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The FarmForward Project: Sustainable and Transformative Strategies for Climate-Resilient Agriculture in VET

WP2

Climate-Resilient Farming Handbook

Handbook 1

Why Climate-Resilient Farming in VET

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QUALIFICATIONS AND
VOCATIONAL EDUCATION
AND TRAINING
DEVELOPMENT CENTRE



The FarmForward Project: Sustainable and Transformative Strategies for Climate-Resilient Farming in VET

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Why Climate-Resilient Farming in VET

Climate change today is no longer merely a theoretical projection or a distant future scenario described in scientific reports – it is a process that is already fundamentally transforming agricultural production systems worldwide and across Europe. According to the Intergovernmental Panel on Climate Change (IPCC), agriculture is among the most vulnerable sectors of the economy, as its performance depends directly on the stability of biological processes and natural cycles.

At the level of the European Union, strengthening resilience to climate change has been established as a core economic growth strategy, requiring rapid adaptation and increased engagement across all sectors, including food production and farming. In this context, climate-resilient agriculture is no longer an option – it has become a strategic competence that must be integrated into vocational education and training (VET) and the preparation of future farmers and specialists in agriculture.

Rising average temperatures, drastic changes in the amount and distribution of precipitation, and increasingly frequent extreme weather events are creating conditions in which uncertainty becomes a daily reality in agriculture, rendering traditional agricultural practices increasingly unreliable.

Across different European countries, climate change manifests in diverse ways; however, it poses equally significant challenges to local farmers and vocational education systems, destabilising the entire food production chain.

In Lithuania, the primary challenge is seasonal unpredictability – late spring frosts, exhausting summer droughts, and intense rainfall that complicates harvesting. In Slovenia and Poland, farmers are increasingly affected by sudden floods and late spring frosts that can destroy an entire season's fruit or berry harvest within just a few nights. Meanwhile, agriculture in Greece and Bulgaria is confronting extreme

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heatwaves and critical water shortages. As a result, in some regions traditional crop production is only possible through radical modernisation of irrigation systems.

Climate change represents a mosaic of local crises that trigger a chain reaction across all agricultural sectors. In crop production, this is reflected in shifts in sowing and harvesting periods – the start of the growing season occurs earlier, yet droughts disrupt crop maturation. Vegetation cycles are changing, often shortening, leaving insufficient time for crops to fully develop and mature. Invasive pests and diseases, previously uncommon in these latitudes, are spreading, reducing productivity and requiring additional resources for crop protection.

The livestock sector is increasingly affected by heatwaves, which cause heat stress, directly compromising animal welfare, reducing productivity, and increasing the risk of disease. At the same time, soils are rapidly degrading due to intensified water and wind erosion and moisture shortages; organic matter levels are declining, and water scarcity is becoming a critical factor even in regions historically characterised by surplus moisture.

All these developments weaken the natural resource base, increase economic risks for farms, and compel farm managers to invest in costly cooling and microclimate management systems, thereby negatively affecting farm incomes. They also create structural challenges for rural labour markets, where maintaining competitive employment opportunities is becoming increasingly difficult. Consequently, the ability to manage climate-related risks is emerging as a fundamental professional requirement for both today's and tomorrow's agricultural workforce.

The need to modernise vocational education and training (VET) is relevant across the entire European Union, as all Member States pursue the common objectives of the Common Agricultural Policy. Although specific climate threats differ by country, the trends in transforming VET systems are similar throughout the region.

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In recent years, Lithuania's VET system has undergone significant transformation in order to contribute to the implementation of the European Green Deal, the Farm to Fork Strategy, and the EU Strategy on Adaptation to Climate Change. Modular programmes are continuously updated to meet the needs of a modern, climate-neutral farm, with education serving as a key lever for translating theoretical policy guidelines into practical competences applied in the field. The preparation of the future modern farmer in Lithuania is based on a flexible modular structure that allows for the rapid integration of emerging topics such as renewable energy on farms, circular economy principles, and sustainable natural resource management.

In Poland, increasing attention within the VET system is devoted to soil conservation and water retention technologies, aiming to mitigate the growing impact of droughts. Accordingly, Polish VET institutions are integrating more precision farming modules, with a strong focus on digital skills and Big Data analytics, enabling farmers to make accurate irrigation and fertilisation decisions under conditions of irregular precipitation.

In Greece and Bulgaria, VET programmes are being revised with an emphasis on water resource management and sustainable agronomy under arid conditions. Future specialists are trained to implement innovative irrigation technologies, work with drought-resistant varieties, and integrate renewable energy solutions to enhance farm energy self-sufficiency.

In Slovenia, particular emphasis is placed on strengthening the resilience of small family farms in mountainous areas. Vocational education promotes closer cooperation between local communities and research centres, with a strong focus on agroecological methods that help preserve soil biodiversity and prevent erosion in mountainous regions.

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However, although climate change poses significant risks, it also opens up opportunities for agricultural transformation. The Food and Agriculture Organization (FAO) promotes the concept of Climate-Smart Agriculture, which aims to increase productivity, strengthen farm resilience to climate variability, and at the same time reduce greenhouse gas emissions.

Today, farm resilience begins with the ability to diversify activities and select appropriate adaptation measures in response to a changing environment. Vocational education encourages future farmers to choose drought-resistant crop varieties, implement smart irrigation systems, and apply integrated pest management approaches based on a holistic farm ecosystem perspective.

Climate-friendly farming is often mistakenly perceived as an additional cost burden; however, in the long term, it represents a strategy for improving efficiency. Reduced fuel consumption, targeted fertilisation based on soil needs, and effective water management directly lower variable farm costs, increase profitability, and provide a competitive advantage in a market where consumers increasingly value sustainably and environmentally responsibly produced food.

All countries – from the Baltic Sea to the Mediterranean region – are united by the European Union’s common objective to significantly reduce net greenhouse gas (GHG) emissions by 2040. This means that a future farmer in Bulgaria or Greece must acquire the same digital and agroecological competences as their counterpart in Lithuania.

To address the challenges posed by a changing climate across the continent, it is not sufficient to rely solely on region-specific adaptation strategies. A coordinated European response is also essential. Europe-wide knowledge exchange enables Southern countries to draw on the experience of Northern regions in managing excess moisture, while Northern countries can prepare for heatwaves that have already become a daily reality in Southern Europe.

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In this context, the Climate-Resilient Farming Handbook is a highly relevant publication designed for teachers and trainers in vocational education and training (VET) institutions, who serve as the primary transmitters of knowledge to future farmers and other agricultural professionals. Their task is to prepare a new generation of farmers who will not merely perform technical operations mechanically, but will be capable of strategically managing a farm as an integrated ecosystem under changing environmental conditions and making well-informed, data-driven decisions.

Vocational education represents the critical link between political ambitions and real-world implementation. The EU CAP Network emphasises that the main risk to VET systems arises when they fail to respond to evolving skills demands related to the green and digital transitions. Insufficient attention to data-based decision-making can deepen skills gaps, reduce farm competitiveness, and diminish the sector's attractiveness in the labour market.

Conversely, integrating climate-resilience competences into vocational education enhances graduates' employability, as agriculture is increasingly becoming a high-skilled sector requiring not only technical expertise but also the ability to implement innovation. Today's agricultural professional must be proficient not only in agronomy, but also in information technologies, data analytics, and compliance with increasingly stringent environmental regulations. This fundamentally transforms the sector's profile and prestige, making it attractive to a new generation seeking to combine work in nature with cutting-edge innovation.

Modern vocational education therefore goes beyond technical instruction; it also develops so-called "soft skills," such as collaboration, critical thinking, and the ability to engage in lifelong learning. Sustainable farms, supported by continuous learning and effective AKIS (Agricultural Knowledge and Innovation System) structures,

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contribute to more stable production systems, more sustainable employment opportunities, and more vibrant rural communities.

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