17th International European Forum
System Dynamics and Innovation in Food Networks
February 13-17, 2023
Garmisch-Partenkirchen, Germany

Climate change perception and some adaptation practices in Hungary

József Tóth, CUB, HU - Sapientia HUT, RO
Daniela Spina, University of Catania, Italy
Manal Hamam, University of Catania, Italy

Research was supported by National Research, Development and Innovation Office, Hungary, Grant—K 143370
"Agricultural Climate Change Adaptation Behavior and Circular Economy"

Why is it important?

Empirical research from around the world

Data and methodology

Results

Conclusions

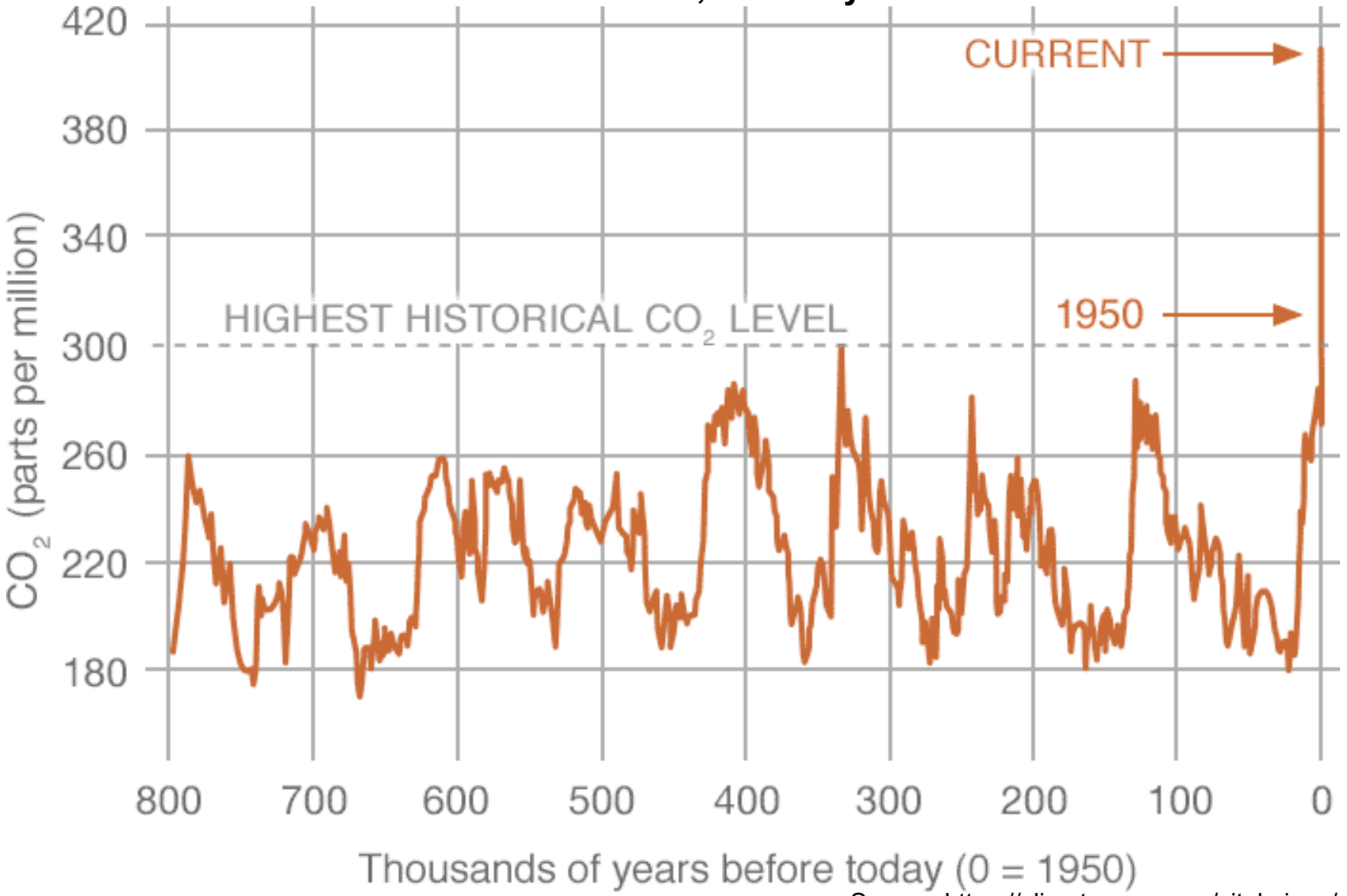
Why is it important?

Empirical research from around the world

Data and methodology

Results

Conclusions



Source: https://climate.nasa.gov/vital-signs/carbon-dioxide/

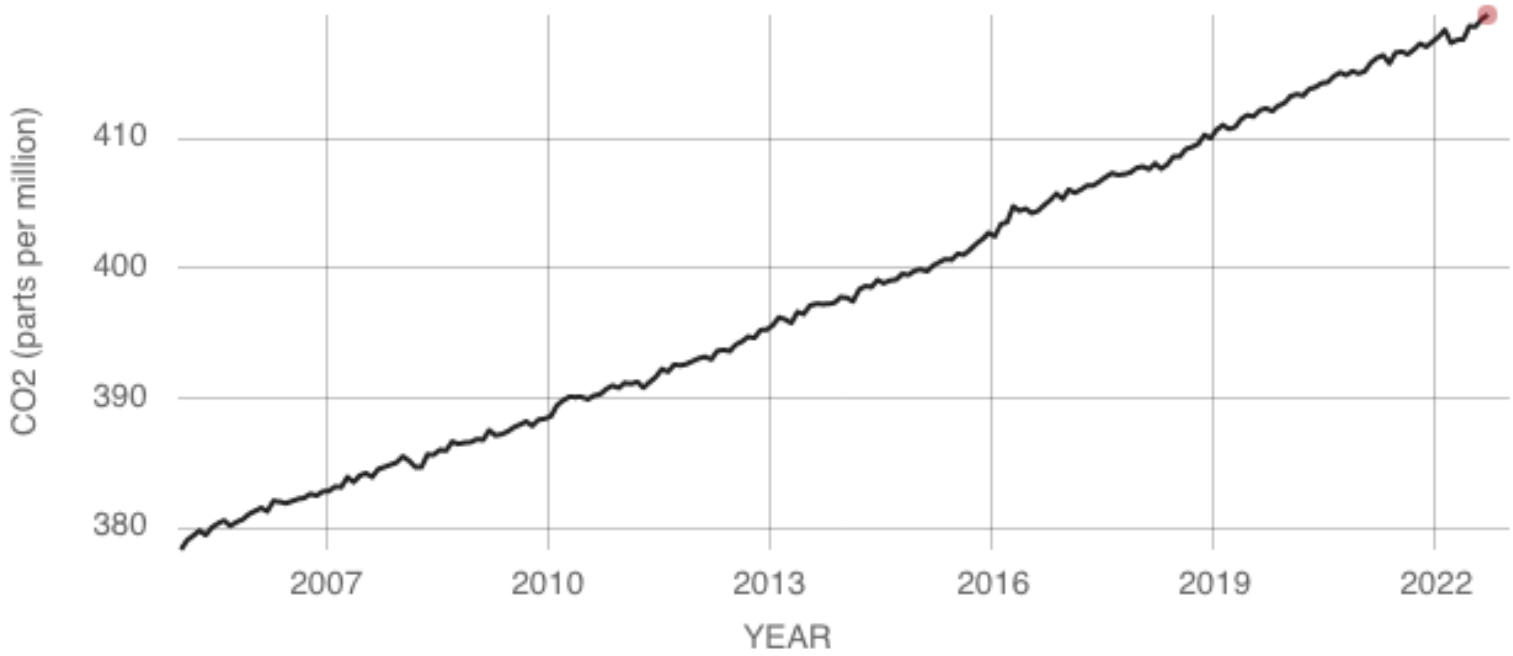
Carbon Dioxide

LATEST MEASUREMENT: September 2022

419 ppm

DIRECT MEASUREMENTS: 2005-PRESENT

Data source: Monthly measurements (average seasonal cycle removed). Credit: NOAA



Source: https://climate.nasa.gov/vital-signs/carbon-dioxide/

Stylized facts :

- Global temperature rise: 1.1℃ since the end of the 19th century
- Shrinking ice sheets: Greenland,150 – 250 km^3
- Declining snow cover: less snow in the northern hemisphere and earlier melting
- Sea level rise: 8 inches in the last century
- Extreme events: high temperatures and heavy rainfall

Strong link between climate change and agriculture

- Although the Earth's climate has been changing throughout history, the current warming is occurring at a rate unprecedented in the last 10 000 years.
- According to the Intergovernmental Panel on Climate Change (IPCC), "since the beginning of systematic scientific assessment in the 1970s, the impact of human activity on the warming of the climate system has become a theoretically established fact".
- Scientific information from both natural sources (such as ice cores, rocks and tree rings) and modern equipment (such as satellites and instruments) show signs of a changing climate.
- From rising global temperatures to melting ice sheets, there is plenty of evidence that the planet is warming.

Forrás: https://climate.nasa.gov/evidence/

Why is it important?

Empirical research from around the world

Data and methodology

Results

Conclusions

- UN: climate-smart agriculture is important, but adoption of CSA (Climate Smart Agriculture) practices is low.
- In India's coastal and non-coastal regions, priority is given to resistant crop and livestock varieties, intercropping, water management and livestock vaccination.
- Indigenous techniques are also used to enhance CSA capacity.
- It is important to encourage farmers towards these priorities.
- The strategy is useful to prioritise and scale up site-specific CSA initiatives.

Das, U., et al. (2022). "Effectiveness and upscaling potential of climate smart agriculture interventions: Farmers' participatory prioritization and livelihood indicators as its determinants." Agricultural Systems 203: 103515.

- There is a two-way relationship between climate change and adaptation farming practices: the impact of adaptation measures is ambiguous (risky).
- Farmers' willingness to take risks is highly dependent on the individual.
- The necessary risk requires a better understanding of the "what, where and how" dimensions of adaptation measures.

Ibrahim, M. A. and M. Johansson (2022). "Combating climate change – What, where and how to implement adaptive measures in the agriculture sector of Öland, Sweden, keeping in view the constraints of carrying capacities and risk of maladaptation." Land Use Policy 122: 106358.

- Climate change threatens the productive and livelihood capacity of rural farming communities in Kenya.
- In the western region of Kenya, where the majority of farms grow maize, farmers believed that climate change was responsible for declining agricultural yields and productivity, as well as crop losses and an increase in fallow land.
- The two most significant forms of adaptation by farmers were changing sowing dates and selecting drought-tolerant varieties.

Kogo, B. K., et al. (2022). "Response to climate change in a rain-fed crop production system: insights from maize farmers of western Kenya." Mitigation and Adaptation Strategies for Global Change 27(8): 50.

- Adapting agricultural systems to seasonal rainfall variations is critical for the agricultural sector in Sri Lanka.
- Motivations and welfare effects are crucial in adopting agricultural strategies to adapt to low rainfall.
- There are three different dimensions: a) vulnerability to water scarcity, b) household productivity and c) household livelihoods.
- The results demonstrate that farmers need to maintain a balance between reducing vulnerability to water scarcity and maximising profitability and welfare outcomes.

Scognamillo, A., et al. (2022). "The challenge of making climate adaptation profitable for farmers: evidence from Sri Lanka's rice sector." Environment and Development Economics 27(5): 451-469.

Research question:

What are the main drivers for Hungarian farmers to adopt climate-smart adaptation practices?

Approach :

- individual decision-makers (farmers)
- exploratory analysis

Why is it important?

Empirical research from around the world

Data and methodology

Results

Conclusions

Data

- Connected to the Hungarian Farm Accountacy Data Network (FADN)
- The Hungarian FADN is based on a sample of more than 106 000 farms (individual farms and partnerships) with an economic size above the standard production threshold of EUR 4 000
- The 2017 Hungarian FADN includes 2100 farms, of which 302 were randomly selected
- Questionnaire to explain farmers' adaptation behaviour

The questionnaire structure

- Beliefs about climate change
- Perception of climate change impacts and degree of climate change exposure of producers
- Producers' adaptation practices
- Barriers to adaptation

Methods applied

- Descriptive statistics
- Exploratory Factor Analysis (EFA) to synthesize Hungarian farmers' perceptions of climate change damages
- Logit model to examine the likelihood of Hungarian farmers adopting new strategies to offset the impacts of climate change

Why is it important?

Empirical research from around the world

Data and methodology

Results

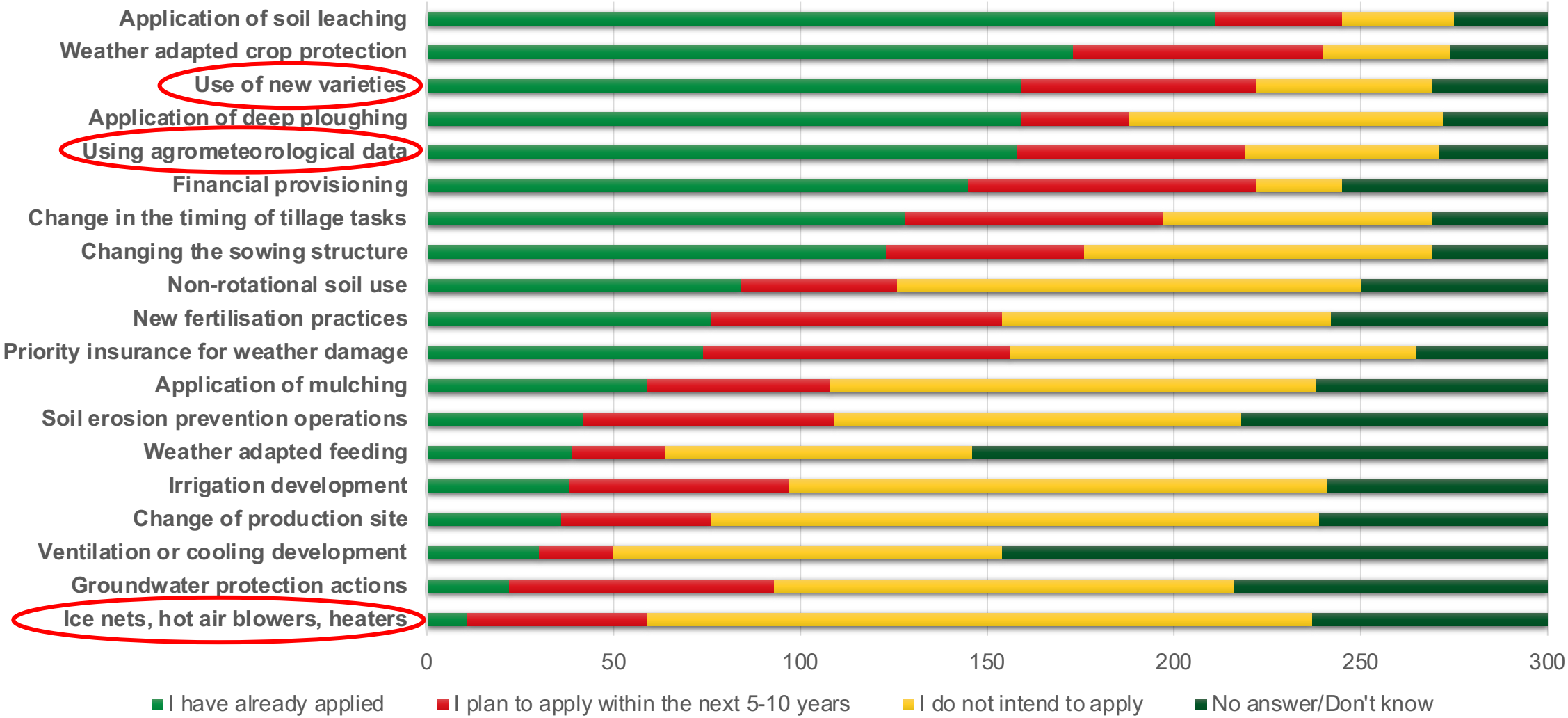
Conclusions

universitätbonn

CORVINUS UNIVERSITY of BUDAPEST

17th International European Forum
System Dynamics and Innovation in Food Networks
February 13-17, 2023
Garmisch-Partenkirchen, Germany

Prevalence of adaptation techniques



Perception variables	Mean	St. dev.
The weather has become volatile	3,35	1,31
Average temperatures have risen	3,37	1,27
The quality of my products has deteriorated	2,68	0,85
Yields have decreased	2,86	0,93
The adverse impact of groundwater has increased	2,02	1,14
Watershed	2,61	1,21
Floods	1,40	0,82
Emergence of new pests	2,94	0,98
Emergence of new pathogens and diseases	2,91	0,97

Note: 1 - strongly disagree; 5- strongly agree

Adaptation variables	Átlag	Szórás
Use of new varieties	0,82	0,38
Ice and frost protection	0,25	0,43
Use of agrometeorological data	0,81	0,39

Note: 0 - do not intend to apply; 1- have already applied or intend to apply in the next 5-10 years

Factors for exploratory factor analysis

	Temperature rise	Water damage	Insect damage	Economic damage
The weather has become volatile	0,92			
Average temperatures have risen	0,93			
The quality of my products has deteriorated				0,82
Yields have decreased				0,81
Water damage to the soil		0,79		
Watershed		0,82		
Floods		0,72		
Emergence of new pests			0,93	
New pathogens and diseases			0,92	

The Logit model used

$$ADAPTATION_i = \alpha + \beta\ climate\ change\ perception_i + \mathbf{v}\ managerial\ qualification_i + \varepsilon_i$$

Management qualification levels: 1) none; 2) vocational; 3) skilled; 4) farm engineer; and 5) agricultural engineer

Logit results on agrometeorological data

	Coefficient	Odds ratio
Economic damage	-0,415	-0,66**
Perception of temperature change	0,757	2,13***
Water damage	0,607	1,83**
Insect damage	0,696	2,01***
Managerial qualification	0,578	1,78**

***, ** *Significant at 0,01 and 0,05 level, respectively*

Logit results on use of **new varieties**

	Coefficient	Odds ratio
Economic damage	0,096	1,10
Perception of temperature change	0,505	1,66**
Water damage	0,489	1,63*
Insect damage	1,07	2,91***
Managerial qualification	0,595	1,81**

***, ** *Significant at 0,01 and 0,05 level, respectively*

Logit results for **frost protection** upgrades

	Coefficient	Odds ratio
Economic damage	0,483	1,62**
Perception of temperature change	-0,042	0,96
Water damage	0,779	2,18***
Insect damage	0,484	1,62**
Managerial qualification	0,169	1,18

***, ** *Significant at 0,01 and 0,05 level, respectively*

Why is it important?

Empirical research from around the world

Data and methodology

Results

Conclusions

- Climate change is accepted as a fact by agribusiness
- Rational behaviour leads them to try to mitigate negative impacts through appropriate responses
- However, the adaptation practices applied represent a risky decision for both the environment and the farmer

- Hungarian farmers perceive climate change mainly through the negative impacts of temperature change, water damage, insect damage and economic damage
- In addition to these perceptual factors, their innovative adaptation responses depend mainly on their level of education
- Agricultural policy should pay particular attention to education, in addition to the use of appropriate financial incentives

Thank you for your attention!

jozsef.toth@uni-corvinus.hu