PhD School on Agriculture, Environment and Bioenergy

(http://sites.unimi.it/dottorato_aab/)

(XL cycle, 2024-27)

Project draft

1.Field of interest

*Indicare **il/i** settore/i scientifico disciplinari:*

AGR-01- Agricultural and Food Economics, and Rural Appraisal

2.Project title

The impact of land use dynamics and climate change on farm profitability

3.Tutor: Chiara Mazzocchi

co-tutor: Giordano Ruggeri

4.Relevance of the topic and state of the art:

Improving economic, environmental, and social sustainability is a major goal for agriculture. Economic sustainability, in particular, is a primary concern for most farmers. Land use changes (LUC) significantly and consistently affect the functioning of socioeconomic and environmental systems, among which the agricultural one (Pande et al., 2024). According to the European Environment Agency the fastest land cover change in Europe is the conversion of agricultural land to artificial surfaces, primarily driven by the expansion of residential and industrial-commercial areas (Mazzocchi et al., 2017). Thus, land use change dynamics could strongly impact on agricultural systems and farm profitability. In addition, one of the major problems that farmers have been facing in recent years is the impact of climate change (CC) and extreme weather events on the profitability of their businesses. Many studies addressing the vulnerability of agriculture to climate change have focused on potential impacts without considering farm management (Reidsma et al., 2010). However, both land use dynamics and climate changes strongly influence current farm performance and are likely to play a crucial role in adapting to future changes. In this context, a lack of knowledge in the assessment of the impact of CC and LUC on agricultural systems has been verified. Thus, assessing the impact of these external factors on farm profitability is needed both by farmers and by policy, in order to take the right path to intervene.

5.Layout of the project (draft)

5.1. Materials & Methods:

The research will be developed within the field of agricultural and environmental economics, using statistical and econometric methodologies for data analysis and processing. The main aim is to understand the relationship between farm profitability. climate change (CC) and land use changes (LUC) in various contexts. Thus, the analysis of the impact of CC and LUC on farm revenues will be potentially assessed both in a local context, as the Lombardy Region, and at a national or european scale. From a methodological perspective, the research will be implemented through the use of

econometric models with the aim of both analyzing trends contained in historical series data and, where possible, hypothesizing future scenarios by employing survey approaches.

The research will be developed by means of different databases, integrating various sources, including both secondary and primary data. The secondary data sources could be the RICA (Rete di Informazione Contabile Agricola) database at Regional and National level and the FADN (Farm Accountancy Data Network) database at European level, both containing economic data on agricultural enterprises. Climate and meteorological data and time series could be downloaded from various sources, i.e. ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale) at National scale and ECAD (European Climate Assessement and Dataset) at European level. Land use change will be analysed by integrating satellite derived maps available for long time series, as an example, Corine Land Cover products and CCI Land Cover maps and with a higher spatial resolution the vector data DUSAF for the Lombardy region.

At the same time, methodologies that enable the involvement of stakeholders can also be used to collect primary data and gather opinions and propose solutions regarding possible compensations for the impacts of land use dynamics and climate change on the profitability of agricultural enterprises. For this purpose, different models of stakeholders' involvement could be used, as focus groups, in-depth interview or more structured models like Group Concept Mapping methodology (Berg et al., 2018).

5.2. Schedule and major steps (3 years):

1st year:

- the candidate will be engaged in his doctoral training with particular attention to the acquisition of advanced skills in the use of statistical and geographic data management software and management and use of climate data;
- a bibliographic analysis on the research issue will be realized and a publication will be planned.

2nd year:

- the research design will be carried out together with the setting up of the model;
- data collection will be led according to the implemented model;
- the candidate will be engaged in his doctoral period abroad.

3rd year:

- the final fine-tuning of the model will be defined;
- the candidate will work on writing thesis and papers.

6. Available funds (to support research):

The research will be supported by using free funds (_38033_CTE_NAZPU21CMAZZ_01).

7. Co-Financing (to support the bourse): -

8. Literature:

Berg et al. (2018). Collective stakeholder representations and perceptions of drivers of novel biomass-based value chains, *Journal of Cleaner Production*, 200, 231-241.

Mazzocchi et al. (2017). Agricultural Land Consumption in Periurban Areas: a Methodological Approach for Risk Assessment Using Artificial Neural Networks and Spatial Correlation in Northern Italy, *Applied Spatial Analysis and Policy*, 10:3–20.

Pande et al. (2024). Characterizing land use/land cover change dynamics by an enhanced random forest machine learning model: a Google Earth Engine implementation, *Environmental Sciences Europe*, 36:84.

Reidsma et al. (2010). Adaptation to climate change and climate variability in European agriculture: The importance of farm level responses, Europ. Journal of Agronomy, 32, 91–102.