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**ECONOMIC, SECURITY AND  
ENVIRONMENTAL  
CHALLENGES OF REGIONAL  
DEVELOPMENT**

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International University of Travnik in Travnik,  
Bosna i Hercegovina

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## ECO-INNOVATIONS IN THE CREATION OF NEW CAPACITIES FOR ACHIEVING THE GOALS OF THE GREEN ECONOMY – CASE OF MIDAS PROJECT<sup>1</sup>

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**ABSTRACT:** Institute for Agriculture and Vegetables, National Institute of importance for the Republic of Serbia, in consortium of 25 partners from 13 European countries engage all relevant stakeholders (agricultural community, bio-based industry, academic community, etc.) in dissemination and exploitation of project results and encouragement of international cooperation to exchange best practices and create scenarios for the benefit of all in development of business plans to encourage circularity at the farm level through engagement agricultural community, industrial actors and academic community through project case studies.

In this context the MIDAS - Marginal lands, industrial crops and innovative bio-based value chains project, which has been funded by the Horizon Europe framework program, decided to address challenges contained in specific goals of the MIDAS: Increasing knowledge about current and future marginal land for “low ILUC” biomass production, challenges biodiversity and ecosystem services, as well as potential common ones benefits from biomass production. “Low-ILUC” (ILUC - Indirect Land Use Change) is a factor that indicates in to what extent is there a risk of changing the use of arable

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<sup>1</sup>“The research was supported by the MIDAS project which received funding by the European Union’s Horizon Europe research and innovation program under grant agreement No 101082070 and the Science Fund of the Republic of Serbia, Grant No. 303, Circular economy as a model of development that forms a new identity of the Republic of Serbia - EDUCIRC2022”

land for the production of raw materials for products that they are not food. Raw materials that have a low ILUC risk were created by growing industrial crops on marginal land or by cultivating areas that were not used for plant production or were abandoned, through the improvement of agricultural practices, which keeps the areas for the production of food raw materials at the same level. Optimization of the production of selected industrial plant species, adapted to cultivation on marginal agricultural land in the 9th state, in 12 localities to achieve a low level of ILUC. Establishment of case studies (12 in 9 countries) of innovative systems cultivation (combined sowing and agroforestry) which have a low ILUC level at marginal agricultural land at the agricultural level farms, for current and future systems in agriculture.

Utilization of marginal lands for growing sustainable industrial crops and developing innovative bio-based products represents significant eco-innovation that contributes to increasing the number and quality of the impacts on the green economy network of excellent case studies: Development of 13 new bio products (biobased) in accordance with circular use biomass. Development of innovative value chains/networks based on biologically effective resources and assessment of production sustainability, including impacts on biodiversity.

**KEYWORDS:** Green Economy, Eco-innovations, Sustainable development, Biodiversity.

## Introduction

Eco-innovation (UNEP, 2023) is a new business approach which promotes sustainability throughout the entire life cycle of a product, while also boosting a company's performance and competitiveness. It can help small- and medium-sized enterprises (SMEs) access new and expanding markets, increase productivity, attract new investment into the business, increase profitability across the value chain, and help SMEs stay ahead of regulations and standards – notably those related to the environment. Also, UNEP defines a green economy as one that results in “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities”(UNEP 2010). In its simplest expression, a green economy is low-carbon, resource efficient, and socially inclusive. In a green economy, growth in income and employment are driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.



The capacity to achieve the goals of the green economy concept grows with the application of an increasing number of eco-innovations. One of the good practice examples that started in 2022 and represents the topic of this paper is MIDAS project, a Horizon Europe Innovation Action, developing and demonstrating innovative solutions to grow industrial crops on marginal agricultural land and build sustainable value chains for a wide range of bio-based products. MIDAS is coordinated by Centre for Renewable Energy Sources (CRES) Greece and brings together 25 partners from 13 countries including research organizations, industries and SMEs. Institute for Agriculture and Vegetables, National Institute of importance for the Republic of Serbia, in consortium of 25 partners from 13 European countries engage all relevant stakeholders (agricultural community, bio-based industry, academic community, etc.) in dissemination and exploitation of project results and encouragement of international cooperation to exchange best practices and create scenarios for the benefit of all in development of business plans to encourage circularity at the farm level through engagement agricultural community, industrial actors and academic community through project case studies.

### **Utilization of marginal lands for growing sustainable industrial crops and developing innovative bio-based products – the case of MIDAS project**

Primarily, in its basis, MIDAS supports the achievement of 7 Sustainable Development Goals:

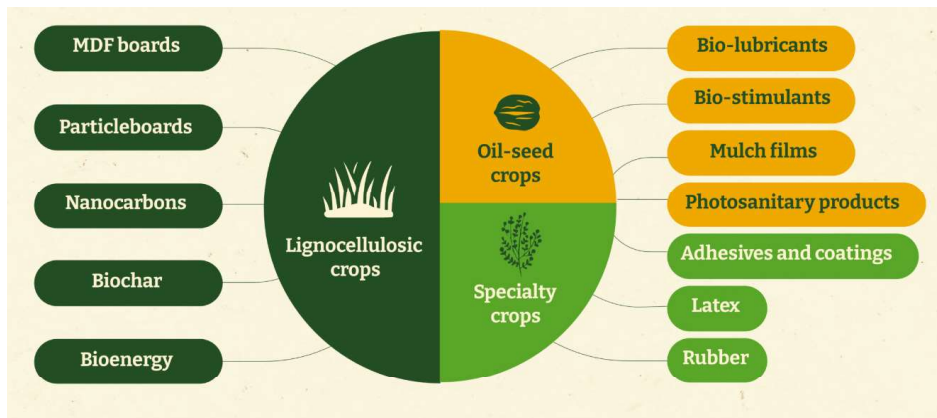
- 1) Clean water and sanitation – by reducing the inputs need of agriculture (fertilizers, herbicides) and by developing bioherbicides, biodegradable mulch films, biostimulants and soil amendments to replace corresponding fossil-based materials.
- 2) Affordable and clean energy by promoting the circular use of biomass through the using of all residues and by-products for bioenergy production.
- 3) Decent work and economic growth by contributing to identify new business models to create economic growth and more job opportunities in rural areas.
- 4) Industry innovation and infrastructure – by fostering innovation on crops, cropping systems, bio-based products and value chain webs.

- 5) Sustainable cities and communities by developing innovative bio-based products (MDF and particle boards, resins and coatings) for the building and housing sector.
- 6) Responsible consumption and production by providing new solutions to replace fossil-based products by others using local resources with lower impact.
- 7) Life on land by promoting the sustainable use of the terrestrial ecosystems by growing non-edible crops that support biodiversity with emphasis on the pollinators on marginal lands.

MIDAS adopts a resource-efficient biorefinery concept to develop a wide range of bio-based products, obtained from innovative value chains and from diverse biomass feedstock produced on marginal land. Oilseeds from annual crops (castor, crambe, safflower and carinata) are used to produce biodegradable mulch films, bio-lubricants and bio stimulants.

Hemp, sorghum, miscanthus, willow and siberian elm are used to produce MDF panels, particle boards, biochar and nanocarbons. Speciality crops (guayule and lavender) are used to produce rubber for car tyres, latex for gloves, adhesives and coatings.

*Picture 1: Products of MIDAS project*



Source: <https://www.midas-bioeconomy.eu/products/>

Challenges, expected outcomes and impacts contained in specific goals of the MIDAS project

MIDAS supports the European Green Deal, the EU Bioeconomy Strategy and the EC Communication on Sustainable Carbon Cycle, with a wide range of outcomes.

1. 15 cases of innovative cropping systems (intercropping and agroforestry) demonstrated at TRL7 for marginal lands in 9 Mediterranean and Continental countries.

2. Development of 11 different bio-based products at TRL 7 and business plans with improved circularity at farm and process level. 5 of the final bioproducts will be applied to agricultural fields to reduce GHGs emissions and environmental footprint of the cropping systems.

3. Low ILUC feedstock production from non-edible crops for the bio-based industry with a circular use of biomass.

4. Improved breeding material for selected non-edible crops with high performance under water scarcity and with reduced needs in terms of inputs.

5. Advanced knowledge of the biodiversity effects of novel cropping systems on biodiversity.

6. Supporting pollinators in marginal land with risk of desertification by growing nectar-producing industrial crops with sustainable agricultural practices.

7. Mapping the actual and future agricultural marginal lands for low ILUC feedstock production taking into consideration the climate change and the biodiversity challenges and potentials.

8. Detailed open access maps of marginal abandoned and degraded land in EU (6 different groups, 55 maps).

Table1: MIDAS carries out a wide range of activities at different levels and scales of multiple bio-based value chains:

1.	Mapping available marginal land	<p>Improve the understanding and the spatially explicit representation of the actual and future available marginal land in Europe.</p> <p>Assess the feedstock potential, the effects on biodiversity, the provision of ecosystem services, as well as the socio-economic impacts of the production of low ILUC risk biomass in available marginal land at scale.</p>
2.	Crop breeding	<p>Optimize selected non-edible crops adapted to marginal agricultural lands through modern biotechnology tools.</p> <p>Advanced breeding of new resource efficient hybrids and varieties adapted to growing in marginal land and evaluation in multi-location trials.</p> <p>Testing and demonstration of selected crops in multi-location trials.</p>
3.	Agronomic optimization and resource efficiency	<p>Tailor agronomic practices for low-inputs and water needs to increase the crop efficiency in marginal land.</p> <p>Application of an innovative subirrigation system in dry Mediterranean areas.</p> <p>Circular use of MIDAS bio-products on crops grown on marginal lands (biochar, bioherbicides, biostimulants, mulching film).</p>
4.	Farm-scale case studies of innovative cropping systems	<p>Demonstrate case-studies of innovative biomass cropping systems in marginal agricultural land in Italy, Germany, Greece, Spain, Serbia, Poland, Czech Republic, France and Hungary, to produce different types of feedstock for multiple bio-based products.</p> <p>Farm-scale trials of agroforestry systems including short rotation woody crops intercropped with annual industrial crops.</p>
5.	Setup of Regional Advisory Groups	<p>Work for the farmers with the farmers and with local partners to optimize agricultural practices and to seize the opportunities offered by diversified agricultural systems designed for marginal land.</p> <p>Understand the co-benefits, potential risks and upscaling potentials of the innovative farming systems to prevent land abandonment in the marginal areas.</p>

6.	Environmental and biodiversity assessment	<p>Development of environmental indicators to assess the beneficial effects of the new farming systems on the ecological networks and their potential for landscape improvement in marginal land.</p> <p>Insect count and flowering area surface measurements at field scale to assess the potential biodiversity impacts and biodiversity restoration capacity of the new farming systems.</p> <p>Development of guidelines for the upscaling of the new cropping systems ensuring the conservation and the possible restoration of insect populations. in marginal land.</p>
7.	Harvesting solutions for industrial crops	<p>Improvement of existing harvesting methods including drying, storage and pre-treatment of woodchips from woody species.</p> <p>Adaptation of existing machineries to reduce seed loss during harvesting of crambe and safflower, reduce castor bean breaking, seed loss and impurities by combine harvesters.</p> <p>Demonstrate mechanized solutions for single step harvest and collection of different biomass fractions (tops, seeds, stems) in fiber crops.</p> <p>Optimize biomass harvest and the extraction of rubber from guayule plants.</p>
8.	Production of multiple biobased products in a biorefinery approach	<p>Development of a range of bio-based products with a cascade use of biomass adopting a biorefinery approach: biochemicals, biocomposites, elastomers, biolubricants, agricultural biostimulants, biodegradable mulching films, adhesive and coatings, latex, rubber, phytosanitary products, MDF and particle boards, nanocarbons, biochar.</p> <p>Development of guidelines for the upscaling of the new cropping systems ensuring the conservation and the possible restoration of insect populations. in marginal land.</p>
9.	Sustainable value chains for bio-based products	<p>Screening of potential biomass-to-products pathways for different types of industrial non edible crops.</p> <p>Integrated sustainability assessment: environmental assessment, Life Cycle Costing, Social Life-Cycle-Analysis.</p> <p>Design of integrated strategies for designing sustainable value chains web concepts for woody crops, oil crops, fiber crops.</p> <p>Development of a roadmap with practical recommendations for the establishment of bio-based value chains and for the development of viable business models.</p>

10.	Sustainable business plans for European farms with marginal land	<p>Develop business plans for farmers by engaging with the farming community and academia through the case studies.</p> <p>Operate the farm level case studies who act as facilitators together with the Regional Advisory Groups.</p> <p>Co-create sustainable business plans together with farmers and industrial actors, to foster circularity and entrepreneurship and to enable farmers to seek financing at national level.</p> <p>Training on sustainable circular business models.</p>
11.	Dissemination, communication and exploitation	<p>Mapping of the key stakeholders potentially interested in taking up the project results.</p> <p>Dissemination of project results via scientific publications, events, stakeholders workshops, webinars.</p> <p>Communication to a wider audience via social media, articles, videos.</p>

Source: <https://www.midas-bioeconomy.eu/activities/>

The MIDAS project is good example from practice which represents wide scale of eco-innovations in driving sustainable development within the green economy framework. By optimizing marginal lands and pioneering innovative bio-based value chains, MIDAS exemplifies circularity, resource efficiency, and environmental responsibility. Emphasizing “low ILUC” biomass production through industrial crop cultivation on marginal lands aligns perfectly with circular economy principles, minimizing land use change risks and promoting sustainable resource utilization. MIDAS’s innovative cropping systems, like agroforestry, harness the potential of marginal lands, promoting biodiversity and ecological balance by optimizing non-edible crops and advanced breeding methods.

The wide range of bio-based products derived from diverse biomass sources epitomizes circularity, reducing carbon emissions, enhancing resource efficiency, and advancing sustainable consumption.

### **Eco-innovations in the creation of new capacities for achieving the goals of sustainable development and the green economy concept**

Moving towards a more circular economy brings numerous advantages for human life and survival planet, as well as reducing pressure on the environment, improving security of supply raw materials, increasing competitiveness, innovation, job creation, as economic growth not only at the local,

national level, but also at the level of our planet (Vukadinovic, p. 14, 2022). In today's increasingly complex world, where sustainability and environmental protection have become essential requirements, the concept of eco-innovations emerges as a pivotal factor in creating new capacities to achieve the goals of sustainable development and the green economy. Through a deeply ingrained understanding of the need for a paradigm shift and embracing innovation as a driving force, this research has explored how eco-innovations can transform the way we operate, produce, and consume. Case of MIDAS project has clearly demonstrated that eco-innovations not only contribute to reducing negative impacts on the environment but also stimulate innovative processes that lead to the development of entirely new products, services, and business models. This case represents how eco-innovations can be key drivers of sustainable development and how we can create synergy between academic research, business practices and societal initiatives. Green economy concept could be operationalized preferably with collaborative efforts of the academic community, industry, governments and citizens.

## Conclusion

In this context the MIDAS - Marginal lands, industrial crops and innovative bio-based value chains project, which has been funded by the Horizon Europe framework program, decided to address challenges contained in specific goals of the MIDAS: Increasing knowledge about current and future marginal land for "low ILUC" biomass production, challenges biodiversity and ecosystem services, as well as potential common ones benefits from biomass production. "Low-ILUC" (ILUC - Indirect Land Use Change) is a factor that indicates in to what extent is there a risk of changing the use of arable land for the production of raw materials for products that they are not food. Raw materials that have a low ILUC risk were created by growing industrial crops on marginal land or by cultivating areas that were not used for plant production or were abandoned, through the improvement of agricultural practices, which keeps the areas for the production of food raw materials at the same level. Optimization of the production of selected industrial plant species, adapted to cultivation on marginal agricultural land in the 9th state, in 12 localities to achieve a low level of ILUC. Establishment of case studies (12 in 9 countries) of innovative systems cultivation (combined sowing and agroforestry) which have a low ILUC level at marginal agricultural land at the agricultural level farms, for current and future systems in agriculture.

Utilization of marginal lands for growing sustainable industrial crops and developing innovative bio-based products represents significant eco-innovation that contributes to increasing the number and quality of the impacts on the green economy network of excellent case studies: Development of 13 new bio products (biobased) in accordance with circular use biomass. Development of innovative value chains/networks based on biologically effective resources and assessment of production sustainability, including impacts on biodiversity.

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