UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Examining the Impact of Regional Wildfires on Environmental Concern and Support for Carbon Tax

Empirical Findings from Sweden

Sofie Hedin Stenvall & Clara Lundberg

Supervisor: Johan Stennek
Master's thesis in Economics, 30 hec
Spring 2023
Graduate School, School of Business, Economics and Law,
University of Gothenburg, Sweden

Abstract

Climate-driven changes in the severity of wildfires are predicted as greenhouse gas concentrations increase. Exposure to local wildfires may represent a source of information for individuals as they evaluate their environmental concerns and support for carbon taxation. Using survey data including expressed environmental concern and support for carbon tax together with regional data on wildfires, we examine the association between regional wildfires, environmental concern, and support for carbon taxation. Examining the period of 2014-2020, we find that wildfires significantly increase the probability that a respondent states the environment as a societal issue. For support for carbon tax, no significant association is found for 2014-2020, but the results suggest wildfires to be positively associated with increased support for carbon tax in the period 2018-2020. The findings contribute to the literature evaluating environmental concern and support for carbon tax by combining spatially disaggregated data on regional wildfires and individual characteristics. Characterizing environmental concern and support for carbon tax is crucial since they affect the policymaking related to reducing carbon emissions.

Acknowledgement

We want to thank our supervisor, Johan Stennek, for his valuable input and constructive comments throughout the process. We would also like to express our gratitude towards Fredrik, Katarina, Jens, and Jessica for your generosity and helpful discussions. To all our student colleagues - it would not have been the same without you. And last but not least, we would like to thank each other for a good collaboration and a great time.

Contents

List of Figures

List of Tables

1 Introduction

The emissions of greenhouse gases have catastrophic consequences and immediate action is required to secure the safety and well-being of the human population (IPCC, 2022). The long time horizon of many effects of climate change poses a challenge for individuals to perceive them, leading to an underestimation of climate risk in the absence of observable climate change events (Pahl et al., 2014). The public's environmental concern and support for environmental policies are important for the success of environmental policies (Drews and Bergh, 2016). Limited public concern for the environment may result in significant economic consequences, particularly if it restricts support for public policies aimed at addressing market failures that contribute to excessive emissions (Sloggy et al., 2021). The contribution from emissions of greenhouse gases to extreme weather events such as severe wildfires will increase nonlinearly with further global warming (Fischer and Knutti, 2015). Severe wildfires are predicted to increase in frequency (De Rigo et al., 2018) and the connection between climate change and wildfires has in recent years been increasingly covered in the media (Berglez and Lidskog, 2019; Brimicombe, 2022; Hopke, 2020).

Although wildfires have historically been an innate part of the landscapes in Sweden and contribute to biodiversity (Sjöström and Granström, 2020), with climate change the area burned (Khabarov et al., 2016) and frequency of wildfires in Europe are expected to increase (Fernandez-Anez et al., 2021). In Sweden, recent examples of severe wildfires include the 2014 wildfire in Västmanland, whose level of intensity and spread were beyond any previously observed wildfire, and the 2018 year's extensive wildfires, which paralyzed large parts of society (Sjöström and Granström, 2020). Approximated costs from the 2014 wildfire were at least 1 billion SEK, including costs of fire extinction, loss of timber and damaged infrastructure and property (County Administrative Board Västmanland, 2014). The 2014 wildfire has impacted news coverage, with Swedish media increasingly connecting wildfires to climate change in the period after 2014 (Berglez and Lidskog, 2019).

We examine if exposure to regional wildfires increases environmental concern and support for a carbon tax on petrol in Sweden by using linear probability models. Specifically, we investigate if the share of regional area burned in wildfires increases the

probability of an individual expressing environmental concern. Moreover, we examine if the share of wildfires increases the probability of an individual expressing support for a carbon tax on petrol. Carbon taxation is a popular instrument among economists because of its relative cost-effectiveness in reducing emissions (Zhang et al., 2016) and is commonly used to measure support for environmental policies (Drews and Bergh, 2016). Our analysis allows us to investigate if wildfires have an additional impact on support that is not mediated through environmental concern.

Previous studies have found inconsistent impacts from wildfires and other extreme weather events on environmental concern and support for environmental policies (Howe et al., 2019; Sisco, 2021). Hoffmann et al. (2022) find some effects of wildfires on environmental concern and voting behavior in Europe. No research has, to our knowledge, investigated the impact of wildfires at the disaggregated level of regions (län) in Sweden. This thesis uses Swedish regional data on wildfires combined with national survey data. Our research design therefore captures the effect of geographic proximity to wildfires when respondents evaluate their environmental concern and support for carbon tax. Other factors found to explain environmental concern and support for carbon tax in the literature are socioeconomic and demographic factors, media coverage and personal impact (e.g., Harring, Jagers, and Martinsson, 2011; Ewald, Sterner, and Sterner, 2022; Hammar, Jagers, and Nordblom, 2008). This thesis contributes to the literature on climate change experiences, by utilizing data that allow us to capture regional experiences while also including individual characteristics. We further contribute to the literature by examining the relationship between media consumption and experiences of regional wildfires.

Whether or not wildfires influence environmental concern and support for carbon tax in Sweden remains an open question with important implications for the societal response to climate change. A positive relationship between wildfires and environmental concern is of relevance for policymakers who aim to address public concerns. Of particular interest to policymakers is the potential impact of heightened environmental concern on behavioral changes and, in our study, the support for policy in the case of increased carbon tax. Wildfire-induced increases in support could indicate favorable conditions and a potential window of opportunity for policy implementation with public support.

The thesis is structured as follows. In the next section, we provide background information on extreme weather events such as wildfires and their relationship to public concern and support for environmental policies. In section 3 we present the theoretical framework and in section 4 our data. In section 5 we discuss our identification strategy and empirical specification. The results are presented in section 6. At last, the results are discussed in section 7 and section 8 concludes this thesis.

2 Literature review

In the following literature review, we describe how extreme weather events are related to environmental concern and attitudes toward environmental policies and in particular carbon taxation. Other important aspects such as political ideology, demographic variables, socioeconomic factors and media coverage will be presented.

2.1 Extreme weather events' impact on environmental concern and policy attitudes

The notability of extreme weather events and their large impacts on society have led to much research on their effects on environmental concern, risk perception, beliefs and climate adaptation/mitigation policies (Hornsey et al., 2016; Howe et al., 2019). Several studies have found significant effects of exposure to extreme weather events on concern (e.g. Konisky, Hughes, and Kaylor, 2016; Owen et al., 2012; Sloggy et al., 2021) and political or policy support (e.g., Hazlett and Mildenberger, 2020; Ray et al., 2017; Rudman, McLean, and Bunzl, 2013; Sloggy et al., 2021) in the USA. It has been shown that more recent, frequent and severe extreme weather events increase the size of the effect, although factors such as ideology and educational level are found to be more important in explaining climate change opinions and support for climate policies (Konisky, Hughes, and Kaylor, 2016). With regard to environmental policies, research shows that extreme weather events can heighten people's attention towards climate change. It can therefore be favorable for policy makers to implement climate policies right after such an event (Sisco, Bosetti, and Weber, 2017). In the case of wildfires, there are mixed results regarding their effect on environmental concern, opinion and policy support (Sisco, 2021). Some significant results have been found by Hazlett and

Mildenberger (2020) in the USA, where exposure to wildfires influences political voting behavior. Positive associations between personal experience of wildfires and support for carbon tax has also been found by Wong-Parodi and Rubin (2022), although the extent to which an individual connects the wildfire to climate change has been shown to be of importance for the association.

The relationship between exposure to extreme weather events and climate concern and political attitudes has also been studied in Europe (e.g., Demski et al., 2017; Kalatzi Pantera, Böhmelt, and Bakaki, 2022; Hoffmann et al., 2022). Personal experience of flooding is found to increase the salience of climate change and support for policies such as increased environmental taxes (Demski et al., 2017). Similarly, Lujala and Lein (2020) find that personal experience of changes in nature leads to higher levels of concern, as well as more positive attitudes towards pro-environmental adaptations in Norway.

Important psychological aspects that moderate the effects of extreme weather events on climate attitudes and behaviors are motivated reasoning and attribution of events, which describe how past beliefs bias the processing of information and how individuals attribute the cause of an event to climate change (Sisco, 2021). Another aspect of wildfires is proximity, where research has found proximity to be of importance when investigating the effect of Californian wildfires on political behavior (Hazlett and Mildenberger, 2019). However, in a German context, Gärtner and Schoen (2021) find no effect of extreme weather exposure on changes in individual's climate change awareness and policy preferences despite that their research design allows for a close geographic pairing. Simultaneously, investigating the relationship on a more aggregated, transnational level, Kalatzi Pantera, Böhmelt, and Bakaki (2022) find that the public's environmental opinion in Europe is affected by natural disasters even when these disasters take place beyond a country's border.

Given the literature's inconsistent findings regarding the relationship between experiences of extreme weather events, environmental concern and support for environmental policies with regard to the type of extreme weather, geographical setting, timing and aggregation level, there is a discernible research gap to be addressed. Therefore, investigating these relationships in a Swedish context contributes valuable insights to the existing literature. The only previous study, to these authors' knowledge,

that has included wildfires when investigating environmental concern and political attitudes in Sweden have done this dividing Sweden into eight zones (Hoffmann et al., 2022). Hoffmann et al. (2022) study trends in environmental concern and voting behavior in 28 European countries. Compared to the study by Hoffmann et al. (2022) this study uses a more detailed division of Sweden to connect individuals to regional wildfires. Also, this study includes individual drivers of environmental concern and support for carbon tax.

2.2 Political ideology, demographic variables and socioeconomic factors

Political ideology, demographic variables and socioeconomic factors have been shown to affect environmental concern and support for carbon taxation. There are large differences in climate change concerns depending on partisan affiliation in the USA (e.g., Dunlap and McCright, 2008; Hazlett and Mildenberger, 2020). Left-leaning citizens have been found to show stronger support for environmental taxes globally (Neumayer, 2004) and increased climate change beliefs as well as higher support for climate policies in Europe (McCright, Dunlap, and Marquart-Pyatt, 2016). Harring and Sohlberg (2017) have found that in Sweden, left-leaning individuals are found to express higher support for a pro-environmental society.

Similarly, Ewald, Sterner, and Sterner (2022) find left-leaning individuals to be more supportive of carbon tax on petrol. They also find that trust in government, perceived fairness and the 'Pigouvian mechanism' (i.e. the belief that the tax is desirably changing behavior) are important for the size of the effect. Climate change concern has also been found to determine support for carbon tax (Fairbrother, Sevä, and Kulin, 2019; Levi, 2021; Wong-Parodi and Rubin, 2022).

Further, in cross-country comparisons, economic development has been proven to be a driver of environmental concern, with higher GDP per capita being associated with a higher level of environmental concern (Duijndam and Beukering, 2021; Franzen and Vogl, 2013). Individual economic conditions have mixed impacts from the literature. Franzen and Vogl (2013) find personal income to be positively associated with environmental concern utilizing a global sample of 33 countries, including Sweden. Higher income has

been found to increase the probability of support for carbon tax, examining European countries, including Sweden (Fairbrother, Sevä, and Kulin, 2019; Levi, 2021). It has also been found, solely investigating Sweden, that neither environmental concern (Harring, Jagers, and Martinsson, 2011) nor climate change opinion and support for carbon tax are significantly affected by income levels (Ewald, Sterner, and Sterner, 2022). Unemployment has been shown to have a negative effect on environmental concern both measured as the national rate and individual employment status (Conroy and Emerson, 2014; Duijndam and Beukering, 2021).

Higher education level is associated with higher environmental concern and support for environmental policies (Klineberg, McKeever, and Rothenbach, 1998; Shao et al., 2014; Franzen and Vogl, 2013), including carbon tax (Ewald, Sterner, and Sterner, 2022; Hammar and Jagers, 2006). The argument behind this relationship is education's impact on the individual's values and analytical skills which are important to understand environmental and climate issues (Dunlap and McCright, 2008).

Some studies find gender to be a determinant of environmental concern, where females are theorized to be raised to show greater concern for the biosphere (Stern, Dietz, and Kalof, 1993; McCright and Xiao, 2014; Olofsson and Öhman, 2006). Others find no significant relationship of gender (Duijndam and Beukering, 2021). Gender is also commonly controlled for when examining support for carbon tax (Fairbrother, Sevä, and Kulin, 2019; Levi, 2021; Wong-Parodi and Rubin, 2022). Being a male is found to be negatively associated with support for carbon tax (Fairbrother, Sevä, and Kulin, 2019; Levi, 2021). Additionally, age has by some been found to have a negative effect on environmental concern with younger individuals being more supportive of environmental policies (Klineberg, McKeever, and Rothenbach, 1998; Olofsson and Öhman, 2006; Franzen and Vogl, 2013; Zanocco et al., 2019). Others have found no significant relationship from age (Casey and Scott, 2006; Gray et al., 2019). Investigating support for carbon tax in Sweden, the effect of age was found to be negative and statistically significant (Hammar and Jagers, 2006).

Finally, the area of residence is relevant when examining environmental concern and support for carbon tax. The effect of living in an urban area has been found to be both positive (Duijndam and Beukering, 2021; Conroy and Emerson, 2014), and in the

case of environmental concern, non-existent (Olofsson and Öhman, 2006). With regards to carbon tax, living in the countryside could reasonably be argued to correlate with less public transport, greater car dependence and subsequently greater personal impact of a carbon tax on petrol, resulting in a negative impact on support for carbon tax. This is supported by findings investigating Swedish attitudes (Ewald, Sterner, and Sterner, 2022).

2.3 Media

Media representations are important to help people interpret and understand the complexities of climate change (Boykoff, 2011, p.2). Media attention is argued to moderate the effects of extreme weather experiences on climate attitudes and behaviors (Sisco, 2021). The media consumed affects the understanding of causes, consequences and solutions to climate change (Stamm, Clark, and Eblacas, 2000). In the case of wildfires, it has been shown that indirect exposure has affected climate change risk perception. This suggests that media and interpersonal conversations matter (Lacroix, Gifford, and Rush, 2020). The importance of indirect exposure to wildfires could potentially be increasingly important in Sweden as the media coverage of foreign wildfires to a larger extent relates wildfires to climate change after the 2014 wildfire in Västmanland (Berglez and Lidskog, 2019).

The pattern of increased media coverage has also been highlighted by Brimicombe (2022) who state that the number of articles relating wildfires to climate change in English-language news articles increased sixfold between the years 2017 and 2021. In a Swedish context this can be compared to the report published by the environmental non-governmental organization Vi-skogen, where they disclose that the number of Swedish news articles covering climate news increased by 38 percent in 2018 compared to the previous year (Retriever, 2021). The increase from 61,121 articles in 2017 to 84,647 articles in 2018 on environmental issues coincides with the widespread wildfires of 2018. This can be compared to the 41,875 articles published in 2014. The increase in coverage suggests that media in recent years could increasingly help citizens connect wildfires to climate change issues, although evidence for this in the Swedish context is yet to be confirmed.

In general, media coverage of environmental issues has been found to have a

positive relationship with the Swedish public's environmental concern (Harring, Jagers, and Martinsson, 2011). The authors find that different levels of political interest influence the effect of media coverage and hypothesize that this is due to political interest affecting the intake of media. Increased newspaper consumption has been found to decrease environmental concern (Udalov and Welfens, 2021). At the same time, high environmental concern is associated with more information seeking and higher media consumption (Metag, Füchslin, and Schäfer, 2017). Further, social media has been found by Diehl et al. (2021) to have a positive effect on climate change beliefs, although the effect is dependent upon political ideology. Individuals can be selective in their media consumption and this is of particular concern with social media usage as filter bubbles result in less exposure to counter-attitudinal information (Diehl et al., 2021).

An individual's receptiveness to information about climate change might improve with locality (Scannell and Gifford, 2013, p.76). Personal relevance has been proven important, e.g. local pollution increasing people's engagement in environmental issues (Blake, 2001). However, the impact of local media is not clear, with some results arguing limited effect of the regional news' agenda-setting with regard to environmental issues (Gooch, 1996). Considering all of the above, the relationship between media consumption, environmental concern and support for carbon tax remains an interesting issue to investigate further. By examining individual media consumption in relation to wildfires we contribute to the existing literature on media's role in moderating the individual's understanding of environmental issues.

3 Theoretical framework and hypotheses

In the following section, we theoretically relate wildfires to environmental concern and support for carbon tax. First, to explain how wildfires may affect support for carbon tax, we introduce an economic model with a utility maximization problem. The theory explains how people's preferred carbon tax level is related to environmental concern. Next, we describe psychological theory explaining why experiences of wildfires may increase environmental concern and support for carbon tax.

3.1 The relationship between environmental concern and support for carbon tax

The carbon tax level preferred by an individual can be illustrated by a utility maximization problem, which here is based on the theory presented by Hammar, Jagers, and Nordblom (2008). Environmental concern enters the individual's utility function as increased disutility from environmental externalities[1]. We assume that an individual's utility, U, is determined by the total consumption of private goods and services $\boldsymbol{C}$, public sector goods and services G and externalities $\boldsymbol{X}$ from consumption. The individual utility function is given by:

$$U = U(\boldsymbol{C}, G, \boldsymbol{X}) \tag{3.1}$$

where the budget constraints are given by:

$$\sum_{k=1}^{K} c_k(1+\tau_k) = \sum_{n=1}^{n} Y_i(1-\tau_i), \qquad G = q\left[\sum_{i=1}^{n}\tau_i \sum_{h=1}^{H} Y_{ih} + \sum_{k=1}^{K}\tau_k \sum_{h=1}^{H} c_{kh}\right]$$

and the externalities $\boldsymbol{X}$ are given by:

$$\mathbf{X} = \sum_{k=1}^{K} \gamma_k \left(\sum_{h=1}^{H} c_{kh}\right)$$

The model includes N different types of income[2], denoted as Y_i, with each being subject to a specific tax rate τ_i. The K different consumption goods, denoted as c_k, also face different tax rates, τ_k. In the economy, there are H taxpayers. The government uses the tax revenues to finance the public sector, G. Governmental quality is denoted by q[3]. The externality, $\boldsymbol{X}$, is negative, directly proportional to the total consumption and modeled as a linear function. The marginal damage caused by c_k is measured by γ_k, where $\gamma_k \geq 0$. For example, car driving is associated with marginal damage γ due to carbon emissions and thereby disutility U'_x. Certain commodity taxes, e.g., carbon tax on petrol, aims at preventing unwanted behavior by intending to decrease the consumption of the good that gives rise to negative externalities.

[1] Where externalities are external effects from consumption goods such as car driving giving rise to carbon emissions.

[2] Income is assumed to be exogenous.

[3] Where $0 < q \leq 1$ and a high q indicates that the government is efficient in turning tax revenue into public goods

The individual's preferences over taxes, maximizing the utility with regard to the optimal commodity tax τ_k, becomes:

$$\frac{\partial U}{\partial \tau_k} = \underbrace{U'_{c_k}\frac{\partial c_k}{\partial \tau_k} + \sum_{l \neq k} U'_{c_l}\frac{\partial c_l}{\partial \tau_k}}_{\text{Total change in U due to change in } \boldsymbol{C}} - \underbrace{U'_G q\left[\sum_h c_{kh} + \tau_k \sum_h \frac{\partial c_{kh}}{\partial \tau_k} + \sum_{l \neq k} \tau_l \sum_h \frac{\partial c_{lh}}{\partial \tau_k}\right]}_{\text{Change in U due to change in G}}$$

$$+ \underbrace{U'_x \gamma_k \sum_h \frac{\partial c_{kh}}{\partial \tau_k}}_{\text{Increased U due to decreased } \boldsymbol{X}} \qquad (3.2)$$

In the case that the consumption c_k gives rise to negative externalities, the individual prefers a higher tax rate. How high this preferred tax rate is depends on the individual's marginal disutility U'_x caused by the externality. Meaning, a person who is more environmentally concerned, should be more supportive of a higher carbon tax compared to a person who is less environmentally concerned. It is the last term in equation 3.1 that captures this, where the increased τ_k increases utility through reduced externalities. The first term show that if the individual consumption of a specific good is large and yields high marginal utility, then the individual will prefer a lower tax rate. In the case of carbon tax this means that a car driver has higher disutility from a tax increase. The total change in utility from a change in consumption is decided by the first two terms, where the second considers changes in consumption c_l due to changes in τ_k. Finally, the third term shows that the tax affects utility through its effect on the tax base and utility of public goods.

The focus of this thesis is on the last term and how changes in disutility from externalities affect support for carbon tax. If wildfires increase the disutility from externalities, larger exposure to wildfires should also lead to a larger support for carbon tax.

3.2 Why wildfires may raise environmental concern and support for carbon tax

There are three channels assumed in the literature through which experiences of extreme weather events impact environmental concern and climate attitudes: decreased

psychological distance, affect activation and increased issue salience (Sisco, 2021).

First, exposure to extreme weather events can make the impacts and related threats seem more temporally close and certain (McDonald, Chai, and Newell, 2015; Spence, Poortinga, and Pidgeon, 2012). In theoretical work, this is expressed as a reduction in psychological distance, which is composed of temporal distance, spatial distance, social distance, and the certainty of an event occurring. An event of low psychological distance could happen in the present, geographically close, affect people that are socially close to the individual and be certain (Trope and Liberman, 2010). In our case, the psychological distance could be lower if a wildfire occurred in an individual's own region compared to it occurring in another part of the country. This could be due to the fact that it is geographically close, but also socially if the individual identifies itself with other citizens in the region. Trope and Liberman (2010) explain how these distance dimensions are also cognitively associated so that a change in a specific distance dimension can affect the perceived distance of an event in the other dimensions. A geographically close wildfire could thus remove some of the uncertainty of an event occurring and hence make the psychological distance smaller.

The second channel, affect activation, is the process through which experiences of extreme weather events can evoke emotional responses (Sisco, 2021). Weber (2006) describes how these emotional responses, together with analytical reasoning, are important for an individual's perception of risk. Without sufficiently serious and noticeable events, it is argued that the risks of climate change are underestimated. This is because more emphasis is placed on the perceived likelihood than on the analytically demanding statistical description of climate change. As such, the affect activation plays a part in the perceived probability, which by Tversky and Kahneman (1973) is also explained by how easy it is for an individual to imagine and recall events. Frequent events are more readily used when estimating the probability of such an event occurring.

This leads us to the third channel through which extreme weather events influence environmental concern: issue salience. Issue salience is the channel whereby a specific issue, such as climate change, is increasingly prominent in the mind of the public. The salience of an issue is explained in part by media coverage and in part by self-interest (Lavine et al., 1996). The salience might increase with extreme weather

events and this might in turn increase environmental concern and climate attitudes (Sisco, 2021). In our case, the extreme weather event of wildfires could through both media coverage and perceived personal impact increase the salience of environmental issues as important.

Finally, as established above in section 3.1, in the case of support for carbon tax environmental concern might affect the support. At the same time, there might be some direct effects on support from the psychological drivers described in this section which are not mediated through environmental concern. Support for environmental policies is affected by how serious an individual believes the environmental problem in question to be (Clayton et al., 2015). In our case, this could be related to wildfires decreasing the psychological distance and hence affecting the perceived seriousness of climate change. Also, issue salience could potentially be a channel through which wildfires affect support for carbon tax without being mediated through environmental concern. Weaver (1991) suggests that increased salience of an issue (in his case, the federal budget deficit) has a positive relationship to increased knowledge about the issue and potential solutions, together with a higher likelihood of expressing an opinion about it. This is interesting as, as we have described in the literature review, the issue of wildfires is increasingly connected to climate change as a cause in the media.

3.3 Hypotheses

Based on the presented literature and theoretical framework, this thesis will test the following hypotheses regarding the relationship between regional wildfires and the probability of respondents expressing environmental concern or support for carbon tax:

Hypothesis 1: *The probability of an individual expressing environmental concern increases with higher exposure to regional wildfires.*

Hypothesis 2: *The probability of an individual expressing support for carbon tax on petrol increases with higher exposure to regional wildfires.*

4 Data

This thesis uses yearly survey data from the SOM (Society, Opinion and Media) Institute, which since 1986 has asked questions to a nationally representative sample. The selection of respondents to the SOM Institute survey is made based on public registers and includes all 21 Swedish regions. Two regions, Kalmar and Gotland, are excluded from our analyses as they are merged by the SOM Institute, hindering proper matching with the regionally coded independent variables[4]. This leaves us with 19 regions. The period investigated is 2014-2020, which captures the years with the largest amount of area burnt.

The individual data from the SOM Institute surveys are combined with data on wildfires from the Swedish Civil Contingencies Agency (MSB), as well as data on dry spells and heat waves, collected from the Swedish Meteorological and Hydrological Institute (SMHI). The representativeness of our final samples compared to the national population is examined in Table 8.1 in Appendix. The comparison is made using data from Statistic Sweden (SCB) on gender, age, education, and regional population density.[5]

4.1 Dependent variables

To test the first hypothesis we use environmental concern as our first dependent variable. Environmental concern is measured using the following open-ended question from the SOM Institute survey: ´Which issue(s) or problem(s) do you feel are the most important in Sweden today?´. The respondent is free to state any issue and can state up to three problems. The dependent variable is binary, coded as 1 if the respondent mentions the environment as an issue and 0 otherwise. Naturally, there might still be individuals that are environmentally concerned without stating it as one of three societal issues. There are alternative measures of environmental concern such as questions where the respondent directly states their level of worry. By using the stated environmental concern however, we avoid the issue of individuals overstating their environmental concern when asked about it directly and specifically (Harring, Jagers, and Martinsson, 2011).

[4]As it is not possible for us to know which region a respondent belongs to, and as the regions are different in several ways, including them could give misleading results. For example, the effect of dry spells in one region would not affect the respondents in the other region.

[5]Our samples are representative with regards to gender and regional population density but slightly under-representative of younger people and people of low education.

To test our second hypothesis we use support for carbon tax as our second dependent variable. It is measured as the opinion on the political proposal ´Increase the CO2 tax on petrol´. The survey variable is ordinal and ranges from '1' very bad proposal to '5' very good proposal. For our analysis, the variable is made binary, where the variable takes the value 1 if the respondent supports the proposal and thereby considers it to be '5' very good or '4' rather good, and 0 otherwise. This categorization is in line with the one made by Hammar and Jagers (2006) and is preferred as we are interested in support and not the different levels of support. Henceforth, we use 'support for carbon tax' to denote a respondent expressing support for an increased CO2 tax on petrol.

4.2 Independent variables

Table 4.1 describes all variables used, including their codings and sources. In the analyses of our dependent variables 'environmental concern' and 'support for carbon tax'

Table 4.1: Description of data

Variable	Description and coding	Source
Dependent variable		
Environmental concern	Dummy variable, ´1´ if the respondent mentions the environment as a societal problem, ´0´ otherwise	SOM Institute (2021)
Support of carbon tax	Dummy variable, ´1´ if the respondent thinks the proposal to increase the CO2 tax on petrol is very or rather good, ´0´ otherwise	SOM Institute (2021)
Independent variables		
Share of wildfires	Share of the regional land areas being burned in wildfires in percent	MSB (2022), SCB (2022)
Control variables		
Dry spell	Seasonal deviation in consecutive days with <1 mm of precipitation from historic mean*	SMHI (n.d.)
Heatwave	Yearly deviation in consecutive days with temperatures >25℃ from historic mean*	SMHI (n.d.)
Ideology	Subjective placement on an ideological left-right scale, from (1) left to (5) right	SOM Institute (2021)
Education	Educational attainment, ´1´ elementary school or less, ´2´ secondary school, ´3´ university or equivalent	SOM Institute (2021)
Age	Age of respondent in years (16-85)	SOM Institute (2021)
Gender	Gender of the respondent, ´1´ female ´2´ male ´3´other	SOM Institute (2021)
Unemployment status	Unemployment status of the respondent, ´1´ unemployed ´0´ employed	SOM Institute (2021)
Household income	Gross household income in scale from (1) very low to (5) very high	SOM Institute (2021)
Residual area (rural-urban)	Current residual area, ´1´ rural area, ´2´ village, ´3´ city/town, ´4´ urban city (Stockholm, Gothenburg, Malmö)	SOM Institute (2021)
Driver	Dummy variable, ´1´ if the respondent drives a car at least once a week, ´0´ otherwise	SOM Institute (2021)
Robustness variables		
High national media consumption	Dummy variable ´1´ if respondent consumes national media every day, ´0´ otherwise	SOM Institute (2021)
High regional media consumption	Dummy variable ´1´ if respondent consumes national media every day, ´0´ otherwise	SOM Institute (2021)

*Compared to the period 1971-2000. 2019-2020 are not observed but modeled by SMHI using the RCP4.5 scenario.

some control variables are included in both specifications, while some differ. Apart from our variable of interest, we divide the control variables into climatic variables and demographic and socioeconomic variables. Descriptive statistics of the included variables for each dependent variable are found in Table 4.2

4.2.1 Variable of interest

The explanatory variable of interest to explain environmental concern and support for carbon tax is 'share of wildfires'. The data on wildfires in Swedish regions are collected from the Swedish Civil Contingency Agency (MSB) for the years 1998-2021[6].

In Figure 4.1 some descriptive statistics are presented illustrating the national quantity and frequency (measured as regions experiencing wildfires larger than 100 hectares) of wildfires for the historic period, 1998-2021. Our chosen period 2014-2020 captures the years with the maximum amount of area burned. The period 2018-2020 is of extra interest as many regions are affected and the area burned is large.

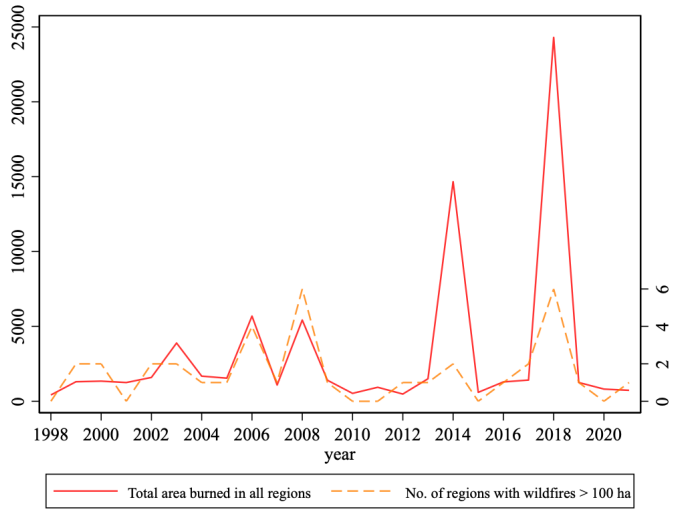
The geographical wildfire spread is illustrated in Figure 4.2. To the left, the population density is illustrated. The spread of wildfires is illustrated divided into wildfires larger than 1 hectare (in the middle) or larger than 100 hectares (to the right). The figure illustrates that the majority of the large wildfires are located in more scarcely populated areas.

We measure the occurrence of wildfires as the regional share of area burned by wildfires to control for differences in size between regions. Wildfires are measured on a regional level as this is the geospatial level on which the respondents in the SOM Institute survey are coded. The minimum value burned in a specific year is 0.000 percent of the regional area, while the maximum value is 1.876 percent area burned. The maximum level was burned in Västmanland in 2014.

A limitation of the data is that we cannot control for how the prior level

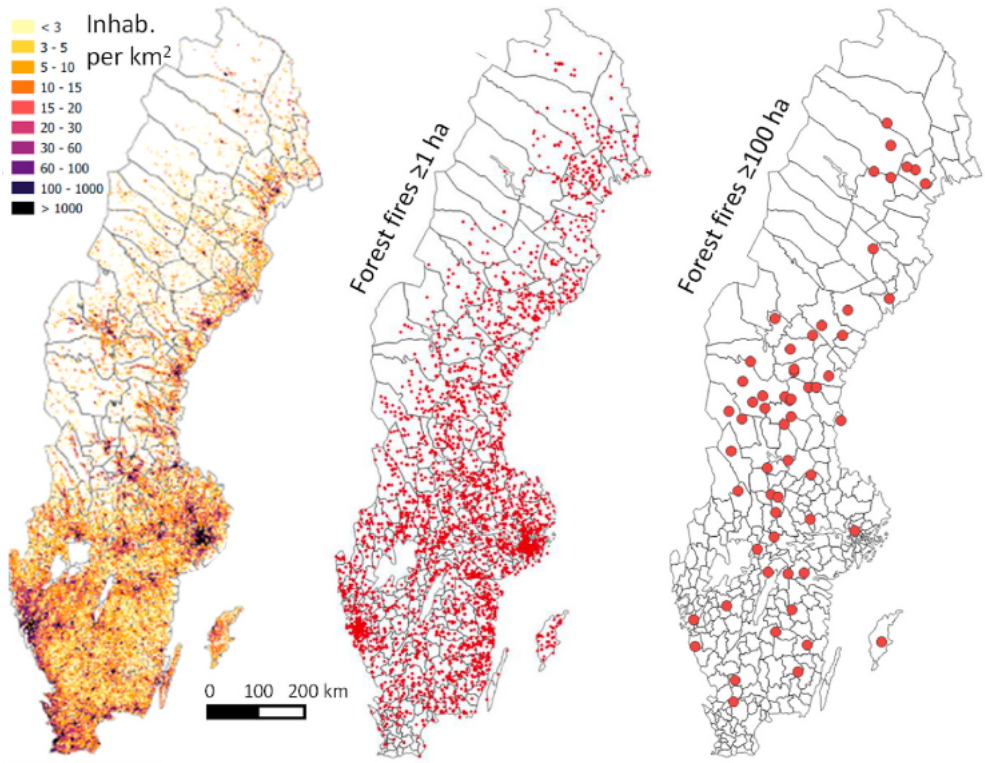
[6]The data from MSB have 13 missing, or partly missing, values out of 2030 for the years 2014-2020 (MSB, n.d.). This could lead to an underestimation of the regional area burnt. Out of the 12 affected municipalities, 10 municipalities are located in the Stockholm region. These 10 have around 50 percent missing information for the second half of 2014. The two remaining municipalities are located in the region of Västerbotten and have missing information for 2016 and 2016-2017 respectively. For the region in total, this leaves 3 missing observations out of 105. Given our relatively large sample size and the relatively small area affected by missing data, we do not expect these missing values to pose a major problem in our estimations.

Figure 4.1: Trends in wildfires, total area burned, and number of regions affected by wildfires larger than 100 hectares



The figure illustrates national levels of area burned in hectares and the number of regions affected by wildfires larger than 100 hectares. The years 2014 and 2018 are outliers regarding the area burned.

Figure 4.2: Population density in squares of 5 km and spread of wildfires



(Left) Population density, (middle) Occurrence of wildfires larger than 1 hectare 1996-2020 and (right) Occurrence of wildfires larger than 100 hectares 1996-2020. Source: Sjöström and Granström (2023).

of environmental concern, beliefs, or worldview impact the interpretation (and hence effect) of wildfires. As previously mentioned in the literature, motivated reasoning and subject attribution affect the interpretation of events. One way to capture the affected interpretation could have been to investigate if the effect of wildfires on support for carbon tax differs depending on the stated environmental concern of the respondent. However, the cross-sectional nature of the data only gives us the stated environmental concern a posteriori the experienced wildfires. We are therefore unable to isolate any effect of the prior level of environmental concern as the experience of wildfires might have increased the environmental concern. The interpretation of climate conditions, presented next, could potentially be affected in the same way.

4.2.2 Climatic variables

The variable 'dry spell' is recorded as the calculated change of the longest seasonal (June-August) dry period (i.e. consecutive days of less than 1 mm precipitation) compared to the reference period. Values for 2014-2018 are observed while the values for 2019-2020 are modeled by SMHI using the RCP4.5 scenario[7]. The minimum value is negative 8.1 days and the maximum value is positive 11.6 days. The variable 'heat wave' is measured as the calculated change of the longest heat wave in days compared to the reference period 1971-2000. The minimum value is negative 10.1 days and the maximum value is positive 42.3 days. Including these climatic conditions are in line with the research by Hoffmann et al. (2022), although our data allow us to investigate this on a more disaggregated level of 19 instead of 8 regions[8].

A limitation of the data on wildfires and climatic conditions is that the geospatial aggregation does not allow us to control for whether the exposure is direct (through property damage, evacuation, or sensory exposure) or indirect (through media exposure or interpersonal communication). Optimally, we would have liked to investigate this on a more disaggregated level, but we believe that our analysis still is informative as people may experience unusual local weather variability vicariously through local news or a personal conversation instead of personally (Gärtner and Schoen, 2021).

[7]Representative Concentration Pathway 4.5 is described as the intermediate scenario where emissions in the scenario are expected to peak in 2040 and the temperature rise is expected to be 2.5°C-3°C in 2100 (IPCC, 2022).

[8]In this thesis temperature anomalies are excluded due to the high correlation (0.94) with heat wave.

4.2.3 Demographic and socioeconomic variables

The individual demographic and socioeconomic variables are collected from the SOM Institute survey. We chose to control for ideology (left-right), level of education, age, gender[9], unemployment status (only for environmental concern), household income and location of residence as these may also explain environmental concern and support for carbon tax (Harring and Sohlberg, 2017; Lewis, Palm, and Feng, 2019; Franzen and Vogl, 2013; Duijndam and Beukering, 2021). The five categories for yearly gross household income are: very low (100,000-200,000 SEK), low (201,000-300,000 SEK), medium (301,000-500,000 SEK), high (501,000-700,000 SEK), and very high (701,000 or more).

In the analysis of our second dependent variable 'support for carbon tax', we include a binary control variable for car driving which takes on the value 1 if the respondent has driven a car weekly during the last 12 months or 0 otherwise. This is included as it captures the association between personal impact and support (Hammar, Jagers, and Nordblom, 2008) and is in line with previous research (Ewald, Sterner, and Sterner, 2022; Hammar and Jagers, 2006). A limitation of our data is that we cannot control for certain important aspects included in the literature, such as trust in government, which is important for support for carbon tax. This is a limitation of our research.

4.3 Descriptive statistics

In Table 4.2 we present descriptive statistics for our two samples (for the dependent variable 'environmental concern' and the dependent variable 'support for carbon tax') together with the independent variable of interest and control variables.

Our final samples for the period 2014–2020 contain 24,878 and 7,466 observations respectively. The reason the sample size for support for carbon tax is significantly smaller is that the respondents receive questionnaires that have some variance in the questions included. Therefore not all answer the question on support for carbon tax [10].

[9] In our analysis only the coefficient for males (compared to females) is commented upon as the number of respondents defining themselves as 'other' are too few to be representative (75 and 39 respectively out of 24,878 and 7,466 respondents) to draw any conclusions.

[10] To not lose variation in the data we choose to keep the larger sample for environmental concern.

Table 4.2: Summary statistics, used in estimations

	Environmental concern		Support for carbon tax	
VARIABLES	Mean	St.Dev.	Mean	St.Dev.
Environmental concern	0.168	0.381	0.171	0.376
Support for carbon tax			0.310	0.462
Share of wildfires	0.010	0.100	0.014	0.125
Dry spell	0.393	3.887	0.652	4.130
Heat wave	6.760	13.435	5.468	14.805
Ideology	3.058	1.189	3.055	1.198
Education	2.342	0.688	2.343	0.683
Age in years	51.973	17.672	51.343	17.594
Gender	1.492	0.504	1.491	0.505
Driver			0.758	0.429
Unemployment status	0.034	0.182		
Household income	3.529	1.347	3.514	1.343
Present residential area	2.738	0.920	2.734	0.926
County code	10.769	7.453	10.846	7.468
Observations	24,878		7,466	

The share of wildfires is skewed towards zero with a median of 0.001 for both samples.

4.4 Robustness variables

To control for different exposure to news about regional wildfires (and thus the indirect exposure to wildfires), their causes, and consequences, we include individual media consumption. Individual media consumption is included and coded as two dummy variables divided into media consumption of national news and news sources that are more regional and local in scope. The variables take on the value 1 for respondents that consume media (national/regional) every day of the week. The national and regional media variables are constructed by several variables from the SOM Institute survey, covering news consumption of both old media and internet-based newspapers. We cannot control for the content of the media consumed but assume that an individual that consumes news daily is exposed to environmental media coverage. In the case of environmental concern we assume that regional or local media impacts the relationship between share of wildfires and environmental concern, as individuals get indirectly exposed to regional wildfires by regional or local media. Regarding support for carbon tax, we are interested in both high regional and national media consumption and their impact of the relationship between wildfires and support for carbon tax.

It is a limitation to our measure that it is not possible to control for the media content and that we do not include social media consumption. Depending on the content of social media, it can have positive or negative effects related to environmental concern

(Diehl et al., 2021). As we cannot control for the type of social media content and as traditional news sources are not individually biased, we chose to include traditional news sources. The inclusion of the national and regional media variables decreases the size of our samples to 15,063 for environmental concern and 7,216 and 4,353 for support for carbon tax. The mean for the high regional media consumption in the environmental concern sample is 0.187 and 0.180 in the support for carbon tax sample. High national media consumption has a mean of 0.594 in the support for carbon tax sample.

Different wildfire measures are included to test the robustness of our results. These include measuring the occurrence of a wildfire, measured as larger than 100 hectares in the region as a dummy variable; the difference in share of wildfires, compared to the previous year; the area burned, in hundreds of hectares; share of wildfires, squared; and share of wildfires, one year lagged.

5 Econometric strategy

In the following chapter, we present the linear probability model (LPM), used for testing our two hypotheses. The LPM can be estimated by ordinary least squares, assuming a linear relationship between the independent variables and the probability of the dependent variable. The coefficients are easily interpreted, where each coefficient represents the impact of a one-unit increase in the related independent variable on the likelihood of the dependent variable being equal to one. A disadvantage of the LPM is that the model may predict probabilities greater than 1 or less than 0. This is nonsensical as the probability of an event occurring is contained within the interval [0,1] (Pedace, 2013, pp. 416-420).

LPM assumes that the error variance is constant across all observations and heteroscedasticity can cause biased and inefficient estimates (Wooldridge, 2002). The error term is clustered on a regional level to account for heteroscedasticity across clusters as suggested by Cameron and Miller (2015). Since each region has several respondents per year, the observations can be expected to correlate within the clusters, i.e. regions. The clustered standard errors correct the risk of overstating the precision of the estimates and the underestimation of the standard error (Wooldridge, 2002).

5.1 Specification for environmental concern

The first LPM examines the relationship between share of wildfires and our first dependent variable 'environmental concern'. The baseline model specification for 'environmental concern' is defined as:

$$EC_{i,t} = \boldsymbol{\beta X} + \beta_1 WF_{j,t} + \alpha_j + \lambda_t + \epsilon_{i,j,t} \tag{5.1}$$

$$\text{j} = 1,...,\text{N}; \quad \text{t} = 1,...,\text{T}$$

where i denotes the individual observation, j denotes the cross-sectional dimension of regions, and t denotes time in years. EC is the dependent variable 'environmental concern'. X denotes a vector of all control variables, including variables capturing climatic conditions and demographic variables. WF is the wildfire measure 'share of wildfires'. α represents regional dummies, λ represents time dummies for each year and ϵ represents the error term.

Using regional fixed effects allows us to control for unobserved time-invariant differences between regions. These could be regional cultures and traditions which impact the societal issues stated by respondents. The yearly fixed effects allow us to consider regional-invariant shocks, such as environmental catastrophes abroad or national policies. Although including fixed effects in our model addresses the problem of Omitted Variable Bias (OVB) that is region and time-invariant, the problem of potential regional and time-varying OVB remains (Stock and Watson, 2020). OVB stems from an omitted variable in the error term being a determinant of the dependent variable and correlated with an included independent variable. For example in our case, the covid-19 pandemic could have a negative impact on the likelihood of a respondent stating environmental concern. This could happen if the health crisis became more prominent and thus decreased the salience of environmental issues in the mind of the respondent. Some of this variation is captured by the time-fixed effect for 2020. However, if there are regional differences in concern over the pandemic due to some regions being better prepared for exceptional circumstances and handling the crisis better, this OVB would remain in our model. We control for factors such as residential area and unemployment, which should

capture some of this OVB. Still, it is outside the scope of this thesis to include variables of all competing societal issues that negatively impact the likelihood of respondents expressing environmental concern. Also, including all of them would risk overfitting the model. In addition, as the respondents can state up to three issues, the emergence of a major societal problem does not necessarily lead to the omission of environmental issues.

5.2 Specification for support for carbon tax

The second LPM examines the relationship between wildfires and our second dependent variable, 'support for carbon tax'. As presented in our theoretical framework 3.1, environmental concern increases the support for higher tax levels. We will begin by examining this empirically. Our first model specification thus becomes:

$$SCT_{i,t} = \boldsymbol{\beta X} + \beta_1 EC_{i,j,t} + \alpha_j + \lambda_t + \epsilon_{i,j,t} \tag{5.2}$$

$$\text{j} = 1,...,\text{N}; \quad \text{t} = 1,...,\text{T}$$

where i denotes the individual observation, j denotes the cross-sectional dimension of regions and t denotes time in years. SCT is the dependent variable 'support for carbon taxation'. X denotes a vector of all control variables, including variables capturing climatic conditions and socioeconomic and demographic variables, see Table 4.2. EC denotes environmental concern, α represents regional dummies, λ represents time dummies and ϵ represents the error term. In this specification, we simply investigate the proposed relationship between environmental concern and support for carbon tax without explicitly including the wildfire measure. Any effect from wildfires on support for carbon tax is found in the error term or captured by increased environmental concern.

To examine whether wildfires have any additional effect separate from environmental concern on the probability of a respondent expressing support for carbon tax, we include both environmental concern and wildfires in specification 5.3. Our second specification is given by:

$$SCT_{i,t} = \boldsymbol{\beta X} + \beta_1 EC_{i,j,t} + \beta_2 WF_{j,t} + \alpha_j + \lambda_t + \epsilon_{i,j,t} \tag{5.3}$$

$$\text{j} = 1,...,\text{N}; \quad \text{t} = 1,...,\text{T}$$

where the only difference in equation 5.3 from equation 5.2 is the addition of regional wildfires WF.

5.3 Robustness and sensitivity tests

For both environmental concern and support for carbon tax, individuals with high media consumption might have different effects from wildfires compared to respondents that do not, in which case the interaction term between high media consumption and share of wildfires should be different from zero. The equations become:

$$EC_{i,t} = \boldsymbol{\beta X} + \beta_1 WF_{j,t} + \beta_2 Media + \beta_3 Media * WF\alpha_j + \lambda_t + \epsilon_{i,j,t} \tag{5.4}$$

and

$$SCT_{i,t} = \boldsymbol{\beta X} + \beta_1 EC_{i,t} + \beta_2 WF_{j,t} + \beta_3 Media + \beta_4 Media_{i,t} * WF_{j,t} + \alpha_j + \lambda_t + \epsilon_{i,j,t} \tag{5.5}$$

$$\text{j} = 1,...,\text{N}; \quad \text{t} = 1,...,\text{T}$$

where the only difference in equation 5.4 from equation 5.1 is the inclusion of the media variable (measured as high regional media consumption) and the interaction term $Media*$ WF. Equation 5.5 is equal to equation 5.3 but also includes the media consumption (measured either as high national or high regional media consumption) and the respective interaction term $Media * WF$.

The robustness of the main estimates is also tested by using different wildfire measures and performing outlier analysis. Furthermore, as we might suspect a nonlinear relationship between the independent variables and the probabilities we estimate Probit models to allow for this. The Probit results for specifications 5.1 and 5.3 are presented in Appendix. As Probit uses a nonlinear functional form, the marginal effects of the

independent variables cannot be interpreted in the same way as the coefficients of the LPM. We, therefore, present the marginal effect calculated at the mean value of all other independent variables to be compared with the LPM coefficients.

6 Results

In this chapter, we begin by using a LPM to analyze our first dependent variable 'environmental concern', following the econometric strategy presented in section 5.1. The heterogeneity of wildfires' relationship to environmental concern relating to media consumption is explored in section 6.1.1. The effect of using different wildfire measures is discussed in section 6.1.2. Robustness checks are presented in section 6.1.3, including comparing the LPM results to results using a Probit model and analyzing outliers.

To continue, we analyze our second dependent variable 'support for carbon tax' following the specifications 5.2–5.3 described in section 5.2. Also for this dependent variable heterogeneity relating to media consumption is explored in section 6.2.1. Different wildfire measures are discussed in section 6.2.2 and robustness checks are presented in 6.2.3. For both dependent variables, we will discuss the differences resulting from limiting the timespan to the more recent period of 2018-2020.

6.1 Environmental concern

The results in Table 6.1 test Hypothesis 1 regarding the relationship between wildfires and environmental concern. Models (1) and (2) report the LPM estimates of the regional share of area burned in wildfires on the dependent variable in the two different timespans, 2014-2020 for model (1) and 2018-2020 for model (2).

The positive associations found in Table 6.1 are consistent with our expectation stated in Hypothesis 1, namely that an increased share of wildfires will positively impact environmental concern. The estimate of 'share of wildfires' is positive and statistically significant in model (1) at a five percent significance level. A one percent increase in share of regional area burned is associated with a 3.9 percent (model 1) increase in the probability of a respondent expressing environmental concern.

Table 6.1: LPM regressions, using 2014-2020 and 2018-2020 samples with environmental concern as the dependent variable

VARIABLES	2014-2020 (1)	2018-2020 (2)
Share of wildfires	0.039**	0.184***
	(0.018)	(0.033)
Dry spell	-0.000	-0.000
	(0.001)	(0.001)
Heat wave	0.001	0.001
	(0.000)	(0.001)
Ideology		
Clearly to the left	0.123***	0.164***
	(0.008)	(0.011)
Somewhat to the left	0.076***	0.103***
	(0.007)	(0.009)
Somewhat to the right	-0.046***	-0.061***
	(0.007)	(0.010)
Clearly to the right	-0.105***	-0.139***
	(0.013)	(0.015)
Education		
Medium	0.017***	0.008
	(0.006)	(0.011)
High	0.097***	0.109***
	(0.008)	(0.012)
Age in years	-0.002***	-0.002***
	(0.000)	(0.000)
Gender (male)	-0.014***	-0.015***
	(0.005)	(0.005)
Unemployment status	-0.029**	-0.034*
	(0.011)	(0.018)
Household income		
Very low	0.010	-0.003
	(0.009)	(0.014)
Low	0.011	0.024*
	(0.011)	(0.013)
High	0.007	0.024*
	(0.007)	(0.013)
Very high	0.038***	0.056***
	(0.009)	(0.011)
Present residential area		
Rural area	0.007	0.009
	(0.006)	(0.007)
Village	-0.022***	-0.028***
	(0.006)	(0.006)
Urban city	0.004	0.004
	(0.003)	(0.007)
Yearly and regional fixed effects	Yes	Yes
Constant	0.161***	0.173***
	(0.015)	(0.045)
Observations	24,878	11,758
Adj. R-squared	0.0931	0.101

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

A stronger relationship in the later period (2018-2020) is consistent with our theoretical expectations as the increased connection made in the media between wildfires

and climate change should decrease the psychological distance and increase issue salience. The relationship between 'share of wildfires' is positive and significant at a one percent significance level (model 2), with a one percent increase in the share of regional area burned being associated with an 18.4 percent increase in the probability of a respondent expressing environmental concern.

Contrary to previous research, we find no significant relationship between the climatic variables ('dry spell' and 'heat wave') and environmental concern. The demographic and socioeconomic variables of ideology and education have expected signs in line with previous research and age and gender are negatively associated with environmental concern. Household income has expected signs for very high and high income but positive signs also for low income in the period 2018-2020. The unexpected positive relationship of low income is however only significant at a ten percent level. The expected relationship of increased environmental concern from living in an urban area is not found. Compared to the reference group (living in a town), living in a village has a negative relationship, while living in a rural area has no significant relationship.

Out of the yearly fixed effects, the three latest years in model (1) have positive and statistically significant coefficients for the period 2014-2020. Compared to 2018, both 2019 and 2020 have positive and statistically significant coefficients in the later period. In 2014-2020 all regional dummies except Uppsala have negative and statistically significant coefficients compared to the comparison region Stockholm. The only difference in the later period is that the regional dummies for two regions are insignificant.[11]

6.1.1 Media consumption and environmental concern

As mentioned in our theoretical framework, we believe media to be of importance for the impact of wildfires on environmental concern.[12] We, therefore, test whether the relationship between wildfires and environmental concern differs depending on the individual's media consumption. The results are presented in Table 6.2. Interacting share of wildfires with high regional media consumption indicates that being a large

[11]Full Tables displaying all yearly and regional dummies are available upon request.

[12]There could potentially be a partly causal relationship between regional media consumption and share of wildfires, with share of wildfires increasing regional media consumption. Unfortunately, due to the cross-sectional nature of our data, we cannot control for individual increases in regional media consumption due to wildfires, as repeated observations of the same respondent are non-existent. However, as the survey is answered by respondents in early autumn to early winter, impacts from temporary spikes in regional media consumption during active wildfires should be limited.

media consumer is associated with a larger positive relationship between wildfires and environmental concern. For the period 2014-2020, there is no significant relationship between share of wildfires and environmental concern for respondents without high regional media consumption. In the later period share of wildfires have a significant positive relationship with environmental concern, where a one percent regional share of wildfires is associated with a 17.8 percent higher probability of expressing environmental concern. This association is larger for respondents with high regional media consumption, where the interaction term is positive and statistically significant at a five percent level. In both models, the coefficient of high regional media consumption is negative and statistically significant.

Table 6.2: Media consumption on environmental concern

VARIABLES	2014-2020 (1)	2018-2020 (2)
Share of wildfires	0.029	0.178***
	(0.031)	(0.041)
High regional media consumption = 1	-0.031***	-0.042***
	(0.005)	(0.011)
High regional media consumption#Share of wildfires	0.041***	0.191**
	(0.007)	(0.068)
Dry spell	-0.001	0.001
	(0.001)	(0.001)
Heat wave	0.000	0.001
	(0.001)	(0.001)
Socioeconomic and demographic controls	Yes	Yes
Yearly and regional fixed effects	Yes	Yes
Constant	0.176***	0.171***
	(0.014)	(0.048)
Observations	15,063	7,310
Adj. R-squared	0.0944	0.0958

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

6.1.2 Different wildfire measures on environmental concern

To test the robustness of our findings we run the LPM with different measures of wildfires presented in Table 8.4 for 2014-2020 and in Table 8.5 for 2018-2020 in Appendix. The results show that our findings are mostly robust to the different measures of wildfires. Simply measuring the occurrence of wildfires as a dummy variable for wildfires larger than 100 hectares yields no significant relationship in the period 2014-2020. This suggests that it is not the occurrence of large wildfires that impacts environmental concern in the longer period, although this is not true for the period 2018-2020 where the relationship is positive

and significant (at a ten percent level).

For the other alternative measures, the relationships are positive and statistically significant, although the significance levels and sizes vary. Non-linear relationships are also examined by including the squared term of share of wildfires. This is positive and statistically significant which indicates a convex relationship where the association between share of wildfires and environmental concern is increasingly large with an increasing share of wildfires. The coefficient of this quadratic term is particularly high for the later period. However, these different measures do not seem to fit the data better and our chosen measure is preferable due to its ease of interpretation.

6.1.3 Sensitivity tests

When examining multicollinearity we identify no major issues. Some multicollinearity seems to be present between the climatic variable heat wave and the yearly dummies. To investigate this further, we run the regressions excluding heat wave. This makes no difference for the period 2014-2020, while if for the period 2018-2020 decreases the size of the coefficient somewhat. The significance levels do not change.

As the variance in regional share of wildfires during the investigated period is large, there are large outliers compared to the median share of wildfires (0.001). The main example of this is the 2014 wildfire in Västmanland, with the share of wildfires being 1.8 percent of the regional area. When running the same regressions removing this outlier, the positive coefficient of share of wildfire becomes significantly larger (0.135) and significant at a one percent significance level for 2014-2020. Removing all outliers leads to insignificant results for our variable 'share of wildfires', also in the 2018-2020 period. However, as these large values represent natural variation in the data, they are true outliers, and removing them limits the remaining variance. We thus argue that they should remain in the data.

Finally, due to the limitations of LPM discussed in section 5, we compare the results in our preferred specification to a Probit specification. The marginal effects, calculated at the means of the other independent variables, are presented in Table 8.3 in Appendix. These results are similar to the LPM results in size, direction of the coefficients, and statistical significance of the coefficients.

6.2 Support for carbon tax

The models in Table 6.3 test the relationship between share of wildfires and support for carbon tax in the period 2014-2020. As described in the theoretical framework, we expect environmental concern to be associated with a higher preferred tax level (model 1). We also investigate whether share of wildfires has an additional impact on support for carbon tax (model 2).

In model (1) we find that, as expected from theory and existing literature, environmentally concerned respondents have a 23.5 percent higher probability of being supportive of a carbon tax compared to respondents that are not concerned. The environmentally concerned individuals have higher disutility from environmental externalities, which is reflected in their utility function and preferred tax level. In model (2) we include both environmental concern and share of wildfires. Interestingly, the inclusion of both variables does not affect the coefficient of environmental concern, nor the fit of the model as illustrated by the adjusted R square value. This suggests that there is no additional impact from share of wildfires on support for carbon tax for the period 2014-2020.

Examining the later period of 2018-2020 in Table 6.4 we find the coefficient of environmental concern to be similar to the one obtained for 2014-2020. There is a positive and statistically significant association between share of wildfires and support for carbon tax in model (2). A one percent share of wildfires is associated with an 18.3 percent increase in the probability of a respondent expressing support for carbon tax. The positive association between share of wildfires and support for carbon tax confirms our expectation stated in Hypothesis 2, that regional wildfires will impact support for carbon tax. This indicates that wildfires have an additional effect on support that is not mediated through environmental concern. As theorized, this additional effect is then unrelated to the environmental concern's impact on the disutility from environmental externalities. The additional effect could instead be related to the psychological drivers: psychological distance and issue salience.

Table 6.3: Support for carbon tax, 2014-2020

VARIABLES	2014-2020 (1)	2014-2020 (2)
Environmental concern	0.235***	0.235***
	(0.008)	(0.008)
Share of wildfires		0.003
		(0.016)
Dry spell	0.001	0.001
	(0.002)	(0.002)
Heat wave	0.000	0.000
	(0.001)	(0.001)
Driver	-0.148***	-0.148***
	(0.018)	(0.018)
Ideology		
Clearly to the left	0.233***	0.233***
	(0.017)	(0.017)
Somewhat to the left	0.136***	0.136***
	(0.016)	(0.016)
Somewhat to the right	-0.047***	-0.047***
	(0.011)	(0.011)
Clearly to the right	-0.135***	-0.135***
	(0.011)	(0.011)
Education		
Medium	0.066***	0.066***
	(0.011)	(0.011)
High	0.166***	0.166***
	(0.013)	(0.013)
Age in years	-0.001***	-0.001***
	(0.000)	(0.000)
Gender (male)	-0.009	-0.009
	(0.008)	(0.008)
Household income		
Very low	0.025**	0.025**
	(0.012)	(0.012)
Low	0.021	0.021
	(0.021)	(0.021)
High	0.008	0.008
	(0.010)	(0.010)
Very high	0.079***	0.079***
	(0.011)	(0.011)
Present residential area		
Rural	-0.064***	-0.064***
	(0.017)	(0.017)
Village	-0.028**	-0.028**
	(0.013)	(0.013)
Urban city	0.053*	0.053*
	(0.026)	(0.026)
Yearly and regional fixed effects	Yes	Yes
Constant	0.335***	0.335***
	(0.028)	(0.028)
Observations	7,466	7,466
Adj. R-squared	0.219	0.219

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 6.4: Support for carbon tax, 2018-2020

VARIABLES	2018-2020 (1)	2018-2020 (2)
Environmental concern	0.228***	0.227***
	(0.012)	(0.012)
Share of wildfires		0.183**
		(0.077)
Dry spell	0.007***	0.007***
	(0.001)	(0.001)
Driver	-0.118***	-0.117***
	(0.026)	(0.026)
Ideology		
Clearly to the left	0.254***	0.254***
	(0.022)	(0.022)
Somewhat to the left	0.145***	0.146***
	(0.022)	(0.022)
Somewhat to the right	-0.062***	-0.062***
	(0.020)	(0.020)
Clearly to the right	-0.150***	-0.149***
	(0.019)	(0.019)
Education		
Medium	0.059***	0.059***
	(0.016)	(0.016)
High	0.149***	0.150***
	(0.020)	(0.020)
Age in years	-0.001	-0.001
	(0.001)	(0.001)
Gender (male)	0.037***	0.038***
	(0.012)	(0.012)
Household income		
Low	0.074**	0.074**
	(0.031)	(0.031)
Medium	0.023	0.023
	(0.021)	(0.021)
High	0.020	0.019
	(0.033)	(0.033)
Very high	0.087***	0.086***
	(0.023)	(0.023)
Present residential area		
Rural	-0.067**	-0.067**
	(0.027)	(0.027)
Village	-0.059***	-0.060***
	(0.020)	(0.020)
Urban city	0.029	0.029
	(0.022)	(0.022)
Yearly and regional fixed effects	Yes	Yes
Constant	0.205***	0.203***
	(0.043)	(0.042)
Observations	2,628	2,628
Adj. R-squared	0.236	0.236

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

In both periods, the control variables car driving, ideology, and education have expected signs in line with previous research. Age has a negative association in 2014-2020 but insignificant in 2018-2020. Contrary, being a male is insignificant in 2014-2020 but

positive and statistically significant in 2018-2020. Household income is positive and statistically significant for very low and very high income in both periods. The positive relationship found between very low income and support for carbon tax is not expected based on previous literature. Possible explanations could be that this population group to a lesser extent are car drivers, which limits the personal impact of a tax increase. Residential area has expected sign, although the positive association for urban area is not significant in 2018-2020. In neither period does the inclusion of share of wildfire change the coefficients of the control variables.

6.2.1 Media consumption and support for carbon tax

We examine whether the relationship between wildfires and support for carbon tax differs depending on individual media consumption. In Table 6.5 we interact share of wildfires first with high national media consumption, in models (1) and (3), and secondly with high regional media consumption, in models (2) and (4).[13] The picture is somewhat less obvious than for environmental concern. The relationship between share of wildfire and support for carbon tax is not significant in any model, except for model (2) in which the relationship is negative at a ten percent significance level.

The results suggest that respondents with high regional media consumption have a positive association between wildfires and support for carbon tax. The coefficient of the interaction term is larger in the period 2018-2020, where a one percent share of wildfires is associated with a 13.6 percent increase in support for carbon tax for those with high regional media consumption. The same relationship is not found for respondents with high national media consumption, where the positive significant relationship for 2014-2020 is not found for 2018-2020. A possible explanation for this might be the limitations of our media measure. It is reasonable to believe that respondents without high national media consumption were still exposed to widespread media coverage of the 2018 wildfires.

[13]The results do not change significantly when including controls for the other level of media consumption: national media consumption (in the case of regional media consumption) or regional media consumption (in the case of national media consumption).

Table 6.5: Media consumption on support for carbon tax

	2014-2020		2018-2020	
VARIABLES	(1)	(2)	(3)	(4)
Environmental concern	0.233***	0.237***	0.224***	0.221***
	(0.010)	(0.014)	(0.014)	(0.018)
Share of wildfires	-0.022	-0.035*	0.147	0.037
	(0.015)	(0.017)	(0.146)	(0.121)
High national media consumption	0.019		-0.007	
	(0.011)		(0.023)	
High national media consumption#Share of wildfires	0.048***		0.121	
	(0.014)		(0.107)	
High regional media consumption		0.016		0.019
		(0.014)		(0.023)
High regional media consumption#Share of wildfires		0.079***		0.136**
		(0.014)		(0.056)
Dry spell	0.000	-0.002	0.006***	0.004
	(0.002)	(0.002)	(0.002)	(0.003)
Socioeconomic and demographic controls	Yes	Yes	Yes	Yes
Yearly and regional fixed effects	Yes	Yes	Yes	Yes
Constant	0.346***	0.330***	0.237***	0.257***
	(0.030)	(0.036)	(0.032)	(0.046)
Observations	7,216	4,353	2,519	1,610
Adj. R-squared	0.219	0.216	0.235	0.215

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

6.2.2 Different wildfire measures on Support for carbon tax

Using the specification of model (2) in Tables 6.3 and 6.4 we continue to test the robustness of our findings by running the regressions with different measures of wildfires. The results are presented in Table 8.6 for 2014-2020 and in Table 8.7 for 2018-2020 in Appendix. For the period 2014-2020, none of the measures are statically different from zero which is equal to the results obtained by using our preferred measure.

For the period 2018-2020, the association between wildfires and support for carbon tax is somewhat dependent upon the chosen measure of wildfires. The different measures vary in size and significance level. Measuring wildfires as the difference in share of wildfires yields no significant results, indicating that it is not the difference in area burned compared to the previous year that is of importance. Wildfires measured as larger than 100 hectares and as area burned are positive and statistically significant, although at a ten percent significance level. Of particular interest is the square of share of wildfire, with a coefficient that is positive, significant at a one percent level, and larger than in our model (2) in Table 6.4. Including a one-year lag does in this period yield coefficients that are both larger in magnitude and are significant at a higher significance level of one

percent. These results are interesting as they indicate that there might be a positive association from experiencing wildfires that consists into the next year.

6.2.3 Sensitivity tests

When examining multicollinearity we identify no major issues for the period 2014-2020. The variable heat wave is however excluded in the period 2018-2020 to avoid multicollinearity issues, as it is highly correlated with the yearly dummies. Analyzing outliers shows that our results are sensitive to the exclusion of large wildfires. Removing the largest wildfire in 2014 yields a positive and statistically significant coefficient for 'share of wildfires' at a five percent significance level for the period 2014-2020. However, as we have previously discussed, the large values are natural outliers and should remain in the sample.

Finally, due to the limitations of LPM discussed in section 5, we compare the results of our preferred specification to a Probit specification. The marginal effects, calculated at the means of the other independent variables, are presented in Table 8.8 in Appendix. These results are similar to the LPM results in size, direction, and statistical significance of the coefficients.

7 Discussion

According to the results, regional wildfires have a positive relationship with environmental concern. This confirms our first hypothesis that the probability of an individual expressing environmental concern increases with higher exposure to regional wildfires. The estimated association is robust to different wildfire measures as well as using Probit estimations. There are certain theoretical reasons why we expect this positive association. The theory of psychological distance states that the proximity of an event is decided by the temporal, geographical, and social dimensions as well as how certain the event feels. By measuring regional wildfires, we capture events that happen close to the respondent both in space, time, and possibly socially (as wildfires might affect people that are similar to the respondent). If the respondent connects the wildfires' causes and consequences to environmental issues, wildfires thus decrease the psychological distance to these issues. Since the dimensions of psychological distance are related, an increased feeling of proximity also affects the sense of certainty of events occurring. This sense of

certainty is argued in the literature to increase concern, which is in accordance with our empirical findings. The positive association between wildfires and environmental concern is in line with the findings by Hoffmann et al. (2022), although their research focuses on European regions over a longer period and includes no individual data.

The relationship between wildfires and environmental concern is stronger in the later period of 2018-2020, which indicates that respondents increasingly relate wildfires to environmental concern. This could be explained by a greater decrease in the psychological distance in this period, as extreme events are becoming increasingly common (IPCC, 2022). Another explanation why wildfires could be positively associated with environmental concern is increased issue salience, where environmental issues become more prominent in the mind of the public. This could be related to the fact that wildfires are increasingly connected to climate change by the media in the period 2018-2020.

Examining the heterogeneous associations between wildfires and environmental concern for respondents with different media consumption reveals a stronger relationship among respondents with high regional media consumption compared to those without. This could be due to the media increasing the respondents' awareness of the occurrence of wildfires, or increasing their understanding of the wildfires' connection to climate change and environmental issues. Which of these aspects drives the increased environmental concern in the later period can only be hypothesized, as our measure of media does not allow for this analysis. The persisting questions regarding the media's role in shaping experiences of wildfires remain promising opportunities for future research to explore. Understanding the media's role could further enable us to decide the relative importance of issue salience compared to other psychological drivers such as psychological distance, which remains a limitation of our analysis.

The relationship between wildfires and support for carbon tax is insignificant for the period 2014-2020. In the later period of 2018-2020, positive and significant associations are found, which lends some support to our second hypothesis that the probability of an individual expressing support for carbon tax on petrol increases with higher exposure to regional wildfires. The results using our preferred measure of share of regional area burned are robust to Probit estimations. The robustness of our findings is limited to the later period and is somewhat sensitive to the use of different wildfire

measures. As predicted by economic theory, an increased environmental concern increases the disutility from externalities harming the environment and thus increases the preferred level of the carbon tax. A positive association between wildfires and support for carbon tax is also in line with findings made by Wong-Parodi and Rubin (2022) on a USA sample. They find that both concern and personal experience are of importance for support for carbon tax, with the former having a stronger association. This is similar to our findings, although a direct comparison of the size of the effect is not possible as the econometric approach used by Wong-Parodi and Rubin (2022) is different.

The positive association between exposure to wildfires and support for carbon tax in the later period could, as in the case of environmental concern, be explained by decreased psychological distance and increased issue salience. It is noteworthy that the relationship between environmental concern and support for carbon tax remains the same when introducing wildfires. If the effect of wildfires on support for carbon tax was happening mainly through its effect on environmental concern, then we would expect the coefficient of environmental concern to change when including the wildfire measure. This is not the case, which can be interpreted as wildfires having an additional effect on support for carbon tax. Worth noting is the limitation that our measure of environmental concern only captures respondents that express environmental issues to be major societal problems. It might be that our wildfire measure captures increased environmental concern from individuals that have not expressed it as a societal issue in the survey.

In the analysis of support for carbon tax, personal impact is controlled for by including individual car driving as well as the residential area. Driving a car is, as expected, negatively associated with support for carbon tax. Compared to the analysis of environmental concern, there is a stronger negative relationship between living in residential areas such as villages and rural areas and support for carbon tax. Individuals living in rural areas tend to be more car-dependent and public transport is usually not as developed, which could explain why we see the negative association with support for carbon tax. Further, our research would be improved if we could control for not only the personal impact of the carbon tax, but also from wildfires, such as measuring personal damage. Additionally, panel data would improve the analysis as it would allow us to control for unobserved individual characteristics, such as personality traits, ability,

and worldview. These aspects could influence how the individual connects wildfires to environmental issues and related policies. Data including prior environmental concern would enable us to determine the impact from prior views on the relationship between wildfires and support for carbon tax.

Examining media consumption and support for carbon tax further, we find that the interaction between high media consumption and wildfires in 2014-2020 is positive and statistically significant independent of the media being national or regional in scope. For the period 2018-2020, the results of national media consumption are not significant. As the unusually hot and dry weather of 2018 was widely spread over the country and covered in the media, it is not surprising that it is not the regional wildfires (as measured by our share of wildfires) that are decisive for the respondents' support for carbon tax. It could instead be the national level of wildfires that is important. Also, a respondent could be concerned about wildfires in neighboring regions, and the fact that we do not consider this is a limitation to our method. It is interesting to note, however that despite the insignificant results when controlling for national media, a significant positive association between share of wildfire and support for carbon remains for those that are high regional media consumers. This suggests that the geographic proximity of the wildfire has an impact on respondents with high regional media consumption.

Our findings could be relevant for policy makers that wish to recognize the concerns of the public. It is of particular interest to policy makers if increased environmental concern leads to changes in behavior, and in our case support for policies. This could suggest a window of opportunity for policy makers to implement policies with public support. Also, an area of future research to investigate is if the results found could be applied to other environmental policies than carbon tax. The stronger association between wildfires and support for carbon tax in the period 2018-2020 gives rise to questions whether this period is a temporary spike of associating wildfires to support or whether wildfires' effect can be expected to increase in the future.

8 Conclusion

In this thesis, we have investigated the relationship between wildfires, environmental concern, and support for carbon tax, combining Swedish survey data and data on

regional wildfires for the period 2014-2020. We base our analysis on two hypotheses: *The probability of an individual expressing environmental concern increases with higher exposure to regional wildfires* and *The probability of an individual expressing support for carbon tax on petrol increases with higher exposure to regional wildfires*. Unlike previous contributions, this paper uses a rich data set allowing for the inclusion of both climatic data on a regional level and data on individual characteristics.

The results indicate that wildfires increase the probability of a respondent expressing environmental concern. The estimates are estimated using a LPM while also being robust to using a Probit model. The magnitudes of the wildfire estimates are larger in the later period of 2018-2020. Respondents with high regional media consumption have a larger impact of wildfires on environmental concern compared to those without. The results further indicate that wildfires are positively associated with support for an increased carbon tax on petrol for the period 2018-2020. For the period 2014-2020, only respondents with high media consumption have an increased probability of expressing support for carbon tax. The main results are robust to using a Probit model as well as different measures of wildfires.

While this thesis provides new insights regarding wildfires' relationship to environmental concern and support for carbon tax, it also highlights the need for further research. The focus of our research has been limited to regional wildfires and their association with environmental concern and support for carbon tax. Data that allow for closer geographical pairing between wildfires and respondents would give further understanding of the relationship between personal experience and changes in environmental concern and support for carbon tax. Limitations of our thesis also include not being able to directly control for how individuals interpret wildfires in relation to climate change and whether they are exposed to media content that makes the same connection. Further, future studies should continue to investigate if the association between wildfires and increased support is present for other environmental policies than carbon tax.

Bibliography

Berglez, Peter and Rolf Lidskog (2019). "Foreign, domestic, and cultural factors in climate change reporting: Swedish media's coverage of wildfires in three continents". In: *Environmental Communication* 13.3, pp. 381–394.

Blake, Donald E (2001). "Contextual effects on environmental attitudes and behavior". In: *Environment and behavior* 33.5, pp. 708–725.

Boykoff, Maxwell T (2011). *Who speaks for the climate?: Making sense of media reporting on climate change*. Cambridge University Press.

Brimicombe, Chloe (2022). "Is there a climate change reporting bias? A case study of English-language news articles, 2017–2022". In: *Geoscience Communication* 5.3, pp. 281–287.

Cameron, A Colin and Douglas L Miller (2015). "A practitioner's guide to cluster-robust inference". In: *Journal of human resources* 50.2, pp. 317–372.

Casey, Paul J and Kylie Scott (2006). "Environmental concern and behaviour in an Australian sample within an ecocentric–anthropocentric framework". In: *Australian Journal of Psychology* 58.2, pp. 57–67.

Clayton, Susan, Patrick Devine-Wright, Paul C Stern, Lorraine Whitmarsh, Amanda Carrico, Linda Steg, Janet Swim, and Mirilia Bonnes (2015). "Psychological research and global climate change". In: *Nature climate change* 5.7, pp. 640–646.

Conroy, Stephen J and Tisha LN Emerson (2014). "A tale of trade-offs: The impact of macroeconomic factors on environmental concern". In: *Journal of environmental management* 145, pp. 88–93.

County Administrative Board Västmanland (2014). *Skogsbranden i Västmanland 2014*. Västerås, Sweden:

De Rigo, D, G Libertà, T Houston Durrant, T Artés Vivancos, and J San-Miguel-Ayanz (2018). *Forest fire danger extremes in Europe under climate change : variability and uncertainty*. Publications Office of the European Union. DOI: doi/10.2760/13180.

Demski, Christina, Stuart Capstick, Nick Pidgeon, Robert Gennaro Sposato, and Alexa Spence (2017). "Experience of extreme weather affects climate change mitigation and adaptation responses". In: *Climatic Change* 140, pp. 149–164.

Diehl, Trevor, Brigitte Huber, Homero Gil de Zúñiga, and James Liu (2021). "Social media and beliefs about climate change: a cross-national analysis of news use, political ideology, and trust in science". In: *International Journal of Public Opinion Research* 33.2, pp. 197–213.

Drews, Stefan and Jeroen CJM Van den Bergh (2016). "What explains public support for climate policies? A review of empirical and experimental studies". In: *Climate policy* 16.7, pp. 855–876.

Duijndam, Sem and Pieter van Beukering (2021). "Understanding public concern about climate change in Europe, 2008–2017: the influence of economic factors and right-wing populism". In: *Climate Policy* 21.3, pp. 353–367.

Dunlap, Riley E and Araon M McCright (2008). "A widening gap: Republican and Democratic views on climate change". In: *Environment: Science and Policy for Sustainable Development* 50.5, pp. 26–35.

Ewald, Jens, Thomas Sterner, and Erik Sterner (2022). "Understanding the resistance to carbon taxes: Drivers and barriers among the general public and fuel-tax protesters". In: *Resource and Energy Economics* 70, p. 101331.

Fairbrother, Malcolm, Ingemar Johansson Sevä, and Joakim Kulin (2019). "Political trust and the relationship between climate change beliefs and support for fossil fuel taxes: Evidence from a survey of 23 European countries". In: *Global Environmental Change* 59, p. 102003.

Fernandez-Anez, Nieves, Andrey Krasovskiy, Mortimer Müller, Harald Vacik, Jan Baetens, Emira Hukić, Marijana Kapovic Solomun, Irena Atanassova, Maria Glushkova, Igor Bogunović, et al. (2021). "Current wildland fire patterns and challenges in Europe: A synthesis of national perspectives". In: *Air, Soil and Water Research* 14, p. 11786221211028185.

Fischer, Erich M and Reto Knutti (2015). "Anthropogenic contribution to global occurrence of heavy-precipitation and high-temperature extremes". In: *Nature climate change* 5.6, pp. 560–564.

Franzen, Axel and Dominikus Vogl (2013). "Two decades of measuring environmental attitudes: A comparative analysis of 33 countries". In: *Global Environmental Change* 23.5, pp. 1001–1008.

Gärtner, Lea and Harald Schoen (2021). "Experiencing climate change: revisiting the role of local weather in affecting climate change awareness and related policy preferences". In: *Climatic Change* 167.3-4, p. 31.

Gooch, Geoffrey D (1996). "Environmental concern and the Swedish press: A case study of the effects of newspaper reporting, personal experience and social interaction on the public's perception of environmental risks". In: *European journal of communication* 11.1, pp. 107–127.

Gray, Sara Goto, Kaitlin T Raimi, Robyn Wilson, and Joseph Arvai (2019). "Will Millennials save the world? The effect of age and generational differences on environmental concern". In: *Journal of environmental management* 242, pp. 394–402.

Hammar, Henrik and Sverker C Jagers (2006). "Can trust in politicians explain individuals' support for climate policy? The case of CO2 tax". In: *Climate Policy* 5.6, pp. 613–625.

Hammar, Henrik, Sverker C Jagers, and Katarina Nordblom (2008). "Attitudes towards Tax Levels: A Multi-Tax Comparison". In: *Fiscal studies* 29.4, pp. 523–543.

Harring, Niklas, Sverker C Jagers, and Johan Martinsson (2011). "Explaining ups and downs in the public's environmental concern in Sweden: the effects of ecological modernization, the economy, and the media". In: *Organization & Environment* 24.4, pp. 388–403.

Harring, Niklas and Jacob Sohlberg (2017). "The varying effects of left–right ideology on support for the environment: Evidence from a Swedish survey experiment". In: *Environmental Politics* 26.2, pp. 278–300.

Hazlett, Chad and Matto Mildenberger (2019). "Wildfire exposure increases pro-climate political behaviors". In: *Available at SSRN 3452958*.

— (2020). "Wildfire exposure increases pro-environment voting within democratic but not republican areas". In: *American Political Science Review* 114.4, pp. 1359–1365.

Hoffmann, Roman, Raya Muttarak, Jonas Peisker, and Piero Stanig (2022). "Climate change experiences raise environmental concerns and promote Green voting". In: *Nature Climate Change* 12.2, pp. 148–155.

Hopke, Jill E (2020). "Connecting extreme heat events to climate change: Media coverage of heat waves and wildfires". In: *Environmental Communication* 14.4, pp. 492–508.

Hornsey, Matthew J, Emily A Harris, Paul G Bain, and Kelly S Fielding (2016). "Meta-analyses of the determinants and outcomes of belief in climate change". In: *Nature climate change* 6.6, pp. 622–626.

Howe, Peter D, Jennifer R Marlon, Matto Mildenberger, and Brittany S Shield (2019). "How will climate change shape climate opinion?" In: *Environmental Research Letters* 14.11, p. 113001.

IPCC (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Summary for Policymakers. Cambridge, UK and New York, USA: Cambridge University Press, pp. 3–33. ISBN: 9781009325844.

Kalatzi Pantera, Dafni, Tobias Böhmelt, and Zorzeta Bakaki (2022). "The transnational influence of natural disasters on environmental attitudes". In: *European Journal of Political Research*.

Khabarov, Nikolay, Andrey Krasovskii, Michael Obersteiner, Rob Swart, Alessandro Dosio, Jesús San-Miguel-Ayanz, Tracy Durrant, Andrea Camia, and Mirco Migliavacca (2016). "Forest fires and adaptation options in Europe". In: *Regional Environmental Change* 16, pp. 21–30.

Klineberg, Stephen L, Matthew McKeever, and Bert Rothenbach (1998). "Demographic predictors of environmental concern: It does make a difference how it's measured". In: *Social science quarterly*, pp. 734–753.

Konisky, David M, Llewelyn Hughes, and Charles H Kaylor (2016). "Extreme weather events and climate change concern". In: *Climatic change* 134, pp. 533–547.

Lacroix, Karine, Robert Gifford, and Jonathan Rush (2020). "Climate change beliefs shape the interpretation of forest fire events". In: *Climatic Change* 159, pp. 103–120.

Lavine, Howard, John L Sullivan, Eugene Borgida, and Cynthia J Thomsen (1996). "The relationship of national and personal issue salience to attitude accessibility on foreign and domestic policy issues". In: *Political Psychology*, pp. 293–316.

Levi, Sebastian (2021). "Why hate carbon taxes? Machine learning evidence on the roles of personal responsibility, trust, revenue recycling, and other factors across 23 European countries". In: *Energy Research & Social Science* 73, p. 101883.

Lewis, Gregory B, Risa Palm, and Bo Feng (2019). "Cross-national variation in determinants of climate change concern". In: *Environmental Politics* 28.5, pp. 793–821.

Lujala, Päivi and Haakon Lein (2020). "The role of personal experiences in Norwegian perceptions of climate change". In: *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography* 74.3, pp. 138–151.

McCright, Aaron M, Riley E Dunlap, and Sandra T Marquart-Pyatt (2016). "Political ideology and views about climate change in the European Union". In: *Environmental Politics* 25.2, pp. 338–358.

McCright, Aaron M and Chenyang Xiao (2014). "Gender and environmental concern: Insights from recent work and for future research". In: *Society & Natural Resources* 27.10, pp. 1109–1113.

McDonald, Rachel I, Hui Yi Chai, and Ben R Newell (2015). "Personal experience and the 'psychological distance'of climate change: An integrative review". In: *Journal of Environmental Psychology* 44, pp. 109–118.

Metag, Julia, Tobias Füchslin, and Mike S Schäfer (2017). "Global warming's five Germanys: A typology of Germans' views on climate change and patterns of media use and information". In: *Public Understanding of Science* 26.4, pp. 434–451.

Neumayer, Eric (2004). "The environment, left-wing political orientation and ecological economics". In: *Ecological economics* 51.3-4, pp. 167–175.

Olofsson, Anna and Susanna Öhman (2006). "General beliefs and environmental concern: Transatlantic comparisons". In: *Environment and behavior* 38.6, pp. 768–790.

Owen, Ann L, Emily Conover, Julio Videras, and Stephen Wu (2012). "Heat waves, droughts, and preferences for environmental policy". In: *Journal of Policy Analysis and Management* 31.3, pp. 556–577.

Pahl, Sabine, Stephen Sheppard, Christine Boomsma, and Christopher Groves (2014). "Perceptions of time in relation to climate change". In: *Wiley Interdisciplinary Reviews: Climate Change* 5.3, pp. 375–388.

Pedace, Roberto (2013). *Econometrics for dummies*. John Wiley & Sons.

Ray, Aaron, Llewelyn Hughes, David M Konisky, and Charles Kaylor (2017). "Extreme weather exposure and support for climate change adaptation". In: *Global Environmental Change* 46, pp. 104–113.

Retriever (2021). *Varmare klimat - iskall nyhet? En rapport om klimatet i svensk media*. Vi-skogen. URL: `https://viskogen.se/app/uploads/2021/05/vi-skogen_rapport_varmare_klimat_iskall_nyhet_2021.pdf`.

Rudman, Laurie A, Meghan C McLean, and Martin Bunzl (2013). "When truth is personally inconvenient, attitudes change: The impact of extreme weather on implicit support for green politicians and explicit climate-change beliefs". In: *Psychological science* 24.11, pp. 2290–2296.

Scannell, Leila and Robert Gifford (2013). "Personally relevant climate change: The role of place attachment and local versus global message framing in engagement". In: *Environment and Behavior* 45.1, pp. 60–85.

Shao, Wanyun, Barry D Keim, James C Garand, and Lawrence C Hamilton (2014). "Weather, climate, and the economy: explaining risk perceptions of global warming, 2001–10". In: *Weather, Climate, and Society* 6.1, pp. 119–134.

Sisco, Matthew R, Valentina Bosetti, and Elke U Weber (2017). "When do extreme weather events generate attention to climate change?" In: *Climatic change* 143, pp. 227–241.

Sisco, Matthew Ryan (2021). "The effects of weather experiences on climate change attitudes and behaviors". In: *Current Opinion in Environmental Sustainability* 52, pp. 111–117.

Sjöström, J and A Granström (2023). "Human activity and demographics drive the fire regime in a highly developed European boreal region". In: *Fire Safety Journal*, p. 103743.

Sjöström, Johan and Anders Granström (2020). *Wildfires in Sweden* (MSB1536). The Swedish Civil Contingency Agency. URL: `https://rib.msb.se/filer/pdf/30223.pdf`.

Sloggy, Matthew R, Jordan F Suter, Mani Rouhi Rad, Dale T Manning, and Chris Goemans (2021). "Changing climate, changing minds? The effects of natural disasters on public perceptions of climate change". In: *Climatic Change* 168, pp. 1–26.

Spence, Alexa, Wouter Poortinga, and Nick Pidgeon (2012). "The psychological distance of climate change". In: *Risk Analysis: An International Journal* 32.6, pp. 957–972.

Stamm, Keith R, Fiona Clark, and Paula Reynolds Eblacas (2000). "Mass communication and public understanding of environmental problems: the case of global warming". In: *Public understanding of science* 9.3, p. 219.

Stern, Paul C, Thomas Dietz, and Linda Kalof (1993). "Value orientations, gender, and environmental concern". In: *Environment and behavior* 25.5, pp. 322–348.

Stock, James H and Mark W Watson (2020). *Introduction to econometrics 4th ed.*

Trope, Yaacov and Nira Liberman (2010). "Construal-level theory of psychological distance." In: *Psychological review* 117.2, p. 440.

Tversky, Amos and Daniel Kahneman (1973). "Availability: A heuristic for judging frequency and probability". In: *Cognitive psychology* 5.2, pp. 207–232.

Udalov, Vladimir and Paul JJ Welfens (2021). "Digital and competing information sources: Impact on environmental concern and prospects for international policy cooperation". In: *International Economics and Economic Policy* 18.4, pp. 631–660.

Weaver, David (1991). "Issue salience and public opinion: Are there consequences of agenda-setting?" In: *International Journal of Public Opinion Research* 3.1, pp. 53–68.

Weber, Elke U (2006). "Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet)". In: *Climatic change* 77.1-2, pp. 103–120.

Wong-Parodi, Gabrielle and Nina Berlin Rubin (2022). "Exploring how climate change subjective attribution, personal experience with extremes, concern, and subjective knowledge relate to pro-environmental attitudes and behavioral intentions in the United States". In: *Journal of Environmental Psychology* 79, p. 101728.

Wooldridge, Jeffrey M (2002). *Econometric analysis of cross section and panel data.* Cambridge, Mass. MIT Press.

Zanocco, Chad, Hilary Boudet, Roberta Nilson, and June Flora (2019). "Personal harm and support for climate change mitigation policies: Evidence from 10 US communities impacted by extreme weather". In: *Global Environmental Change* 59, p. 101984.

Zhang, Kun, Qian Wang, Qiao-Mei Liang, and Hao Chen (2016). "A bibliometric analysis of research on carbon tax from 1989 to 2014". In: *Renewable and sustainable energy reviews* 58, pp. 297–310.

Appendix

Table 8.1: Comparison of representation, national share and samples

VARIABLES		Share (environmental concern)	Share (support for carbon tax)	National share
Gender	Female	51.01%	51.15%	49.67%
	Male	48.77%	48.61%	50.33%
Age	Age 16-19	3.29%	3.51%	5.48%
	Age 20-29	10.26%	11.09%	16.76%
	Age 30-39	13.74%	13.64%	16.35%
	Age 40-49	16.11%	16.84%	16.39%
	Age 50-59	18.00%	17.63%	15.80%
	Age 60-69	18.86%	19.53%	14.05%
	Age 70-79	15.96%	14.56%	11.48%
	Age 80-85	3.79%	3.21%	3.69%
Education	Low	12.42%	12.07%	19.31%
	Medium	40.99%	41.60%	42.76%
	High	46.59%	46.33%	35.53%
Region	Stockholms län	22.25%	22.16%	23.52%
	Uppsala län	3.94%	3.71%	3.77%
	Södermanlands län	2.92%	2.72%	2.97%
	Östergötlands län	4.83%	4.73%	4.66%
	Jönköpings län	3.49%	3.52%	3.63%
	Kronobergs län	2.08%	2.33%	2.01%
	Blekinge län	1.65%	1.51%	1.61%
	Skåne län	13.51%	13.66%	13.70%
	Hallands län	3.48%	3.15%	3.31%
	Västra Götalands län	18.29%	18.70%	17.23%
	Värmlands län	2.79%	2.88%	2.86%
	Örebro län	2.98%	2.81%	3.04%
	Västmanlands län	2.48%	2.36%	2.76%
	Dalarnas län	2.94%	3.08%	2.91%
	Gävleborgs län	2.76%	2.86%	2.91%
	Västernorrlands län	2.57%	2.67%	2.50%
	Jämtlands län	1.57%	1.41%	1.32%
	Västerbottens län	2.85%	2.88%	2.74%
	Norrbottens län	2.62%	2.85%	2.56%

Table 8.2: Cross-correlation table

Variables	SCT	EC	WF	DS	HW	Inc	Edu	Age	Gen	Une	Dri	Inc	RA	HNMC	HRMC
Support for carbon tax	1.000														
Environmental concern	0.143	1.000													
Share of wildfires	-0.003	-0.004	1.000												
Dry spell	-0.002	0.049	0.002	1.000											
Heat wave	-0.055	0.049	0.075	0.523	1.000										
Ideology	-0.148	-0.187	-0.001	0.015	0.008	1.000									
Education	0.114	0.151	-0.018	0.026	-0.007	-0.016	1.000								
Age in years	-0.087	-0.108	0.005	-0.017	-0.009	0.018	-0.254	1.000							
Gender	-0.043	-0.049	0.008	0.006	0.013	0.099	-0.105	0.024	1.000						
Unemployment status	0.012	-0.009	0.014	0.006	0.010	-0.039	-0.046	-0.124	0.015	1.000					
Driver	-0.120	-0.077	0.015	-0.045	-0.011	0.153	0.004	0.133	0.143	-0.079	1.000				
Income	0.020	0.054	0.001	0.032	0.005	0.152	0.301	-0.213	0.064	-0.125	0.256	1.000			
Residential area	0.104	0.069	-0.040	0.079	0.021	-0.035	0.187	-0.118	-0.008	0.021	-0.257	0.062	1.000		
High national media consumption	-0.009	-0.041	0.003	-0.006	-0.009	0.056	-0.005	0.239	0.050	-0.048	0.072	0.056	0.032	1.000	
High regional media consumption	-0.020	-0.054	0.025	-0.024	0.003	0.036	-0.053	0.187	0.024	-0.020	0.037	-0.017	-0.006	0.351	1.000

This correlation table includes all variables used in the main estimations.

Table 8.3: Probit models, using environmental concern as dependent variable

VARIABLES	2014-2020 (1)	2018-2020 (2)
Share of wildfires	0.040**	0.186***
	(0.017)	(0.039)
Dry spell	-0.000	0.001
	(0.001)	(0.001)
Heat wave	0.000	0.001
	(0.001)	(0.001)
Ideology		
Clearly to the left	0.120***	0.165***
	(0.010)	(0.012)
Somewhat to the left	0.075***	0.105***
	(0.009)	(0.012)
Somewhat to the right	-0.043***	-0.060***
	(0.006)	(0.009)
Clearly to the right	-0.093***	-0.133***
	(0.009)	(0.010)
Education		
Medium	0.023***	0.013
	(0.006)	(0.012)
High	0.101***	0.115***
	(0.009)	(0.013)
Age in years	-0.001***	-0.002***
	(0.000)	(0.000)
Gender (male)	-0.013***	-0.015***
	(0.004)	(0.005)
Unemployment status	-0.026**	-0.031
	(0.011)	(0.019)
Household income		
Very low	0.012	-0.004
	(0.009)	(0.015)
Low	0.012	0.023*
	(0.012)	(0.014)
High	0.009	0.024**
	(0.006)	(0.012)
Very high	0.038***	0.057***
	(0.007)	(0.009)
Present residential area		
Rural	0.006	0.008
	(0.008)	(0.009)
Village	-0.022***	-0.030***
	(0.007)	(0.007)
Urban city	0.000	0.000
	(0.003)	(0.006)
Yearly and regional fixed effects	Yes	Yes
Observations	24,878	11,758

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 8.4: Different definitions of wildfire (2014-2020) with environmental concern as the dependent variable

VARIABLES	(1)	(2)	(3)	(4)	(5)
Wildfire dummy (>100 hectares)	0.005				
	(0.016)				
Difference in share of wildfires		0.033*			
		(0.016)			
Area burned in 100 ha			0.001***		
			(0.000)		
Share of wildfires squared				0.016***	
				(0.005)	
Share of wildfires					0.035**
					(0.016)
Share of wildfires, one year lag					-0.031*
					(0.016)
Dry spell	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Heat wave	0.001	0.001	0.001*	0.001	0.001
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Demographic and socioeconomic controls	Yes	Yes	Yes	Yes	Yes
Yearly and regional fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.161***	0.161***	0.158***	0.162***	0.161***
	(0.013)	(0.015)	(0.016)	(0.016)	(0.015)
Observations	24,878	24,878	24,878	24,878	24,878
Adj. R-squared	0.0930	0.0932	0.0932	0.0931	0.0932

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 8.5: Different definitions of wildfire (2018-2020) with environmental concern as the dependent variable

VARIABLES	(1)	(2)	(3)	(4)	(5)
Wildfire dummy (>100 hectares)	0.041*				
	(0.021)				
Difference in share of wildfires		0.118***			
		(0.017)			
Area burned in 100 ha			0.001***		
			(0.000)		
Share of wildfires squared				0.314***	
				(0.044)	
Share of wildfires					0.133***
					(0.034)
Share of wildfires, one year lag					-0.104***
					(0.024)
Dry spell	0.000	-0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Heat wave	0.002	0.001	0.002	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Demographic and socioeconomic controls	Yes	Yes	Yes	Yes	Yes
Yearly and regional fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.157**	0.175***	0.168***	0.183***	0.173***
	(0.062)	(0.043)	(0.050)	(0.040)	(0.046)
Observations	11,758	11,758	11,758	11,758	11,758
Adj. R-squared	0.101	0.101	0.101	0.101	0.101

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 8.6: Different definitions of wildfire (2014-2020) with support for carbon tax as the dependent variable

VARIABLES	(1)	(2)	(3)	(4)	(5)
Environmental concern	0.231***	0.231***	0.231***	0.231***	0.231***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Wildfire dummy (>100 hectares)	-0.003				
	(0.009)				
Difference in share of wildfires		-0.005			
		(0.005)			
Area burned in 100 ha			0.000		
			(0.000)		
Share of burned squared				-0.005	
				(0.005)	
Share of wildfires					0.002
					(0.019)
Share of wildfires, one year lag					0.009
					(0.012)
Dry spell	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Demographic and socioeconomic controls	Yes	Yes	Yes	Yes	Yes
Yearly and regional fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.336***	0.335***	0.335***	0.336***	0.335***
	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)
Observations	11,512	11,512	11,512	11,512	11,512
Adj. R-squared	0.201	0.201	0.201	0.201	0.201

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 8.7: Different definitions of wildfire (2018-2020) with support for carbon tax as the dependent variable

VARIABLES	(1)	(2)	(3)	(4)	(5)
Environmental concern	0.215***	0.215***	0.214***	0.214***	0.215***
	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)
Wildfire dummy (>100 hectares)	0.031*				
	(0.016)				
Difference in share of wildfires		0.014			
		(0.020)			
Area burned in 100 ha			0.001*		
			(0.000)		
Share of wildfires squared				0.172***	
				(0.032)	
Share of wildfires					0.255***
					(0.069)
Share of wildfires, one year lag					0.191***
					(0.048)
Dry spell	0.002*	0.002	0.002*	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Demographic and socioeconomic controls	Yes	Yes	Yes	Yes	Yes
Yearly and regional fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.274***	0.278***	0.273***	0.276***	0.274***
	(0.023)	(0.023)	(0.021)	(0.022)	(0.022)
Observations	5,985	5,985	5,985	5,985	5,985
Adj. R-squared	0.195	0.194	0.195	0.194	0.195

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 8.8: Probit models, using support for carbon tax as dependent variable

VARIABLES	2014-2020 (1)	2018-2020 (2)
Environmental concern	0.231***	0.221***
	(0.008)	(0.012)
Share of wildfires	-0.004	0.236**
	(0.020)	(0.094)
Heat wave	0.000	
	(0.001)	
Dry spell	0.001	0.007***
	(0.002)	(0.002)
Driver	-0.158***	-0.128***
	(0.020)	(0.030)
Ideology		
Clearly to the left	0.263***	0.284***
	(0.019)	(0.025)
Somewhat to the left	0.151***	0.163***
	(0.015)	(0.024)
Somewhat to the right	-0.049***	-0.065***
	(0.012)	(0.020)
Clearly to the right	-0.144***	-0.153***
Education		
	(0.018)	(0.016)
Medium	0.082***	0.077***
	(0.014)	(0.019)
High	0.194***	0.177***
	(0.016)	(0.022)
Age in years	-0.001***	-0.001
	(0.000)	(0.001)
Gender (male)	-0.014	0.042***
	(0.009)	(0.014)
Household income		
Very low	0.027**	-0.028
	(0.013)	(0.026)
Low	0.023	0.049
	(0.025)	(0.037)
High	0.008	-0.003
	(0.011)	(0.024)
Very high	0.094***	0.073***
	(0.012)	(0.016)
Present residential area		
Rural	-0.083***	-0.090***
	(0.021)	(0.032)
Village	-0.036**	-0.079***
	(0.016)	(0.024)
Urban city	0.051*	0.022
	(0.029)	(0.027)
Yearly and regional fixed effects	Yes	Yes
Observations	7,466	2,628

Notes: Standard errors in parentheses. Statistical significance *** at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.