

## Article

# Climate Change and Lithuania's Livestock Farms: Awareness and Reactions, an Explorative Study

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**Abstract:** Climate change is a global issue widely recognized by the European population. Researchers generally acknowledge that the agricultural sector contributes significantly to climate change. The livestock sector produces about two thirds of the total Greenhouse gases emissions (GHG) generated from all farm production processes. On the other hand, climate change affects agriculture and zootechny in multiple ways. There is abundant literature on the measures that could be adopted by the farmers to mitigate the climate change effects and adapt their activity to the changes. Nonetheless, these studies focus predominantly on Africa and Asia, and fewer studies involve Europe and Nordic areas. This study aims at analyzing livestock holders' perception of climate change, verifying whether and why they adopt mitigation and/or adaptation techniques, and identifying the limitations that delay the spread of these measures. For this purpose, a survey was conducted among a livestock holdings sample in Lithuania. The findings have suggested that the holders with a small number of animals, situated in the regions where livestock production is not very economically advanced, have difficulties in adopting the climate-change-related measures because they do not have sufficient funds to implement them and are not aware of the possibilities for such measures.

**Keywords:** climate change; livestock farms; Lithuania; farmer's perception; mitigation and adaptation



**Citation:** Calciolari, F.; Novikova, A.; Rocchi, L. Climate Change and Lithuania's Livestock Farms: Awareness and Reactions, an Explorative Study. *Sustainability* **2021**, *13*, 10567. <https://doi.org/10.3390/su131910567>

Academic Editors: Rhys Manners and Irene Blanco-Gutiérrez

Received: 4 August 2021

Accepted: 21 September 2021

Published: 23 September 2021

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## 1. Introduction

Agriculture and climate change (CC) are closely interrelated considering that agriculture is one of the main contributors of CC and that agriculture is one of the sectors that are highly sensitive to CC [1]. The effects may be positive for certain countries; however, the majority of the observed consequences cause negative change [2]. One of the most common impacts is the change in the quantity and quality of croplands and pastures depending on location, livestock system, and species [1,3]. These changes create major challenges for attaining sustainability in agriculture through the depletion of natural resources [4].

Among agriculture activities, livestock is among the main CC contributors: in 2018, the total impact of livestock was about 3.5 billion tons CO<sub>2</sub>eq, i.e., about two thirds of the total greenhouse gases (GHG) emissions generated by all production processes located within the farm phase [5]. The sector contributes both directly and indirectly to GHG emissions and influences climate through land use change, feed production, animal production, manure, processing, and transport [3].

Although the livestock sector is commonly considered as one of the main causes of CC, it is also strongly affected by CC, both directly and indirectly. Direct impacts may be observed through changes in eating behavior and animal physiology. Indirect impacts include pathogen ecology, water resource quality, and increased mortality [6]. The modulation of direct and indirect impacts of CC obviously depends on the geographical location, specific animal characteristics, intensity of extreme events, and level of exposure [7]. In

particular, animal conditions and health can be highly affected by heat waves that have a negative impact on both the quantity and quality of animal products [6,8,9].

For the above reasons, it seems imperative for farmers to undertake actions against CC, implementing certain measures and precautions to reduce their impact on the climate and mitigate the negative effects of global warming on agriculture, at the same time increasing the sustainability of all the food production processes. This is also true for the Nordic or Baltic countries, which are not listed among the most affected countries, although they are subject to both the negative and positive effects of CC [10]. The literature on identification of farmers' perceptions and attitudes towards adaptation and mitigation is particularly concentrated in Africa and Asia [11]. Fewer studies cover Europe and the Nordic European areas, including Denmark [12], Scotland [13], Sweden [10,14], Norway [15], and Finland [10,16], whilst Baltic countries, to the authors' existing knowledge, are not considered at all.

The present paper is the first qualitative study on the farmers' perceptions of vulnerability of the agricultural systems and application of mitigation and adaptation strategies in the Baltic area, specifically in Lithuania. The main aim of the research was to analyze livestock holders' perception of climate change and then to verify their knowledge about mitigation and adaptation techniques. Moreover, the spread of these techniques among farms specialized in animal production in Lithuania was also analyzed. In particular, specialized animal farms were considered as they contributed to CC and experience its consequences. Although studies on vulnerability and adaptation of agricultural systems are always highly area-specific, they are also helpful in building an idea about the overall degree of adaption of the sector to CC.

## 2. State of Art

### 2.1. Farmers' Behavior and Climate Change

To better understand the strategies of mitigation and adaptation to CC, it is important to analyze how the farmers perceive CC and its effects, both primary and secondary ones. The primary effects of CC refer to the changes in the composition of the atmosphere due to increased greenhouse gases, for instance, the rising of average temperatures, the variations in intensity, duration, and number of rainfalls, as well as the change in crop growth response, whilst the secondary effects comprise the shift in suitable places for cultivation and physical and chemical changes in agricultural soil, which include a different and/or more frequent presence of pests and diseases on crops and animals as modifications to their natural habitats [17]. The farmers will obviously implement these mitigation and/or adaptation measures only if they have the perception that the natural conditions of their activity are subject to certain changes by certain factors. The literature about farmers' perceptions is abundant. It focuses both on the process which starts with the observations and finishes with a decision (implementation of measures), as well as on the relation with the perceived risk [18]. A study conducted in Austria [19] has suggested that farmers' beliefs and perceptions about CC shape their judgement of the risk and opportunity and therefore their actions. Furthermore, direct experience of CC and its impacts profoundly affects the judgement of CC [20]. In addition, the CC-related values and beliefs are the drivers of adaptation and mitigation measures [16,21].

Several studies point out that the impacts of CC are only perceived on the local scale, as reported by ref. [22]. Extreme weather events affect the perception of climate risk, and awareness is, in most cases, in line with the weather changes, although some general uncertainty remains [13]. However, there is certain consensus in the literature on the main observed climate-related impacts, i.e., extreme maximum temperatures in summer and extreme minimum temperatures in winter [23] and the consequences of both scenarios, along with the perception among the farmers that the amount of annual rainfall has decreased [22].

## 2.2. Implications and Patterns of Climate Change in Lithuania

Lithuania is predominantly a rural country with 85.1% of the territory classified as an intermediate or predominantly rural region [24]. Moreover, 71% of the population live in the areas attributed to this type [24]. The utilized agricultural land comprises 46% of the total land of Lithuania, and agriculture is one of the key economic activities in the country [25]. In 2020, agriculture, forestry, and fishing contributed to 3.5% of the national Gross Domestic Product (GDP) and 3.66% of Lithuania's Gross Value Added (GVA) [25]. According to the data by Statistics Lithuania [26], animal production accounted for 35% of total gross agricultural production, and dairy was the principal livestock product, followed by poultry and pork.

Although Lithuania is still considered as a country subject to minor effect of the CC, the extreme events are becoming increasingly frequent, and the data provide a different picture than the generally accepted views [27]. According to Lithuania's meteorological monitoring data, the mean annual air temperature has increased by 1.8 °C compared to the 18th century and by 0.8 °C compared to the beginning of the 20th century. The fastest increase in the mean annual air temperature has been the most evident in the winter and spring seasons. Changes in precipitation have also been observed, such as an increase in the precipitation in the cold period (November to March) and decrease in the precipitation in the warm period (April to October).

Changes in temperature and precipitation considerably affect the development and productivity of the agricultural sector, in particular, crop production. This is due to the negative effect of droughts during the growing period; strong rainfall and the resulting flooding of the fields; low temperature on winter crops due to snow cover being too thin [28]. In light of these changes, farms' ability to adapt to CC is becoming increasingly relevant. These outcomes are particularly important, in particular, when compared to the Nordic countries, which are seen as benefiting from CC. Nonetheless, this strongly depends on individual farmers' decisions and whether or not they are able to take advantage of it [10]. Moreover, in Lithuania, animal husbandry may be considered a secondary activity and the dimension of the holdings is generally under the EU average, with a decrease in the dimension of the herd [25,29]. Due to the small dimensions and inner characteristics, it is reasonable to consider the livestock holdings in Lithuania to be vulnerable to the consequences of CC. Therefore, there is the need to adjust measures of adaptation to and mitigation of its consequences, and to understand and analyze farmers' perceptions about CC.

## 3. Materials and Methods

### 3.1. The Survey Structure

A semi-structured questionnaire was used mixing closed and open-ended formats in order to gather the data on farmers' perception about climate change and to understand whether they are interested in mitigation and/or adaptation measures and whether and why they choose to adopt them. The questionnaire was adapted from a previous study prepared and administered by the Italian National Rural Network (NRN) in Italy [30]. Adjustments to adapt the questions to the Lithuanian case study were made.

- The questionnaire was structured in three different sections: The first section presents few introductive close-ended questions relating to the respondent's personal data and general information about her/his holding.
- Middle section: it is the core of the questionnaire. The interviewees were asked about their perception of CC and their effects (closed-end format). They were asked about mitigation and adaptation measures implemented, and the reasons behind their choices and behavior. This part consisted of 6 closed-end questions aimed at identifying farmers' willingness and application of CC mitigation measures at their farm.
- Final section: it is a collection of good practices operated by farmers. This part of the questionnaire is organized in the open-question way and consists of 3 questions

asking to identify which mitigation measures are used, how the implementation is organized, and what finances are used.

The survey also aimed to split out farmers into three general categories:

- uninformed/uninterested farmer;
- informed but non-active farmer;
- informed and active farmer.

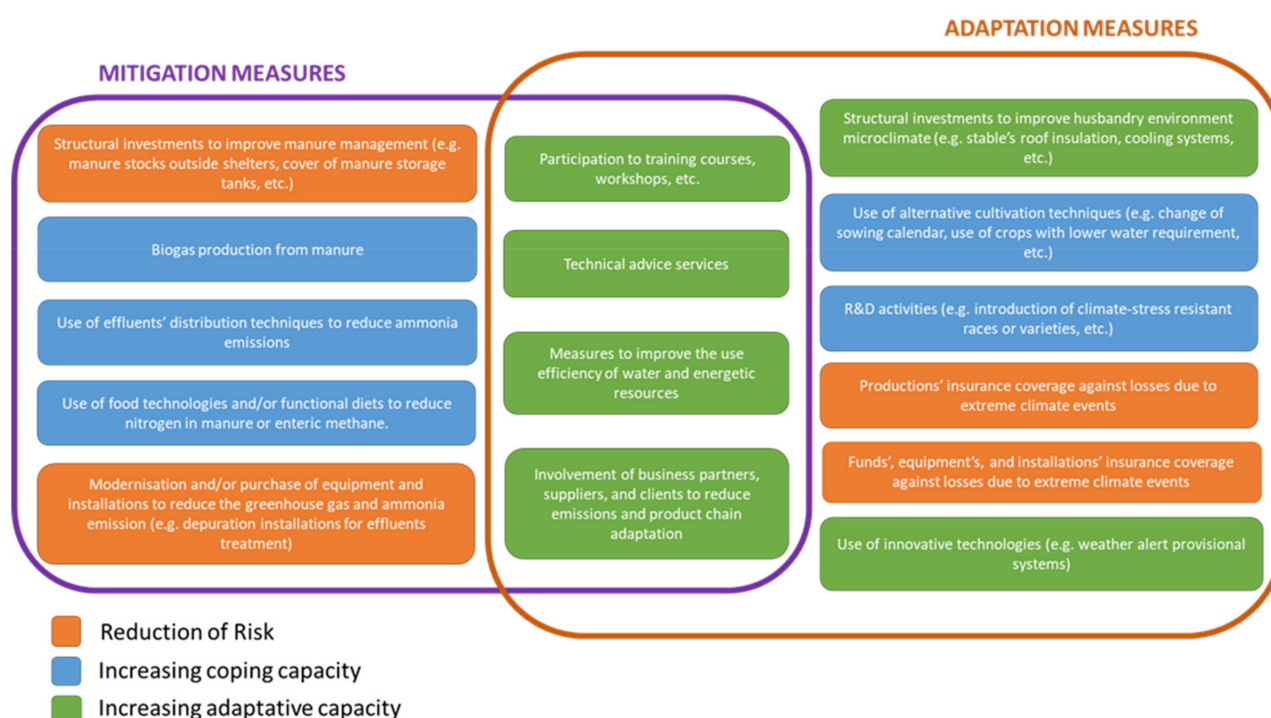
To identify these profiles, two key questions that led to different parts of the questionnaire were provided:

- The first key question was provided at the beginning of the second section to separate the *uninformed* and *uninterested farmers* from the others. It asked about knowledge of changes in the main climatic variables (in particular, temperatures and rainfall) and then if they believe that global climate change would have significant consequences in the next 10–20 years. The two-part question aimed to understand if the interviewees were aware of CC and its effects on their everyday activities (*uninformed farmers*) or even in case they were aware of them, they were uninterested (*uninterested farmers*). Only positive answer led to continue the survey. In case of a negative answer, the interviewees had to answer to a question related to their opinion on climate change.
- The second key question was whether the farmers chose to implement mitigation and/or adaptation or not. A negative answer led to a question relating to acknowledgement of the reasons behind their choice to not implement any adaptation and/or mitigation strategies. The question enabled the researchers to separate *active farmers* from *non-active* ones. Informed and active farmers were asked about the measures they adopted or were willing to adopt, proposing a list of both adaptation and mitigation actions. Final section about mitigation measures already applied and how they were implemented and financed was only for the informed and active farmers.

In the paper, adaptation to CC has been considered as an adjustment in ecological, social, or economic systems in response to the observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts of change or take advantage of new opportunities in a sustainable way [31]. Therefore, CC mitigation would be considered as the actions intended to limit the magnitude or rate of global warming and its related effects [32]. In particular, the adaptation and mitigation measures can be summarized in the questionnaire according to the categories proposed by ref. [33]:

- a. Enhancing carbon removals: measures to restore degraded lands; afforestation; no or minimum tillage; incorporation of organic matter;
- b. Optimizing nutrient use: precise dosage and timing when applying organic and inorganic fertilizers; incorporating nitrogen-fixing legumes into rotations;
- c. Improving productivity: approaches that increase the yield of edible output per unit of emissions generated, including crop and animal breeding; feed optimization and dietary additives; pest and disease management;
- d. Managing and benefiting from the outputs: including manure and plant biomass: composting and the use of anaerobic digestion;
- e. Reducing the carbon intensity of fuel inputs through energy efficiency improvements and the use of alternative fuels such as biomass, biogas, wind, and solar power.

Measures proposed to the farm in the survey were selected on the ground of the the Italian National Rural Network study (NNR) [30] as well as of the literature [34–37]. Mitigation measures proposed aim to reduce or sequester GHG, through investment and/or agriculture practices, whilst the adaption one aims to manage the climate risk to an acceptable level. However, some measures can be considered as hybrid and considered as adaptation or mitigation strategies, depending on the way of application. Figure 1 reports the measures proposed to the farmer and their division in the group (mitigation, adaptation, hybrid), along with their main scope (reduction of the risk; increase of coping or adaptative capacity).



**Figure 1.** Classification of the mitigation and adaptation measures identified in the survey.

### 3.2. Administration of The Questionnaire

In total, 250 questionnaires were submitted in July 2020 and 2021, involving livestock producers of cattle, swine, and poultry. The surveys were administered to the farmers during the training courses organized by Vytautas Magnus University Agriculture Academy and by the collaboration with the Lithuanian Farmers' Union, which helped distribute the questionnaires to its members, randomly chosen. Therefore, it cannot be considered a probability sample. However, it fulfills some essential requirements as no part of the population was systematically excluded from the sample and the composition of the sampled units with respect to the observed characteristics corresponds (Table 1) to the composition of the larger population [33]. The total of 120 surveys were filled in, of which only 93 were considered as properly completed. Incomplete questionnaires were not included in the analysis.

The sample could be deemed as being representative of the Lithuanian livestock holders considering their personal characteristics, although it included the owners who were older than the general population (Table 1). Considering the holdings' characteristics, the percentage share of swine and poultry holders should have been more significant in this study in order to correctly describe the country, while the bovine holders (Beef and Dairy cattle) were overrepresented. The second important difference was related to the agricultural land: the farms smaller than 30 hectares were underrepresented in the sample and, on the other hand, the large ones were overrepresented (Table 1). Despite the presence of these discrepancies, the sample may provide interesting indication for several reasons. First of all, relatively large farm sizes are usually more likely to take up new adaptation strategies when compared to farmers holding small size farms [38]. Therefore, the hesitations in applying adaptation and mitigation measures should be considered more present among smaller farmers. In terms of the different share of the species, enteric fermentation is one of the most important sources of direct GHG emission, along with manure management for  $N_2O$  [39]. Thus, the authors of the present paper included bovine holders as the holders of the most impacting species into the sample.



**Table 1.** Socioeconomic characteristics of the study sample and the general population.

Socioeconomic Characteristics		Sample	General Population <sup>1</sup>
Holders' gender	Male	53%	53%
	Female	47%	47%
Holders' age	Younger than 40	28%	12%
	40 or older	72%	88%
Main business (in terms of revenue)	Beef cattle	43.01%	66.47%
	Dairy cattle	48.39%	
	Fattening pigs	2.15%	16.16%
	Poultry	6.45%	13.57%
Utilized agricultural land	Less than 2 ha	2%	5.84%
	2–9.9 ha	11%	53.27%
	10–29.9 ha	11%	26.81%
	30–49.9 ha	16%	5.60%
	50 or more ha	59%	8.41%
	No agricultural land	1%	0.04%
Occupancy form	Self-employed	83%	99.68%
	Associated	15%	0.27%
	Other	2%	

<sup>1</sup> Source: [22,27].

#### 4. Results and Discussions

Data were processed using univariate analysis. The results show that farmers were generally aware of CC and its effect, in line with the results obtained by other studies [10,18–20,22,40]. Moreover, the analysis of the data showed that farmers observed effects of CC on their activity: a majority of them claimed to have noticed significant changes in climate variables in the recent 10 years (85% of the respondents). The remaining share of the sample (15%) was classified as *uninformed* or *uninterested* farmers and therefore they are not included in the analysis.

In their responses to questions on the long-term effects of climate change, farmers mostly noticed an increase in temperatures (86%). A less relevant percentage observed a decrease in the number of rainfalls (46%) and an increase in the intensity of rainfalls (33%). Their perception of CC was almost in line with the reality, in particular in relation to precipitations, which was something expected [11,41]. Furthermore, farmers were asked about the consequences of CC which affected their activities in the recent 3–5 years and to what extent (Table 2).

**Table 2.** Climate change's long-term effects observed by farmers in Lithuania.

	Not at All/A Bit	Enough	A Lot
Heavy rainfalls and flood risk	27.8%	34.2%	30.4%
Sudden and exceptional temperature decreases (e.g., late frost)	24.1%	44.3%	24.1%
Sudden and exceptional temperature increases (e.g., heat waves)	10.1%	48.1%	39.2%
Drought and water scarcity for irrigation	6.3%	54.4%	36.7%
Erosion and deterioration of soil quality	27.8%	25.3%	38.0%
Seasonal delays and/or advances for crops	21.5%	20.3%	48.1%
More frequent presence of diseases and pest on crops or animals	16.5%	41.8%	36.7%
Natural habitats modification and loss of biodiversity	25.3%	26.6%	38.0%

The great share of respondents who were particularly aware of heat waves acknowledged that it was not surprising, as they were surrounded by the climatic alterations with the greatest impact on the conditions and health of animals, as reported in the literature. The negative effects of heat stress on livestock could result in: (1) an increase in animal mortality rates, in particular due to the impaired immune responses and the spread of infectious diseases [6]; (2) a reduction in fertility due to the altered hormonal patterns [6,9]; (3) a reduction in feed intake and growth rates [6]; (4) a reduction in the amounts of milk, in particular, in high-producing dairy cows [6]; and (5) a worsening of the quality of all productions [8].

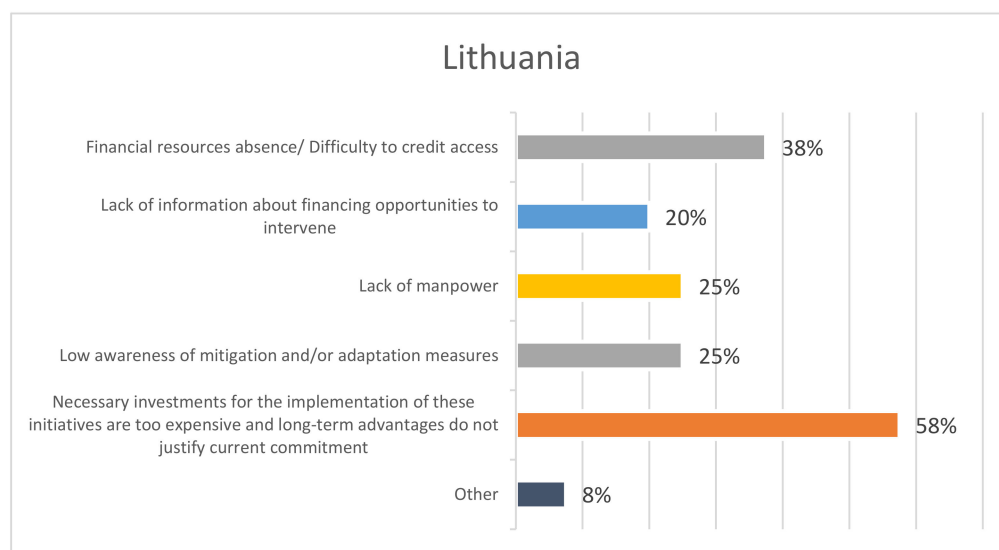
Farmers' perceptions of the negative effects of CC were usually the strongest motivational factor in the adoption of mitigation and adaptation strategies, as well as the knowledge of CC and the trust in scientific information [42–44]. Despite a certain percentage (48%) of the respondents who claimed having been informed of climate change through participation in training courses, workshops, etc., the majority of the livestock holders (77%) chose traditional networks such as television, radio, and newspaper as the source of information about their activity, or modern ones such as the web, forums, and social networks (62%). These percentages are comparable to those observed in developing countries, where these values were justified by the level of education in the general population [40]. Less farmers stated that they had received technical advice (20%) or had been made aware by information campaigns (23%). Indeed, it was not comforting to learn that the respondents would rarely learn about CC from specific and technical sources, indicating that their knowledge was common and generalist, while very positive effects on the farmers' behavior in CC-related adaptation and mitigation activities when consulting activities/services are used has been proven in the Lithuanian context [28].

When asked about the impact of the CC on agricultural activities, the respondents stated that CC affected their farm work in three major ways: difficulties in normal tillage performance (84.9%), decrease in fodder production, and increase in general production cost (89.6% each). On the other hand, more than half of the respondents did not notice any damages to the service infrastructure, installations, or buildings. Modifications of the qualitative and quantitative production of fodder is not a completely expected result. The rising of temperature in humid temperate region would be expected to lead to an increase in productivity; however, changes in the season duration may have the opposite effect [3].

Although majority of the farmers were aware of CC, only about half of them stated that they had decided to implement mitigation and/or adaptation measures. They can therefore be considered as *informed and active farmers*. On the other hand, 55% of the farmers could be classified as *informed but inactive*, and the reasons behind the decision to implement any measures are shown in Figure 2. The most popular rationalities were the economic ones. Similarly, the leading factors in case of implementation of enforcements were economic: 58% of respondents stated that they had implemented adaptation and mitigation measures to reduce business economic vulnerability. Mitigation and adaptation measures are expected to not reduce farmers' income and compromise agricultural production sustainability [43]. Another important motivation chosen by the 44% of the respondents was the imposition by the international or national legislation. On the other hand, implementation in view of the business image and competitiveness or adoption of international certification standards was irrelevant.

Since the economic reasons were the leading factor in deciding in favor of either implementation or non-implementation, the farms in a more difficult economic situation reasonably decided not to implement them. Following this consideration, it was interesting to see the percentage of farmers who claimed they had low awareness of mitigation measures, and they did not have any information about financing possibilities. Although the percentage was fairly low, this gave rise to the following question of possession of technical information among the farms, as discussed above: could information and technical advice bring more knowledge about economical possibilities for implementation of the measures against CC? The importance of the socioeconomic reasons for implementation of

any mitigation or adaptation measures had already been highlighted for the Asian context and a similar effect could also be expected in this case study [44]. Ref. [21] found that the awareness of CC's impacts would increase the farmers' willingness to participate in adoption and mitigation programs. They highlighted the necessity of increasing farmers' awareness of CC issues before the implementation of adaptation programs [21].



**Figure 2.** Main reasons behind the decision to implement any mitigation/adaptation measures.

Livestock holders who were classified as “*informed and active farmers*” were asked about the enforcements that they had adopted at their farm or that they were willing to adopt. These were divided in three different sections: mitigation measures, adaptation measures, and measures for both adaptation and mitigation, as shown in Figure 1. The results are provided in Tables 3–5: respondents could point out more than one option. The analysis of the implemented mitigation and/or adaptation measures showed that most of them were aimed at improving animal management or business productivity. This meant that farmers were willing to invest in order to make their main activity more profitable and reduce the economic losses. A lot of respondents ignored other measures less related to the core business of the holding, such as biogas production from manure or the implementation of the enforcements to reduce GHG emissions by engaging business partners, suppliers, and clients. In general, most of the measures adopted were the technological developments or the adapted farm production practices [45,46]. These results were similar to the NRN research, highlighting again that the implementation of any measures was mostly an economic decision.

Based on the classification proposed in Figure 1, it could be affirmed that the possible actions mainly aim to improve or at least maintain the productivity and manage and benefit from the manure. Moreover, most of them are more devoted to reduction of the risk than improvement of the adaptability in the short and long term (coping and adaptative capacity).

Deeper inquiry into the measures for the adaption strategies showed a huge amount of direct and indirect actions related to manure and fertilizer management, corresponding to the literature review findings. Mitigation practices regarding manure usually involve shortening of the storage duration, improvement of the timing and application of manure, use of anaerobic digesters, covering the storage, using a solids separator, and changing the animal diets [3]. Anaerobic digestion may reduce methane emissions while producing biogas, thereby reducing the potential of GHG emissions by methane to CO<sub>2</sub> conversion. Fertilizer application leads to an increase in the nitrous oxide emissions; therefore, the mitigation measures include increase in the nitrogen use efficiency, plant breeding and genetic modifications, use of organic fertilizers, regular soil testing, use of technologically



advanced fertilizers, and combining legumes with grasses in pasture areas, which may decrease GHG emissions in feed production [3].

Finally, it was particularly interesting to observe that the respondents were interested in almost every option proposed, stating that they would implement them in the future. This suggested that the adoption of the enforcements against CC was still new to Lithuania, and the farmers who were already aware of the enforcements were only starting to discover and study them, building their interest in the implementation in the future.

**Table 3.** Possible mitigation measures: implementation state and willingness to implement.

Mitigation Measures	Future or Next Implementation	Already Implemented	Will Not Be Implemented
Structural investments to improve manure management (e.g., manure stocks outside shelters, cover of manure storage tanks, etc.)	25.0%	44.4%	16.7%
Modernisation and/or purchase of equipment and installations to reduce the greenhouse gas and ammonia emission (e.g., depuration installations for effluents treatment)	36.1%	38.9%	8.3%
Use of food technologies and/or functional diets to reduce nitrogen in manure or enteric methane	36.1%	25.0%	16.7%
Use of effluent distribution techniques to reduce ammonia emissions	30.6%	19.4%	25.0%
Biogas production from manure	22.2%	5.6%	44.4%

**Table 4.** Possible adaptation measures: implementation state and willingness to implement.

Adaptation Measures	Future or Next Implementation	Already Implemented	Will Not Be Implemented
Structural investments to improve husbandry environment microclimate (e.g., stable's roof insulation, cooling systems, etc.)	36.1%	25.0%	16.7%
Use of alternative cultivation techniques (e.g., change of sowing calendar, use of crops with lower water requirement, etc.)	38.9%	27.8%	11.1%
R&D activities (e.g., introduction of climate-stress resistant races or varieties, etc.)	41.7%	19.4%	19.4%
Production insurance coverage against losses due to extreme climate events	41.7%	11.1%	25.0%
Funding of equipment and installation insurance coverage against losses due to extreme climate events	38.9%	27.8%	11.1%
Use of innovative technologies (e.g., weather alert provisional systems)	41.7%	11.1%	19.4%

**Table 5.** Possible mitigation and adaptation measures: implementation state and willingness to implement.

Adaptation and Mitigation Measures	Future or Next Implementation	Already Implemented	Will Not Be Implemented
Participation in training courses, workshops, etc.	27.8%	44.4%	13.9%
Technical advice service	38.9%	30.6%	8.3%
Measures to improve the efficiency of the use of water and energy resources	50.0%	22.2%	8.3%
Involvement of business partners, suppliers, and clients into reduction of emissions and product chain adaptation	30.6%	5.6%	33.3%

Informed and active farmers were also asked about the way of implementation. All the respondents stated that they implemented their measures individually, and most of them used their own funds, therefore, it could be claimed that their actions were intended [39]. Farmers mostly used two economic tools to finance the implementation of their measures: the Rural Development Program fund (69%) and their own funds (78%). Almost half of them also applied for the subsidized loans (44%). Less relevant was the use of insurance policies and general loans (14% and 11%, respectively). On very rare occasions, the respondents resorted to sectoral contracts or mutual funds (3% and 6%).

The uninformed/uninterested farmers, who stated not having observed CC in their activity, were asked about their general opinion on CC. Two thirds of the respondents stated that they did not believe that CC would have any significant impact in the future. However, since very few respondents were classified as “uninformed/uninterested farmers”, these answers were not of particular statistical relevance.

While the results regarding farmers’ perception were similar to ref. [28], the situation was changing in the area of implementation of mitigation and adaptation measures. In the NRN study, nearly 70% of the respondents stated that they had implemented enforcements to counteract CC, while in Lithuania, these were only 47%. The farmers who did not implement any enforcements mostly referred to the economic reasons: the investments were too expensive, and their benefits did not justify the cost and difficulty to access to credit; another significant motivation was the lack of information. This could be explained by the fact that the Italian Rural Network mostly interviewed farmers who owned large and specialized holdings, working in one of the areas that was the most suitable for the livestock production in Italy. On the other hand, livestock holdings in Lithuania were smaller, especially in terms of gross production, and located in area where other agricultural sectors were favored.

## 5. Conclusions

This paper is the first attempt to find out whether the Lithuanian farmers are aware of CC and have adopted or are willing to undertake measures to combat this phenomenon. The study has shown that the farmers perceive CC and its effect on their businesses. They have mainly noticed an increase in temperature, resulting in the phenomena such as heat waves and an increase in conditions of drought and scarcity of water for irrigation. The results also suggest that technical and specific information is rare among respondents, pinpointing the issue of general understanding of climate change.

Economic reasons are the main motivators that lead the farmers to decide whether or not to adopt mitigation and/or adaptation measures. Since Lithuania is a nation where animal husbandry is not one of the main agricultural activities, holding owners are strongly conditioned by the economic variable. Their goal is to reduce possible economic losses and improve the performance of their core business in the CC scenario. This information is important for public decision makers who seek to encourage the adoption of mitigation

and adaptation measures, in particular in light of the observed fact that the farmers do not collaborate with each other, investing mainly on their own. As noticed by FPP Consulting [26], there is still lack of research exploring agricultural production and the ways to make rational and sustainable use of the EU and national resources and other policies in the context of CC. Despite the dimension of the sample, the results of this work may be useful as the first attempt to understand the Lithuanian farmers' perceptions and responses in relation to CC, to be followed by a subsequent study. In particular, the results should be considered in the light of the new Common Agriculture Policy and of the new strategy aimed at challenging the CC and environmental degradation, the so-called Green Deal. The Lithuanian Agriculture and Rural Development 2021–2027 strategic plan is currently under preparation. One of the main goals of the strategic plan is to help mitigate and adapt to CC and to generally stimulate development of the bio-economy in the agricultural and food sectors.

**Author Contributions:** Conceptualization, L.R.; methodology, F.C.; validation, F.C., A.N. and L.R.; formal analysis, F.C.; investigation, A.N.; writing—original draft preparation, L.R., F.C. and A.N.; writing—review and editing, L.R., F.C. and A.N.; supervision, L.R.; All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

**Conflicts of Interest:** The authors declare no conflict of interest.

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