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## **Agricultural education and its audiences facing the challenge of climate change. A socio-economic analysis of the contribution of this training device to the implementation of Nature-Based Solutions.**

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### **Short abstract**

Climate change and its consequences on our society are a concern for all the population. In order to reduce or adapt to the coming changes, we need to modify our lifestyles. To accompany this change of practices, different means can be used but one of the most important is the education of young people. It is therefore important to modify diplomas, training and teaching in order to integrate the issue of climate change and its solutions. In this study, we want to present such a process for the training of French agricultural high schools. To do so, we surveyed 10 agricultural high schools and 300 students. We started our analysis by focusing on the knowledge and perceptions of the students on climate change, then we did the same with their teachers. In a final step, we brought the teachers together to present the results of the surveys and discuss how to integrate these results into their teaching.

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### **Extended abstract**

#### **Purpose**

The issues of climate change are challenging growing sections of civil society. Citizens are beginning to organize in order to raise awareness and put pressure on governments. In particular, mobilization is growing among youth. "The global climate strike movement" inaugurated in 2018 by Swedish high school student Greta Thunberg has been emulated in various other countries, including France. Based on the alarming conclusions of the report of the Intergovernmental Panel on Climate Change (IPCC), these youth movements are demanding a new way to deal with the climate issue. In particular, they militate for the maintenance of the integrity of all ecosystems and the preservation of biodiversity to be placed at the heart of the fight against global warming. In other words, they want "Nature-based Solutions" (NBS) to be privileged in this fight.

Nature-based solutions are defined by the International Union for Conservation of Nature (IUCN) as, "actions to protect, sustainably manage, and restore natural or modified ecosystems to directly address societal challenges in an efficient and adaptive manner, while ensuring human well-being and producing benefits for biodiversity" (2016, p.6). The idea carried by this concept is that preserving, restoring, or creating ecosystems provide different types of services for society (regulatory services, provisioning services, and cultural services). In the case of climate change, the ecosystem services concerned are regulating services, which aim at mitigating climate change or adapting ecosystems and populations to its effects.

However, if the NBSs meet with a growing success in the citizen mobilization of youth as well as in the scientific community, their practical implementation is not self-evident. Indeed, the latter requires not only the development of new scientific and technical knowledge, but also requires the adherence of

actors to new values (those related, in a general way, to the recognition of the primacy of Nature over human activities) and to the establishment of a concerted management of natural resources on a territorial scale.

Based on these observations, the purpose of this research is to analyze and understand how youth and teachers actually position themselves with respect to NBSs and how this may impact the trainings with which they are affiliated. Few studies have so far focused on this category of the population. Yet it is today's youth who will suffer the most from the impacts of global warming and, if nothing is done, who will have to adopt emergency measures in the future.

## **Design/Methodology/Approach**

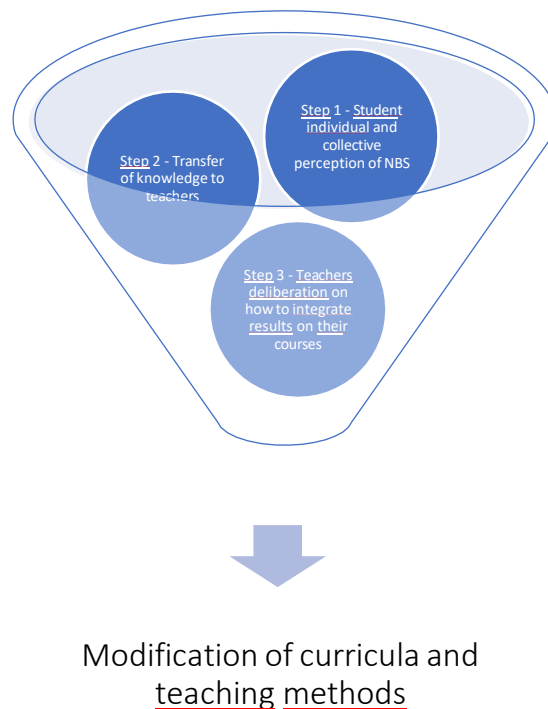
### **Field of study**

Within the framework of a project called DEFICLIM (Labex SMS), we have created a network with 10 agricultural high schools, 20 teachers of economics, agronomy and biology and one to two classes of BTS per school ranging from 10 to 50 students. The aim of this project is to analyze the perception of climate change and nature-based solutions of these young people. This allowed us to create a team of teachers committed to the survey protocol from the beginning.

### **Methodology**

In order to help teachers evolve their practices towards a better integration of climate change issues, we used a three-step method (Figure 1). The first step consists in estimating and ranking the preferences for NBSs of students. More precisely, we want to know and analyze their preferences towards these NBSs and their capacities to project themselves towards actions for the protection and maintenance of these NBSs. To do so, we use economic valuation to identify and measure their preferences and guide public policy makers (Sutter et al., 2019). Some work has already shown that these young people may be willing to pay for environmental protection whether it is to reduce the risk to their health (Guerriero et al., 2018) or for environmental protection more generally (Dardanoni and Guerriero, 2021).

To conduct this monetary assessment, we chose the Deliberative monetary valuation approach (DMV, Kenter, 2017). DMV is based on a complex process. Its implementation relies on a combination of Choice Modeling and deliberation. Choice Modeling would capture the individual preferences of young adults regarding Nature-based Solutions. Using an individual questionnaire, it is possible to identify how young people position themselves with respect to these solutions (the value they attribute to them), the way in which they envisage mobilizing them in their future professional activity, the changes in behavior that they are ready or not to make in order to do so, etc. Deliberation allows us to examine the extent to which an interactive debate between students can change the group's representations of NBSs and lead participants to evaluate their common priorities for NBSs. This examination is done through focus groups with project stakeholders.



*Figure 8 – A three step approach*

The second step is to transfer this knowledge to teachers. Themes related to the use of NBS for climate change adaptation, and more broadly to the management of environmental commons, are becoming increasingly important in agricultural education curricula. However, teachers, especially economics and management teachers who were our main contacts during the initial stages of our research, do not always have the conceptual and methodological frameworks to deal with these topics with their students. The teachers' difficulties are all the more exacerbated because scientific advances in the fields of environmental economics and natural resources are relatively recent and the scientific knowledge produced has so far only been partially transposed into agricultural technical education. The first stage described above was the opportunity to carry out an initial transfer of this knowledge via the individual surveys carried out and the deliberative workshops set up (concepts of private, club, common, public goods; ecosystem services; territorial governance, etc.). Moreover, if the activities proposed to the students served to collect material essential to our research, they also contributed to the construction by the students, but also the teachers, of the operative value of the said knowledge thanks to their implementation in the resolution of concrete cases. Finally, these activities allowed the teachers to experiment with new methodologies that could be used in the classroom (network analysis and economic evaluation methods) and to test new tools for raising environmental issues with the students. In our opinion, these transfers need to be continued and deepened.

Finally, the third step aims to accompany the teachers in the action in organizing a workshop with the 20 teachers that participate to the project. From the preceding stage, the teachers are supposed to become aware of the new knowledge on the Climate Change and NBS, but also of the perceptions of young people regarding these environmental issues. To measure this, before the workshop, an online

questionnaire will be sent to the participants in order to collect their representations of a teaching-learning point, the definition that each of them attributes to climate change, the values and anti-values that they associate with it. This seems important to us because we consider that education and the issue of climate change inevitably mix knowledge, social and political values (Roth, Barthes & Cohen, 2020). During the workshop, in order to understand the social representations of teachers with regard to climate change, the focus group will also allow us to encourage the expression of these values and anti-values<sup>1</sup>. To understand teachers' social representations of climate change, we will mobilize the work of the Aix School, which approaches social representations from the theory of the central core and peripheral elements (Abric, 1994). They are therefore asked to work together to create lectures and tools integrating these new knowledge and values.

### **Findings**

For the moment, the first two stages are finished and the material collected is being analyzed. However, the workshop with the teachers will take place between May 10 and 12. Nevertheless, we can already draw some lessons from this material.

- The online student survey shows that the vast majority of students are aware of climate change issues and only 3% appear to be climate skeptics. In contrast, although a large proportion of students are aware of Nature-based Solutions, very few see them as threatened. As a result of the class discussion, 61% of students revised their judgment of NBS by considering that the use of NBS could effectively address climate change.
- The economic evaluation based on the responses to the individual questionnaires reveals that students are very sensitive to the preservation of fruit and vegetable quality, terrestrial and aquatic biodiversity. Maintaining water availability is an attribute considered less critical. Students stated that they are willing to pay in the form of a pledge from conservation organizations the equivalent of 76 euros per month to ensure the maintenance of these three attributes: 29 euros per month for terrestrial biodiversity, 24 euros per month for aquatic biodiversity, and 23 euros per month fruit and vegetable quality. After deliberation, the students make a radical change in the values attributed to NBSs. They are no longer willing to pay to protect them, while at the same time the students indicate that the debate has made them more aware of the importance of maintaining the benefits of NBS.
- Discourse analyses provide some insights into this paradox. While deliberation is accompanied by a greater awareness of the importance of NBSs for society, students believe that the preservation of the environmental goods that give rise to NBSs requires a shared effort. Thus, they are willing to make individual efforts only if others do as well.

For their part, the teachers learned about these results and debriefed them with their students. They also created a think tank or knowledge sharing group in which they exchanged book references and other knowledge vectors around climate change and NBS.

### **Practical Implications**

The project is not finished, but the practical implications are already present. First, individual teachers have begun to receive training on the impacts of CC through a French professional training process called "Plan National de Formation". These PNFs are offered by the French Ministry of Agriculture. Other teachers decided to train in the animation of the "fresque du climat"

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<sup>1</sup> For Canguilhem (1966): "any value must be gained against an anti-value" as a test of a contestation" (norm/anti- norm).

(<https://fresqueduclimat.org>) which is a pedagogical tool use to raise awareness on CC issues. As a group of teachers has created an exchange group on new knowledge in environmental economics.

In the longer term, we hope that this project will have a deeper impact on teachers' practices.

### Theoretical Implications

Even if this project is more practical than theoretical in scope, the theoretical dimension remains present. Firstly, because we would like to have our teacher support protocol validated by a scientific expert committee. We believe that this protocol, which starts from the individual and collective knowledge and perceptions of the students, is relevant. Indeed, it allows to bring a new point of view to the teacher on these practices and the object of his job. In France, teachers in agricultural high schools undergo one year of training before being confronted with their students. During this year, they consolidate their theoretical knowledge, learn the didactics of the disciplines and get to know some pedagogical tools. However, during this training time they are rarely in the presence of students and consequently, they produce their lessons with missing data. Our protocol helps to fill these gaps.

Another theoretical implication is the use of DMV. It is a recent method and very little used because it is complicated to organize. Indeed, in order to implement this method, it is necessary to ensure the presence of a sufficient number of people to be able to perform econometric analyses. We were able to carry out this experiment and will be able to compare our results with those of the literature.

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