



# Farmers' perceptions of climate change and their likely responses in Danish agriculture



Bryndís Arndal Woods<sup>a,c,\*</sup>, Helle Ørsted Nielsen<sup>b</sup>, Anders Branth Pedersen<sup>b</sup>, Dadi Kristofersson<sup>c</sup>

<sup>a</sup> NORD-STAR: the Nordic Center of Excellence for Strategic Adaptation Research

<sup>b</sup> Aarhus University, Frederiksborgvej 399, 4000 Roskilde, Denmark

<sup>c</sup> University of Iceland, Sæmundargata 2, 101 Reykjavík, Iceland

## ARTICLE INFO

### Keywords:

Climate change  
Adaptation  
Agriculture  
Farmers  
Experience  
Behavior

## ABSTRACT

Farmers are accustomed to coping with year-to-year changes in climate, but climate change is expected to accelerate the need and magnitude of farmers' adaptation (Wheeler and Tiffin, 2009). Based on a survey of farmers across Denmark (1053 responses), this paper assesses how farmers perceive climate change, weigh its attendant risks, and envision the barriers to adaptation as these factors stand to affect their likelihood to undertake adaptive action in the Global North. Descriptive statistics and an ordered probit model were used to disentangle the magnitude and direction of the cognitive factors underpinning farmers' likelihood to adapt. We also differentiate between adaptation to positive and negative potential impacts of climate change and provide important new insights on loss aversion and, more specifically, the conditions under which loss aversion may give way to a preference for gains. Our results indicate that Danish farmers are not terribly concerned about climate change impacts and perceive many barriers to adaptation, yet they indicate a moderate likelihood to undertake adaptive action in the future, particularly to potential opportunities from climate change impacts. However, we also find that the more concerned a farmer is about climate change, the more he is likely to adapt in response to negative climate impacts – the balance between loss aversion and gain preferences appears to depend on context. In either case, Danish farmers appear to prefer incremental and flexible adaptations in the face of uncertain future climate change impacts.

## 1. Introduction

The impacts of climate change have been studied extensively, and most indicate major impacts on agriculture (see e.g. Glantz et al., 2009; FAO, 2016). However, climate change is expected to affect agriculture very differently in different parts of the world (Parry et al., 1999; Glantz et al., 2009). In Europe, agricultural productivity is expected to increase in northern Europe and decrease in southern Europe as a result of climate change (Iglesias et al., 2012; Olesen et al., 2007). Productivity increases in northern Europe would result from the introduction of new crop species and varieties, higher crop production, the expansion of suitable cropping areas, and a longer growing season (Olesen and Bindi, 2002) (Olesen and Bindi, 2002). Situated in northern Europe, Denmark is therefore expected to experience increased opportunities as well as negative impacts from climate change in its agricultural sector. Decision making theory suggests that decision makers react differently to threats and opportunities (Kahnemann and Tversky, 1974; Kahneman, 2012; Patt and Zeckhauser, 2000); yet, the climate adaptation literature has largely ignored the fact that climate change impacts

may be both positive and negative by focusing by and large on “rural, resource-dependent communities of developing countries” where climate change impacts on agriculture are expected to be overwhelmingly negative (Wise et al., 2014; Mertz et al., 2009; Deressa et al., 2011; Tambo and Abdoulaye, 2012; Dang et al., 2014; Barnes and Toma, 2012). It is therefore important to conduct adaptation studies in different contexts where climate change will have different impacts.

Regardless of whether the impacts of climate change on Northern European agriculture are predominately beneficial or detrimental, the lion's share of adaptation will depend on autonomous adaptive action by farmers, which the Food and Agricultural Organization (FAO) of the United Nations defines as the “ongoing implementation of existing knowledge and technology by farmers themselves” in response to experienced or expected changes in climate (2007; Leclere et al., 2013). However, farmers' adaptive decisions are affected by more than just climatic factors; socioeconomic and market considerations are also important. In addition, decision makers are more likely to look for incremental changes when facing complex decisions (Lindblom, 1959). Previous studies of farmer decision-making, based on qualitative inter-

\* Corresponding author.

E-mail addresses: [bryndis.woods@gmail.com](mailto:bryndis.woods@gmail.com) (B.A. Woods), [hon@envs.au.dk](mailto:hon@envs.au.dk) (H.Ø. Nielsen), [abp@envs.au.dk](mailto:abp@envs.au.dk) (A.B. Pedersen), [dmk@hi.is](mailto:dmk@hi.is) (D. Kristofersson).

views, have found that farmers reduce risk by applying an incremental mode of decision-making, opting for smaller, gradual changes in the face of complex decisions (Öhlmér et al., 1998; Nielsen, 2009).

A growing body of work points to cognitive processes as being important factors in whether an individual is likely to undertake adaptive behavior; a trend to which this paper contributes. Previous work has demonstrated the importance of perceptions of concept of global climate change (e.g. Niles et al., 2013; Haden et al., 2012), climate risk perception (e.g. Palinkas and Szekely, 2008; Dang et al., 2014), and economic, institutional and technical barriers to adaptation (e.g. Grothmann and Patt, 2005) when considering farmers' likelihood to adapt. There are many differences in such perceptions from one place to another since perceptions are culturally and socially contextual, which necessitates evaluating these perceptions within a particular geographical context. While a belief in climate change and concern regarding its impacts serve to motivate adaptation, the presence of barriers to adaptation can limit the implementation of adaptation options in both the short and long-term. If farmers perceive barriers to adaptation, this can also affect their perceived adaptive capacity (Iglesias and Garrote, 2015; Grothmann and Patt, 2005). Adaptive capacity is defined by the Intergovernmental Panel on Climate Change (IPCC) as “the potential or capability of a system to adapt to (to alter to better suit) climatic stimuli or their effects or impacts” (2001). In other words, at the level of an individual farmer, an ability to implement adaptation measures requires both personal cognitive motivation as well as societal and systemic support (Darnhofer et al., 2010).

This paper presents a case study of climate adaptation among farmers in Denmark. Drawing on cognitive and behavioral theory we examine how perceptions of climate change, of climate risk, and of adaptation barriers affect farmers' likelihood to undertake climate change, and we explicitly distinguish between potential positive and negative effects of climate change. The study employs the results from the survey with 1053 respondents, representing farmers across Denmark. We ask what motivates farmers' autonomous adaptation, whether its drivers vary based on the expected direction of impact, and how the uncertainty associated with climate change impacts affects the scope of adaptation actions. To the best of our knowledge, we provide the first large-scale case study of this size that deals with farmers' climate change adaptation in the Global North. We find that perceptions of climate change, like a belief in global climate change and concern regarding its potential impacts, affect whether or not a farmer is likely to adapt in the future. Farmers indicate a higher likelihood to take advantage of opportunities presented by climate change than to protect against its dangers. However, farmers who are more concerned about climate change impacts are more likely to take action to prevent threats from climate change. This mixed pattern of findings contributes to a more complex understanding of the motivational mechanisms behind climate adaptation, specifically the relative powers of gains and losses, and demonstrates the importance of analyzing responses to positive and negative impacts from climate change in context. When it comes to the form that adaptive actions may take in the future, our results indicate that Danish farmers would rather make small, flexible adjustments to their farming system than larger, more permanent changes in the face of uncertain external pressures.

The paper is organized as follows: Section 2 presents our theoretical and conceptual framework; Section 3 provides a brief description of our research site and Section 4 outlines our methodological approach and data. The results are presented in Section 5 and discussed in Section 6. Finally, Section 7 presents concluding remarks, including potential policy implications and recommendations for further research.

## 2. Theoretical (Conceptual) framework

Early studies on the impacts of climate change on agriculture often assumed that farmers were either constrained to their current practices and therefore would not react to any future climate scenario, or that

farmers were fully rational and therefore would adapt to climate change immediately and effortlessly (e.g. Reilly et al., 2003; Mendelsohn et al., 1994). Schneider et al. (2000) suggested the notion of “realistic farmers” as an alternative, arguing that it is necessary to examine what drives farmers' decisions under real-life conditions rather than assuming no adaptation response whatsoever or a full adaptation response. Indeed, researchers are paying more attention to the range of factors and issues that motivate adaptive behaviors – a trend to which this paper contributes (Nainggolan et al., 2014).

In line with this realist trend, we draw on behavioral decision-making theory, much of which assumes that decision makers are boundedly rational, using simple decision heuristics instead of synoptic rational decision models (Simon, 1997; Kahneman and Tversky, 1974). This implies that we cannot analyze adaptive behavior solely based on objective conditions such as vulnerability or available resources, but must also understand the cognitive processes and perceptions that form behavior. Specifically, we borrow elements from Grothmann and Patt's Model of Private Proactive Adaptation to Climate Change (MPPACC), which holds that perceptions of risk and of one's own adaptive capacity are important determinants of adaptation action (2005). In order to be able to account for possible differences in decisions regarding negative and positive impacts from climate change, we add theories about loss aversion versus a preference for gains, including prospect theory, to this framework (Kahneman and Tversky, 1979).

The remainder of this section outlines the analytical framework we apply, detailing the explanatory factors considered in this study: climate change risk perception, belief in global climate change, perceived barriers to undertaking adaptive action (perceived adaptive capacity), and loss aversion versus preference for actions that lead to gains.

### 2.1. Climate change risk perception

Climate change represents significant uncertainty with regard to both the magnitude and the temporal/spatial trajectory of its effects on individual decision makers (e.g. Wise et al., 2014; Yousefpour and Hanewinkel, 2016; Ylhäisi et al., 2015). According to Grothmann and Patt (2005), studies of how people behave under conditions of uncertainty indicate that individuals systematically underestimate the likelihood of a hazard affecting them and that this can bring severe consequences. Cognitive studies of decision-making have demonstrated that a number of decision biases are activated when uncertainty is high, including being overly optimistic about one's own risk compared with others, or being overly influenced by salient memories (Grothmann and Patt, 2005; Simon, 1997; Patt and Zeckhauser, 2002; Tversky and Kahneman, 1974). Such biases may skew perceptions of risk, which is a key mechanism in motivating adaptive behavior. For instance, studies of flood insurance purchases have shown that people tend to ignore the risk associated with flooding when presented with a scenario of a low probability of flooding, even if the damages from flooding would be great (Kunreuther, 1978 in Simon, 1997: 285). Furthermore, decision makers exhibit a temporal bias whereby immediate risks are perceived as being greater than risks with long time horizons (OECD, 2012). And if people underestimate the risks associated with climate change they are less likely to take adaptive action.

### 2.2. Belief in global climate change

Past work has also demonstrated that belief in climate change as an actual phenomenon affects adaptive behavior. Thus, farmers' responses to climate policy, climate change impacts, and other issues are influenced by their perceptions about, as well as by their previous experiences with, climate change (see Niles et al., 2013; Haden et al., 2012; Blennow and Persson, 2009; Dang et al., 2014). However, even when individuals believe that global climate change is occurring, it does not necessarily translate into a high-risk appraisal at the local

Download English Version:

<https://daneshyari.com/en/article/6461127>

Download Persian Version:

<https://daneshyari.com/article/6461127>

[Daneshyari.com](https://daneshyari.com)