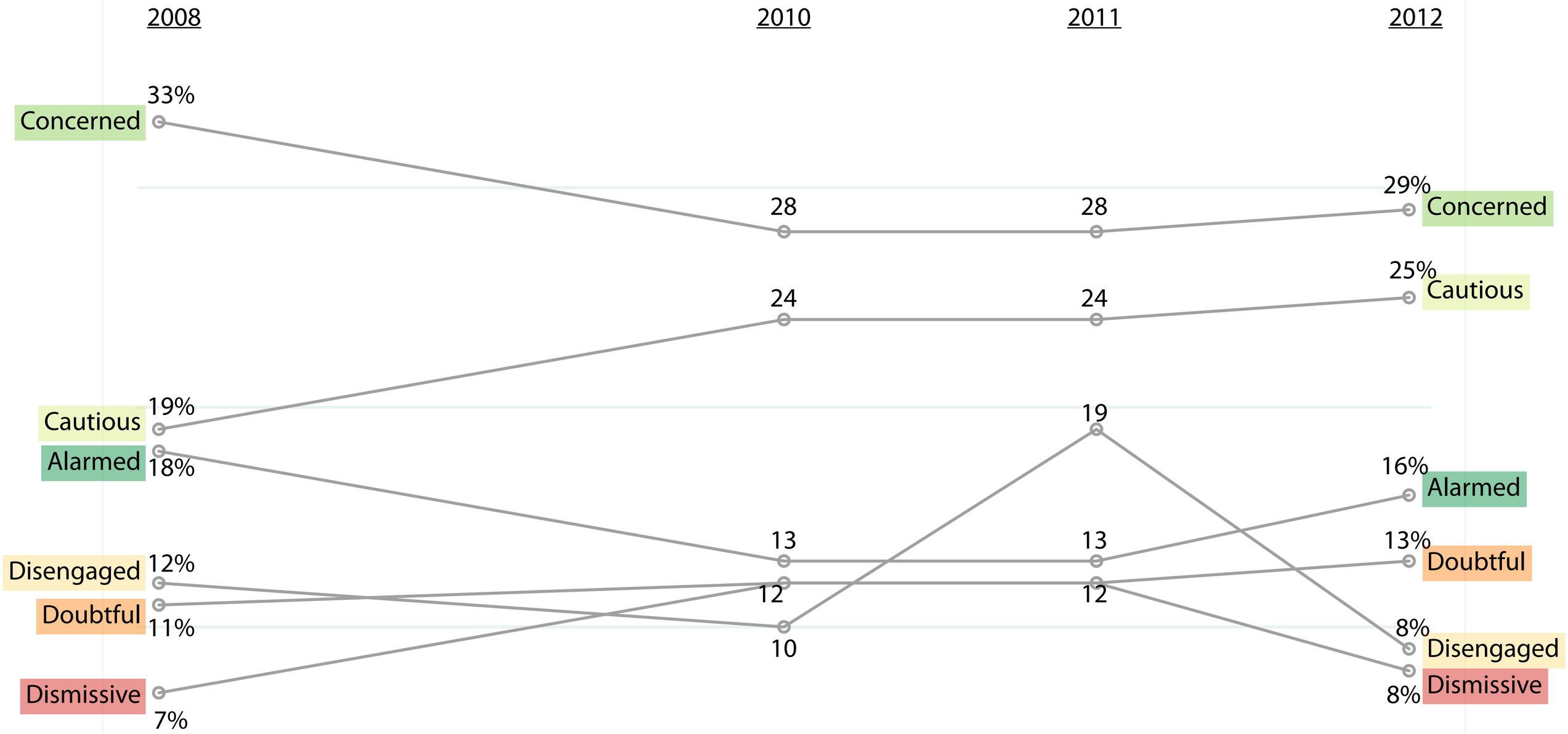
Questions so far?



http://people-press.org/report/528/

Why?

Illustration: Stephen Wilkes


2008
2010
2011
2012
33%
Concerned
28
28
29%
Concerned
24
24
25%
Cautious
Cautious
19%
19
Alarmed
18%
13
13
16%
Alarmed
Disengaged
12%
12
12
13%
Doubtful
Doubtful
11%
10
8%
Disengaged
Dismissive
7%
8%
Dismissive