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Lead beneficiary			
Imperial College London			
Exhibition Road, SW72AZ London			
<a href="http://www.imperial.ac.uk">www.imperial.ac.uk</a>			
Responsible Author			
Calliope Panoutsou	Imperial College London	<a href="mailto:c.panoutsou@ic.ac.uk">c.panoutsou@ic.ac.uk</a>	+44 7557341846
Additional Authors			
Name	Organization	Email	Telephone
Asha Singh	Imperial College London	<a href="mailto:asha.singh@ic.ac.uk">asha.singh@ic.ac.uk</a>	-
Thomas Christensen	Imperial College London	<a href="mailto:thomas.christensen17@ic.ac.uk">thomas.christensen17@ic.ac.uk</a>	-
Obby Areekul	Imperial College London	<a href="mailto:yanida.areekul17@imperial.ac.uk">yanida.areekul17@imperial.ac.uk</a>	-

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- OTHER** ☐

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## Publishable executive summary

The policy analysis in MAGIC used the linear policy analysis model and value chain analysis and worked together with stakeholders to understand current policy landscapes, policy relevant challenges and gaps and formulate a set of future concepts for policy interventions that can overcome challenges and facilitate the delivery of sustainable biomass (from industrial crops) to biobased sectors. The work has been performed in three interrelated stages:

- Analysis and direction reviewed current policy landscapes in relation to the challenges within each value chain stage. Following a gap analysis is performed to understand which issues are not well included by current policies.
- Policy aim built on stage 1 and formulates the future policy aim considering: i) the key challenges, ii) why government intervention is necessary and iii) what are the policy objectives and the intended effects. The participation of relevant stakeholders across the value chain is essential at this stage.
- Policy design created (future) concepts for policy interventions, tailored to overcome the challenges identified in stage 1. The suggested concepts aim to ensure the mobilisation of domestic, resource efficient biomass value chains, which can create synergies for a sustainable bio-based economy (e.g. through cascading and biorefineries).

Following, a policy likelihood assessment has been performed, communicated to relevant stakeholders, and validated for its credibility and accuracy.

Overall, the research employed a set of qualitative and quantitative approaches to understand how policy affects the activities in marginal land use, industrial crop production, conversion to biobased products and usability by the consumer. The suggested interventions can contribute to future policy formation for the following issues:

- Are current policy mechanisms for restoring marginal land available and how efficient they can be in turning such land types to productive, regenerative systems for bioeconomy?
- Industrial crops are produced in Europe and their cultivation is already regulated and financed by several directives and funding schemes respectively. What more can be done to speed up their introduction to land systems with mild or severe marginality?
- Innovation is the cornerstone of the European Green Deal. How can policy facilitate a faster upscaling and large-scale commercialisation of innovative conversion technologies for biobased products?
- Consumers, more and more, prefer biobased products, as they appreciate the need to act for the planet but also for people's health and resilience. How can future policy empower them to make informed choices and ensure the biobased products they consume meet the highest quality standards, respect safe planetary boundaries and at the same time allow room for prosperity and economic growth in remote rural areas in Europe?

## 1 Introduction

The work in this task used the linear policy analysis model<sup>1 2</sup> and value chain analysis and worked together with stakeholders to understand current policy landscapes, policy relevant challenges and gaps and formulate a set of future concepts for policy interventions that can overcome challenges and facilitate the delivery of sustainable biomass (from industrial crops) to biobased sectors.

The deliverable is grouped in six sections:

- a) the description of the methodological approaches followed during the study
- b) an overview of the policy related areas that impact on industrial crops, marginal (or with unfavourable conditions) land, conversion and end use markets and perform gap analysis at EU and MS level (with validation at least to the participating ones and the others based on the European databases)
- c) the rationale for future policy interventions
- d) a set of future policy intervention concepts tailored to meet the challenges that occur within the individual value chain stages of industrial crop cultivation in marginal land and their conversion to biobased products
- e) A policy likelihood assessment through a set of key performance indicators that are relevant to the Common Agricultural Policy and the Sustainable Development Goals, and
- f) A separate Annex with policy briefs for each EU Member State and the UK. A quick scan during the policy review at national level, in the countries with Good Practice cases (see Deliverables 7.1 to 7.3) did not identify and special policy for the use of marginal land for industrial crops and their integration in the respective Smart Specialization Strategies. The individual funding source used in the Good Practice cases is described in Deliverable 7.1.

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<sup>1</sup> The linear policy formation model defines as main policy formation stages the following: agenda, decision and implementation.

<sup>2</sup> Sutton, R. (1999). The policy process: An overview. London: Overseas Development Institute

## 2 Methodology

### 2.1 Integrated policy framework for industrial crops in marginal land

The integrated policy framework used in Magic is based on Panoutsou and Singh, 2020<sup>3</sup>. The structure of the work can help deliver a dedicated biomass policy by analysing and understanding how interventions that are integrated across the biomass value chain stages can overcome individual challenges and resolve gaps in a more effective way than isolated sector-specific policies.

Such policy formation would allow policy makers to recognize the value chain stages that need further support and develop targeted interventions that can increase market uptake of domestic feedstocks within geographical settings. These policies can better capitalise on the strengths and opportunities, prioritise the resource efficient mobilization of domestic biomass value chains and address the prevailing challenges and policy relevant gaps. The framework comprises three stages (Figure 1).

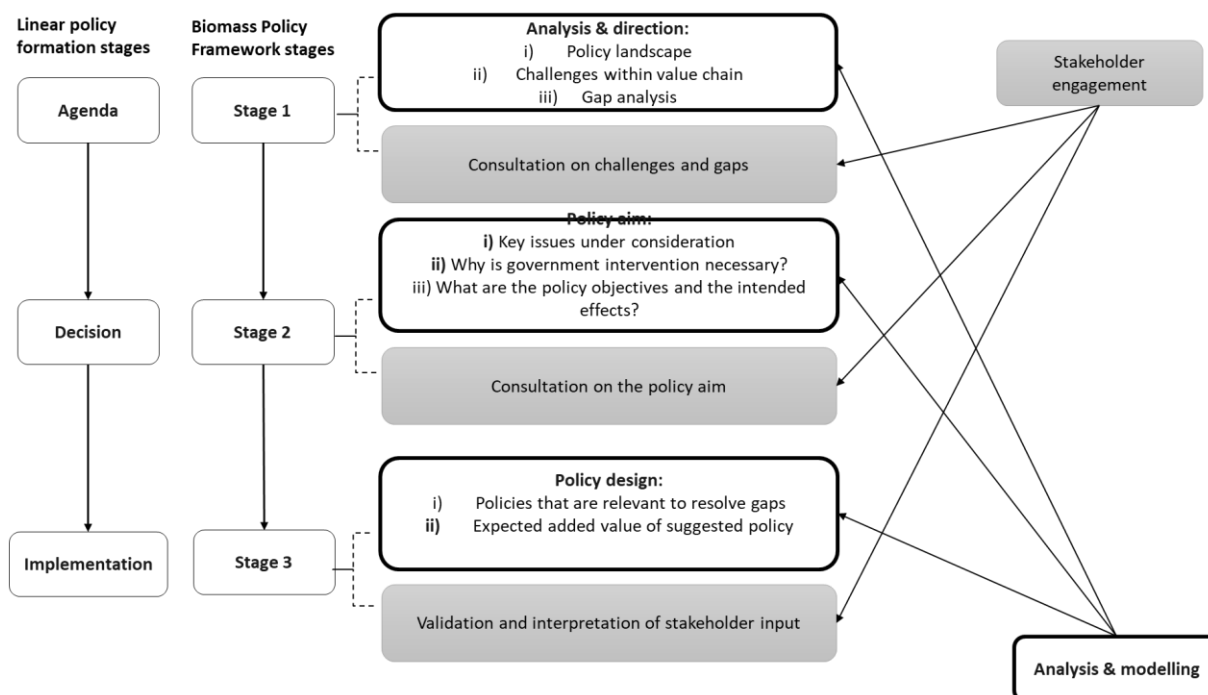


Figure 1 Steps included in the Integrated Policy Framework  
(adapted from Panoutsou and Singh, 2020)

**Stage 1: Analysis and direction** reviews current policy landscapes in relation to the challenges within each value chain stage. Following a gap analysis is performed to understand which issues are not well included by current policies.

<sup>3</sup> C. Panoutsou, A. Singh. 2020. A Value Chain Approach to Improve Biomass Policy Formation. Global Change Biology Bioenergy. (2020), 10.1111/gcbb.12685



**Stage 2: Policy aim** builds on stage 1 and formulates the future policy aim considering: i) the key challenges, ii) why government intervention is necessary and iii) what are the policy objectives and the intended effects. The participation of relevant stakeholders across the value chain is essential at this stage.

**Stage 3: Policy design** creates (future) concepts for policy interventions, tailored to overcome the challenges identified in stage 1. The suggested concepts aim to ensure the mobilisation of domestic, resource efficient biomass value chains, which can create synergies for a sustainable bio-based economy (e.g. through cascading and biorefineries).

Finally, a policy likelihood assessment has been performed, communicated to relevant stakeholders, and validated for its credibility and accuracy. This has been done through interviews and surveying, in combination with the work performed for the Social Life Cycle Analysis in Magic (MAGIC Deliverable 6.6: Social Life Cycle Assessment).

Table 1 Stakeholder groups contacted during the policy aim and justification process and their relevance to the value chain stages.

Value chain stage	Stakeholders contacted	Number	Country
	<b>Farmers</b>	<b>40</b>	
Land use, Biomass Production	Farmers (incl. representatives from cooperatives)	29	UK, BE, S, I, RO, BG, HUN, SI, DE, FIN, HR, BG
	Landowners (incl. associations)	11	BE, UK, FR, FIN
	<b>Value chain actors</b>	<b>27</b>	
Biomass Production, Conversion, End use	Biobased industries	12	DE, I, S, FIN, ES, FR, HUN, HR
	Advanced biofuels	8	FI, UK, FR, ES, DE
	Steel industry	2	DE, UK
	Logistics companies	5	FR, DE, I, UK, RO
	<b>Local community</b>	<b>13</b>	
	Innovation clusters	3	NL, DE, UK
	Local government	4	
	Local business owners	2	UK, FR
	NGOs	4	BE, DE, UK, BG

### 2.1.1 Analysis and Direction: understand the system

The work in this section provides the context and describes the baseline for the analysed system- in the case of Magic, industrial crops cultivated in marginal land as raw material for biobased products.



Understand the system: define key stages and underlying activities within value chains; review policies, identify challenges that trigger major uncertainties; and define policy relevant gaps for sustainability and resource efficiency.

Figure 2 Context of research in the analysis and direction stage for Magic

### 2.1.1.1 Key stages and activities

The key stages included in the policy analysis of Magic are land use, biomass production, conversion and end use.

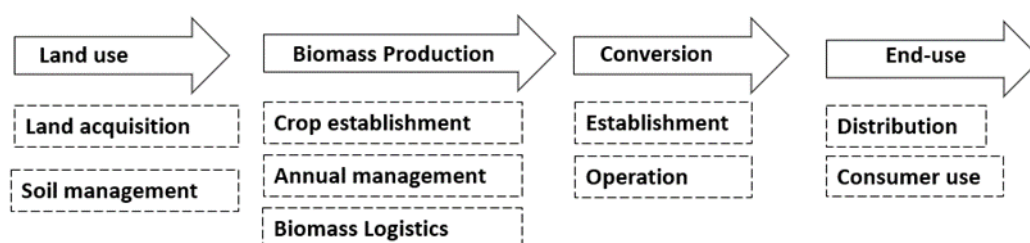


Figure 3 Value chain stages and activities

**Land use:** The cultivation of industrial crops is land-based. The main activities in this stage are land acquisition and soil management. Decision makers face challenges including the need to avoid displacement of other land-based activities and the need to ensure sustainable practices that improve soil quality. These can be optimised through soil, air and water quality improvements and safeguarded with regulatory frameworks that will prevent displacement of other land-based activities.

**Biomass production** includes the following activities: crop establishment and management, harvesting, pre-treatment (chipping, drying, milling, briquetting, etc.), storage and transport. Crop establishment and management practices must recognize and enhance biodiversity, enable low input cultivation systems and minimise intensity of agricultural practices. These can be optimized with the appropriate selection of crops, cropping practices (rotation, cover crops, sequential cropping etc.), and inputs.

Conversion pathways of biomass to biobased products include biochemical<sup>4</sup>, thermochemical<sup>5</sup> and physical or chemical depolymerisation<sup>6</sup>. The main activities are the design, financing, construction and operation of conversion installations, distribution of the product and disposal of residues or wastes. Challenges with regards the design, financing and construction include site selection and access to technology. With regards to operation, challenges include low emissions performance, handling mixed volumes of feedstocks and optimising synergies for valorisation of residues and co-products. These can be optimized with the development of infrastructure (stand-alone installations or co-location with associated installations), feedstock valorisation and use of co-products as well as optimisation of the conversion process.

End use of biobased products includes activities related to distribution and consumer use. Biobased products should be compatible with existing infrastructure, standards and distribution channels. Furthermore, their successful market uptake will be subject to their fitness to replace existing products and commodities in sectors as chemicals, food, energy, fuels, etc.

#### **2.1.1.2 Policy review & gap analysis**

The policy review process followed the value chain approach and reviewed policies with relevance to marginal land, bioeconomy and industrial crops at EU level. Firstly, policy landscaping of all the existing policies across the value chain stages has been performed based on literature and relevant policy databases.<sup>7</sup> The Common Agricultural Policy (CAP), EU Forest Strategy, Waste Framework Directive are some of the key policies in the land use and biomass production stages. Biobased value chains are also affected by climate change, environment and research and innovation policies. European climate and environment policies like 2030 Climate and Energy Policy, the European Green Deal, and the European Structural and Investment Fund (ESIF) are all reviewed in this paper. This landscaping of relevant policies across value chains and biobased sectors is important to understand the existing policy interventions at each stage of the value chain and to identify the gaps in policies for future cultivation of industrial crops in marginal land in Europe.

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<sup>4</sup> Small to medium scale installations (residential) will focus on the production of heat, as well as some industrial installations (producing process heat). From a certain scale - in particular when passing 1 - 5MWth – electricity production will come into focus, first in combination with heat (heat driven CHPs). Typical fields of applications for biomass CHP plants are wood processing industries and sawmills, district heating systems (newly erected or retrofitted systems) as well as industries with a high process heat and cooling demand. Installations focusing on only electricity production generally start from 20 MWe and bigger. These require large amounts of biomass. In Scandinavia also large-scale CHP is applied, reaching higher overall efficiency than condensing power plants.

<sup>5</sup> These conversion processes tend more towards biorefineries, producing fuels and/or chemicals (potentially also heat and electricity as side product or to feed into the internal process). Pyrolysis oil production can also be combined in a CHP plant. Fischer-Tropsch synthesis needs to have large scale to be commercial. The other processes can be medium scale.

<sup>6</sup> Physical or chemical treatment is required to remove lignin from biomass and deconstruct cellulose to make it more accessible for further microbial conversion. <https://www.scitecheuropa.eu/bioeconomy/93538>

<sup>7</sup> Climate Policy Database (<https://climatepolicydatabase.org/>)

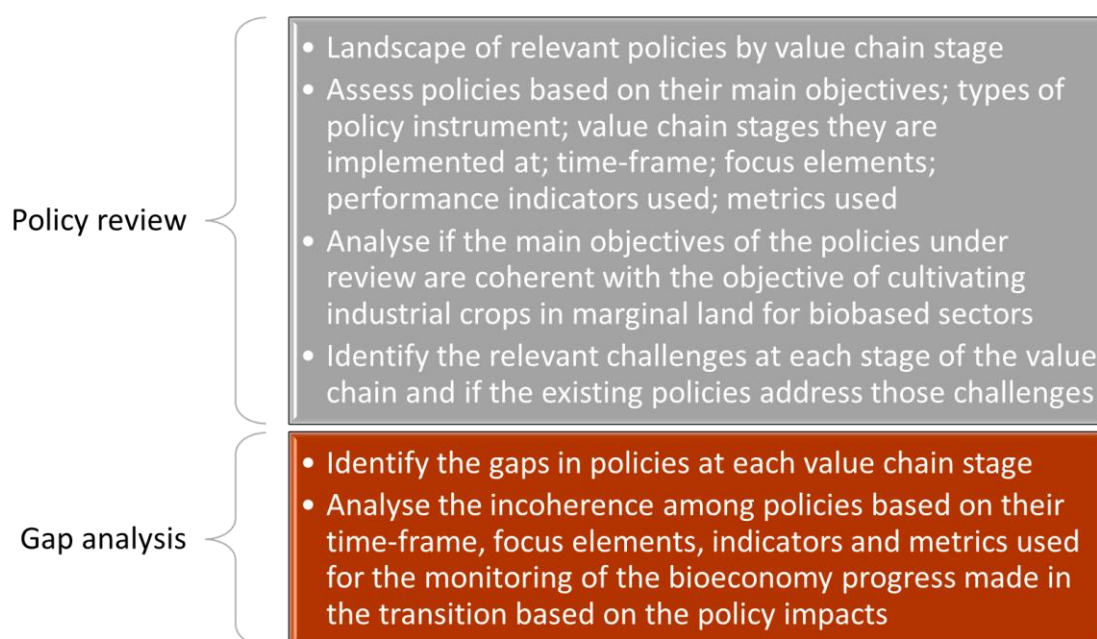


Figure 4 Overview of issues covered in the policy review and gap analysis

### 2.1.2 Metrics to address challenges and assess performance

Indicators play a vital role in policy formation. They shape the evidence base and support policy makers to monitor progress. Moreover, they provide feedback on policy outcomes through quantifying effectiveness so that new agendas and issues can be identified in the outline of new policy goals<sup>8</sup>. Indicators, therefore, inform about relevant metrics that are required in decision-making. Their use improves transparency since they allow the public or any stakeholders to trace the policy's rationale, progress and delivery over time as well as allowing comparisons across countries and databases<sup>9</sup>.

Transparency plays a significant role in sustainable development policies and indicators have often been used in this policy area due to their ability to integrate stakeholders' views and improve their understanding of one another. Improved mutual understanding enables policy decisions to be better shaped to avoid conflicts and address issues of high importance for stakeholders<sup>10</sup>.

<sup>8</sup> Pinter, L., Swanson, D. & Barr, J. E. (2004) Use of Indicators in Policy Analysis. International Institute for Sustainable Development.

<sup>9</sup> Josling, T. E. & Valdes, A. (2004) Agricultural Policy Indicators. The Food and Agriculture Organization of the United Nations.

<sup>10</sup> Pinter, L., Swanson, D. & Barr, J. E. (2004) Use of Indicators in Policy Analysis. International Institute for Sustainable Development.



Focus on economic, social and environmental challenges: propose metrics to enable assessing performance within individual value chains and across sectors.

Figure 5 Context of metrics to address challenges and assess performance

The work in this report, due to the nature of marginal land and the potential cultivation of industrial crops, introduces two sets of indicators from i) Sustainable Development Goals<sup>11</sup>, and ii) the Common Agricultural Policy (CAP)<sup>12</sup>.

### 2.1.2.1 Indicators linking to the Sustainable Development Goals (SDGs)

Interest in Sustainable Development indicators has risen at all governance levels including global organisations such as the Organisation for Economic Co-operation and Development (OECD). OECD uses sustainable development and environmental metrics to monitor and compare the relationship between economic activity and environment pressures to support policy evaluation<sup>13</sup>. Establishing a system of indicators in this policy area is complex due to the various policies objectives, sectors, stakeholders, and indicator's functions<sup>5</sup>.

The UN established the SDGs to provide a common set of ambition to unite global efforts in tackling these seventeen goals (Figure 6) that are defined to be the global sustainable development priorities by 2030. The SDGs not only aim to achieve the millennium development goals (MDGs) but also address other inter-connected challenges across the three dimensions of sustainable development: economic, social and environment. The SDGs seek worldwide action from governments, organization and even efforts from businesses in private sector to have a role in contributing to these goals<sup>14</sup>.

<sup>11</sup> <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

<sup>12</sup> [https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance\\_en](https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en)

<sup>13</sup> Neuhoff, K., Laing, T., Lester, S. & Rysanek, A. (2014) The role of indicators for effective policy implementation. University of Cambridge.

<sup>14</sup> UN Global Compact. (2015) Learn More About the SDGs. Available from: <https://sdgcompass.org/sdgs/> [Accessed Feb 20, 2019].



Figure 6 *The 17 UN Sustainable Development goals*

The cultivation of industrial crops in marginal land can play a significant role in achieving the SDGs since they offer solutions to the following goals (IRENA, IEA Bioenergy & FAO, 2017):

- SDG (2): Ending hunger by reducing competition for land that is suitable for food crops
- SDG (7): Offer affordable and clean sustainable energy for everyone by cultivating bioenergy/ biofuel crops in marginal land
- SDG (13): Contribute to climate goals with its significant impact on GHG savings when implemented with good practices
- SDG (15): Promote better land use since through restoration of marginal land with sustainable practices accounting for biodiversity and other ecosystem services.

#### **2.1.2.2 Indicators linking to the Common Agricultural Policy (CAP)**

Sixteen common indicators relevant to Common Agricultural policy (up to 2020) have been considered in this analysis. These provide a monitoring and evaluation framework for the EU Common Agriculture policy<sup>15</sup>. Figure 7 illustrates how the sixteen indicators portray the impacts on the three sustainability pillars: economic, social and environment.

<sup>15</sup> ENRD. (2018) GUIDELINES ASSESSING RDP ACHIEVEMENTS AND IMPACTS IN 2019. European Commission.





Figure 7 Common Agricultural Policy indicators categories according to the sustainability dimensions (in green environmental measures; in blue economic and in yellow social)

This indicator system is too wide and complex to measure the cultivation of industrial crops in marginal land. Therefore, it needs to further adapted and focused. To do this, the CAP impact indicators were assessed for their relevance not only to agriculture but also to the Sustainable Development Goals (SDGs) and EU Bioeconomy targets<sup>16</sup>. This was done based on literature and interviews with selected stakeholders.

The indicators were scored according to how relevant or applicable they could be to measure the progress of the different SDGs and EU Bioeconomy targets. The EU Bioeconomy strategy established the five following goals: food security, sustainable management of natural resources, reducing dependency of fossil-based resource, mitigating Climate change and sustainable economic growth<sup>17</sup>. The indicators that cover the maximum number of goals have been selected as the indicators to be used in the project to evaluate the current biofuel policies. It is noted that recommended indicators must address the whole sustainable dimensions of economy, society and environment. Figure 8 illustrates this process.

<sup>16</sup> [https://ec.europa.eu/commission/news/new-bioeconomy-strategy-sustainable-europe-2018-oct-11-0\\_en](https://ec.europa.eu/commission/news/new-bioeconomy-strategy-sustainable-europe-2018-oct-11-0_en)

<sup>17</sup> Newton, A., Lescai, F., Carrez, D., Carus, M. & Jilkova, J. (2017) Expert Group Report: Review of the EU Bioeconomy Strategy and its Action Plan Brussels, European Union.

Figure 8: Indicator selection process through scoring system by comparing the 16 CAP indicators with the SDGs

CAP indicators	Sustainable dimension	EU Bioeconomy Challenges (/5)	Description	SDGs																	Totals			Comments
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Highly reliable	Relatables	SUM	
1 Agricultural entrepreneurial income	Social	1	Sustainable economic growth																		2	6	8	Only consider agriculture stream - doesn't cover the whole bioeconomy primary resources such as waste stream
2 Agricultural factor income	Social	1	Sustainable economic growth																		2	6	8	
3 Total factor productivity in agriculture	Economics	2	Sustainable economic growth, sustainable management of natural resources																		4	8	12	Effects the production cost of all bioeconomy products/energy and include data on competition with non-renewable resources
4 EU commodity price variability	Economics	3	Food security, sustainable economic growth, Reducing dependency of fossil-based resource																		3	6	9	
5 Consumer price evolution of food products	Economics	2	Food security, sustainable economic growth																		3	5	8	
6 Agricultural trade balance	Economics	1	Sustainable economic growth																		1	2	3	
7 Emissions from agriculture	Environment	3	Sustainable management of natural resources, reducing dependency of fossil-based resource, mitigating climate change																		6	8	14	Threshold standards, been apply to several procedures and policies
8 Farmland bird index	Environment	2	Sustainable management of natural resources, mitigating climate change																		1	3	4	
9 High nature value (HNV) farming	Environment	2	Sustainable management of natural resources, mitigating climate change																		0	1	1	
10 Water abstraction in agriculture	Environment	2	Sustainable management of natural resources, reducing dependency of fossil-based resource																		2	4	6	
11 Water quality	Environment	2	Sustainable management of natural resources, mitigating climate change																		3	4	7	
12 Soil organic matter in arable land	Environment	4	Food security, Sustainable management of natural resources, reducing dependency of fossil-based resource, mitigating climate change																		3	5	8	Effects the productivity of bio-based resources
13 Soil erosion by water	Environment	2	Sustainable management of natural resources, mitigating climate change																		0	2	2	
14 Rural employment rate	Social	1	Sustainable economic growth																		2	6	8	Easier to obtain data
15 Degree of rural poverty	Social	1	Sustainable economic growth																		2	6	8	
16 Rural GDP per capita	Economics	1	Sustainable economic growth																		2	4	6	

Keys:	
	Highly Reliable
	Slightly Reliable
	Not reliable



From Figure 8, there were many indicators that rank the top three when assessing with the SDGs. However, when combining the score with the EU Bioeconomy targets, the recommended indicators were narrowed to the following: i) EU Commodity price variability, ii) Emissions from agriculture, iii) Soil organic matter in arable land and iv) Degree of rural poverty. It is worth mentioning that degree of rural poverty did not score highest when compared to other indicators but, it is the highest amongst social indicators and is included to help fulfil the sustainability dimensions.

The following paragraphs provide a short description for the recommended indicators' and its rationale for this assessment (European Commission, 2016<sup>18</sup>):

### **EU Commodity price variability**

- **Description:** It measures the EU and world market commodity price variability of agricultural commodities. It is measured by calculating the commodities' coefficient of variation with the mean over the certain period (roughly 3-5 years).
- **Rationale:** It is a helpful indicator since biomass feedstocks for advanced biofuels will be regarded as commodities once the market is developed and any volatility and uncertainty of their prices can cause barrier for investment. Also, the indicator offers the market analysis and comparison between biofuels and fossil fuels.

### **Emissions from agriculture**

- **Description:** The indicator measures both the greenhouse gas (GHG) and ammonia emissions from agriculture activities.
- **Rationale:** This indicator is useful since several policies from other bioeconomy sectors already account for this indicator. Additionally, the methods of measuring the indicator have been established through standards such as Environmental Impact Assessment (EIA).

### **Soil organic matter in arable land**

- **Description:** This indicator portrays the estimation of the total organic carbon content in arable soils. There are two groups of factors that influence inherent soil organic matter content: natural factors and human-induced factors (e.g. land use, management)
- **Rationale:** It is essential to measure the organic matter in soil since a decline of this content can cause negative impacts e.g. a decrease in fertility and loss of structure, which ultimately linked to soil degradation. In other words, it effects the productivity of the biomass resource in the future as well as food security. Hence, policy-makers, farmers and foresters must promote sustainable practices to avoid the interconnected nature of the factors causing soil degradation (ENRD, 2018).

### **Degree of rural poverty**

- **Description:** The indicator measures the share of population at risk of poverty or social exclusion in thinly populated areas (used as proxy for rural areas).

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<sup>18</sup> European Commission. (2016) IMPACT INDICATORS FOR THE CAP POST 2013 . European Commission DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT.

- *Rationale:* The indicator highly inter-link with the upstream indicator of “employment”. Additionally, this indicator is directly associate with the EU bioeconomy goals on the regional development aspect.

In addition to the above, the following three indicators are also added to this recommended list to ensure coverage of the complete value chain:

- sector turnover
- carbon emission along its value chain and
- employment.

All seven indicators combined ensure that the whole value chain of industrial crops cultivated in marginal land is being covered across key sustainability dimensions for environment, economy, and society.

### 3 Policy review and gap analysis for the cultivation of industrial crops in marginal land

The aim of this section is to provide a landscape of the current policy agenda for the cultivation of industrial crops for biobased industries in European marginal land. The work provides a detailed policy landscape, at EU level, across the value chain stages (land use, biomass production, conversion, end use). By employing a value chain approach, the analysis cuts across sectorial segregation of policies and allows understanding how these can interrelate towards the common goal, namely, to establish industrial crops and restore marginal land in a sustainable and resource efficient manner.

*Part of this section has been published in: Singh, A.; Christensen, T.; Panoutsou, C. Policy review for biomass value chains in European bioeconomy. Glob. Transit. 2021, 3, 13–42; <https://doi.org/10.1016/j.glt.2020.11.003>*

#### 3.1 Land use

The key activities in the first stages of the value chains are land acquisition for biomass production, soil preparation and management to maintain the land or soil quality. All these activities come with their own challenges and there are policies in place to support these activities and there are gaps in policy which needs to be reformed.

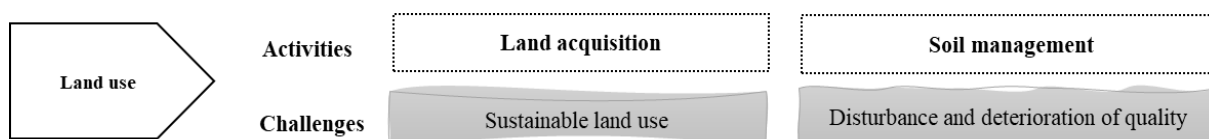


Figure 9 Outline of activities and challenges for marginal land use

##### 3.1.1 Current policy landscape

Exploitation of marginal lands for bioeconomy as a mean to reduce pressure on agricultural land (Banja et al., 2019)<sup>19</sup> is still questioned by scholars<sup>20</sup> due to scepticism for lack of clarity on which sectors should such land type be oriented for, the cost effectiveness of crop productivity and related environmental risks which may outweigh the benefits of using marginal lands.

<sup>19</sup> Banja M, Sikkema R, Jégard M, Motola V, Dallemand J-F. Biomass for energy in the EU—The support framework. Energy Policy. 2019;131:215-28.

<sup>20</sup> A. Muscat, E.M. de Olde, J.J.L. Candel, I.J.M. de Boer, R. Ripoll-Bosch, The Promised Land: Contrasting frames of marginal land in the European Union, Land Use Policy, Volume 112, 2022, 105860, ISSN 0264-8377, <https://doi.org/10.1016/j.landusepol.2021.105860>.)

In the renewable energy sectors, there are already policies like the **Indirect Land Use Change (ILUC) Directive 2015/1513**<sup>21</sup> which supports the production of biomass and GHG emissions reduction by replacing the fossil with biofuels and bioliquids and minimise the direct and indirect land use change. Other relevant policies include the **Common Agricultural Policy (CAP)**, the **Renewable Energy Directive 2018/2001 (RED II)**, the **2030 Climate and Energy Framework**, and the **Land use and forestry regulation (LULUCF) 2018/841** which supports the sustainable use of land for biomass production and reduction of GHG emissions from land use change. These policies implement regulatory measures like certification of low and high ILUC risk biomass feedstock; cross compliance with standards of Good Agricultural and Environmental Condition (GAECs); compliance with sustainability criteria and GHG emission criteria for bioliquids; targets of GHG emission reductions and share of renewable energy and energy efficiency to regulate the sustainable use of land for biomass production. Similarly there are financial support programmes and plans like EAFRD, EAGF, SET plan which supports the acquisition of land for biomass production.

The proposal of the Soil Framework Directive COM (2006)232 is not a legally binding component of the Soil Strategy as it was not adopted by all member states due to administrative burden and costs for its implementation but there are other sectorial policies like the **Soil Thematic Strategy (COM 2012)46 final**<sup>22</sup>, and the **CAP, Industrial Emissions Directive (IED)** which govern the protection of soil quality. Good Agricultural and Environmental Condition of land (**GAEC**) has been an important cross compliance regulatory tool under the CAP to introduce cross compliance regulatory instrument in soil quality management. **The CAP reform 2020 (COM (2018 392 final)**<sup>23</sup> proposed a new GAEC on organic matter protection. It banned arable stubble burning, ploughing of wetlands and carbon-rich soils. Under the Greening measures of CAP Pillar I the Member State were obliged to maintain GAEC standard of minimal soil cover maintenance, land management practices to limit soil loss and soil organic matter level. There are international standardisations measures under **CEN Standards for Soil Improvers, Directive for Pesticides 2009/128/EC and Standards for fertilizers and liming materials** which support the regulation of the soil quality. The **Industrial Emissions Directive** also introduced regulatory provisions like polluter pays principle to ensure that the industrial installations do not lead to deterioration in soil quality.

### 3.1.2 Gaps relevant to marginal land restoration

Regulatory and financial instruments are in place to manage sustainable land use and minimise impacts due to (direct and indirect) land use change. Existing policies, however, do not have a common understanding of what constitutes (definition) marginal land, therefore they lack targeted interventions that can facilitate its sustainable exploitation. Though there are some good practice examples of sustainable practices to exploit marginal lands and there is

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<sup>21</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32015L1513>

<sup>22</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0046>

<sup>23</sup> European Commission Proposal for a Regulation of the European Parliament and of the Council Establishing Rules on Support for Strategic Plans to Be Drawn up by Member States Under the Common Agricultural Policy (CAP Strategic Plans) and Financed by the European Agricultural 2018.

strong pressure from policies to do so there is a gap in common understanding of what land categories (from statistical datasets) can be categorised under marginal land. Therefore, the first step would be to address the biophysical and socio-economic marginality challenges related to marginal lands at policy level.

There are sectorial policies which regulate soil quality but there is absence of uniform standards for this issue and lack of integration among various, demand policies that address this issue through their raw material sourcing. The integration of soil protection across different European Union policies which are working towards the sustainable use of soil has been one of the main focus of the Soil Thematic Strategy going forward (EC, 2012)<sup>24</sup> and remains an ongoing process. The recent integration of soil carbon as agro-environmental indicators in the EU policies under the European Green Deal and emphasis on carbon sequestration as means to offset GHG emissions is expected to reinforce the soil protection legislation across all interrelated sectors -agriculture, forest and waste management, water, climate change environment<sup>25</sup>.

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<sup>24</sup> Report by European Commission The implementation of the Soil Thematic Strategy and ongoing Activities, COM/2012/046. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0046&from=EN>

<sup>25</sup> Panagos, P., & Montanarella, L. (2018). Soil Thematic Strategy: An important contribution to policy support, research, data development and raising the awareness. Current Opinion in Environmental Science & Health, 5, 38-41. <https://doi.org/10.1016/j.coesh.2018.04.008>

Table 2 Challenges for land use, existing policies to address these challenges and policy gaps

Challenge(s)	Relevance to Magic/ bioeconomy priorities	Do existing policies address challenges to meet the bioeconomy objectives?	If not, what are the policy gaps?
Sustainable land use	<i>Managing natural resources sustainably</i>	-Regulatory and financial instruments are in place to regulate the sustainable use of marginal land and to reduce environmental impacts due to land use change	- Lack of common definition for marginal land- matching data collection with national statistics
Soil quality improvements through sustainable management practices	<i>Mitigating and adapting to climate change</i>	-There are sectorial policies which regulate soil quality but are only related to food security issues	-Lack of specific financial or regulatory interventions to exploit marginal lands by linking to biophysical and socio-economic marginality challenges  -No specific regulatory instrument to monitor the soil quality although there are many sectorial policies which lack integration.

### 3.2 Biomass production- Industrial Crops cultivation

The key activities in the biomass production (cultivation of industrial crops) stage are crop establishment and management, biomass harvest, pre-treatment, storage, and transportation of the biomass to the conversion plants.

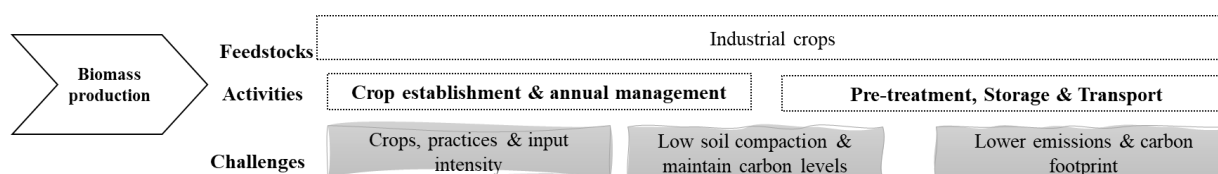


Figure 10 Outline of activities and challenges for the cultivation of industrial crops in marginal land

#### 3.2.1 Current policy landscape

Industrial crop cultivation has impacts on biodiversity, soil and water bodies in the surrounding areas; therefore, sustainable management practices and resource efficiency are fundamental to minimise environmental impacts.

There are policies like **EU Biodiversity Strategy to 2020(COM/2011/244)**<sup>26</sup> which support the conservation of biodiversity and natural habitats to minimise the ecological costs of biomass production and maintain the balance in ecosystem services. The new **EU Biodiversity Strategy to 2030**<sup>27</sup> aims to establish policy coherence among the interlinked sectors in which biodiversity is crucial so that the objectives can be achieved. Unlike the old strategy in the new one it is proposed that the objectives must be legally binding so that there is firm commitment from the Member States. These policies ensure that the production of biomass (for the analysis in Magic, industrial crops) using land (forest and agriculture) or water ecosystems is done in a sustainable manner to reduce impacts on biodiversity and environment.

The **Habitat Directive 94/43/EEC** and the **Bird Directive 2009/147/EC** are also supporting policies whose main objective is the conservation of species and their natural habitats. These policies have regulatory mechanisms which also set biodiversity targets to achieve the long-term vision of sustainable ecosystem and land designation strategies to create special protection areas.

There are also funding programmes like LIFE, ESIF, Cohesion policy funds, Natura 2000 which aim to fund the conservation of biodiversity during sustainable industrial crop production and harvesting.

<sup>26</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0244&from=EN>  
<https://ec.europa.eu/environment/nature/info/pubs/docs/brochures/2020%20Biod%20brochure%20final%20lowres.pdf>

<sup>27</sup> Brunner and Herrero, 2019. Position Paper on The EU Biodiversity Strategy. Birdlife International.  
[https://www.birdlife.org/sites/default/files/attachments/birdlife\\_position\\_biodiversity\\_web\\_01.pdf](https://www.birdlife.org/sites/default/files/attachments/birdlife_position_biodiversity_web_01.pdf)



Agriculture practices such as adding fertiliser, pesticides and other nutrients to increase the yield of biomass production can lead to harmful ammonia emissions in air and nitrate leaching into groundwater leaching causing eutrophication of water, decrease in aquatic species diversity, soil acidification, global warming etc. The **Soil Thematic Strategy (COM 2012)46**, **Integrated pollution prevention and control (IPPC) (96/61/EC) Directive**, **Standards for soil improvers (CEN-TC223)**, the **Nitrate Directive 91/676/EEC**<sup>28</sup>, the **EU Water Framework Directive 2000/60/EC**<sup>29</sup> and the **Clean Air Programme for Europe COM/2013/0918**<sup>30</sup>, **Directive for sustainable use of pesticides 2009/128/EC** enforce strict fertiliser application levels and types to maintain the quality of land, air and water. The **standards for soil improvers (CEN-TC223)** mainly regulate mineral fertilisers while the new **EU Fertilising Products Regulation EU 2019/1009**<sup>31</sup> will boost the bio-based (waste-based) fertilisers and promote the use of recycled materials to reduce dependency on imported fertilisers.

All the above policies are implemented through regulatory instruments like emission limit values, quality standards, best available techniques (BAT) to adopt at national level, monitoring and reporting mechanisms to establish a harmonized inventory of emissions and their sources. There are no financial mechanisms to promote the implementation of these policies. There are also voluntary product label guidelines for soil improvers, voluntary codes of good agricultural practice under Nitrates Directive.

Biomass feedstock sustainability and resource efficiency are the other key challenges in the biomass production stage. There are policies like, **the Common Agricultural Policy, Roadmap to Resource Efficient Europe COM 2011/571, Circular Economy Package, 2030 Climate and Energy Framework, Renewable Energy Directive (RED II)** prioritizes the biomass sustainable biomass production and resource efficiency. **RED II** has sustainability criteria as well as low and high ILUC risk biomass feedstock criteria as regulatory mechanism to ensure the sustainability.

The recent **Carbon Farming initiative**<sup>32</sup> (2021) can be funded the CAP and other EU programs – LIFE, the cohesion funds, Horizon Europe – which can support the upscaling of carbon farming by funding the roll out of the practices, as well as for example by covering additional costs related to monitoring, reporting and verification aspects, or by financing projects that improve the understanding of carbon farming practices (and their suitability and usefulness to marginal land) and fulfil the existing knowledge gaps. The proposed Regulation (EU) 2018/841 for Land Use, Forestry, and Agriculture already sets a governance and incentive framework for Member States, thereby encouraging the design of national policies

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<sup>28</sup> European Commission Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy. Official Journal, L 327 (2000)

<sup>29</sup> European Commission Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources. Official Journal, L 375 (1991)

<sup>30</sup><https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0918>

<sup>31</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1009&from=EN>

<sup>32</sup> [https://ec.europa.eu/clima/eu-action/forests-and-agriculture/sustainable-carbon-cycles/carbon-farming\\_en](https://ec.europa.eu/clima/eu-action/forests-and-agriculture/sustainable-carbon-cycles/carbon-farming_en)



for carbon farming. The Agricultural Knowledge and Innovation System (AKIS) will underpin CAP Strategic Plan implementation through support to advisory services, knowledge exchange, training, information actions or interactive innovation projects for farmers and foresters. Through AKIS, Member States will ensure advice and knowledge transfer on environmental aspects, thereby potentially facilitating carbon farming. On-farm calculations, moreover, will enable land managers – or their advisors – to access carbon farming schemes more easily, to assess carbon sequestration potentials of an individual land holding and to optimise strategy

The **European Climate Pact**<sup>33</sup> can enable a direct exchange of experiences among land managers that can become Climate Pact ambassadors, to lead by example and raise awareness on carbon farming in their neighbourhoods and further, also via a dedicated social platform

Finally, the **Innovation Fund**<sup>34</sup> is the world's largest funding programmes for the deployment at scale of innovative low-carbon technologies. It is financed by the EU ETS and is currently expected to provide financial support of around EUR 25 billion over the period 2021-2030 (based on a carbon price of EUR 50/tCO<sub>2</sub>). Activities for large scale cultivation of industrial crop in marginal land can be included as eligible in the future.

### 3.2.2 Policy relevant gaps to the cultivation of industrial crops for biobased products

There are well-developed regulatory tools and information provision documents which monitor the impacts of crop production activities on land, soil, air, and water quality degradation. Further improvements to regulatory measures are however needed to include specific sustainability criteria for water quality and water use monitoring as well as standards and specifications for the use of wastewater in industrial crop cultivation.

Several policy measures address climate change through GHG emissions reduction targets and management of carbon stocks, yet there are no financial mechanisms aimed at improving sustainability and resource efficiency of the cultivation of industrial crops in marginal land, nor for mobilising underutilised resources such as wastewater to address resource competition and/ or scarcity due to climate change.

Last, there are no dedicated policies to support post-harvest biomass logistical activities like pre-treatment, storage and transport.

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<sup>33</sup> [https://europa.eu/climate-pact/index\\_en](https://europa.eu/climate-pact/index_en)

<sup>34</sup> <https://www.euinnovationfund.eu/>

Table 3 Challenges per value chain stage, existing policies to address these challenges and policy gaps

Challenges	Relevance to Magic/ bioeconomy priorities	Do existing policies address challenges to meet the bioeconomy objectives?	If not, what are the policy gaps?
<p>Sustainable agricultural practices (biodiversity conservation, soil, water and air quality), resource efficiency</p> <p>Low soil compaction and maintenance of soil carbon</p> <p>Low emissions and carbon footprint during crop cultivation</p>	<p><i>Managing natural resources sustainably</i></p> <p><i>Mitigating and adapting to climate change</i></p>	<p>-Regulatory policy instruments support conservation of natural resources and reinforce sustainable agricultural practices to promote soil health.</p> <p>-There are also policy measures which address climate change mitigation through reduction of GHG emissions and management of carbon stock.</p>	<p>- Lack of sustainability criteria for water quality and water use monitoring</p> <p>- Lack of standards and specifications for the use of wastewater in industrial crop cultivation.</p> <p>- Absence of tailored financial mechanisms to support the cultivation of industrial crop in marginal land.</p> <p>-Lack of financial mechanisms for post-harvest biomass logistical activities</p>

### 3.3 Conversion

After the acquisition of sustainably harvested biomass the next step is the conversion of this biomass into biobased products. The main activities in this step of the value chain are the construction of the biorefineries and their sustainable, efficient operation.

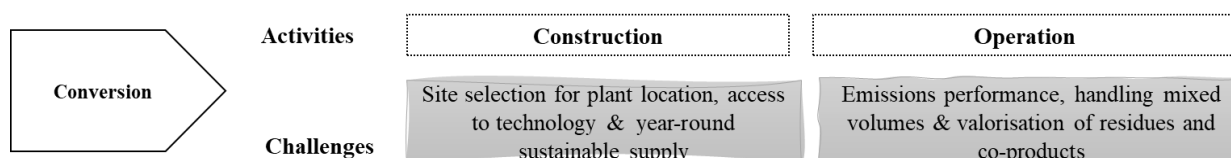


Figure 11 Outline of activities and challenges for the conversion of industrial crops to biobased products

#### 3.3.1 Current policy landscape

Advanced biorefineries are seen as a vehicle for this transition to bio-based economy as they can contribute in sustainable conversion of biomass into bioenergy and bioproducts. Increasing awareness and building capacity of SMEs and bio-based industries will support the identification of the optimal location for the biorefineries, ensure uninterrupted supply of the biomass, minimise the logistical complexities and choose the most efficient biotechnologies for the conversion process which meet the regulated emissions standards and products standards.

So far, there are several financing mechanisms to support the research and innovation in bioeconomy sector under large funding programmes like - **European Structural and Investment Fund (ESIF), Horizon 2020, European Fund for Strategic Investment (EFSI)**. All these funding programmes create new financing opportunities for bioeconomy projects, promote the research and innovation, digital technologies, low-carbon economy, sustainable management of natural resources and small businesses with an ultimate objective to create jobs and to promote sustainable economy and environment in EU. However, there is lack of specific funding mechanisms to support the Upscaling and large-scale commercialisation of innovative conversion technologies which are successful in pilot stage or demonstration stage.

**The European Green Deal<sup>35</sup>** launched on December 2019 aspires to support this transition and make EU climate-neutral by 2050 and one of the focus action area is to help European industries to become global leaders in adopting clean products and technologies.

All industrial value chains are deemed to have key role to play in this transition to climate-neutral Europe by 2050. The European Industrial Strategies focuses their support on SMEs

<sup>35</sup> [https://ec.europa.eu/info/sites/info/files/european-green-deal-communication\\_en.pdf](https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf)

(as 99% of the European firms are SMEs) to make *Europe sustainable and competitive* which is line with the Bioeconomy Strategy objective. **A new EU industrial strategy**<sup>36</sup> was launched in March 10, 2020 which aims to bring together industries and companies, academic and research institutions, service providers and suppliers and create alliances which will boost the growth of key biotechnologies. The strategy's main objectives are in coherence with core Bioeconomy objectives of transition to sustainable green, circular economy and to improve the competitiveness of Europe in global arena. Capacity building, investing, digitisation are some of the ways the Strategy aims to achieve their objectives. Under the new industrial strategy

**The EU Emissions Trading System Innovation Fund, Just Transition Mechanisms**<sup>37</sup> are some of the financial mechanism which will be deployed to support large-scale innovative projects to support clean products and decarbonise energy intensive sectors, create jobs, provide technical assistance and investment in renewable energy sources.

Similarly the **EC adopted a new Circular Economy Action Plan**<sup>38</sup> in March 11, 2020 to support the sustainable growth agenda of Green Deal and to make tackle one of the core challenges of the Bioeconomy Strategy, which is *creating jobs and maintaining European competitiveness*. There are policies like **Smart specialisation Strategies (S3)** which aims to promote the partnership among business, public entities and knowledge institutions through S3 Platform to support the emerging technologies and build competitive advantage by addressing the emerging opportunities.

Reducing emissions and increasing energy efficiency across are key challenges in the conversion stage of the value chain. There are policies like **Energy Efficiency Directive 2012/27/EU**<sup>39</sup> which was established in 2012 with 20% energy saving target by 2020. The Directive supports the overall bioeconomy aim of decarbonising the energy system and meeting the GHG emissions reduction target of 40% by 2030 compared to 1990 level. In 2018 the Directive was amended and establishes energy efficiency target for 2030 to be at least 32.5% as a part of **Clean Energy for All European Package**. The amendment in the new directive needs to be transposed into national level law by June 2020 and come up with 10-year national energy and climate plans (NECPs) to meet energy efficiency targets for 2030. The long-term renovation strategies are covered under **Energy Performance of Buildings Directive (EU) 2018/844**<sup>40</sup>. These energy sector policies are important policies in the conversion stage of the value chain to regulate the emission standards and they are also in

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<sup>36</sup> [https://ec.europa.eu/info/sites/info/files/communication-eu-industrial-strategy-march-2020\\_en.pdf](https://ec.europa.eu/info/sites/info/files/communication-eu-industrial-strategy-march-2020_en.pdf)

<sup>37</sup> [https://ec.europa.eu/info/news/launching-just-transition-mechanism-green-transition-based-solidarity-and-fairness-2020-jan-15\\_en](https://ec.europa.eu/info/news/launching-just-transition-mechanism-green-transition-based-solidarity-and-fairness-2020-jan-15_en)

<sup>38</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN#footnote5>

<sup>39</sup> European Commission, Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN>

<sup>40</sup> European Commission, Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1529483556082&uri=CELEX:32018L0844>

coherence with the objectives bioeconomy sector *-reducing dependence on non-renewable resources and mitigating and adapting to climate change.*

One of the primary policies in place at the European level to regulate the emissions standards during the biomass conversion process is the **Industrial Emissions Directive (IED) 2010/75/EU**<sup>41</sup> which is designed to protect the environment and human health by reducing harmful industrial emissions. Integrated approach, application of best available techniques (BAT), public participation are few of the several pillars of the Directive. The Directive also focuses on energy efficiency, recovery and recyclability as key criteria while choosing the best available technology for conversion. Article 27 of the Directive also encourages member states to develop and apply the emerging technique. There is also the **Clean Air Policy Package**<sup>42</sup> which complements the emissions standards regulated under the IED.

Emission regulating policies are very important both for the upstream and the downstream of the value chain. Since medium scale combustion plants are the major source of emissions, a special directive was proposed under the Clean Air Package, the **Medium Combustion Plant Directive (MCPD) 2015/2193** which regulates emission just from combustion plants which has thermal input size of >1 MWth and <50MWth<sup>43</sup> as the IED regulated the emissions from large combustion plants of >50MWth. Similarly the **Ecodesign Directive 2015/125/EC**<sup>44</sup> covers the smaller appliance <1MWth. The Ecodesign directive main focus is to set an ecodesign requirement for energy-related products to contribute in sustainable development by increasing the energy efficiency. **The roadmap to resource efficient Europe**<sup>45</sup> is a policy framework which supports the change towards resource efficiency and low-carbon economy in Europe. The framework recognised Ecodesign Directive as one of the key instruments in this change. **The Action Plan for the Circular Economy**<sup>46</sup> also highlighted Ecodesign Directive as important policy instrument to address resource efficiency in the design stage of the energy-related products. **Solid fuel boilers** are specific regulatory policy (energy labelling requirement) in place for ecodesign requirement of the solid fuel boiler space heaters.

**EU REACH (1907/2006)**<sup>47</sup> is a policy in place which regulates the chemicals used in the manufacturing process to protect the health of human and environment. **Standardisation on**

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<sup>41</sup> European Commission, Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control); OJ L 349, 19.12.2012, p. 57–65 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2010:334:FULL&from=EN>

<sup>42</sup> "Clean Air Policy Package" Commission Staff Working Document. Impact Assessment (SEC(2005) 1133)/Annex to COM(2005) 446/447 (2013)

<sup>43</sup> Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants.

<sup>44</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0125>

<sup>45</sup> European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Roadmap to a Resource Efficient Europe, European Commission, Brussels (2011)

<sup>46</sup> European Commission, 2015. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Closing the Loop - an EU Action Plan for the Circular Economy,

<sup>47</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006R1907-20140410>

**Surface Active Agents (Bio-surfactants) CEN TC276**<sup>48</sup> regulates the chemicals used in the conversion process of biomass into bio-based products. Performance indicators for CEN standards are different for different biochemical compounds. The standardisation helps make the European market competitive and product high quality products which is in coherence with Bioeconomy Strategy - *maintaining European competitiveness* by focusing on the sustainability and quality of the conversion process.

### **3.3.2 Policy relevant gaps to the conversion of industrial crops to biobased products**

-There is lack of dedicated policies for the optimisation of complex conversion logistics by providing support to reduce energy inputs to reduce pre-processing cost of biomass feedstocks, improve access to technologies for improving energy efficiency, location of biorefineries to secure the uninterrupted supply of biomass and collaboration among suppliers.

- There is need of regulatory interventions which is harmonised with the EU Chemical policies on recycled materials (REACH Review report, 2018)<sup>49</sup> so that the clearly defined labels on chemical composition of the bio-based products become easy to adopt. This will help improving the circularity and sustainability of bio-based products.

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<sup>48</sup> <https://standards.cen.eu/BP/6257.pdf>

<sup>49</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2018:116:FIN>

Table 4 Challenges for conversion, existing policies to address these challenges and policy gaps

Challenges	Relevance to Magic/ bioeconomy priorities	Do existing policies address challenges to meet the bioeconomy objectives?	If not, what are the policy Gaps?
Site selection for plant location, access to technology & year-round sustainable supply	<i>Reducing dependence on non-renewable, unsustainable resources</i>	There are policies which support the R&D and innovation activities to promote the eco-innovative technologies and provide necessary support to uptake technology from small scale to large commercial scale through access to finance and business support services.	Lack of specific funding mechanism for upscaling and large scale commercialisation of innovative technologies
Emissions performance	<i>Mitigating and adapting to climate change</i>		Lack of capacity building programmes for SMEs and industries to support complex biomass logistics during conversion process and valorisation of value-added products from industrial crops cultivated in marginal land.
Handling mixed volumes & valorisation of residues and co- products	<i>Strengthening European competitiveness and creating jobs</i>	There are regulatory policy measures which enforce standards to regulate the chemicals used in the production process of bio-based plastic and surface active agents and regulates the industrial emissions (GHGs and other pollutants)	
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### 3.4 End Use

The main activities at this stage include the distribution of the biobased products and their fitness for consumers' use.

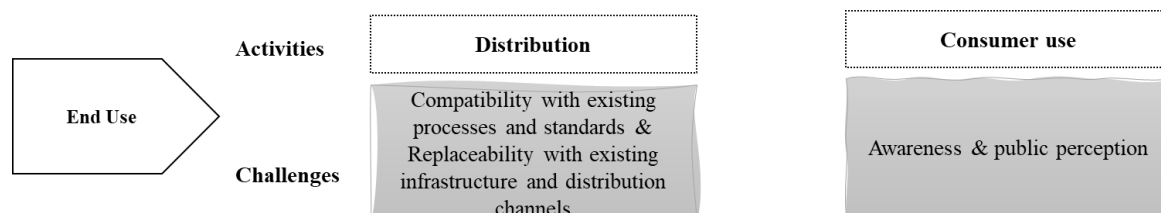


Figure 12 Outline of activities and challenges for the end use of biobased products

#### 3.4.1 Current policy landscape

Once the production of the end-products is complete, the next important step is the distribution of the products for the consumption. At this stage the main challenge is to ensure the compatibility of new products with existing distribution channels and standards. In addition to that another key aspect is to increase consumer's awareness about the quality and labelling of the bio-based products and availability of bio-based products among consumers. Sustainability of the bio-based products is as important as the bio-production process. As Klien et al.<sup>50</sup> suggest, future policies should also set standards on end-of-life usage of the on bio-based plastics as this would improve consumers' knowledge on the properties and functions of the bio-based products. Such policies are expected to improve their acceptability by consumers. The **Sustainable Consumption and Production Action Plan (SCP-AP)**<sup>51</sup> adopted in 2008 was established to enhance the environmental performance of products for increased consumer use. The action plan set ambitious standards to regulate internal markets and improve products through incentives and public procurement, labelling and eco-design of energy- and energy-related products.

The FQD and RED II set sustainability criteria for biofuels to minimise negative impacts starting at the biomass production stage. FQD's sustainability criteria help establish a single, European-wide fuel market for vehicles. Certification initiatives such as **International Sustainability and Carbon Certification (ISCC)**<sup>52</sup> and **Forest Management Certification (FSC)**<sup>53</sup> are implemented at European level to monitor the production of biofuels and are now

<sup>50</sup> Klein, F., Emberger-Klein, A., Menrad, K., Möhring, W., & Blesin, J.-M. (2019). Influencing factors for the purchase intention of consumers choosing bioplastic products in Germany. *Sustainable Production and Consumption*, 19, 33–43.

<sup>51</sup> European Commission (2008c). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan. COM/2008/0397 final. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008DC0397&from=EN>

<sup>52</sup> <https://www.iscc-system.org/certificates/all-certificates/>

<sup>53</sup> Forest Stewardship Council. <https://fsc.org/en/forest-management-certification>



progressively incorporating other material uses of biomass (Ladu et al., 2017) to broaden market competitiveness. ISCC complies with RED II and FQD and covers all sustainable feedstocks (including agricultural and forestry biomass), circular materials and renewables, and includes voluntary certification activities for biodiversity protection, GHG emissions and hazardous chemicals reduction, and water footprint. Market-based mechanisms deployed under **Energy Taxation Directive 2003/96/EC (ETD)**<sup>54</sup> aim to support the uptake of bio-based products by establishing a harmonised tax on energy products to avoid distortions in trade. End-product distribution requires the coordinated development of alternative fuels infrastructure, both from the supply and demand side (distribution networks, recharging and refuelling points). The **Directive on deployment of Alternative Fuels Infrastructure 2014/94/EU**<sup>55</sup> was adopted for development of alternative fuels infrastructure at national level. Policies also exist to support the use of green technologies or emissions standards at the consumption level. For example, the **Clean Vehicles Directive 2009/33/EC**<sup>56</sup> aims to enforce mandatory public procurement for each member state to support the early stage deployment of vehicles and reduce emissions and pollutants. Similarly, the **Green Public Procurement COM (2008/400)**<sup>57</sup> developed the **EU GPP criteria**<sup>58</sup> which member states can adopt at their own discretion to support sustainable technologies, renewables and products, including a focus on socio-economic impacts.

Regulations such as **Emission Performance for new passenger cars**<sup>59</sup> for road transport take into consideration the weight of vehicles to reduce CO<sub>2</sub> emissions (Pinto, 2009; Marousek et al., 2012; Helms and Krack, 2016). The **EU Regulation 595/2009 on Heavy duty vehicles (HDV) standards**<sup>60</sup>, **EU regulation EU 2017/2400 CO2 emissions and fuel consumption**

<sup>54</sup> European Commission (2003c). Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/dir/2003/96/oj>

<sup>55</sup> European Commission (2014). Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/dir/2014/94/oj>

<sup>56</sup> European Commission (2009e). Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles. Retrieved from the Official Journal of the European Union website: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0033&from=EN>

<sup>57</sup> European Commission (2008d). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Public procurement for a better environment. COM/2008/0400 final. Retrieved from the Official Journal of the European Union website: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0400>

<sup>58</sup> European Commission (2008e). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Public procurement for a better environment. COM/2008/0400 final. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008DC0400&from=EN>

<sup>59</sup> European Commission (2009f). REGULATION (EC) No 443/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO<sub>2</sub> emissions from light-duty vehicles. Retrieved from the Official Journal of the European Union website: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0001:0015:EN:PDF>

<sup>60</sup> European Commission (2009g). REGULATION (EC) No 595/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions

of heavy-duty<sup>61</sup>, **EU Regulation (EU) 2018/956 Monitoring and reporting of CO<sub>2</sub> emissions from, and fuel consumption of, new heavy-duty vehicles<sup>62</sup>** and **EU Regulation 692/2008 on light vehicles standards<sup>63</sup>** all work towards the common objective of promoting the adoption of clean and efficient technologies and fuel consumption, by targeting GHG and particulate matters throughout lifecycle performance. Obligation to determine and declare for certification of CO<sub>2</sub> emissions and fuel consumption of new vehicles under the EU Regulations (EU) 2018/956 aims to increase transparency of HDV performance. The **EU Monitoring, Reporting and Verification (EU MRV) 2015/757** is designed to quantify CO<sub>2</sub> emissions for maritime transport and establish reduction targets for ships above 5,000 gross tonnage.

Market uptake of innovative products requires consistent and coherent information about their content, sustainability and environmental indicators (Sijtsema et al., 2016; Blind et al., 2017; Bahrami et al., 2019) to build consumer trust. Standardisation, certification schemes and labels support this effort as essential tools to help communicate the availability and benefits of purchasing bio-based products (Ladu et al., 2017). **Energy Labelling (Directive 2010/30/EU and Regulation 2017/1369)<sup>64</sup>** aims to regulate labelling for energy-related products and helps consumers make informed decisions while **EcoLabel<sup>65</sup>** is developed to communicate the benefits of bio-based products and improves their market integration. Similarly, lack of appropriate infrastructure is also an obstacle for the uptake of the products. For example, the apparent lack of refuelling stations to distribute alternative fuels is seen as a major obstacle (ACEA and UITP Press, 2019)<sup>66,67</sup> to meet renewable energy targets in the transport sector. To address issues on alternative infrastructure there are policies like Green Public

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from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information and amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC. Retrieved from the Official Journal of the European Union website: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009R0595>

<sup>61</sup> European Commission (2019e). Regulation (EU) 2017/2400 implementing Regulation (EC) No 595/2009 — determination of CO<sub>2</sub> emissions and fuel consumption of heavy-duty vehicles. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/reg/2017/2400/oj>

<sup>62</sup> European Commission (2018i). Regulation (EU) 2018/956 of the European Parliament and of the Council of 28 June 2018 on the monitoring and reporting of CO<sub>2</sub> emissions from and fuel consumption of new heavy-duty vehicles. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/reg/2018/956/oj>

<sup>63</sup> European Commission (2008f). Commission Regulation (EC) No 692/2008 of 18 July 2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/reg/2008/692/oj>

<sup>64</sup> European Commission (2017). Regulation (EU) 2017/1369 of the European Parliament and of the council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU. Retrieved from the Official Journal of the European Union website: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R1369>

<sup>65</sup> European Commission (2010c). Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/reg/2010/66/oj>

<sup>66</sup> The European Automobile Manufacturers' Association (ACEA) <https://www.acea.be/press-releases/article/bus-charging-and-refuelling-infrastructure-lacking-warn-auto-industry-and-p>

<sup>67</sup> International Association of Public Transport (UITP) UITP Press Office 2019 [https://www.uitp.org/sites/default/files/UITP\\_ACEA\\_jointPR.pdf](https://www.uitp.org/sites/default/files/UITP_ACEA_jointPR.pdf)

Procurement, Alternative Fuels Infrastructure, SCP-AP, **EU Energy Union Strategy**<sup>68</sup>, European Green Deal, ETIP-Bioenergy, **Research and Innovation Strategies for Smart Specialisation (RIS3)**<sup>69</sup>, **Bio-based Industries Joint Undertaking (BBI-JU)**<sup>70</sup>, and the new Circular Economy Action Plan, among others. These policies have a common objective to adopt low carbon technologies and products, reduce GHG emissions, and take part in the global climate change mitigation effort.

Standardisation policies<sup>71</sup> provide consistent terminology, standards of bio-solvents, bio-based content, application of LCA, end-of the life options, and sustainability criteria. They include **Standards for solid biofuels (CEN/TC335), Standards for Solid Recovered Fuels (SRF) (CEN-TC343), European Norm Sustainability criteria for biofuels and bioliquids: EN16214, European Norm biodiesel-FAME (Fatty acid methyl esters): EN14214, European Norm Petrol: EN228, and prEN16723 - Natural gas and biomethane, CEN/TC 19- Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin**. Each of these is developed to standardise biomass used for biofuels production and support the market integration of bio-based products. RED II aims to incentivise the production of the sustainable aviation fuels (SAFs) at the industrial scale through regulatory targets for the uptake of advanced fuels. In support of RED II there are other certification tools such as ISCC, FSC, FQD which are all implemented at European level with an objective to monitor the production of sustainable biofuels and certification activities.

Concerning market-based instruments improving energy efficiency of bio-based products and consumption patterns, the **Ecodesign Directive 2015/125/EC**<sup>72</sup> is a key instrument targeting change in products and consumption patterns. The **Action Plan for the Circular Economy**<sup>73</sup> also highlights this Directive as an important policy instrument addressing resource efficiency.

<sup>68</sup> European Commission (2015c). Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee, The Committee Of The Regions And The European Investment Bank A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. COM/2015/080 final. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2015:80:FIN>

<sup>69</sup> Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C., & Ortega-Argilés, R. (2012). Guide to Research and Innovation Strategies for Smart Specialisations (RIS3). <https://s3platform.jrc.ec.europa.eu/documents/20182/84453/RIS3+Guide.pdf/fceb8c58-73a9-4863-8107-752aef77e7b4>

<sup>70</sup> European Commission (2013). Report on the proposal for a Council regulation on the Bio-Based Industries Joint Undertaking. (COM(2013)0496 – C7-0257/2013 – 2013/0241(NLE). <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02014R0560-20180215&from=FR>

<sup>71</sup> <https://standards.cen.eu/dyn/www/f?p=CENWEB:105::RESET::>

<sup>72</sup> European Commission (2009h). Directive 2009/125/EC of The European Parliament And Of The Council Of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products. Retrieved from the Official Journal of the European Union website: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0125>

<sup>73</sup> European Commission (2015d). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Closing the Loop - an EU Action Plan for the Circular Economy. Retrieved from: [https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1&format=PDF)

The **Eco-design requirement of solid fuel boilers Regulation (EU) 2015/1189<sup>74</sup>** is a specific example of a regulatory policy enacting energy labelling for woody biomass, with energy use and CO<sub>2</sub> reduction potential as key indicators assessing the performance of conversion technologies (Rietbergen and Blok, 2013).

Long-term renovation strategies covered under **Energy Performance of Buildings Directive (EU) 2018/844<sup>75</sup>** objective is to create opportunities for energy savings through both infrastructural renovation for energy efficiency as well as accurate consumer information provision, for instance through installing smart meters.

### 3.4.2 Policy relevant gaps for the end use of biobased products

- Lack of financial instruments which support the large-scale distribution of innovative low carbon fuels and technologies e.g. advanced fuels, SAF.

- Existing labelling and certification policies do not provide information on the wide range of bio-based products and services, their circularity and sustainability impacts. Consumers need clear information to become aware of the benefits from choosing bio-based over petrochemical products.

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<sup>74</sup> European Commission (2015e). Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers. Commission Regulation (EU) 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers. Retrieved from the Official Journal of the European Union website: <http://data.europa.eu/eli/reg/2015/1189/oj>

<sup>75</sup> European Commission (2018j). Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1529483556082&uri=CELEX:32018L0844>

Table 5 Challenges for end use existing policies to address these challenges and policy gaps

Challenges	Relevance to Magic/ bioeconomy priorities	Do existing policies address challenges to meet the bioeconomy objectives?	If not, what are the policy gaps?
<p>Compatibility of bio-based products and services with existing processes, standards and distribution channels.</p> <p>Replaceability with existing infrastructure and distribution channels</p> <p>Lack of consumer's awareness about the quality (sustainability) and availability of bio-based products</p>	<p><i>Reducing dependence on non-renewable, unsustainable resources</i></p> <p><i>Strengthening European competitiveness and creating jobs</i></p>	<p>There are policies which are supporting the consumption of alternative (clean) fuels by enforcing emission limits and building of alternative infrastructure, promotion of green technologies through public procurements and financial mechanisms to promote energy efficiency.</p> <p>Policies employing standards, labelling, certification mechanisms which provide key information about bio-based products.</p>	<p>Existing policies do not cover the wide range of bio-based products and provide limited information on their circularity and sustainability impacts.</p> <p>New standardisation initiatives should include information on cradle to grave which highlights the end-of-life advantages of bio-based products in comparison to petrochemical based products.</p>

## **4 Policy aim and justification**

This section defines the key issues under consideration for the cultivation of industrial crops in marginal land across Europe, justifies the need for government intervention and shortly describes the policy objectives and intended effects.

### **4.1 Key issues under consideration**

- Marginality challenges can be both biophysical and socio-economic.
- They are always specific to agro-climatic conditions, economic development as well as needs and perceptions of the respective local communities.
- Marginal land, when restored, can provide a variety of ecosystems services and future policy must address its future exploitation under a systemic, value chain lens.

### **4.2 Why is government intervention necessary?**

- Despite high political attention to land under marginal conditions (abandoned, degraded, etc.) there is lack of appropriate terminology to categorise such land types and further design policy interventions that will be suitable to overcome the biophysical and the socio-economic challenges they face.
- Action is required to ensure the environmental compatibility of the use of marginal land for bioenergy and bio-based products, but also for other competing uses of the same land.
- Social aspects such as rural development and sustainable employment should be considered. This will help to ensure the development of marginal land for the benefit of the environment and society.
- Profitability of value chains based on the cultivation of industrial crops in marginal land will require tailored financing interventions at local level.

### **4.3 What are the policy objectives and the intended effects?**

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.



#### **4.4 What evidence has the MAGIC project provided to inform the suggested future policy interventions?**

- Characterisation and quantification of marginal land per biophysical challenge across EU Member States and the UK.
- Careful selection of suitable industrial crops; this has been carried out based on prevailing biophysical conditions of the marginal lands and considering potential impacts on ecosystems services. Thus, the selection of crops within MAGIC aims not only at achieving high yields but also helps to create co-benefits such as improving soil health and restoring long-term productivity, particularly in the case of degraded lands. The selection of industrial crops in MAGIC considered their yield potential and quality suitability for biomass use. At the same time crops have been selected that can deal with marginality constraints, such as drought, contamination, and slopes. Such crops are often characterized by high water and nutrient use efficiency. This reduces the pressure on water resources and demand for fertilizers.
- Analysis of all sustainability (environmental, economic and social) implications associated with selected bioenergy carriers and bio-based products from industrial crops grown on marginal land in Europe.

## 5 Policy design

This section presents future concepts for policy interventions in the value chain stages, tailored to overcome the challenges in the cultivation of industrial crops in marginal land and their conversion to biobased products.

### 5.1 Land use

There is lack of a common definition for marginal land and lack of statistical data collection.

- *Soft actions to establish a set of definitions at cross-sectoral level in EU and globally are required.*

The restoration of marginal land, with mild or severe biophysical constraints can be very challenging since most cases require significant effort and material input to turn land to productivity. This can be particularly challenging in land with high contamination and result to environmental risks, rather than environmental benefits.

- *Future policy interventions must be in place to regulate the ratio of input/ output and ensure sustainable low input practices are safeguarded.*

Land preparation in marginal conditions can be very costly.

- *There is need for financial support to farmers and landowners. The opportunities currently discussed in the carbon farming initiative and the options for including such activities to eco-schemes, as beneficial for soil carbon are well suited.*

In many occasions marginal land can be found in remote rural areas where farmers and landowners have limited access to knowledge on how they can restore it and/ or how to apply low input regenerative practices.

- *Training and capacity building in local communities with marginal land will facilitate knowledge transfer and create more opportunities to exploit such land for biobased value chains.*



Table 6 Policy aim for marginal land use, relevant policy mechanisms, their added value and role of stakeholders

Aim for future policy	Relevant policy mechanisms	Added value	Role of stakeholders
To promote sustainable land management practices by promoting marginal land use.	Regulatory measures to enforce sustainable land use practices through utilisation of marginal lands and uniform standards to regulate soil quality	Create a harmonized regulatory tool to manage soil quality inventory which will be useful in monitoring the impacts of land use change due to biomass production	Agronomist, farmers and government authorities can adopt a uniform soil quality monitoring and reporting methodology
To improve integration among sectorial soil quality policies and harmonised soil inventory	<p>Financial support for the initial establishment and soil preparation activities on marginal lands</p> <p>Capacity building and information provisions to raise awareness about the benefits of mobilising abandoned marginal lands</p>	<p>Create value and job opportunities in the rural area from mobilisation of abandoned and marginal land.</p> <p>Build capacity and knowledge of the stakeholders who are interested in growing energy crops in marginal land.</p>	<p>Policy makers can encourage the use of marginal land and sustainable land-use practices across the Europe by designing information provisions to create uniform definition of marginal lands.</p> <p>Farmers and landowners can take initiative and interest to learn about the potential opportunities of mobilisation of marginal land and integrate production of energy crops into their existing land use practices.</p>

## 5.2 Biomass (Industrial crops) Production

Compliance of agronomic practices with sustainability and certification is critical to ensure that the cultivation of industrial crops in marginal land will be performed within planetary boundaries.

- *Reinforcement of certification and monitoring of compliance to sustainability.*
- *Introduction of sustainability criteria for water management where appropriate.*

Lack of long-term funding combined with the financial uncertainty of the farmers/ landowners makes difficult to commit their time and resources for a medium to long term implementation.

- *Introduce tailored incentives per land area, and/ or production unit as well as subsidies for crop establishment (especially for perennial species).*
- *Capital support for logistics' infrastructure (storage, transportation, etc.)*

Low level of farming community- industry collaboration causes scepticism to farmers about the long-term economic viability of cultivating industrial crops in marginal land.

- *Soft actions to establish networking channels. Use open & participatory" approach that ensures efficient transfer of knowledge for the innovative practices required to cultivate industrial crops in marginal land.*

Small scale of farming implies time-consuming and significant level of training, networking and complex interactions that delays the integration of the value chain to the agricultural systems.

- *Develop effective training and learning from good practices sessions.*

Table 7 Policy aim for industrial crops production, relevant policy mechanisms, their added value and role of stakeholders

Aim for future policy	Relevant policy mechanisms	Added value	Role of stakeholders
To support the implementation of regulatory measures in place for sustainable crop cultivation practices.	Reinforce certification, monitoring and introduce criteria for sustainable water management.	Sustainable and resource efficient biomass production.	<b>Government/policy makers</b> can create a risk-free market environment for biomass producers and small scale farmers.
To address feedstock competition by mobilising underused biomass feedstock source. To improve logistics of biomass production by investment in infrastructure like separate waste collection system, recycling centres etc	Financial incentives and investment support for sustainable cultivation of industrial crops in marginal land  Investment support for infrastructure necessary for the logistical processes like collect, store, transport the biomass to the biorefineries or bio-based industries	Encouraging investments in cropping and improving income opportunities for farmers and landowners	<b>Bio-based business and industries</b> should invest in the biomass production activities and support biomass producers to secure the biomass supply.  <b>Farmers</b> should take initiatives to adopt new agricultural practices and advantage of opportunities available to make the biomass production resource efficient.
To provide targeted financing to improve sustainability and resource efficiency.	Capacity building programmes for biomass producers, suppliers, distributors		

### 5.3 Conversion

Most of the conversion technologies in the value chains analysed in MAGIC involve significant innovations as they are at low Technological Readiness Level (TRL).

- *Developing flexible financing mechanisms to encourage private investments and public-private partnerships which reduces the investment risks whilst at the same time allow innovative technologies reach commercialisation.*

Access to knowledge for technological innovations and skilled personnel is not always easy for small and medium enterprises.

- *Organise capacity building and information provision programmes for SMEs and industries who are early adopters of low-carbon biobased technologies.*

Table 8 Policy aim for conversion of industrial crops to biobased products, relevant policy mechanisms, their added value and role of stakeholders

Aim for future policy	Relevant policy mechanisms	Added value	Role of stakeholders
Increase the funding support and information provisions to facilitate the uptake of low- carbon biobased technologies which are already successful at small scale.	<p>-Financial mechanism like grants, funds and tax incentives to uptake the low-carbon technologies. Encourage private investments and public-private partnership by programmes which reduces the investment risks.</p> <p>-Capacity building and information provisions for SMEs and industries who are early adopters of low-carbon biobased technologies</p>	<p>Unlock the potential of the local SMEs and industries by mobilising the local biomass feedstocks</p> <p>Create a market environment where a smooth transition to bio-based economy from fossil - based economy is possible by taking advantage of the new innovative low-carbon technologies</p>	<p><b>Policy makers</b> can design bioeconomy policies with a longer time frame to communicate the assurance and reduce uncertainty and sense of risk among biomass producers, businesses and industries.</p> <p><b>Government</b> should support create funds and capacity building programmes which supports SMEs and industries to adopt low-carbon technologies and reduce the burden of initial high investment cost.</p> <p><b>Researchers and biotech industries</b> should invest in collaboration and knowledge for capacity building to spread the innovation from small demonstration to large scale.</p>

## 5.4 End Use

Existing policies do not cover the wide range of bio-based products and provide limited information on their circularity and sustainability impacts. New standardisation initiatives should include information on cradle to grave which highlights the end-of-life advantages of bio-based products in comparison to petrochemical based products.

- *Create European level (or international level) eco labels and standards to create a credible standard for all bio-based products and services.*

There is a large variety of biobased products and services, which most of the time derive from highly innovative processes. Their bio-based component is not always measured and certified so that the consumer can be made aware of the potential benefits for his health and quality of life.

- *Improve the financial support to improve the large-scale distribution as well as certification of the bio-based products and services*

Table 9 Policy aim for the end use of biobased products, relevant policy mechanisms, their added value and role of stakeholders

Aim for future policy		- Relevant policy mechanisms	Added value	Role of stakeholders
End Use	Create European level (or International level) eco labels and standards to create a credible standard for all bio-based products and services.	- Regulatory eco labelling and standardized certification procedures which is of international standards. Include end-of-life labelling procedure to improve the circularity of the bio-based products	Coherent and consistent information on the bio-based products and services would give early adopters (either individual consumers or firms) and opportunity to make informed choice and ability to advocate for the bio-based products and services. The effect communication builds trust and improves the acceptance by increasing awareness and reducing uncertainty among consumers and firms (suppliers, distributors) who wants to shift their consumption practices.	<p><b>Policy makers</b> should make uniform regulatory mechanisms about eco-labelling and standardisation for all bio-based products and services.</p> <p><b>Biomass producers</b> (farmers), <b>bio-industries</b> have responsibility to provide coherent and consistent information on the content, environmental and sustainability indicators of the bio-based products and services.</p> <p><b>Government and bio-based industry</b> should invest in consumer awareness about available bio-based products and services and their benefits</p> <p><b>Consumers</b> (early adopters) should make informed choices and give a fair chance for the bio-based products to compete with fossil based products.</p>
	Improve the financial support to improve the large scale distribution as well as certification of the bio-based products and services	- Financial incentives and funding support to improve the distribution channels and certification procedures so that the production costs can be lower. - Information provisions for effective communication		



## 6 Policy likelihood assessment

Policy assessment is required to provide evidence-based knowledge and help policymakers make decisions on whether and how to implement policies. Impact assessment is selected as a form of quantitative method to predict and assess the potential economic, social and environmental impacts of the policy options.

In this section, recommended policies are evaluated for their impact using the selected key indicators documented above. The overall impact score for each policy option is calculated by multiplying level of impact and the likelihood that the EC will agree with the policy being implemented. Tables (1) and (2) define the scale of the score for impact level and likelihood.

Table 10 Scale definition of the likelihood of the policy being implemented by 2030 and the impact level

Likelihood of the policy being implemented by 2030	
Score	Definition
5	Almost certain that the policy will be implemented
4	Highly likely that the policy may be implemented
3	Possible chance that the policy could be implemented
2	Highly unlikely policy will be implemented
1	Almost certain that the policy will not be implemented by 2030.

Table 11 Scale definition of the impact level of policy towards the key indicators

Impact of policy towards the key indicators	
Score	Definition
5	Positive significant impact
4	Positive minor effect
3	Negligible or unsure impact
2	Negative minor effect
1	Negative significant impact

To evaluate whether policy is effective for cultivating industrial crops in marginal land as raw materials for biobased products, the overall impact score that is calculated for each policy option is matched with the impact scoring matrix in Table 11.

Overall impact scores are colour-coded and are categorized as low, medium and high effectiveness. The impacts score and commentary are provided in Figures () and () respectively.

Table 12 Overall impact scoring matrix

Impact	5	5	10	15	20	25
	4	4	8	12	16	20
	3	0	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
Likelihood						

Policy effectiveness	
	Significantly effective
	Little or no effect
	Negative effect

Table 13 below provides the scoring for likelihood as it has been prepared by the project team and assessed by stakeholders during the interviews and surveying. The key findings are described below.

**EU Commodity price variability** will be highly improved through policy interventions that will facilitate broadening the feedstock base and reduce impacts for resource competition. From the interventions recommended during the policy analysis in Magic these include:

- Financial support for the initial establishment and soil preparation activities on marginal lands.
- Reinforce certification, monitoring and introduce criteria for sustainable water management.
- Financial incentives and investment support for sustainable cultivation of industrial crops in marginal land
- Investment support for infrastructure necessary for the logistical processes like collect, store, transport the biomass to the biorefineries or bio-based industries.
- Financial incentives and funding support to improve the distribution channels and certification procedures so that the production costs can be lower.

**The turnover of bioeconomy sectors** can be improved by year-round, secure availability of raw material and fast market uptake of highly innovative conversion technologies. From the interventions recommended during the policy analysis in Magic these include:

- Financial support for the initial establishment and soil preparation activities on marginal lands.
- Financial incentives and investment support for sustainable cultivation of industrial crops in marginal land.
- Financial mechanism like grants, funds, and tax incentives to uptake the low-carbon technologies. Encourage private investments and public-private partnership by programmes which reduces the investment risks.

Table 13 Policy likelihood and impact assessment of recommended policies according to the indicators

Policy suggestions	Likelihood	Indicators														Total
		EU Commodity price variability Impact	Total	Turnover of each bioeconomy sector Impact	Total	Emissions from agriculture Impact	Total	Carbon emissions across the value chain Impact	Total	Soil organic matter in marginal land Impact	Total	Degree of rural poverty Impact	Total	Employment Impact	Total	
1 Regulatory measures to enforce sustainable land use practices though utilisation of marginal lands and uniform standards to regulate soil quality	4	3	12	2	8	5	20	5	20	5	20	2	8	2	8	8
2 Financial support for the initial establishment and soil preparation activities on marginal lands	4	5	20	4	16	3	12	3	12	3	12	5	20	5	20	20
3 Capacity building and information provisions to raise awareness about the benefits of mobilising abandoned marginal lands	4	2	8	2	8	3	12	3	12	3	12	4	16	5	20	20
4 Reinforce certification, monitoring and introduce criteria for sustainable water management.	5	3	15	2	10	4	20	4	20	4	20	2	10	2	10	10
5 Financial incentives and investment support for sustainable cultivation of industrial crops in marginal land	4	5	20	4	16	3	12	3	12	3	12	5	20	5	20	20
6 Investment support for infrastructure necessary for the logistical processes like collect, store, transport the biomass to the biorefineries or bio-based industries	3	5	15	4	12	3	9	3	9	3	9	5	15	5	15	15
7 Capacity building programmes for biomass producers, suppliers, distributors	3	2	6	2	6	3	9	3	9	3	9	4	12	5	15	15
8 Financial mechanism like grants, funds and tax incentives to uptake the low-carbon technologies. Encourage private investments and public-private partnership by programmes which reduces the investment risks.	4	5	20	4	16	3	12	3	12	3	12	5	20	5	20	20
9 Capacity building and information provisions for SMEs and industries who are early adopters of low-carbon technologies	4	2	8	2	8	3	12	3	12	3	12	4	16	5	20	20
10 Regulatory eco labelling and standardized certification procedures which is of international standards. Include end-of-life labelling procedure to improve the circularity of the bio-based products	4	3	12	2	8	5	20	5	20	5	20	2	8	2	8	8
11 Financial incentives and funding support to improve the distribution channels and certification procedures so that the production costs can be lower.	3	5	15	4	12	3	9	3	9	3	9	5	15	5	15	15
12 Information provisions for effective communication	4	2	8	2	8	3	12	3	12	3	12	4	16	5	20	20

**Emissions from agriculture, soil organic matter in marginal land, carbon emissions across the value chain** can be improved through robust regulation that firstly sets limits and then monitors the performance of both machinery and activities during land use and crop production as well as product labelling. From the interventions recommended during the policy analysis in Magic these include:

- Regulatory measures to enforce sustainable land use practices through utilisation of marginal lands and uniform standards to regulate soil quality
- Reinforce certification, monitoring and introduce criteria for sustainable water management.
- Regulatory eco labelling and standardized certification procedures which is of international standards. Include end-of-life labelling procedure to improve the circularity of the bio-based products.

The **degree of rural poverty and employment** can be improved through tailored financing for the cultivation of industrial crops in marginal land as raw materials for biobased products and through continuous training and capacity building activities that can improve knowledge and empower local communities, farmers and landowners make informed decisions. From the interventions recommended during the policy analysis in Magic these include:

- Financial support for the initial establishment and soil preparation activities on marginal lands
- Capacity building and information provisions to raise awareness about the benefits of mobilising abandoned marginal lands
- Financial incentives and investment support for sustainable cultivation of industrial crops in marginal land
- Investment support for infrastructure necessary for the logistical processes like collect, store, transport the biomass to the biorefineries or bio-based industries
- Financial mechanism like grants, funds and tax incentives to uptake the low-carbon technologies. Encourage private investments and public-private partnership by programmes which reduces the investment risks.
- Capacity building and information provisions for SMEs and industries who are early adopters of low-carbon technologies
- Financial incentives and funding support to improve the distribution channels and certification procedures so that the production costs can be lower.
- Information provisions for effective communication

## 7 Conclusions

Policy analysis in MAGIC worked in a collaborative manner with various stakeholders across the value chain stages and explored how future policy interventions can assist landowners, farmers, biobased industries and the consumers to overcome current challenges in restoring marginal land for the cultivation of industrial crops, as raw materials for biobased in industries.

The research employed a set of qualitative and quantitative approaches to understand how policy affects the activities in marginal land use, industrial crop production, conversion to biobased products and usability by the consumer and deliver a set of policy relevant recommendations for future policy formation.

### ***Are current policy mechanisms for restoring marginal land available and how efficient they can be in turning such land types to productive, regenerative systems for bioeconomy?***

- The term marginal land still lacks a definition that can be consistent across all relevant policy sectors (agriculture, environment, bioeconomy, etc.). Cross-sectoral efforts are required.
- There are no timeseries of statistical data for the amount and type of marginal land. The Joint Research Centre of the European Commission and the European Environmental Agency have been delivering consistent information on how the various biophysical, climate change related challenges affect land in Europe. European projects like MAGIC, SEEMLA, FORBIO, etc. have performed detailed research and delivered up-to-date mapping tools for such issues. Coordinated efforts are still needed to harmonise statistical data collection with mapping activities and modelling projections that inform target setting in Europe and at national, local level.
- Financing will be essential, at least at the initial stages of land restoration to share costs and risks in returning – and maintaining- marginal land in productive state.
- Landowners, regional governors, and planning authorities as well as farmers and farming cooperatives must be informed, educated, and well trained to accept joining efforts and coping with the technical challenges for turning marginal land into opportunity for raw material provision.

### ***Industrial crops are produced in Europe and their cultivation is already regulated and financed by several directives and funding schemes respectively. What more can be done to speed up their introduction to land systems with mild or severe marginality?***

- Cultivation in marginal land will have the same sustainability risks as in any other type of arable or productive land. Sustainability principles, robust criteria and effective monitoring procedures are required to operate within safe planetary boundaries.

- Crop cultivation in marginal land is costly. Knowledge gained throughout the policy analysis but also from the analysis of Good Practice cases in the project shows that if financing is only dependent on public funding, then there is a risk of stopping the project at the initial research and demonstration stage. Start up financing from the industry, equity, and inclusion of farmers as shareholders of the supply chain creates better prospects for the longevity and commercial success of the crop production.

***Innovation is the cornerstone of the European Green Deal. How can policy facilitate a faster upscaling and large-scale commercialisation of innovative conversion technologies for biobased products?***

- Reducing investment risk is critical to speed up the upscaling and market uptake of innovative technologies for biobased products, which have high environmental standards, and can deliver optimised resource and process efficiencies.
- Small scale enterprises across Europe can contribute actively to the transition towards low carbon circular economies. To do so, networking, training and educational activities must be intensified at local and regional level and public private partnerships must consider higher inclusion of SMEs.

***Consumers, more and more, prefer biobased products as they appreciate the need to act for the planet but also for people's health and resilience. How can future policy empower them to make informed choices and ensure the biobased products they consume meet the highest quality standards, respect safe planetary boundaries and at the same time allow room for prosperity and economic growth in remote rural areas in Europe?***

- The biobased content in products must be clearly labelled and certified; this will facilitate transparency and increase consumers' confidence.
- Communicating the benefits of biobased products to consumers must continue and be further improved with tailor messages that can reach out to a multitude of individuals from young children to remote and elderly parts of the population with limited access to new knowledge.
- Distribution of biobased products to remote and rural areas must be reinforced to maximise their outreach to consumers. Tailored financing for branding and retailers as well as implementing and monitoring green procurement will facilitate this process.

## **Annex with Country Profiles**



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## 8 Austria

Adverse soil terrain, adverse climate, adverse rooting conditions and excessive soil moisture are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Austria	27%	16%	0%	1%	23%	30%

### 8.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 8.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Austria.

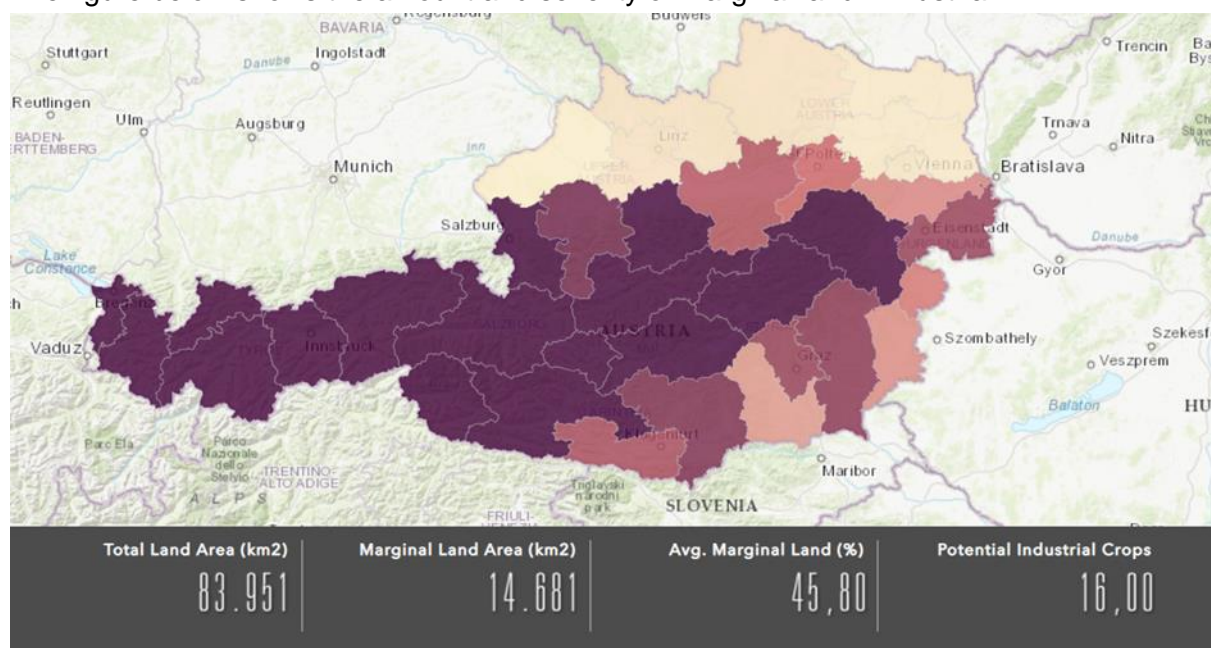


Figure 13 Estimated marginal land in Austria (source: Magic project)<sup>76</sup>

The estimated marginal land amounts for 14.7 km<sup>2</sup> which is more than 45% of the total area of the country.

<sup>76</sup> <https://iasa-spatial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Sixteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 14 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Austria

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 8.2 Policy aim<sup>77</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>77</sup> The policy aim is the same across all countries

## 8.3 Policy design

### 8.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 15 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 8.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 16 National policy landscape and potential integration of interventions

Land Use & Crop cultivation	Conversion	Distribution	End-use
Grants and tax-free loans			Biobased feedstock carbon premium
CAP Implementation (LWG)	Electricity Act 2010		Climate and Energy Fund: Subsidy Scheme wood heating
New CAP: Crop establishment grants			
OPUL-Austrian Agri-environmental Porgramme 2007	Combined Heat and Power Act		
	Green Electricity Feed-in-Tariff		
Regulation on agricultural feedstock for biofuels and bioliquids			
	Fuel Order Amendment 2012 Biofuel quota		
	Bioethanol regulation		
		Ambient air quality	
		Greening of Transport Act	
		Mineral Oil Tax Act	



## 9 Belgium

Low soil fertility, adverse climate, adverse chemical contamination and adverse rooting conditions are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Belgium	8%	0%	5%	10%	4%	0%

### 9.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 9.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Belgium.

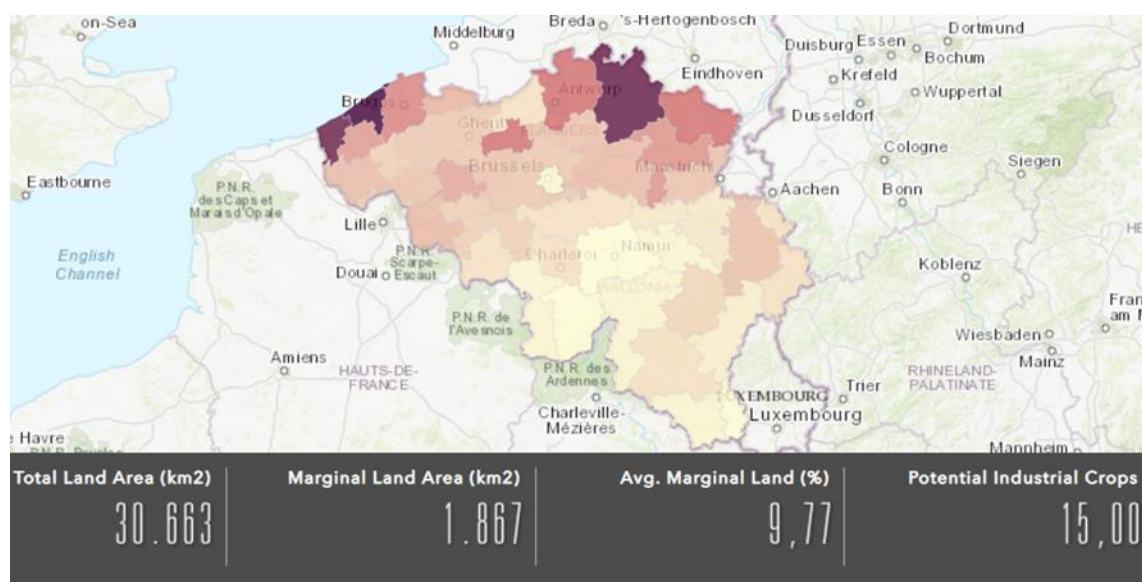


Figure 14 Estimated marginal land in Belgium (source: Magic project)<sup>78</sup>

The estimated marginal land amounts for 1.9 km<sup>2</sup> which is approximately 10% of the total area in the country.

<sup>78</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Fifteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 17 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Belgium

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 9.2 Policy aim<sup>79</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>79</sup> The policy aim is the same across all countries

## 9.3 Policy design

### 9.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 18 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 9.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 19 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP		Law on Blending of Biofuels	
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Product Norms			Rapeseed as biofuel (Taxation)
Sustainability criteria for biofuels			Tax exemption for sustainable biofuels
Nitrate regulations			
Support Eco-Investments			Greening Certificates
			Energy Premium for Buildings

## 10 Bulgaria

Adverse soil terrain and adverse rooting conditions are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Bulgaria	0%	0%	0%	0%	3%	5%

### 10.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 10.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Bulgaria.

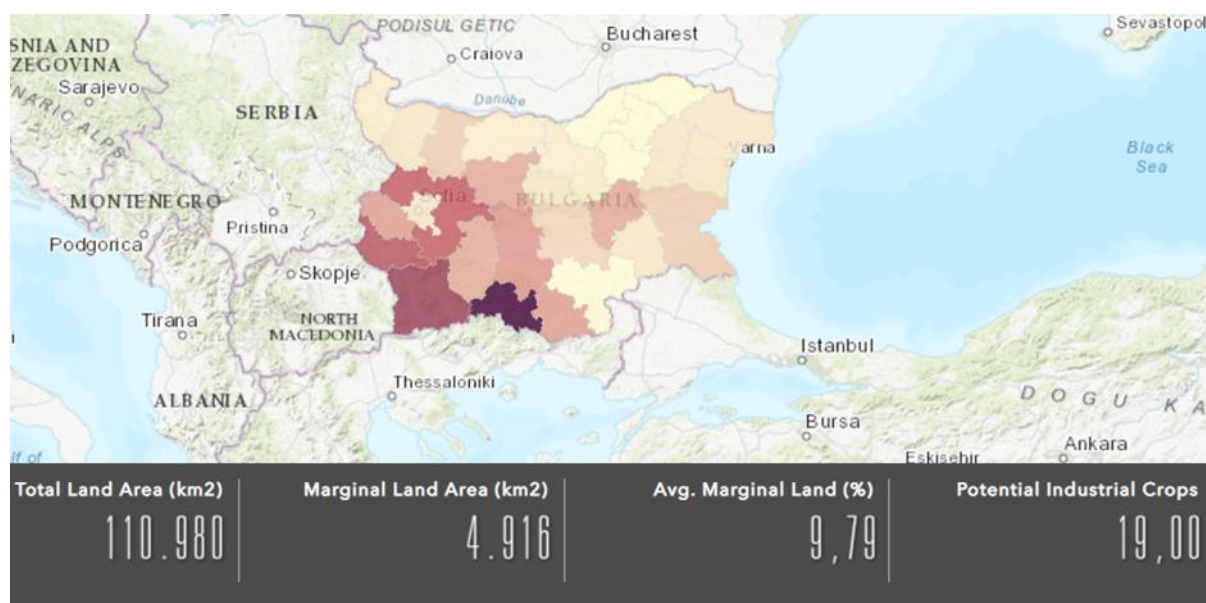


Figure 15 Estimated marginal land in Bulgaria (source: Magic project)<sup>80</sup>

The estimated marginal land amounts for 4.9 km<sup>2</sup> which is approximately 10% of the total area in the country.

<sup>80</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Nineteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 20 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Bulgaria

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				



## 10.2 Policy aim<sup>81</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>81</sup> The policy aim is the same across all countries

## 10.3 Policy design

### 10.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 21 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 10.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 22 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP- RDP		ERSA- Biofuel Quota	
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
BEERECL: Investment, Subsidies and Loans		ESRA Grid Connection	
	ESRA FiT		
		Excise Duties and Tax Warehouse Act	
Agricultural Land Act	Fund for Environmental Protection and Energy Efficiency		
Nitrates	State Support for environment		

## 11 Croatia

Adverse rooting conditions, excessive soil moisture and adverse soil terrain are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Croatia	0%	15%	0%	0%	23%	5%

### 11.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 11.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Croatia.

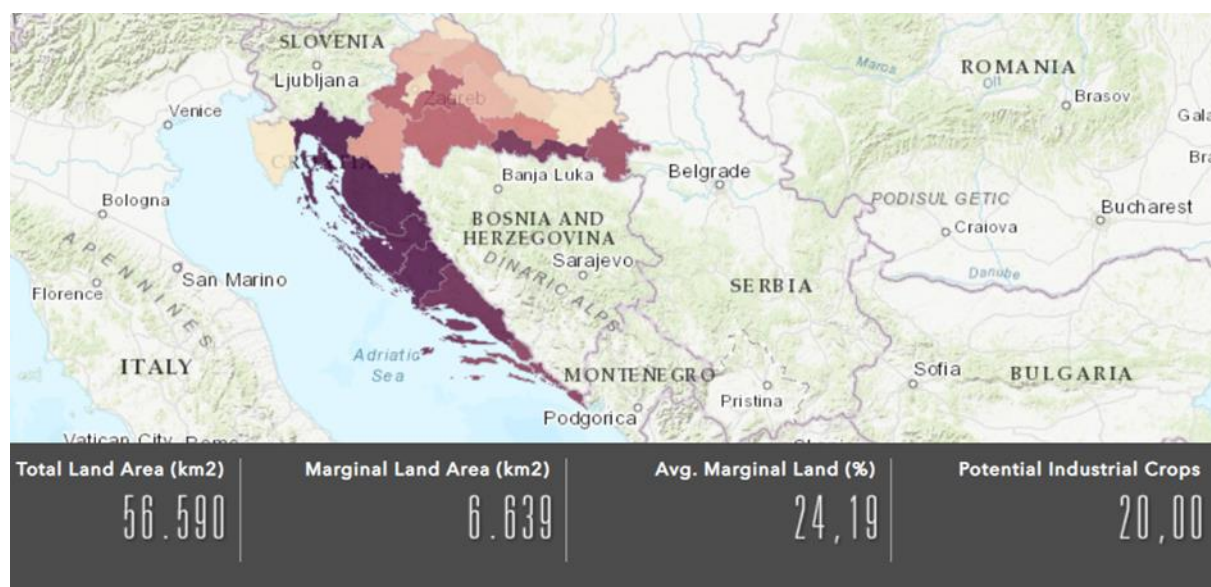


Figure 16 Estimated marginal land in Croatia (source: Magic project)<sup>82</sup>

The estimated marginal land amounts for 6.6 km<sup>2</sup> which is more that 24% of the total area in the country.

<sup>82</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Twenty industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 23 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Croatia

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Miscanthus sacchariflorus (P)	Bioenergy, building materials				
Lupin	Feed, chemicals, lubricants, cosmetics				

### 11.2 Policy aim<sup>83</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>83</sup> The policy aim is the same across all countries

## 11.3 Policy design

### 11.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 24 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing



out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 11.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 25 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
Agricultural Land Act	Fund for Environmental Protection and Energy Efficiency		
Nitrates	State Support for environment		
CAP: Croatian RDP		Tariffs for RES and CHP Electricity	
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
		Loans Environmental Protection, Energy Efficiency and RES	
		Act on Biofuel for transport	
		Act on Special tax for motor vehicles	
	Regulation for Biofuel Quality		
	Excise Duty Act		
	Air emission limit from stationary sources		

## 12 Czech Republic

Low soil fertility, excessive soil moisture, adverse terrain and adverse climate are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Czech Republic	1%	3%	0%	4%	0%	2%

### 12.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 12.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Czech Republic.

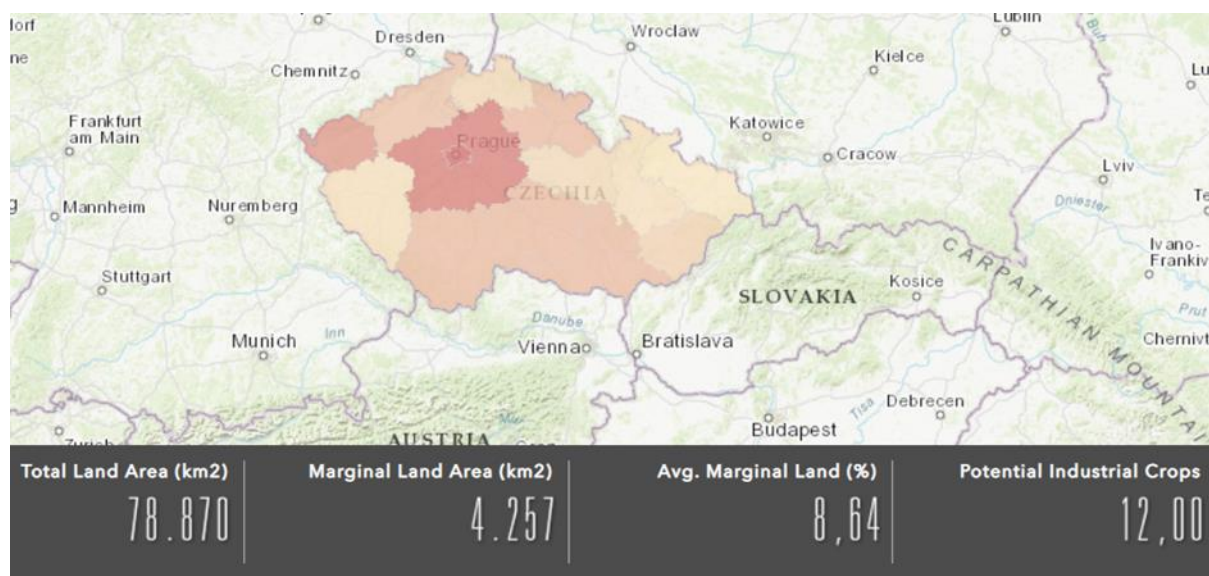


Figure 17 Estimated marginal land in Czech Republic (source: Magic project)<sup>84</sup>

The estimated marginal land amounts for 4.3 km<sup>2</sup> which is approximately 9% of the total area in the country.

<sup>84</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Twelve industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 26 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Czech Republic

C	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 12.2 Policy aim<sup>85</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>85</sup> The policy aim is the same across all countries

## 12.3 Policy design

### 12.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 27 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 12.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 28 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
Act on converting agricultural and forest lands	Operational Programme Environment		Clean Air Act: Biofuel Quota
New CAP: Crop establishment grants			
Act on plant protection	Eco-energy programme		
Act on the protection of nature and the landscape		Act on promoted energy sources: FiT	
Grants and tax-free loans			Biobased feedstock carbon premium
Water act			
Examination of agricultural lands and soils of forest lands			
Fertilisers act	Carpathian Convention		
	Act on Environmental Impact Assessment	Act on consumption tax	
Law on Agriculture	Property Tax		
	Air Protection Act		
Sustainability criteria for biofuels			

## 13 Denmark

Adverse rooting conditions and excessive soil moisture are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Denmark	0%	6%	0%	0%	7%	0%

### 13.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 13.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Denmark.

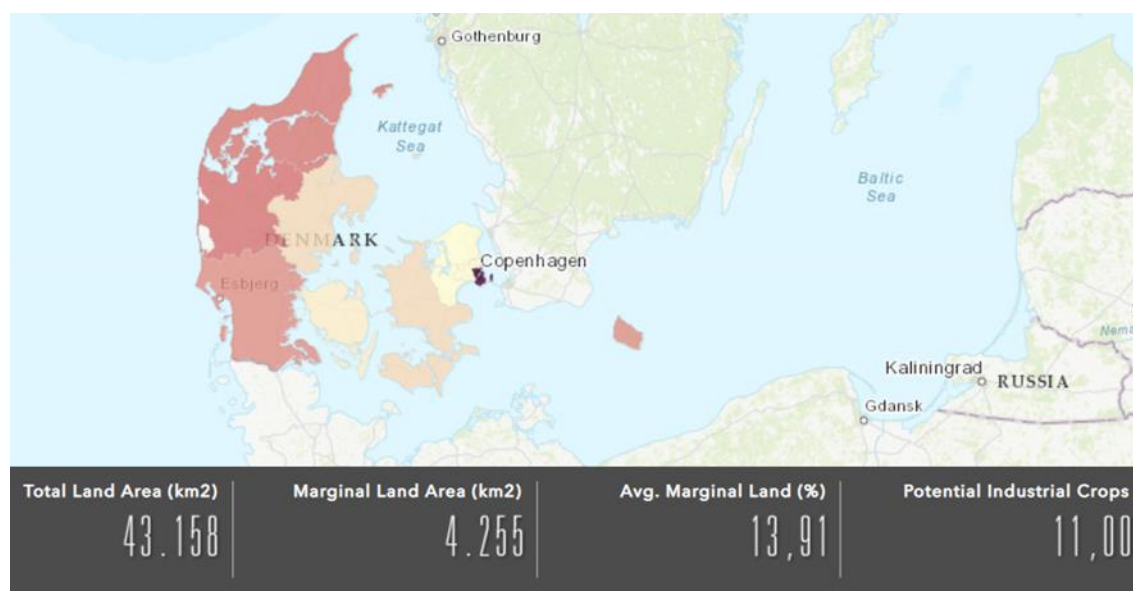


Figure 18 Estimated marginal land in Denmark (source: Magic project)<sup>86</sup>

The estimated marginal land amounts for 4.3 km<sup>2</sup> which is more than 13% of the total area in the country.

<sup>86</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>



Eleven industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 29 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Denmark

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				

### 13.2 Policy aim<sup>87</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>87</sup> The policy aim is the same across all countries

## 13.3 Policy design

### 13.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 30 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 13.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 31 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Act on electricity supply			
Act on nature conservation			
	Grants to promote renewable electricity		
Biofuels Act			
CAP			CO2 tax on energy products
Contaminated soil act			Tax on mineral oil
Environmental protection act			
	Law on promotion of renewable electricity (FiTs)		

## 14 Estonia

Adverse climate and excessive soil moisture are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Estonia	100%	35%	0%	1%	2%	0%

### 14.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 14.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Estonia.

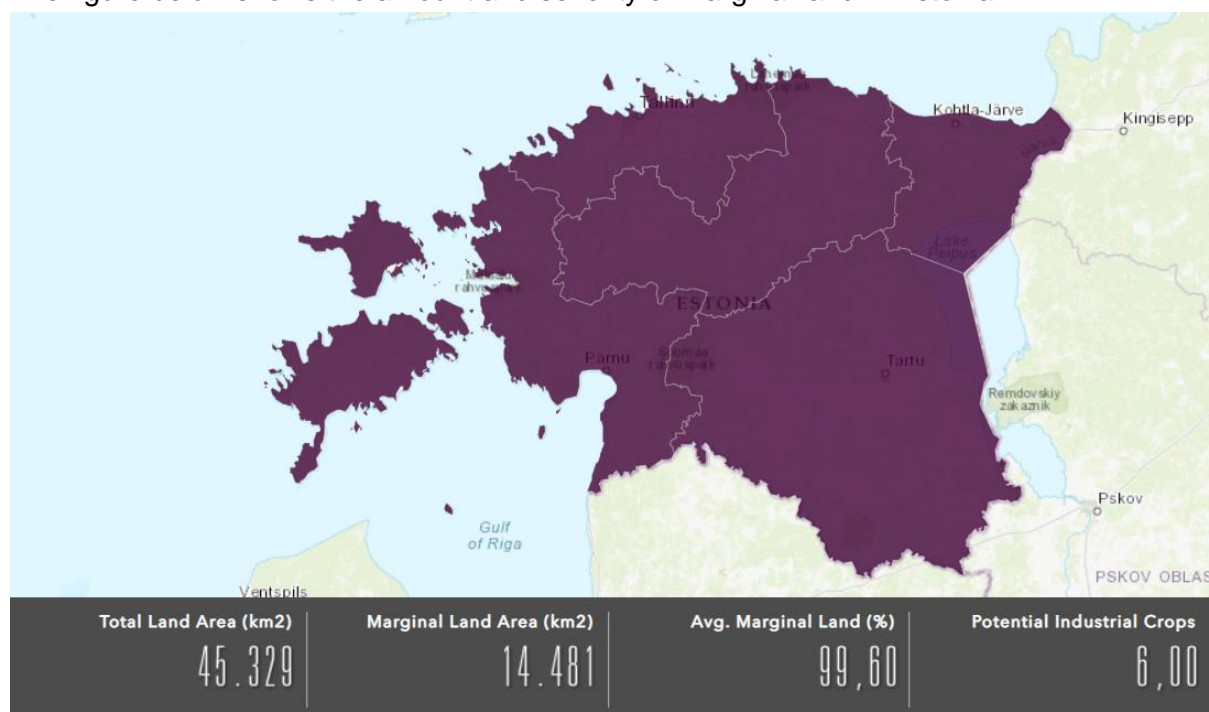


Figure 19 Estimated marginal land in Estonia (source: Magic project)<sup>88</sup>

<sup>88</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 14.5 km<sup>2</sup> which is more than 9% of the total area in the country.

Six industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 32 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Estonia

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
<b>Camelina (A)</b>	Feed, chemicals, lubricants, cosmetics, bioenergy				
<b>Crambe (A)</b>	Feed, chemicals, lubricants, cosmetics, bioenergy				
<b>Reed Canary Grass (P)</b>	Bioenergy, building materials				
<b>Tall Wheatgrass (P)</b>	Bioenergy, building materials				
<b>Poplar (P)</b>	Bioenergy, building materials				
<b>Willow (P)</b>	Bioenergy, building materials				

## 14.2 Policy aim<sup>89</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>89</sup> The policy aim is the same across all countries











## 14.3 Policy design

### 14.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 33 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 14.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 34 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Environmental Strategy 2030			
	District Heating Act		
	Electricity Market Act (FiTs)		
CAP			Environmental Charges Act
Investment Support Bioenergy for Farmers			
Nature Conservation Act			

## 15 Finland

Adverse climate, adverse rooting conditions, excessive soil moisture, low fertility and adverse soil terrain are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Finland	100%	7%	0%	5%	10%	1%

### 15.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 15.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Finland.

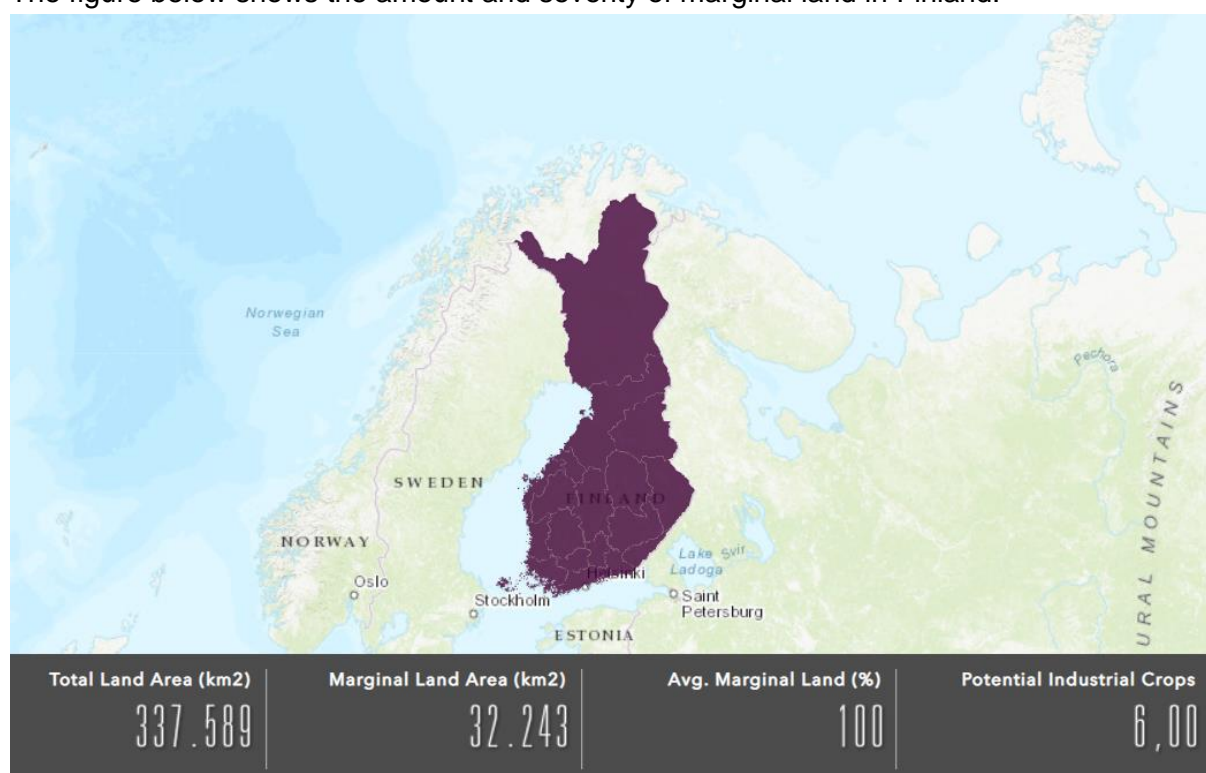


Figure 20 Estimated marginal land in Finland (source: Magic project)<sup>90</sup>

<sup>90</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 32.2 km<sup>2</sup> which is more than 95% of the total area in the country.

Six industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 35 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Finland

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				

## 15.2 Policy aim<sup>91</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.









<sup>91</sup> The policy aim is the same across all countries

## 15.3 Policy design

### 15.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 36 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 15.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 37 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: RDP	Act on regional development		
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Fertiliser Product Act	Energy Aid		
Fertiliser Product Decree	Energy Taxes		
Organic Products	Fuel Tax		
Nature Conservation Act	Production subsidies for renewable electricity		
Wilderness Act	Act on emission trading		
	Act on Energy Certificates for Buildings		
	Act on Environmental Impact Assessment Procedure		
	Act on placing timber and wood products to market		
	Act on sustainability of biofuels and biofluids		
	Biofuels for transport obligation		
	Decree on air quality		
	Emission regulations for combustion plants		
	Energy Efficiency Act		
	Environmental Protection Act		
	Guarantee of Origin of electricity		
	Energy Efficiency Agreements and Audits		
	Public procurement rules		
	Cleantech Strategy		
	Energy and Climate Roadmap 2050		
	Finland's Regional Development Strategy		
	Finnish Bioeconomy Strategy		
	Innovation Policy Guidelines		
	National Energy and Climate Strategy		
	Transport 2030		

## 16 France

Adverse rooting conditions, adverse soil terrain, excessive soil moisture and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
France	2%	1%	1%	0%	8%	4%

### 16.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 16.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in France.

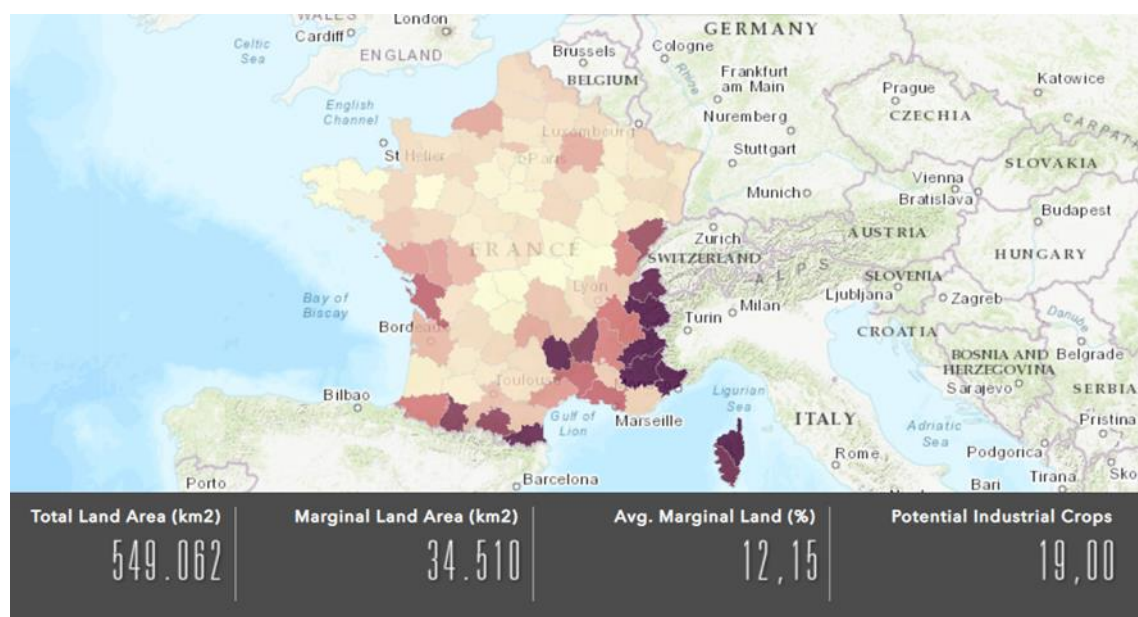


Figure 21 Estimated marginal land in France (source: Magic project)<sup>92</sup>

The estimated marginal land amounts for 34.5 km<sup>2</sup> which is more than 12% of the total area in the country.

<sup>92</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>



Nineteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 38 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in France

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				



## 16.2 Policy aim<sup>93</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>93</sup> The policy aim is the same across all countries

## 16.3 Policy design

### 16.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 39 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 16.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 40 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP RDP	FiT		
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Environmental Code	Tax code- tax credit and VAT reduction		Fund for thermal renovation of private housings
Nitrates	Tenders for renewable energy plants		Grenelle -Heat Fund
Community Water Policy			Zero percent interest loan for housing renovation
Rural Development and Marine Fishing Code			Biofuel quota
	Act on granting priority to renewable energy sources		

## 17 Germany

Excessive soil moisture, adverse rooting conditions and adverse soil terrain are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Germany	0%	8%	0%	0%	5%	1%

### 17.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 17.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Germany.

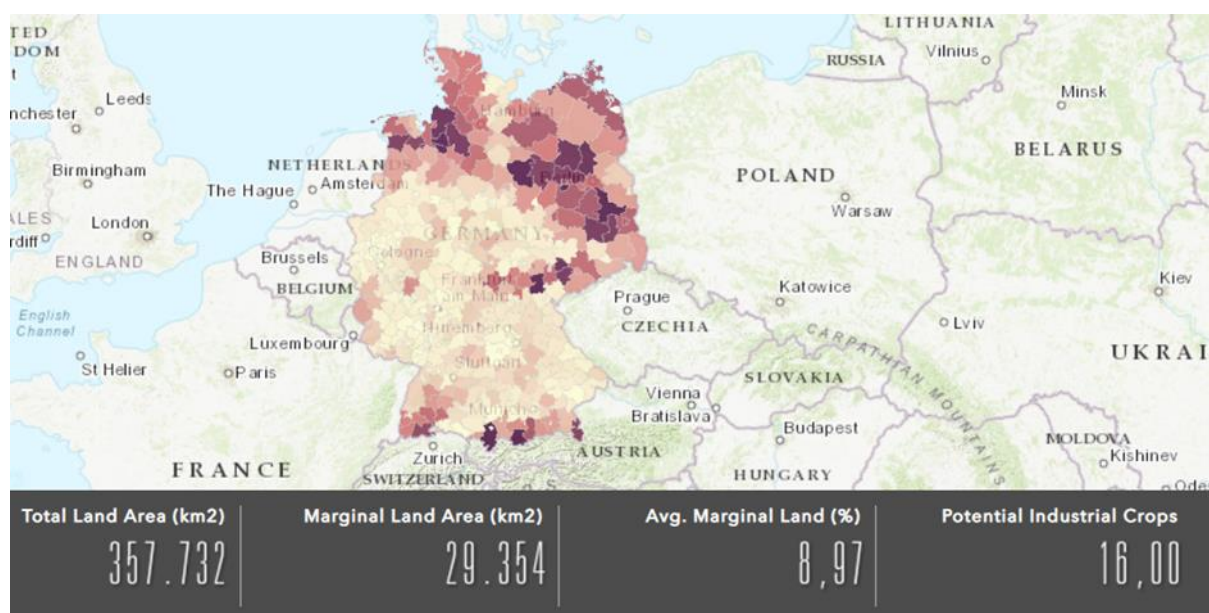


Figure 22 Estimated marginal land in Germany (source: Magic project)<sup>94</sup>

The estimated marginal land amounts for 29.35 km<sup>2</sup> which is approximately 9% of the total agricultural are in the country.

<sup>94</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Sixteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 41 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Germany

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 17.2 Policy aim<sup>95</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>95</sup> The policy aim is the same across all countries

## 17.3 Policy design

### 17.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 42 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 17.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 43 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP Implementation	Market premium		Renewable Energies Heat Act-Act to Promote renewable energy for heating
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
OPUL: Financial support for cultivation on SRC			
Joint Task on Agricultural structures and Coastal Protection	Flexibility Premium		BAFA renewable heat investment support
Feedstock bonus for plants using straw			
Fertilisation Ordinance	Ordinance on the generation of electricity from Biomass		Energy tax act
	KfW Renewable Energy Programme Premium		
National sustainability strategy of the federal government/Biomass sustainability regulation			
	Federal Emission Control Act		
		National Bioeconomy Strategy	



## 18 Greece

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Greece	5%	0%	2%	1%	25%	18%

### 18.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 18.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Greece.

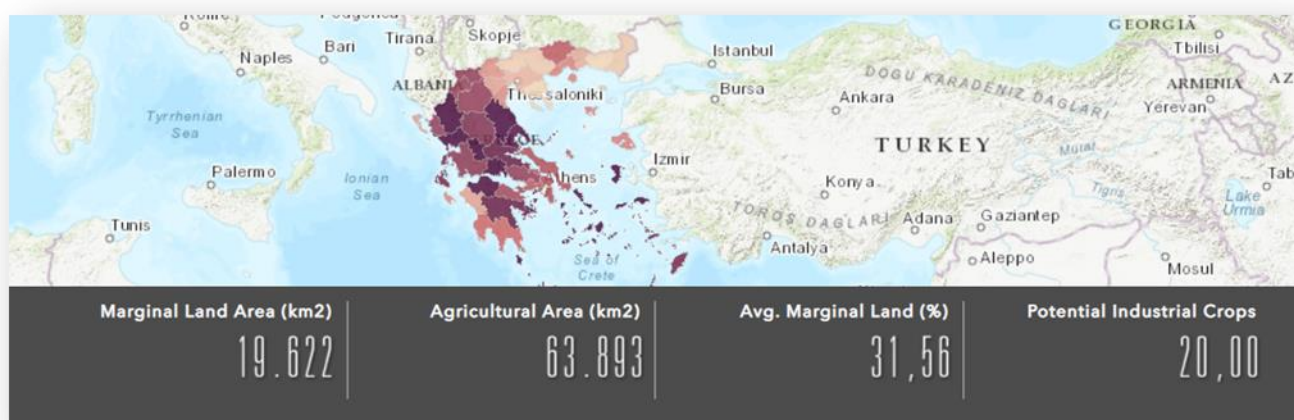


Figure 23 Estimated marginal land in Greece (source: Magic project)<sup>96</sup>

The estimated marginal land amounts for 19.6 km<sup>2</sup> which is more than 30% of the total area in the country.

Twenty industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

<sup>96</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Table 44 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Greece

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Miscanthus sacchariflorus (P)	Bioenergy, building materials				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 18.2 Policy aim<sup>97</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>97</sup> The policy aim is the same across all countries

## 18.3 Policy design

### 18.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 45 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 18.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 46 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP RDP	Biomass Heating Regulation		Green Fund
Good Agricultural Practices for Prevention of Nitrate pollution from Agricultural Activities	FiT scheme for RES Electricity		Biofuels Quota
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
	Investment incentives law		RES promotion and biofuels sustainability criteria
		Energy performance residential buildings	
Increasing of the value of forest products			
	Law on income tax		
	Solid biofuel quality standards for heating applications		

## 19 Hungary

Adverse chemical contamination, excessive soil moisture, adverse soil terrain, low soil fertility and adverse rooting conditions are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Hungary	0%	5%	10%	3%	2%	4%

### 19.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 19.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Hungary.

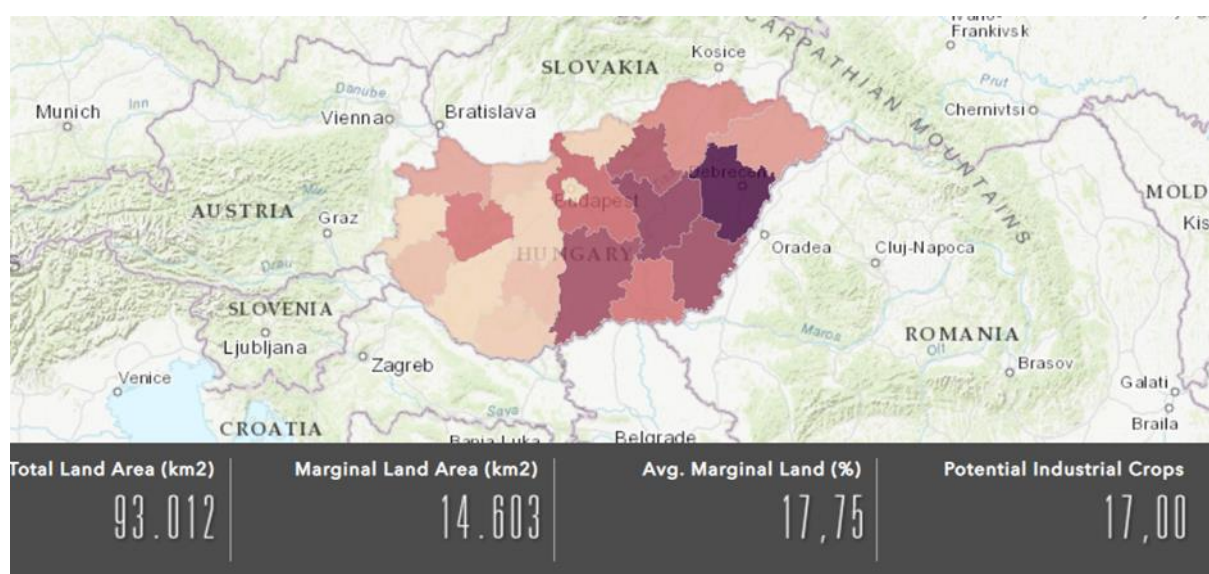


Figure 24 Estimated marginal land in Hungary (source: Magic project)<sup>98</sup>

The estimated marginal land amounts for 14.6 km<sup>2</sup> which is more than 17% of the total area in the country.

<sup>98</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Seventeen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 47 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Hungary

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 19.2 Policy aim<sup>99</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>99</sup> The policy aim is the same across all countries











## 19.3 Policy design

### 19.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 48 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 19.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 49 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP RDP	Operational programme environment and energy		
National Land Fund		FiT	
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
National Land Fund	Environmental Protection Act		
Nitrates Directive		GHG emission allowance	
Carpathian Convention	Decree on air protection		
Water mgmt act		Biofuel excise duty	
		Biofuel quota	

## 20 Ireland

Excessive soil moisture, adverse rooting conditions, adverse soil terrain, low fertility and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Ireland	1%	93%	0%	1%	26%	5%

### 20.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 20.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Ireland.

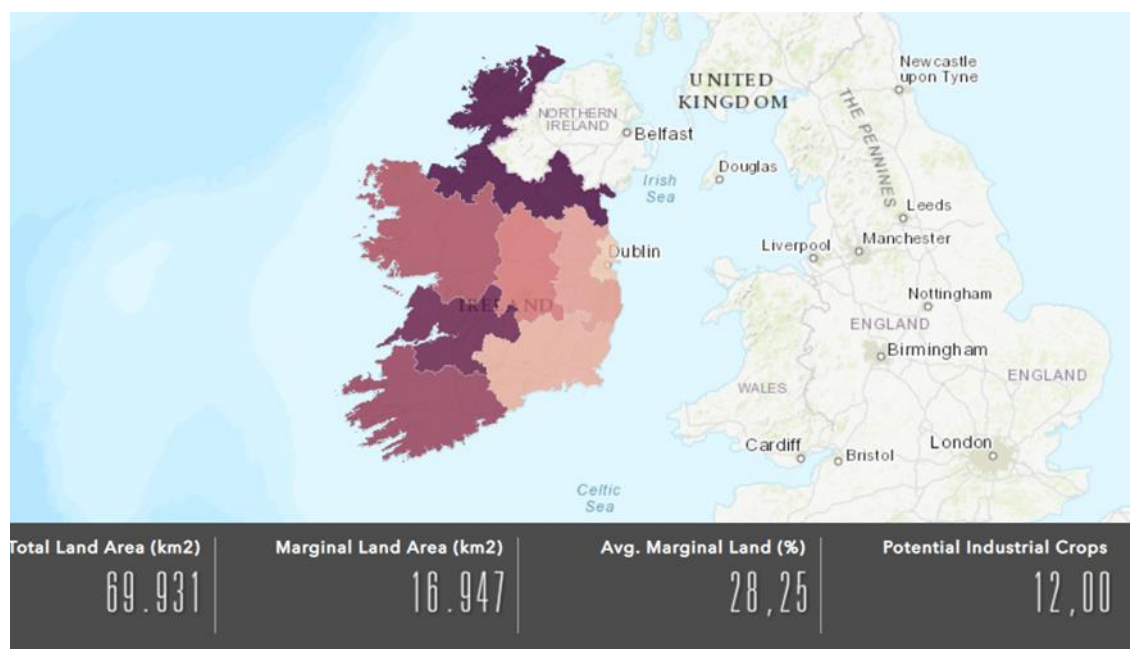


Figure 25 Estimated marginal land in Ireland (source: Magic project)<sup>100</sup>

<sup>100</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 16.9 km<sup>2</sup> which is more than 28% of the total area in the country.

Twelve industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 50 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Ireland

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				

## 20.2 Policy aim<sup>101</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>101</sup> The policy aim is the same across all countries

## 20.3 Policy design

### 20.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 51 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 20.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 52 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP RDPs	Renewable Energy FiT		Biofuel Obligation Scheme
New CAP: Crop establishment grants			
Good Agricultural Practice for Protection of Waters Regulations 2014	Environmental Aid Scheme (2014-20)		
Grants and tax-free loans			Biobased feedstock carbon premium
	Tax consolidation		
	Green Tenders		
	Climate Action and Low Carbon Development Bill 2015		
	Industrial Emissions Regulations 2013		
			Biofuel Quota System

## 21 Italy

Adverse soil terrain, adverse rooting conditions, adverse climate, excessive soil moisture, and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Italy	23%	10%	4%	5%	35%	75%

### 21.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 21.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Italy.

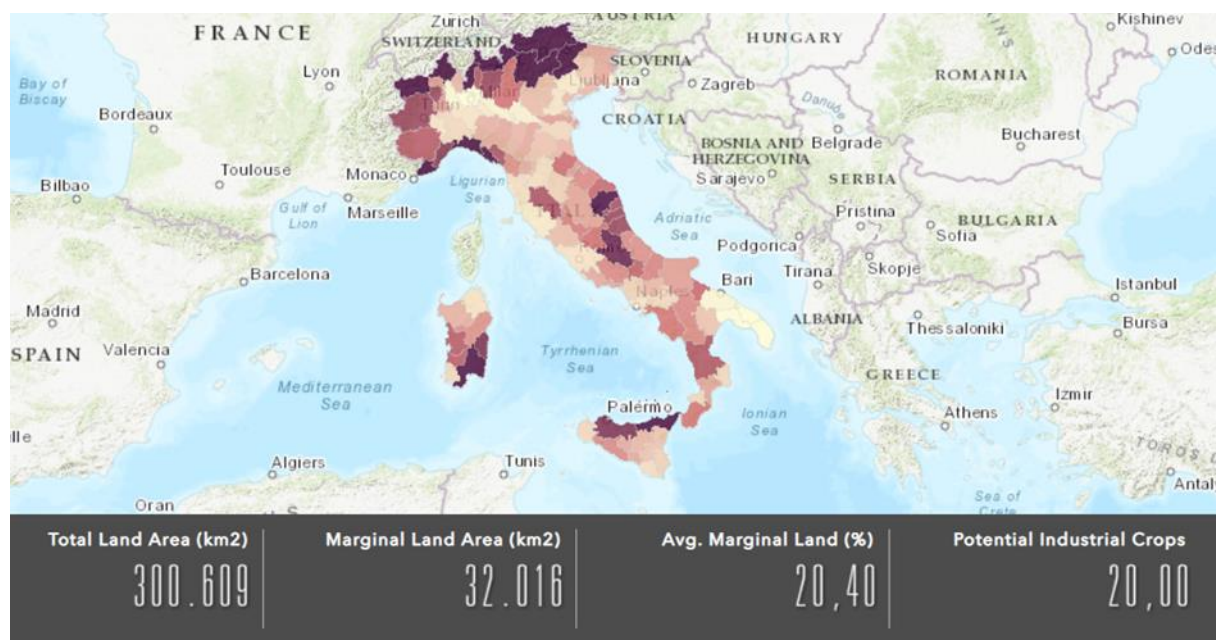


Figure 26 Estimated marginal land in Italy (source: Magic project)<sup>102</sup>

<sup>102</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>



The estimated marginal land amounts for 32 km<sup>2</sup> which is more than 20% of the total agricultural area in the country.

Twenty industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 53 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Italy.

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Miscanthus sacchariflorus (P)	Bioenergy, building materials				

## 21.2 Policy aim<sup>103</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>103</sup> The policy aim is the same across all countries

## 21.3 Policy design

### 21.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 54 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 21.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 55 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Regional rural development plans	Energy Efficiency for production, transport and Final use		
Italian transposition of Nitrates Directive	Auction system for large RES-E plants		
Single Environmental Text	FIT order		
Regulation of agro-food markets	Renewable Heat Incentive		
CAP: RDP	Tax exemption for energy efficiency investments		
	Guidelines for renewable energy sources		
	Environment Code		
	White Certificate Mechanism		

## 22 Latvia

Adverse climate, excessive soil moisture, adverse rooting conditions and adverse soil terrain are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Latvia	88%	22%	0%	0%	9%	2%

### 22.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 22.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Latvia.

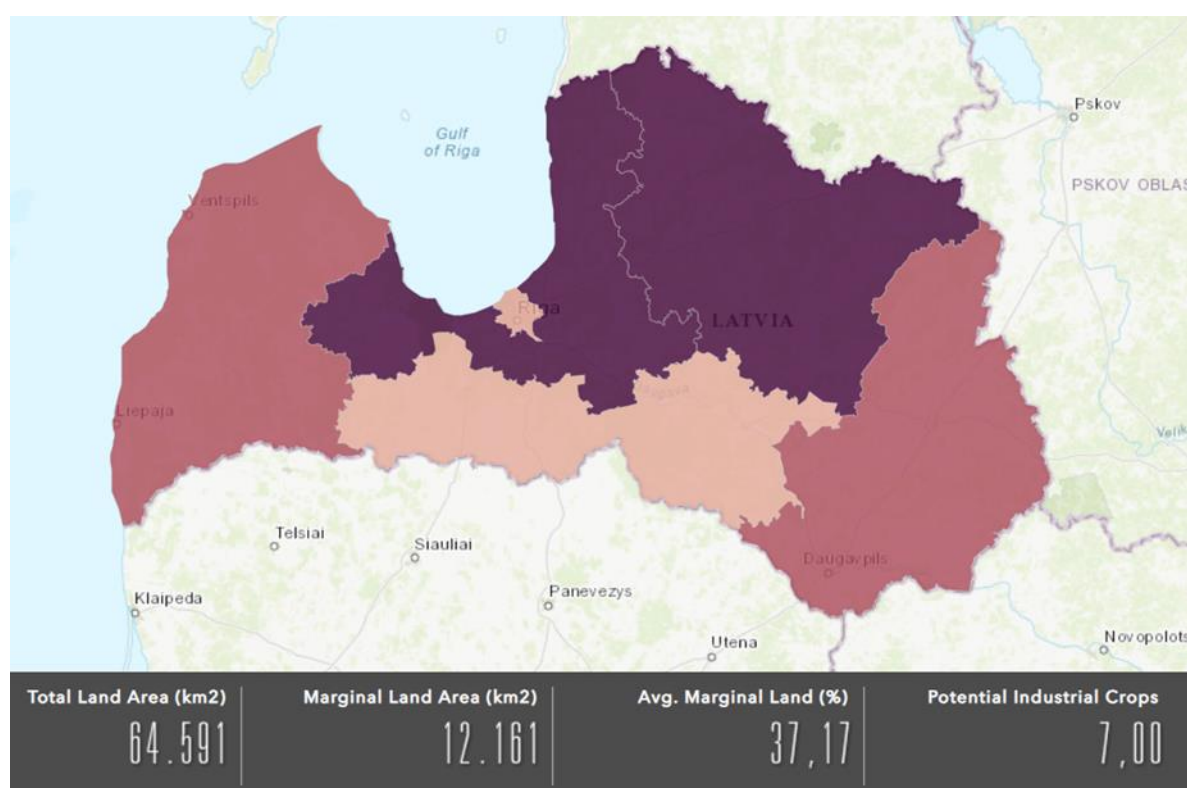


Figure 27 Estimated marginal land in Latvia (source: Magic project)<sup>104</sup>

The estimated marginal land amounts for 12.2 km<sup>2</sup> which is more than 37% of the total area in the country.

Seven industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 56 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Latvia

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				

<sup>104</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

## 22.2 Policy aim<sup>105</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>105</sup> The policy aim is the same across all countries

## 22.3 Policy design

### 22.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 57 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing



out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 22.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 58 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP:RDPS	Electricity Market law		
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Env. Protection Law	Law on Pollution		
Natural resources tax law	FiT		
Water Mgmt Law		Minimum Biofuels Requirement	
Plat Protection Law		Biofuel quality requirement	

## 23 Lithuania

Adverse rooting conditions, adverse soil terrain, excessive soil moisture and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Lithuania	3%	11%	0%	1%	87%	1%

### 23.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 23.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Lithuania.

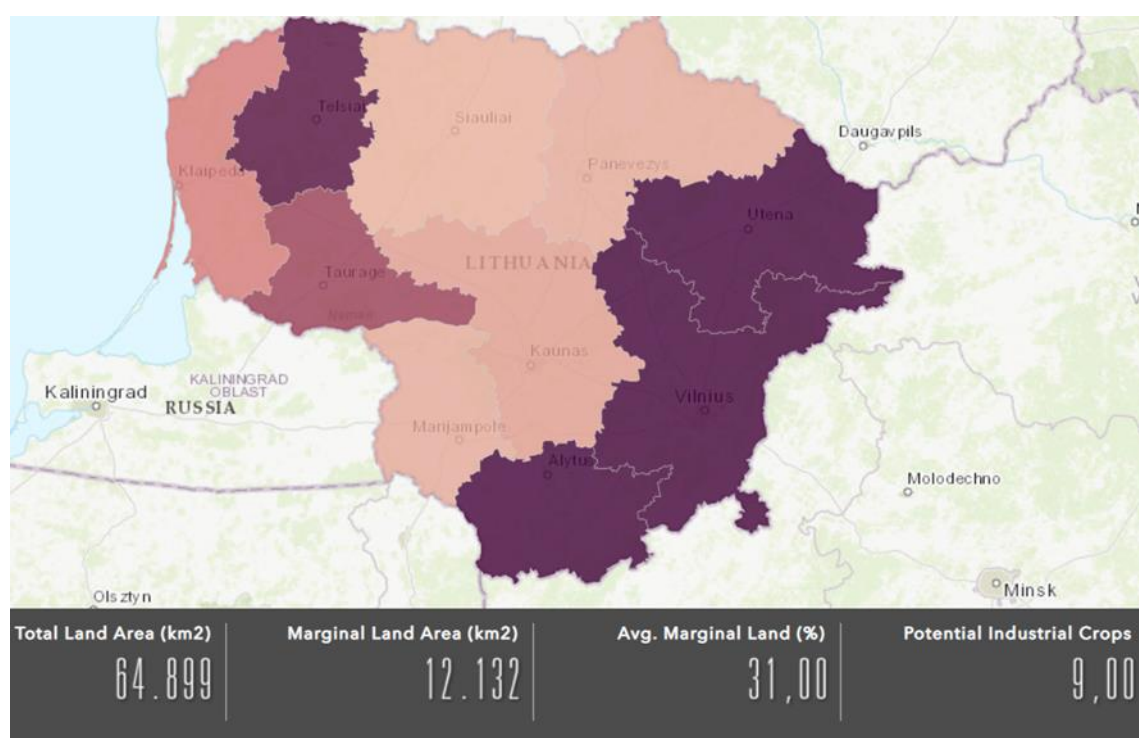


Figure 28 Estimated marginal land in Lithuania (source: Magic project)<sup>106</sup>

<sup>106</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 12.1 km<sup>2</sup> which is more than 30% of the total area in the country.

Nine industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 59 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Lithuania

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Pennycress (A)	Bioenergy, building materials				

### 23.2 Policy aim<sup>107</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>107</sup> The policy aim is the same across all countries

## 23.3 Policy design

### 23.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 60 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 23.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 61 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: RDP	Law on Heat Sector		Fund for Climate Change Mitigation
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Law on environmental Protection	Environmental Pollution Tax		Lithuanian Environmental Investment Fund
Law on water	Law on Energy from Renewable Sources (FiTs)		Biofuel Production Funding
	Law on Excise Tax		
	Tax on Natural Resources		
	Law on Pollution Tax		

## 24 Netherlands

Adverse rooting conditions, adverse soil terrain, excessive soil moisture, low soil fertility and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Netherlands	2%	43%	0%	7%	49%	5%

### 24.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 24.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in the Netherlands.

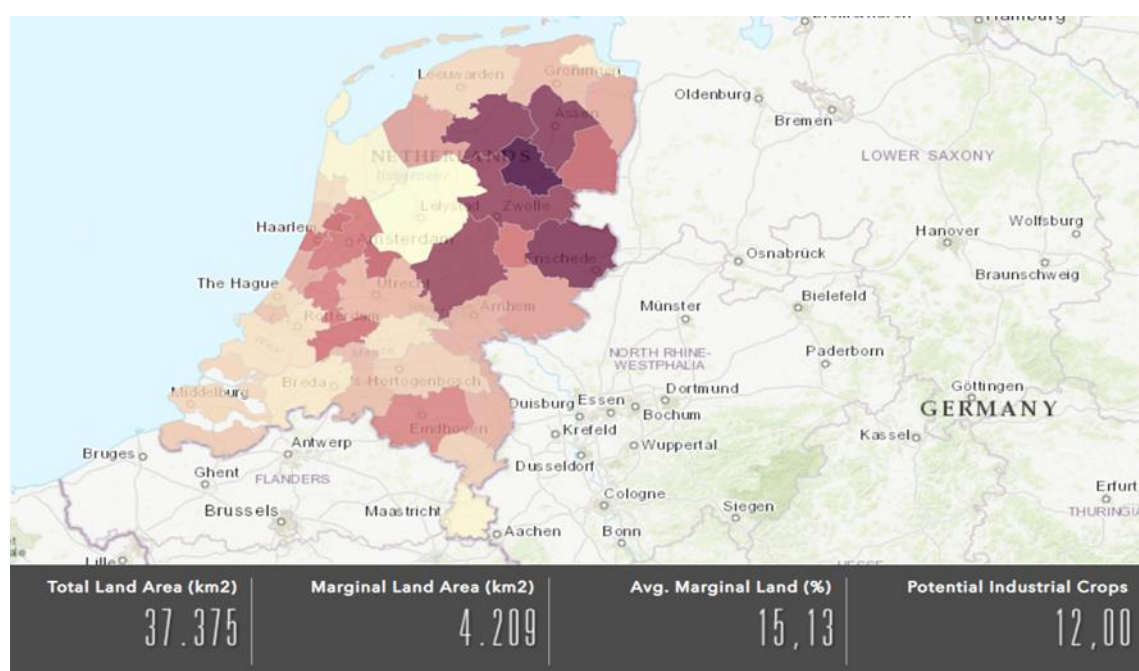


Figure 29 Estimated marginal land in the Netherlands (source: Magic project)<sup>108</sup>

<sup>108</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 4.2 km<sup>2</sup> which is more than 15% of the total agricultural area in the country.

Twelve industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 62 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in the Netherlands

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				



## 24.2 Policy aim<sup>109</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>109</sup> The policy aim is the same across all countries

## 24.3 Policy design

### 24.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 63 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 24.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 64 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: RDPs	Renewable Energy Production Incentive Scheme (SDE+)		Vision Biomass 2030
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
	Environmental Investment Allowance		Renewable Energy in Transport Order
	Energy Investment Allowance		
		Tax reductions for Heat boilers	
	Environment Protection Tax		
	Taxation of Passenger Cars and Motorcycles		
	Activities Decision Environmental Management		

## 25 Poland

Adverse rooting conditions, adverse soil terrain, adverse chemical contamination and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Poland	3%	1%	12%	0%	82%	32%

### 25.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 25.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Poland.

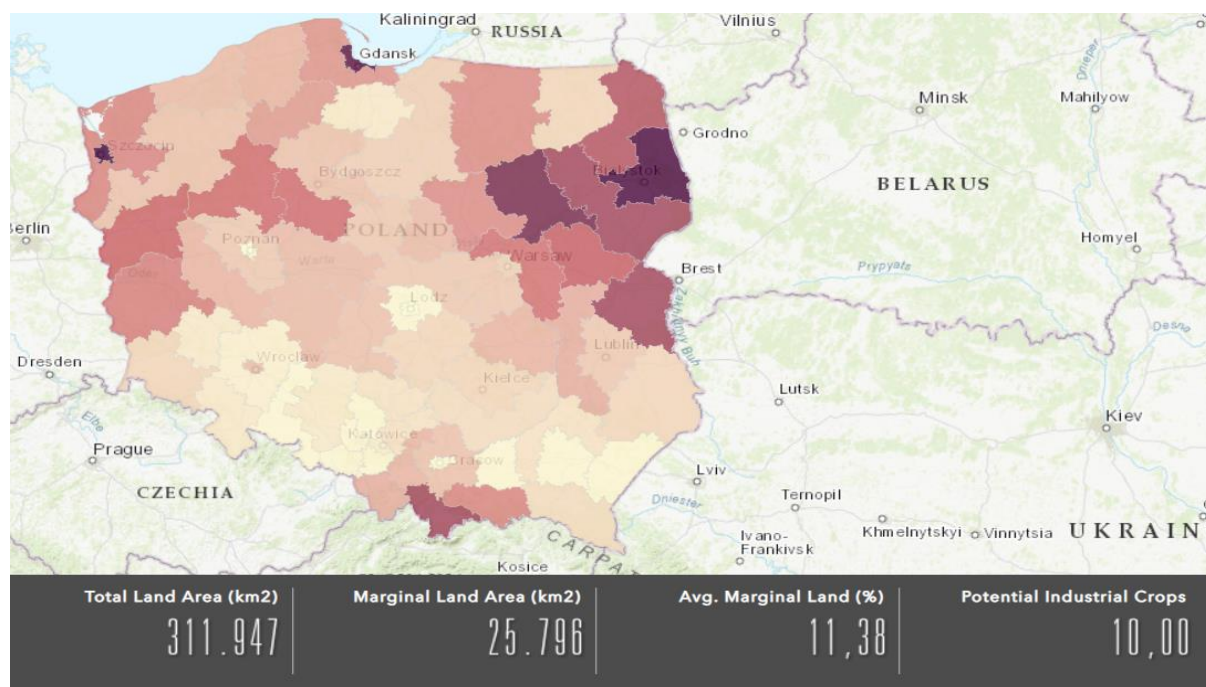


Figure 30 Estimated marginal land in Poland (source: Magic project)<sup>110</sup>

<sup>110</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 25.8 km<sup>2</sup> which is more than 11% of the total area in the country.

Ten industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 65 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Poland

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				

## 25.2 Policy aim<sup>111</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>111</sup> The policy aim is the same across all countries

## 25.3 Policy design

### 25.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 66 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 25.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 67 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: Polish RDPs	Energy Law		
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Protection of Ag and Forest land	Act on Thermo-Modernisation		
Water Law	RDP		
Ag system Act	Tax Act		
		Biocomponents and biofuels Act	



## 26 Portugal

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Portugal	15%	21%	24%	2%	49%	37%

### 26.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 26.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Portugal.

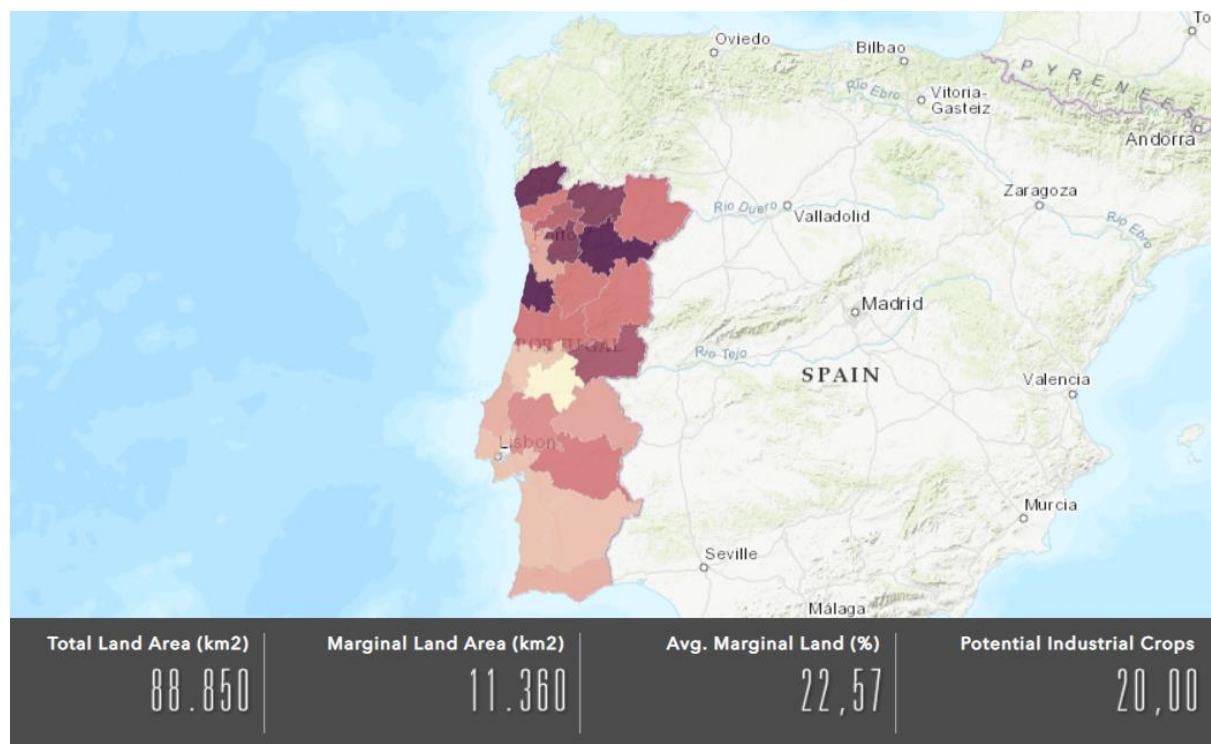


Figure 31 Estimated marginal land in Portugal (source: Magic project)<sup>112</sup>

The estimated marginal land amounts for 11.4 km<sup>2</sup> which is more than 22% of the total agricultural area in the country.

Twenty industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 68 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Portugal

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Miscanthus sacchariflorus (P)	Bioenergy, building materials				
Lupin	Feed, chemicals, lubricants, cosmetics				

<sup>112</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

## 26.2 Policy aim<sup>113</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>113</sup> The policy aim is the same across all countries

## 26.3 Policy design

### 26.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 69 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 26.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 70 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: RDPs	GHG emission trading system		Fund to support Innovation
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Fund for Biodiversity protection	Industrial Emissions		Biofuels Quota
Decree on Biodiversity protection	FiT regulation		
Decree on Discharge of Dangerous substances in Ag.	RE in microproduction units		
Nitrates	RES-E small power installations		
Water Act	Co-generation		

## 27 Romania

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Romania	0%	0%	0%	0%	0%	100%

### 27.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 27.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Romania.

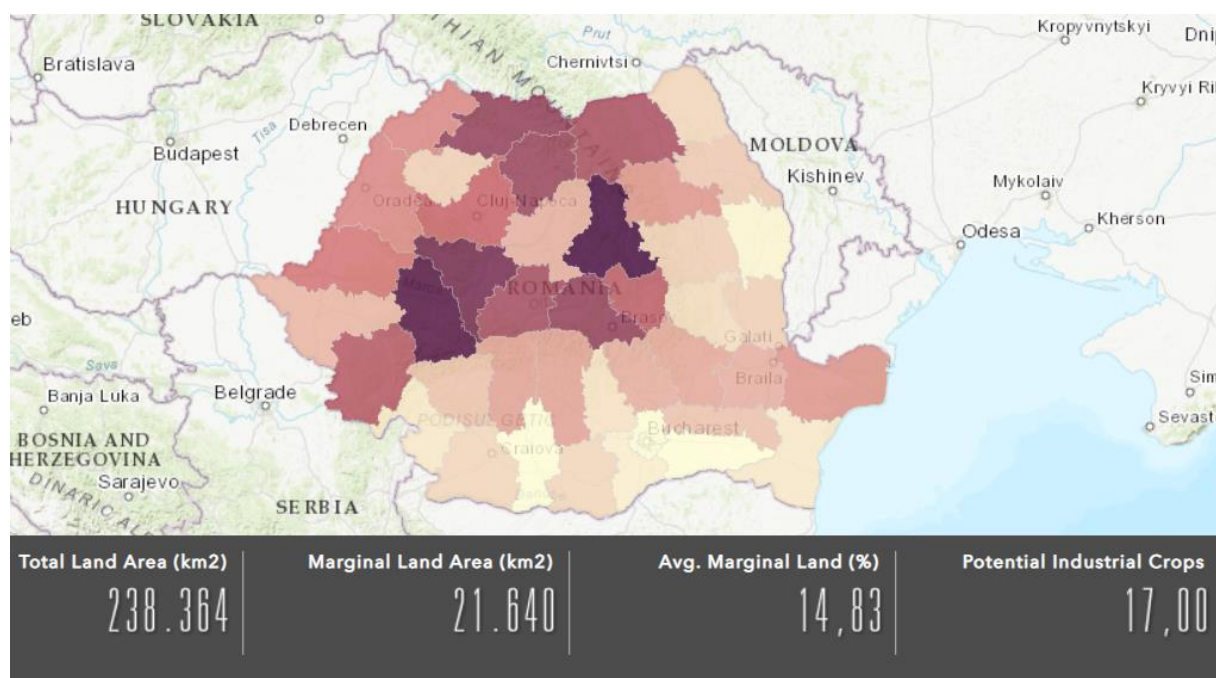


Figure 32 Estimated marginal land in Romania (source: Magic project)<sup>114</sup>

<sup>114</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 21.6 km<sup>2</sup> which is more than 14% of the total agricultural area in the country.

Seventeen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 71 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Romania

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 27.2 Policy aim<sup>115</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>115</sup> The policy aim is the same across all countries











## 27.3 Policy design

### 27.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 72 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 27.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 73 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: RDP			FiT
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Increasing the added value of agricultural and forestry products			Biofuel quota
Modernisation of agro-cultural exploitation			Priority Grid Access
			Quota and Tradable Green Certificates
			RES-H Building Recommendation

## 28 Slovakia

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Slovakia	9%	3%	9%	4%	68%	30%

### 28.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 28.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Slovakia.

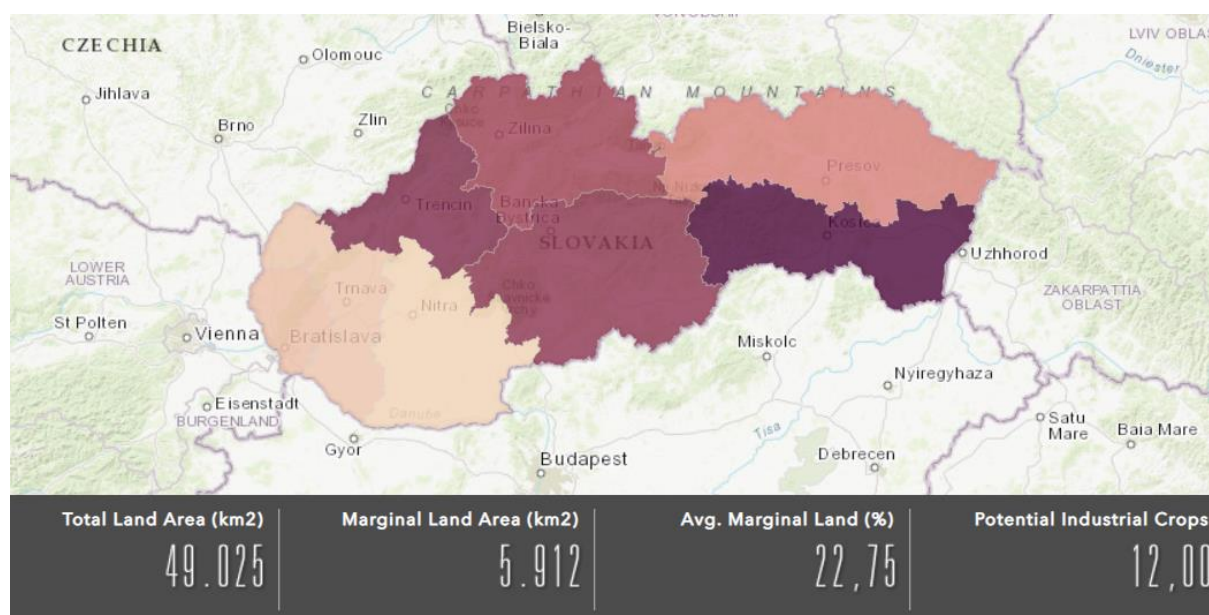


Figure 33 Estimated marginal land in Slovakia (source: Magic project)<sup>116</sup>

The estimated marginal land amounts for 5.9 km<sup>2</sup> which is more that 22% of the total agricultural are in the country.

<sup>116</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Twelve industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 74 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Slovakia

C	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 28.2 Policy aim<sup>117</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>117</sup> The policy aim is the same across all countries

## 28.3 Policy design

### 28.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 75 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 28.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 76 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: Slovakia RDP	Emissions from stationary sources		
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
	RES Act-FiT		
	Excise Tax Act		
		Higher Use of Biomass and Solar Energy in HHs	
		Operational Programme Bratislava region	
		Operational Programme Competitiveness and Economic Growth	
		Operational Programme Environment	
Decree on biofuel sustainability criteria and transport fuel GHG targets			
	RES Act-Biofuel quota		Fuel Tax



## 29 Slovenia

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Slovenia	11%	50%	1%	0%	71%	35%

### 29.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 29.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Slovenia.

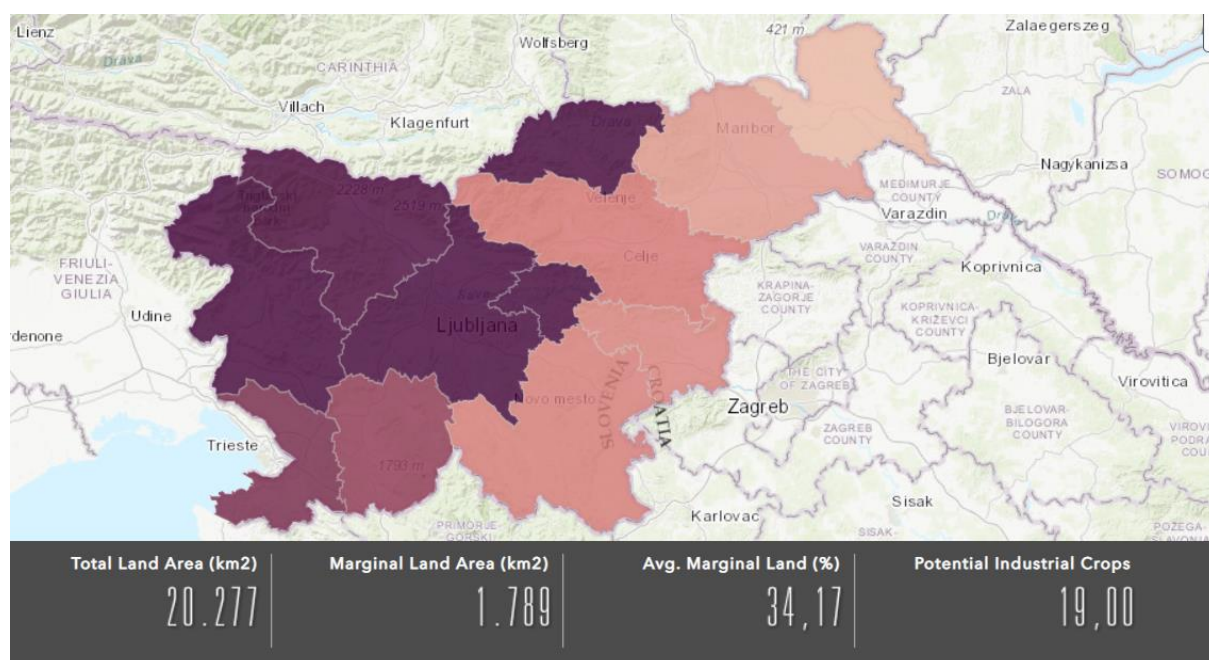


Figure 34 Estimated marginal land in Slovenia (source: Magic project)<sup>118</sup>

<sup>118</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>



The estimated marginal land amounts for 1.8 km<sup>2</sup> which is more than 34% of the total area in the country.

Nineteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 77 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Slovenia

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				

## 29.2 Policy aim<sup>119</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>119</sup> The policy aim is the same across all countries

## 29.3 Policy design

### 29.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 78 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 29.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 79 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: Slovenian RDPs	SL-NEEAP: Energy Efficienchny Action Plan		
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
	SL-NREAP: Renewable Energy Action Plan		
	SL-ReNEP: Renewable Energy Action Plan		
	SL- EA: Requirements, Substitution Obligation, Permitting, Zoning		
	Act on Sustainable Biofuels		
	SL- RTFO: Substitution Obligation		
	SL_DESFC: Subsidies		
		Decree on Renewable Electricity support & SL- EPA: Feed in tariffs	
		Co-financing of investments in to district heating system	
		Excise Duties Act	

## 30 Spain

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Spain	48%	3%	2%	20%	60%	20%

### 30.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 30.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Spain.

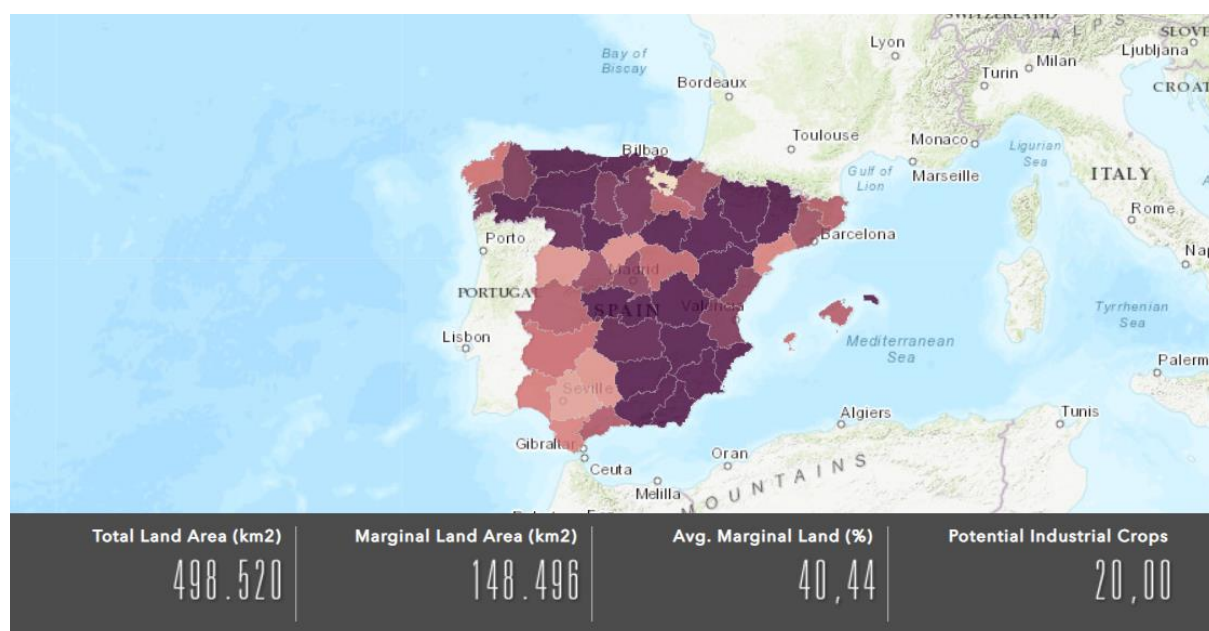


Figure 35 Estimated marginal land in Spain (source: Magic project)<sup>120</sup>

The estimated marginal land amounts for 148.5 km<sup>2</sup> which is more than 40% of the total agricultural area in the country.

<sup>120</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Twenty industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 80 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Spain

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Castor bean (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Biomass sorghum (A)	Bioenergy, building materials				
Giant reed (P)	Bioenergy, building materials				
Miscanthus (P)	Bioenergy, building materials				
Switchgrass (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Eucalypt (P)	Bioenergy, building materials, pharmaceuticals				
Elm (P)	Bioenergy, building materials, pharmaceuticals				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Miscanthus sacchariflorus (P)	Bioenergy, building materials				

### 30.2 Policy aim<sup>121</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>121</sup> The policy aim is the same across all countries

### 30.3 Policy design

#### 30.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 81 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing



out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 30.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 82 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
Guarantee of Origin for RE and CHP	Decrees on RES Electricity (Feed-in Tariffs) RE Auctions		Biomass for heating in buildings (subsidies
CAP	Investment Subsidies		Royal Decree on Electricity Distribution (Grid Access etc) Decrees
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
Animal By-Products		BIOMCASA I and II: Funding for Efficient Biomass use	

## 31 Sweden

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
Sweden	99%	23%	0%	7%	14%	9%

### 31.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 31.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in Sweden.

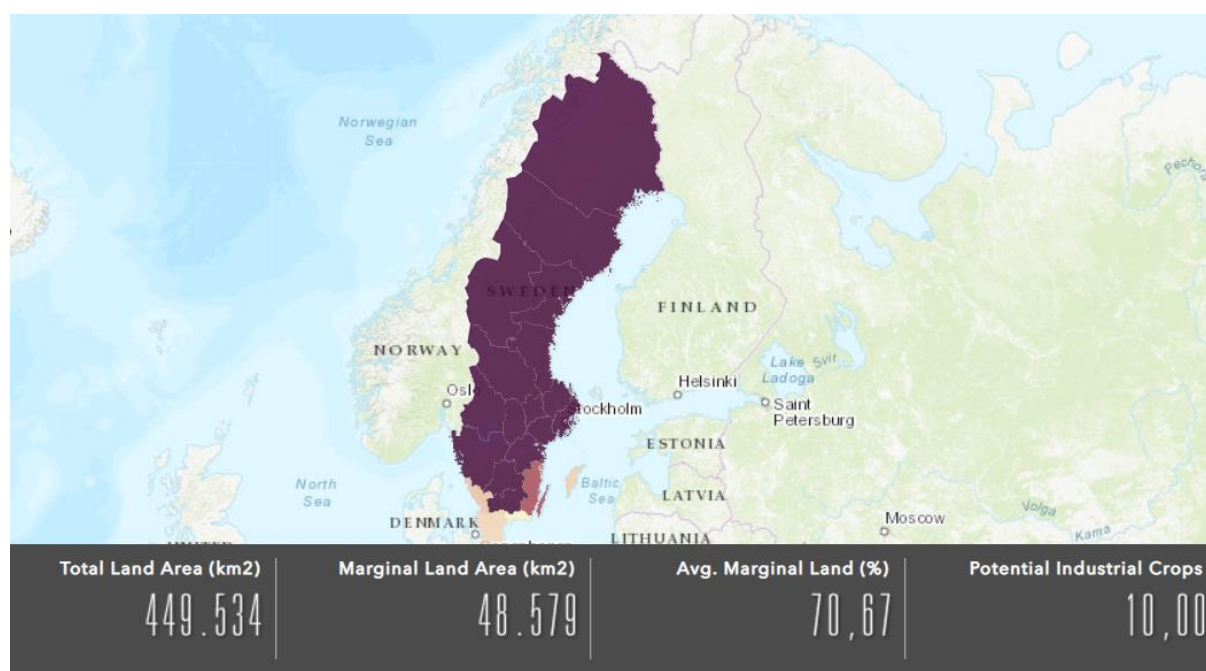


Figure 36 Estimated marginal land in Sweden (source: Magic project)<sup>122</sup>

<sup>122</sup> <https://iasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

The estimated marginal land amounts for 48.6 km<sup>2</sup> which is more than 10% of the total agricultural area in the country.

Ten industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 83 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in Sweden

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				

### 31.2 Policy aim<sup>123</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>123</sup> The policy aim is the same across all countries

### 31.3 Policy design

#### 31.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 84 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 31.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 85 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP: Swedish Rural Development Programmes	Swedish Electricity Act		Tax Deduction Process for Installation Works in HHs
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
	Electricity Certificates		
	Energy Tax		
	Excise Duties on Energy		
	Environmental Code		
	Electricity Certificates		
	Climate and Energy		
		Swedish Research and Innovation Bioeconomy Strategy	

## 32 United Kingdom

Adverse soil terrain and climate change are the most important marginality challenges that influence the prospects of and decision making for marginal land restoration and the respective choices of crops that can be cultivated.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain
United Kingdom	30%	74%	0%	4%	30%	14%

### 32.1 Analysis & Direction

The research work in MAGIC project estimated the amount of marginal land in the country and evaluated the prospects of selected industrial crops that can be cultivated.

#### 32.1.1 Marginal land, industrial crops

The figure below shows the amount and severity of marginal land in the United Kingdom.

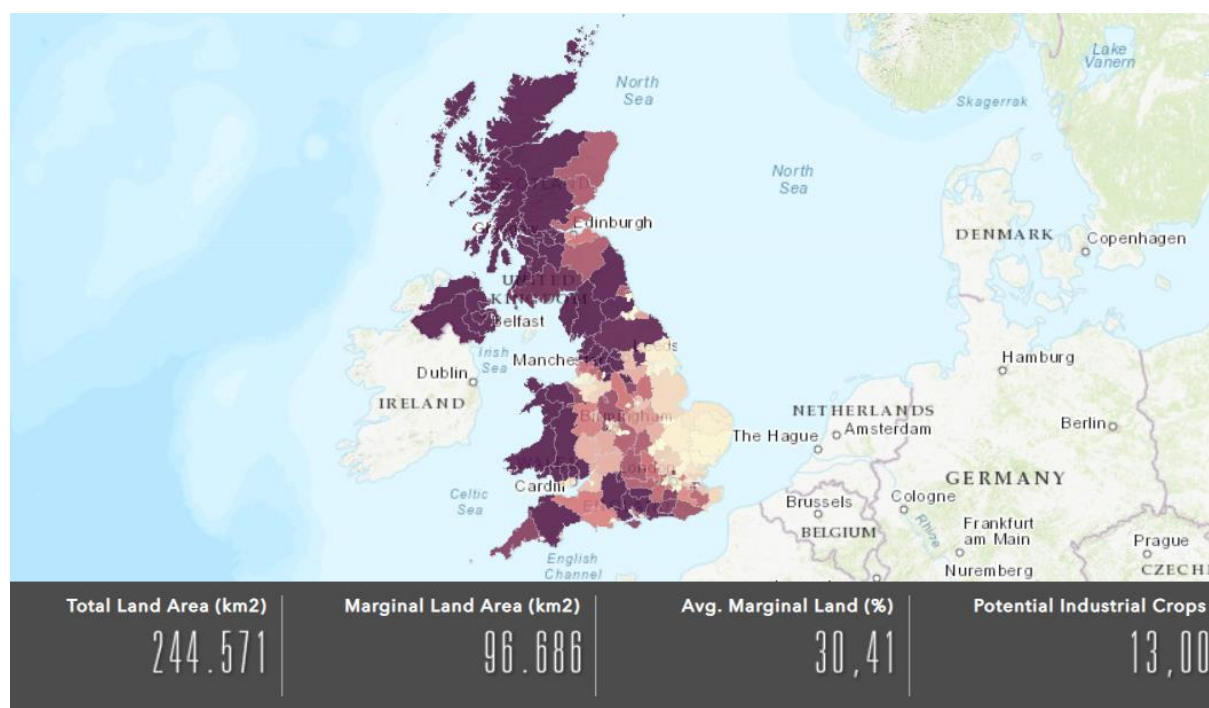


Figure 37 Estimated marginal land in the United Kingdom (source: Magic project)<sup>124</sup>

The estimated marginal land amounts for 19.6 km<sup>2</sup> which is more than 30% of the total agricultural area in the country.

<sup>124</sup> <https://iiasa-patial.maps.arcgis.com/apps/webappviewer/index.html?id=a813940c9ac14c298238c1742dd9dd3c>

Thirteen industrial crops, a mix of annual and perennial species, have been considered appropriate for cultivation in marginal land in the country. Their main traits are described in the table below.

Table 86 Strengths of industrial crops selected as suitable in MAGIC for cultivation in marginal land in the United Kingdom

Crop (Annual: A; Perennial: P)	Biobased markets	Strengths (internal)			
		Adaptability	Tolerance to stress and pest, diseases	Inputs requirement (water, nutrients, pesticides, herbicides)	Ecological benefits
Camelina (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Cardoon (P)	Bioenergy, building materials, chemicals, protein for cheese production				
Crambe (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Ethiopian mustard (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Miscanthus (P)	Bioenergy, building materials				
Reed Canary Grass (P)	Bioenergy, building materials				
Tall Wheatgrass (P)	Bioenergy, building materials				
Poplar (P)	Bioenergy, building materials				
Willow (P)	Bioenergy, building materials				
Pennycress (A)	Bioenergy, building materials				
Safflower (A)	Feed, chemicals, lubricants, cosmetics, bioenergy				
Hemp (A)	Feed, chemicals, lubricants, cosmetics, bioenergy, textiles				
Lupin	Feed, chemicals, lubricants, cosmetics				



### 32.2 Policy aim<sup>125</sup>

To facilitate the restoration of marginal land with the cultivation of industrial crops through policy interventions:

- Introduce sustainable land use practices (and concepts for an environmentally more sustainable integration of industrial crop cultivation into existing farming systems.)
- Steer and regulate the exploitation of marginal land biomass.
- Develop strategies for promoting sustainable living and working conditions in rural areas.
- Invest more in research in this field - to develop and implement appropriate evaluation and funding models for environmentally more sustainable marginal land utilization strategies.
- Promote resource and conversion efficiency through targeted financing per value chain.
- Address competition through resource efficiency.
- Support for ongoing research on less developed plant species, e.g. annual and perennial biomass crops, should be fostered.

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<sup>125</sup> The policy aim is the same across all countries

## 32.3 Policy design

### 32.3.1 Relevant policy interventions

The table below presents a set of policy interventions that have been based in the policy analysis performed at EU level. These have been narrowed down to reflect relevance for eco-schemes and for CAP specific objectives.

Table 87 Policy interventions, relevance to eco-schemes and the European Green Deal

Policy interventions	Potential relevance to eco-schemes	Main agricultural EGD target	CAP specific objectives
Tax free grants for marginal land restoration activities	Restoration of marginal, abandoned land	Prevention of soil degradation, soil restoration, improvement of soil fertility and of nutrient management	 
Loans with low interest rates			
Crop establishment grants	Use of crops/plant varieties more resilient to climate change	Climate change adaptation, Protection or improvement of water quality Protection of biodiversity	  
Biobased feedstock premium when raw material is produced in marginal land	Payments per hectare granted to farmers who undertake practices contributing specifically to environmental and climate objectives		 
Hybrid carbon farming support			

Dedicated support, including the above suggested policy interventions, can be obtained through:

- Common Agricultural Policy (eco-schemes, etc.),
- Carbon farming support initiatives through pure national financing, i.e. State aid, to reduce net GHG emissions from the land use sector and meet targets under the LULUCF Regulation, etc.
- Cohesion funds and in particular the Just Transition Fund which support the social, economic, and environmental challenges of Member States stemming from the phasing

out of fossil fuel-related activities or decarbonising GHG-intensive processes or products.

- Links to the Horizon Europe mission “A Soil Deal for Europe” creates a network of 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

### 32.3.2 Potential integration to current national policy landscape

The table below provides an outline of the national policy landscape which is relevant for cultivation of industrial crops in marginal land as raw material for biobased sectors (energy and non- energy ones).

Table 88 National policy landscape and potential integration of interventions

Production	Conversion	Distribution	End-use
CAP England, Scotland, Northern Ireland, Wales	Energy act / Green Deal Order		Finance Act-Climate
New CAP: Crop establishment grants			
Grants and tax-free loans			Biobased feedstock carbon premium
	Feed-in Tariffs Order		Change Levy
	Renewable Obligation Scheme: Green Certificates		
	Renewable heat incentive		
	Renewable heat incentive for Northern Ireland		
	Renewable Transport Fuel Obligation (RTFO)		