InnoCSA

Innovations for Climate Smart Agriculture

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CLIMATE-SMART AGRICULTURE InnoCSA PROJECT OVERVIEW

BOOKLET

Co-funded by the European Union

The ***"Innovations for Climate Smart Agriculture" (InnoCSA)*** *project aims to support the transformation of the agricultural sector towards climate resilient and climate change mitigating practices.*

Co-funded by the European Union

LEARNING OUTCOMES

Knowledge

Theoretical or practical knowledge and information (“facts”).

Skills

Cognitive ability to apply practices, methods, techniques etc.

Competences

Ability to take autonomous and informed decisions based on knowledge and skills.

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THE GOALS AND OBJECTIVES OF THE INNOCSA PROJECT

Contribute to the diversity and viability of the agricultural sector and ultimately to the transformation of the food system from a greenhouse gas emitting sector to a climate neutral or even climate negative sector.

Introducing and explaining climate smart agriculture to farmers, aspiring farmers, students and other relevant stakeholders.

Informing about opportunities of climate smart farming.

Inspiring farmers to apply climate smart farming approaches.

Creating synergies from Knowledge transfer between European countries.

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10 LEARNING MODULES

Covered topics include agro-forestry, paludiculture, livestock management, water and crop management, agri-photovolataic and more.

CASE STUDIES

Practical knowledge from other farmers who have already developed and implemented CSA innovations.

INNOVATION MANAGEMENT

Learning opportunities on required entrepreneurial skills and tools to enable farmers to apply CSA principles.

InnoCSA PROJECT OVERVIEW

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10 LEARNING MODULES

- INTRODUCTION: WHY CSA
- WATER MANAGEMENT
- SOIL MANAGEMENT
- ENERGY MANAGEMENT AND GREEN ENERGY PRODUCTION
- SELECTION OF CROPS AND THE USE OF GENETIC RESOURCES
- CLIMATE SMART CROP PRODUCTION
- CLIMATE SMART LIVESTOCK
- AGROFORESTRY
- THE USE OF ICT FOR CLIMATE-SMART AGRICULTURE
- LANDSCAPE MANAGEMENT

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Association of Private Farming CZ
(Prague, Czech Republic)

CIA Agricoltori Italiani Umbria
(Perugia, Italy)

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WHAT IS CLIMATE SMART AGRICULTURE?

CSA - short for “Climate Smart Agriculutre” - is an approach towards agriculture aiming to achieve **sustainable agricultural development** for food security under climate change.

The 3 main pillars of this approach are:

- An increase of **agricultural productivity** and **incomes** in sustainable manner
- Adaptation and building resilience to **climate change**
- Reducing or removing **greenhouse gas emissions** where possible

Food Security
The rising population in the world means an growing requirement for **food production**. Together with the adverse effects of **climate change**, this presents an icreasing challenge. Without any adaptations, climate change will cause a decrease and increased variability of food production.

Agriculture
To limit the effects of climate change, agriculture must also adapt approaches and technologies that help **reduce the grenhouse gas footprint** of the industry. This includes the impact of agricultural production on other ecosystem services such as **flood prevention**, **carbon sequestration** or **transportation**.

Efficient and resilient systems
Efficient systems, such as an integrated crop and livestock system, help **mitigate the effects of climate change** but also **helps to secure incomes for farmers**. Resilient systems **reduce vulnerabilities**, help mitigate risks and to recover from possible shocks.

WATER MANAGEMENT

- Climate impact on water resources and farming
- Weather forecasting models and agriculture
- Water quantity and quality control bodies
- Rational water use in sustainable field cultivation
- Rational water use in greenhouses

A rise in the average global temperature of more than **1.5 °C** will cause long drought periods and a major increase in the quantity and intensity of **extreme climatic events.**

Rational water use is an absolute necessity for farmers dealing with a limited water availability due to climate change conditions and farm needs.

FLOODS

DROUGHTS

RATIONAL WATER USE

Rational water use is an imperative issue specially in the Mediterranean regions. Employ rational water use to:

- Reduce water consumption
- Increase the efficiency of irrigation systems
- Re-use and cycle water

CASE STUDY: ZAHRADNICTVÍ BÍLÝ JEDNOROŽEC

The primary agricultural activity at Zahradnictví Bílý jednorožec is mixed farming. The farm integrates various types of cultivation and livestock management, taking advantage of the diverse landscape. The multifunctional activities include the management of pastures, orchards, and cropland.

The farm has solved long term issues with inadequate hydrological conditions through innovative means of water retention, such as the installation of a wind powered water pump and the restoration and deepening of a ancient well. Water is then drawn into an above-ground fiberglass tank, from where it is gravity-fed into float-activated water troughs.

ESTABLISHED: **2004**
TOTAL AREA: **53 HA**
TYPE: **CULTIVATION, LIVESTOCK**
NUMBER OF WORKERS: **3**

UNDERSTANDING SOIL HEALTH AND CLIMATE CHANGE

- Key concepts in Soil Management
- Conservation Agriculture Techniques
- Soil Fertility Management
- Soil Monitoring and Assessment
- Precision Agriculture Technologies

Soil management is a critical component of climate-smart agriculture, which aims to enhance agricultural productivity, increase resilience to climate change, and reduce greenhouse gas emissions. Effective soil management practices can improve soil health, mitigate climate change impacts, and contribute to sustainable food production.

Practices such as **cover cropping, contour farming, drip irrigation** or **minimum tillage** help mitigate the adverse effect of climate change.

By adopting sustainable agricultural practices, farmers can improve soil structure, fertility, water retention and **overall agricultural productivity.**

Key concepts in soil management include **soil organic matter**, **soil erosion control**, **nutrient management**, **soil pH and fertility** and **water management.**

SOIL HEALTH

Soil health refers to the capacity of soil to sustain biological productivity, maintain environmental quality and suppport plant and animal life.

Climate changes always present a threat to soil health.

BENEŠOV, STŘEDOČESKÝ KRAJ, CZECH REPUBLIC

©Statek Novotinky

CASE STUDY: STATEK NOVOTINKY

Founded in 1999, Statek Novotinky in Benešov covers an area of 1000 hectares and is managed by six workers. The primary scope of the farm is crops cultivation and livestock breeding.

The farm had historically suffered from erosion and reduced humus content, leading to excessive tillage and use of chemicals. To address these issues, Statek Novotinky has adopted ‘no till’ technique and integrated diverse crops and multi-species buffer zones.

As a result, the farm has seen significant improvements in soil quality, increased amounts of organic matter and better water retention. Erosion has been substantially reduced, leading to better crop yield and reduced dependency on chemical inputs.

ESTABLISHED: **1999**
TOTAL AREA: 1000 **HA**
TYPE: **CULTIVATION, LIVESTOCK**
NUMBER OF WORKERS: **6**
SOIL PROFILE: **LOAMY**

BENEFITS OF MINIMUM TILLAGE OR NO-TILL

‘Minimum tillage‘ or ‘No till’ technique offers a direct seeding method that eliminates traditional plowing. This approach ensures continuous soil cover with plants, maximizes the utilization of the entire growing season for photosynthesis, and enhances the organic matter content in the soil.

©Statek Novotinky

ENERGY MANAGEMENT AND GREEN ENERGY PRODUCTION

- Energy management optimization measures
- Integrated approach to renewable energy for farming
- Innovations and renewable energy sources
- Greenhouse gas emissions reduction systems

Innovations in energy management in the agri-food system can make a contribution to the transition to climate-smart agriculture and achieving **food, climate and energy security**.

The challenge of reducing dependence on fossil fuels can be met through the expansion of **energy-efficient food systems**. These systems improve energy efficiency, increase the use and production of renewable energy.

Among the various solutions for energy conservation and renewable energy production belong technologies such as **solar panels**, **biomass plants**, or **wind** and **hydroelectric power** production.

BIOMASS

Electricity can be generated by burning **organic material** - biomass. This includes all sorts of organic matter - **plants, wood, food waste**. The production of bioenergy releases carbon dioxide (CO_2), however biomass fuels are considered renewable, as they can regrow and **absorb as much carbon** as they release during their lifetime.

DRESDEN,
SAXONY, GERMANY

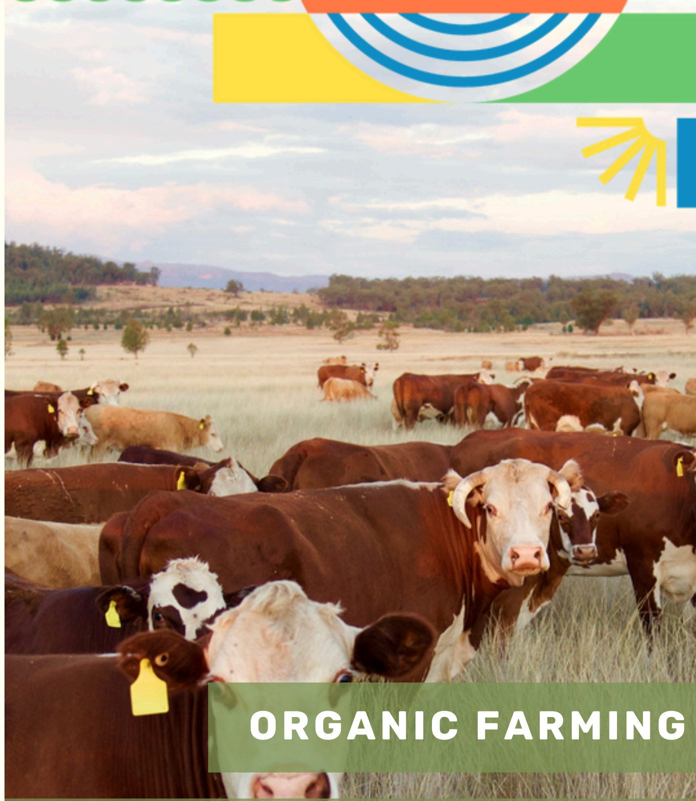
©Vorwerk Podemus

CASE STUDY: VORWERK PODEMUS

Vorwerk Podemus has stood for organic farming, active nature conservation and ecological enthusiasm for over 30 years. While the farm has been owned by the Probst family since 1900, in 1991 it has undergone a rebirth with an entirely different agricultural scheme: the farm covers the entire chain, from primary production to processing, all of which while utilising organic materials and selling the products at local organic markets.

On more than 400 hectares of arable grassland, various crops are grown without the use of any synthetic fertilisers, pesticides or monocultures. Animals are cared for with love and respect, enjoying spacious stables and free range on their own pastures.

ESTABLISHED: **1991**
TOTAL AREA: **400 HA**
TYPE: **LIVESTOCK, CULTIVATION**
NUMBER OF WORKERS: 220



ORGANIC FARMING

Farming at Vorwerk Podemus is entirely organic. The main activity of the farm is **animal husbandry** and **meat production**, paired with cultivation in order to self-sustain the **whole value chain by itself**. The farm is completely self-sufficient, with no need for prophylactic medication, feed antibiotics or growth hormones for the animals or artificial flavours, flavour enhancers, preservatives or curing accelerators for the meat production process.

SELECTION OF CROPS AND THE USE OF GENETIC RESOURCES

- Crop Genetic Resources
- Threats to crop genetic diversity
- Sustainable use of crop genetic resources
- Benefits of sustainable use of crop diversity

Ensuring food security for future generations requires **preserving the valuable genetic diversity** of plants, animals, and microorganisms used in food and agriculture.

The **crop genetic resources** mean the heritable material (DNA) within plants that determines their characteristics - **varieties** and **landraces**.

There are many advantages to using diverse crop varieties - for example, diverse varieties have a **higher resilience** to **drought**, **heat**, **flooding** and other stresses. At the same time, they provide a **wider range of vitamins** and **nutrients**, contributing to food security and better nutrition values. Lastly, when it comes to the sale of such products, their **unique characteristics** offer attractivity for niche markets, creating economic incentives for conserving diversity

TRADITIONAL KNOWLEDGE

Leveraging traditional and local agricultural knowledge can provide insights into **sustainable farming practices** that have been **refined over generations**. This includes knowledge on **crop rotation**, **intercropping**, and **natural pest management techniques** well adapted to local varieties that can improve productivity and sustainability.

CLIMATE SMART CROP PRODUCTION

- Potential impacts of climate change
- Vulnerabilities of crop production
- Systemic approaches of CSA in crop production
- Benefits and limitations of CSA in crop production
- Framework requirements for adoption

Climate change poses **severe challenges** to crop production and food security. However, it is possible to **offset these risks** through various CSA strategies, such as **increasing yields** and enhancing **resilience**, reducing greenhouse gas emissions and mitigating the impact of crop production on the environment, or enhancing the **sustainability** and **efficiency** of cropping systems.

The **degree of susceptibility** to the adverse effects of climate change depends on key crop and regional factors, for example temperature and water needs, or stages of growth when submitted to intense heat waves.

Good CSA practices to **reduce the risks** of crop failure include organic agriculture, precision agriculture, integrated pest management, agroforestry, nutrient management, smart irrigation and many more.

INTEGRATED PEST MANAGEMENT

Integrated pest management combines biological, cultural, physical, and chemical tools in a coordinated way to **manage pest populations** at economically acceptable levels while **minimizing risks to humans**, **animals**, and the **environment**. It is an effective approach to help mitigate climate change, as it helps reducing the reliance on chemical inputs.

CLIMATE SMART LIVESTOCK FARMING

- Increasing demand of animal produce
- Livestock farming and emissions
- Reducing the emissions from livestock farming
- Land-based and land-less systems

Due to steadily increasing demand, the **global meat production** is expected to more than **double** within the next 30 years, from 229 million tons in 1999/2001 to 465 million tons in 2050, while **milk production** is expected to increase from 580 to 1,043 million tons.

Naturally, livestock plays a crucial role in the **global supply** of animal based products. To maximize the necessary contribution, livestock production must be carefully managed.

Livestock farming is also a **major contributor** to climate change, as it creates significant **quantities of carbon dioxide**, **methane** and **nitrous oxide**. Greenhouse gases are produced both directly by the livestock and indirectly through the production process. However, there is a wide range of solutions that can be adapted to make livestock farming less harmful to the climate.

PASTURE MANAGEMENT

Pasture management measures involve the **sowing of improved varieties** of pasture, typically the replacement of native grasses with **higher yielding and more digestible forages**, including perennial fodders, pastures and legumes. There are far fewer opportunities for sowing improved pastures in arid and semi-arid grazing systems.

AGROFORESTRY

- Benefits of agroforestry systems
- Costs and profitability of agroforestry systems
- Agrisilvicultural systems
- Silvopastoral systems
- Agrosilvopastoral systems

Although agroforestry systems are not a novelty, they are currently attracting **renewed attention**. Their current attractiveness comes from their possible role in **offsetting the negative climate change impacts**, due to their environmental, social and economic advantages. Agroforestry systems can also make an important contribution to **sustainable agricultural development** for food security.

The term "agroforestry" means the **intentional use** of **trees** and **shrubs** in agricultural systems. **Areas adjacent** to the planted vegetation is **integrated** into farming, raising livestock or gardening. Agroforestry systems are **flexible** and can be designed to meet farmers' objectives.

While agroforestry is an ancient concept, their current premise is a little different - modern agroforestry systems differ from the old ones in that they are **adapted to current agricultural production** technology and offer a more **climate-friendly** farming method with **less impact on biodiversity**.

BENEFITS OF AGROFORESTRY

Agroforestry systems **reduce the effects** of various **climate change impacts**, such as **heavy rainfall, drought, heat waves** and even higher exposion to **radiation** (through a weakened ozone layer). Agroforestry helps farmers to reduce the impact of extreme weather events, reduce soil erosion, increase soil fertility and more.

DIGITAL TECHNOLOGIES AND CSA

- Digital technologies within the Green Deal perspective
- Kinds of digital technologies supporting the CSA
- Impact of digital technologies on CSA concept and practice
- Sustainable smart farming and digital transition
- DIgital Technologies and CSA good practices

The COVID-19 pandemic has demonstrated even more the importance of effective digital communication systems. Plans such as the **Digital Europe Program** (DEP) aim to improve digital education and training and bridge the gap in rural areas.

Digital technologies are crucial to **improve the effectiveness** of farming and thus **bringing down costs**, but also **improving availability** to farmers through **ease of use** and **offsetting climate change** negative effects through smart solutions.

Studies show that as much as **50 %** of all crop treatment effectivness lies within correct decisions on **when, what** and **how** to treat crops. Technologies such as sensors, drones or robotics do very well in optimizing these processes.

Digital technologies and connectivity offer **enormous potential** and represent key elements in improving the quality of life and ensuring balanced development in rural areas.

UAVS

A great example of innovative digital technologies, UAVs, short for **Unmanned Aerial Vehicles**, also called drones, are remote-operated flying machines equipped wtih **scanning or camera systems**. They can provide with all kinds of information and data on the fields, such as potential **development of crops** or a general **overview on weeds**.

CASE STUDY: CANTINA CENCI

SAN BIAGIO DELLA VALLE, UMBRIA, ITALY

©Cantina Cenci

The Cenci family has been making wine for four generations, respecting the tradition of the Olivetan monks. Cantina Cenci is able to offer organic high quality wines, combining tradition with innovative technologies, from the field to the cellar, under the guidance of Giovanni Cenci who acts as the winery's viticulturist, winemaker, and sommelier.

The innovation in this case is simple but effective, based on local meteorological data constantly collected and cross-referenced with satellite data. This method, without neglecting the technical visual control in the field, allows you to precisely determine the times, methods and quantities necessary for preventive interventions anticipating the presence of cryptogams or other plant diseases.

ESTABLISHED: **1950**
TOTAL AREA: **40 HA**
TYPE: **WINE PRODUCTION**
SOIL PROFILE: **TRAVERTINE, LIME**

SATELLITE DATA AND DECISION SUPPORT SYSTEMS

Decision support systems operate under the farmers' **control in real time**, implementing satellite data. Based on these, suggestions are created, through **algorithmic processes**, to determine the times, methods, quantities or technical means.

In the case of Cantina Cenci, the decision support system allowed an **estimated saving of 30% of pesticide and fungicide products** and a 15% water saving by regulating supply and flow based on weather forecasts.

CLIMATE SMART AGRICULTURE ON A REGIONAL SCALE

- Climate change adaptation and mitigation strategies
- Drought and heavy rains in agriculture
- Crop diversification
- Agroforestry
- Climate-Resilient Livestock Management

Climate-smart agriculture practices **extend their benefits far beyond individual farms, offering significant regional implications.**

By enhancing water retention capacity, CSA not only ensures the sustainability of the implementing farm but also **positively impacts downstream fields**. This increased water retention mitigates erosion, leading to healthier soil and reduced sedimentation in water bodies, benefitting **entire ecosystems**. Furthermore, CSA contributes to enhanced **regional resilience** to droughts by optimizing water usage and promoting drought-tolerant crops.

These **collective benefits** underscore the importance of adopting CSA practices on a regional scale to foster sustainable agriculture and mitigate the adverse impacts of climate change.

MEANS OF COLLABORATION AND COMMUNITY

Farmers collaborate within **cooperatives** to share knowledge, resources, and best practices in CSA implementation. These cooperatives **facilitate collective decision-making** and enable smallholder farmers to access markets and inputs more effectively. Furthermore, collaborations between research institutions allow for the translation of scientific research into practical solutions for farmers.

HODONÍN, JIHOMORAVSKÝ KRAJ, CZECH REPUBLIC

ESTABLISHED: **2010**
TOTAL AREA: **65 HA / 11 HA**
TYPE: **CROP CULTIVATION**
NUMBER OF WORKERS: **5**

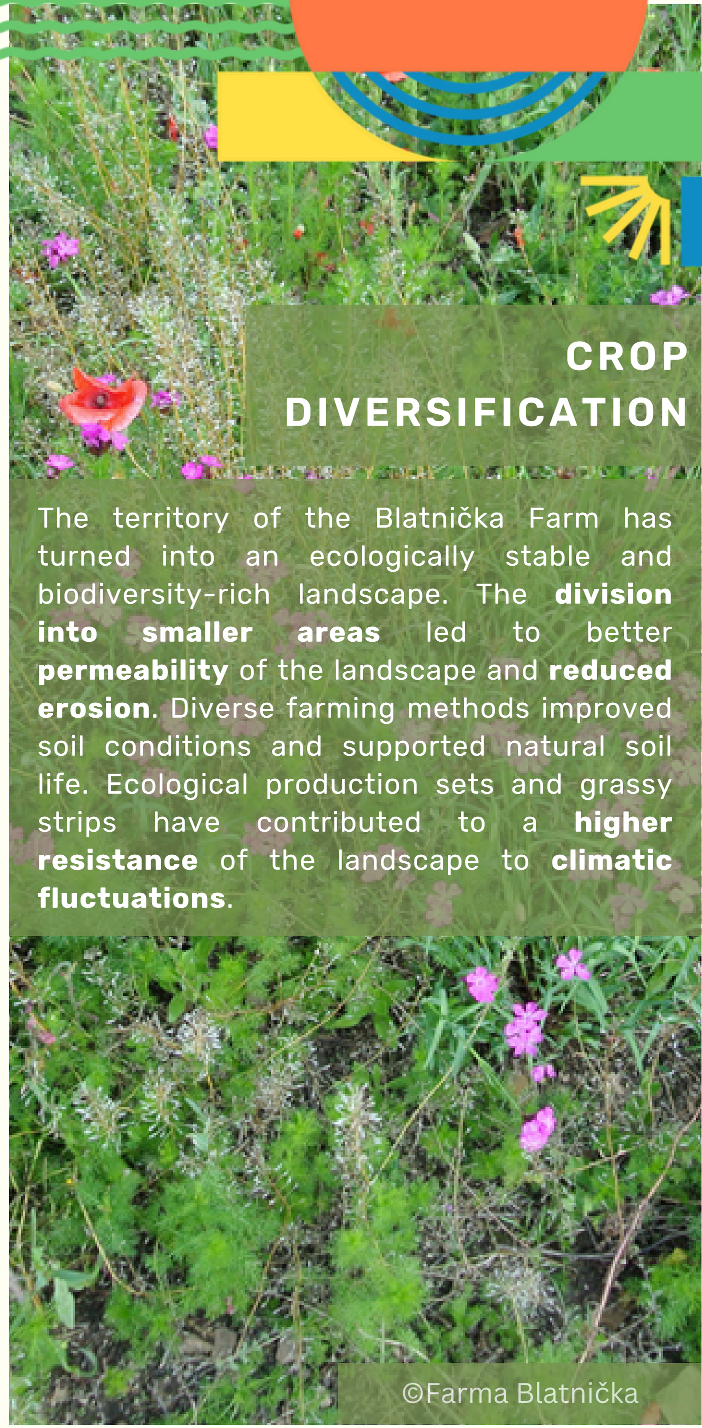
©Farma Blatnička

CASE STUDY: FARMA BLATNIČKA

Farma Blatnička has been established in 2010 with a vision to revolutionize conventional farming practices. The farm spans an area of 65 hectares and relies on usually less than five workers. The initiator of the project, Martin Smetana, owns 11 hectares of the farm himself.

Its unique approach consists in dividing the farmland into areas smaller than 10 hectares with different plants and farming methods.

Aside from the divided farmland with intensive crop diversification, Martin Smetana's holistic approach to agricultural management encompasses various agronomic practices aimed at enhancing ecological resilience and biodiversity while mitigating the adverse impacts of intensive agricultural practices. Key focal points include the implementation of infiltration strips, tree alleys, biodiversity promotion, erosion control measures, and microclimate management strategies.



CROP DIVERSIFICATION

The territory of the Blatnička Farm has turned into an ecologically stable and biodiversity-rich landscape. The **division into smaller areas** led to better **permeability** of the landscape and **reduced erosion**. Diverse farming methods improved soil conditions and supported natural soil life. Ecological production sets and grassy strips have contributed to a **higher resistance** of the landscape to **climatic fluctuations**.

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