



Marginal lands for Growing Industrial Crops

D1.10– Final version of the MAGIC Decision Support System (DSS)

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1 Publishable executive summary

Several studies agree on the existence of a considerable amount of land in Europe deemed less favourable for conventional agriculture. This land has been either abandoned because of its productivity, or it is used as grassland. MAGIC is based on the premise that cultivation of selected industrial crops on areas facing natural constraints (e.g., extreme climatic conditions, low soil productivity, steep slope, etc.) can i) ensure the production of resource-efficient feedstocks, with low indirect land-use change (iLUC), for a growing bio-based industry, and ii) increase farmers' incomes through access to new markets and the revalorization of marginal land.

This Deliverable (D1.10) describes the final version of the Decision Support System (DSS), aiming to provide the underlying information as required from above and generated within the MAGIC project for various interested stakeholders across Europe. The marginal land area, marginality factors and associated information can now be visualized and queried at the Local Administrative Unit (LAU-2), which equates to the municipal level in most countries. For the Ukraine, the comparable administrative level was used.

All three related information platforms (MAGIC-MAPS, MAGIC-CROPS and the MAGIC-DSS) are available at <http://magic-h2020.eu/>.

2 Introduction

The MAGIC Decision Support System (MAGIC-DSS) has been developed to address the information needs of the MAGIC stakeholders (i.e., industry and farmers). The MAGIC-DSS accesses the spatially explicit database of marginal lands (MAGIC-MAPS) (Task 2.4) which also includes the MAGIC-CROPS (Task 1.2) providing a set of tools for decision support enabling at a minimum the most promising industrial crops at any geo-location in EU and Ukraine. MAGIC-DSS can also visualize both the current and future marginal land in Europe resulting from the mapping exercise (Task 2.4). This information, presented both in tabular and map format, will allow farmers and industry to determine at any marginal land location the optimal selection of potential marginal crops.

With the final version of the MAGIC-DSS, users can explore marginal land at the LAU-2 level, along with potential associated crops taking account of areas delineated by specific bio-physical characteristics typical for marginal lands. A user needs assessment (for farmers and industry) was the first step in the DSS set-up determining its design. The final versions of the MAGIC-MAPS, MAGIC-CROPS and MAGIC-DSS are now available on the MAGIC website (Figure 1), along with the Bio2Match Tool.

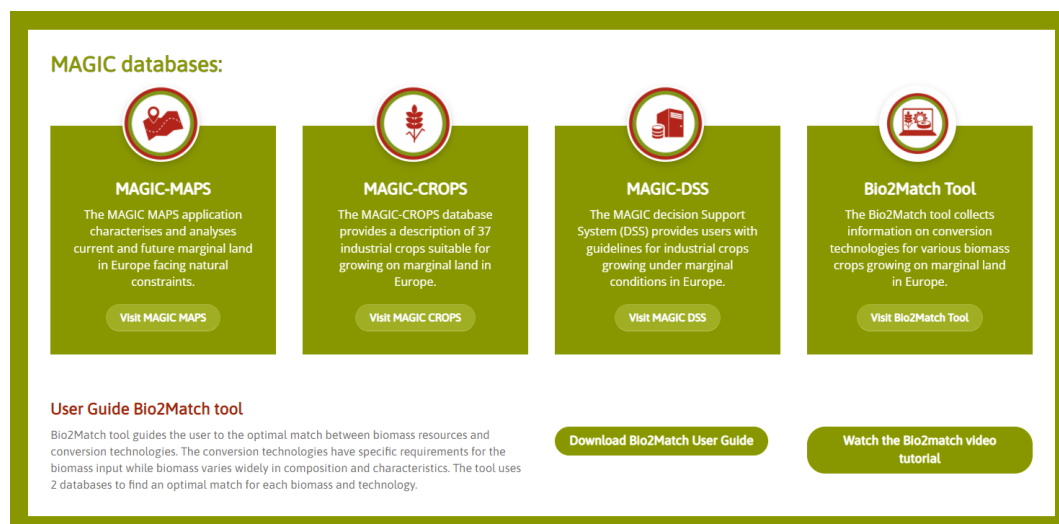


Figure 1: Magic Maps, Crops and DSS on the MAGIC website (along with the Bio2Match Tool).

3 Methods

The MAGIC DSS brings together a variety of maps and databases being developed across the MAGIC Project (Figure 2). This includes the MAGIC-MAPS and MAGIC-CROPS. Furthermore, a variety of additional datasets were ingested or queried within MAGIC and contribute to the final DSS. The following schematic diagram outlines the connection of the various spatial datasets within MAGIC, ultimately feeding into the MAGIC-DSS.

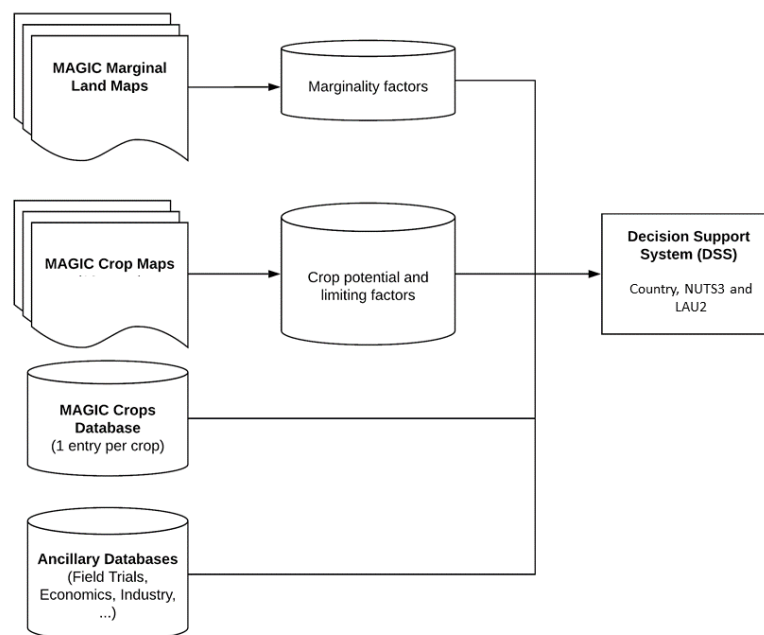


Figure 2: The design of the MAGIC-DSS and related data.

4 Results

4.1 MAGIC-MAPS

The purpose of MAGIC-MAPS is to characterize and analyse projections for current and future marginal lands in Europe facing natural constraints. The elements that were considered in building the classification include biophysical limitations clustered in six main groups. In addition, the resulting marginal land map was further classified according to, land use management, socio-economic limitations, ecosystem services and drivers and pressures influencing the ecosystem functions present. As a result, in total 29% of the agricultural land (i.e. land classified as agricultural by Corine Land Cover since 1992) in the European Union are classified as marginal. The most common limitations are rooting limitations, over 12% of the agricultural area. This is followed by adverse climate and excessive soil moisture occurring in respectively 11% and 8% of the agricultural land.

Further assessments are now made to identify more precisely the current status of land management and abandonment in these marginal lands. This is important information to have as it provides a better understanding of the opportunities to use these marginal lands for industrial crops without competing with food production on these lands. MAGIC-MAPS provide the basic marginal land mapping by marginal land type. The data has now been updated in terms of spatial resolution, going from the previous NUTS-3 level to the Local Administrative Units (LAU-2) level.

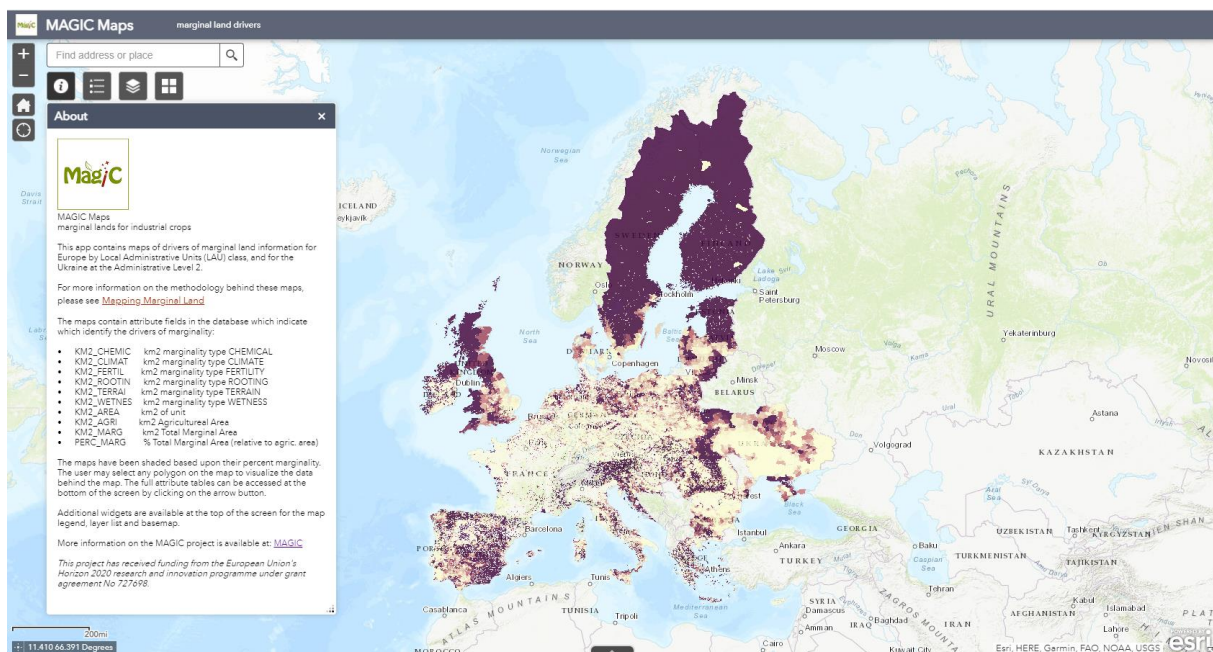
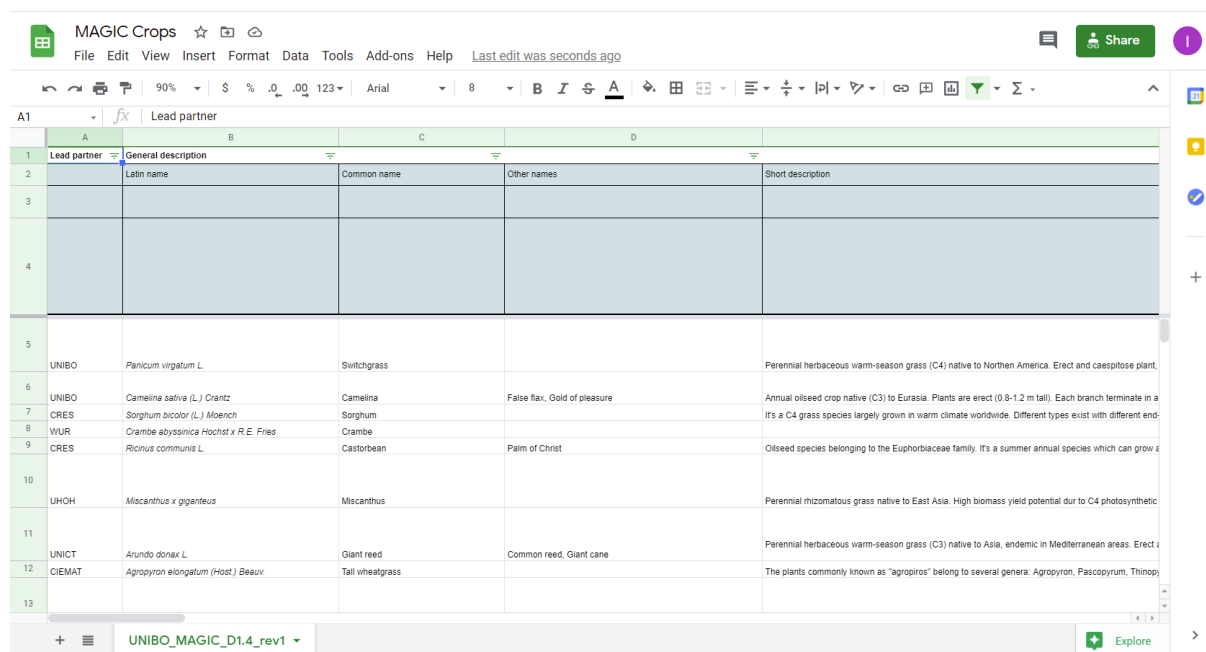


Figure 3: The MAGIC-MAPS platform.

4.2 MAGIC-CROPS

The dataset MAGIC CROPS contains information on existing resource-efficient industrial crops suitable for cultivation on different types of marginal land. Industrial crops can broadly be classified into oil, lignocellulosic, carbohydrate or specialty crops. Moreover, MAGIC-CROPS provides information on agronomic management, input requirements, yield performance and quality characteristics for end user applications. For this purpose, the results of several long-term field trials with important industrial plants such as Miscanthus, Giant Reed, Reed Canary Grass, Camelina, Hemp and Poplar, which are carried out European-wide under the most important marginal growth conditions, are collected and evaluated in MAGIC. Many of these field trials are still on-going. In addition, the best low-input agricultural cultivation strategies for crop categories such as ‘tillage’, ‘nitrogen fertilization’, ‘weed control’ and ‘irrigation’ will be identified and made accessible through MAGIC-CROPS.

The MAGIC-CROPS database is made available via an online sheet. This allows for simple viewing and querying of the database, along with downloading and commenting options.



The screenshot shows a Google Sheet titled 'MAGIC Crops'. The sheet contains a table with the following columns: Lead partner, General description, Latin name, Common name, Other names, and Short description. The table lists various industrial crops and their associated partners and descriptions.

	Lead partner	General description	Latin name	Common name	Other names	Short description
5	UNIBO	Panicum virgatum L.	Switchgrass			Perennial herbaceous warm-season grass (C4) native to Northern America. Erect and caespitose plant.
6	UNIBO	Camelina sativa (L.) Crantz	Camelina	False flax, Gold of pleasure		Annual oilseed crop native (C3) to Eurasia. Plants are erect (0.8-1.2 m tall). Each branch terminate in a
7	CRES	Sorghum bicolor (L.) Moench	Sorghum			It's a C4 grass species largely grown in warm climate worldwide. Different types exist with different end-
8	WUR	Crambe abyssinica Hochst x R.E. Fries	Crambe			
9	CRES	Ricinus communis L.	Castorbean	Palm of Christ		Oilseed species belonging to the Euphorbiaceae family. It's a summer annual species which can grow i
10	UHOH	Miscanthus x giganteus	Miscanthus			Perennial rhizomatous grass native to East Asia. High biomass yield potential due to C4 photosynthetic
11	UNICT	Arundo donax L.	Giant reed	Common reed, Giant cane		Perennial herbaceous warm-season grass (C3) native to Asia, endemic in Mediterranean areas. Erect i
12	CIEMAT	Agropyron elongatum (Host.) Beauv.	Tall wheatgrass			The plants commonly known as "agropyros" belong to several genera: Agropyron, Pascopyrum, Thinopy

Figure 4: The MAGIC-CROPS database.

4.3 MAGIC-DSS

The MAGIC Decision Support System is a culmination of the entire MAGIC information system, and contains the information on marginal land via MAGIC-MAPS, marginal crops (MAGIC-CROPS) and related information. The MAGIC-DSS has been developed taking into consideration the feedback from the initial survey, along with experience gained from past

projects and previously developed systems, along with feedback obtained during the course of the Project.

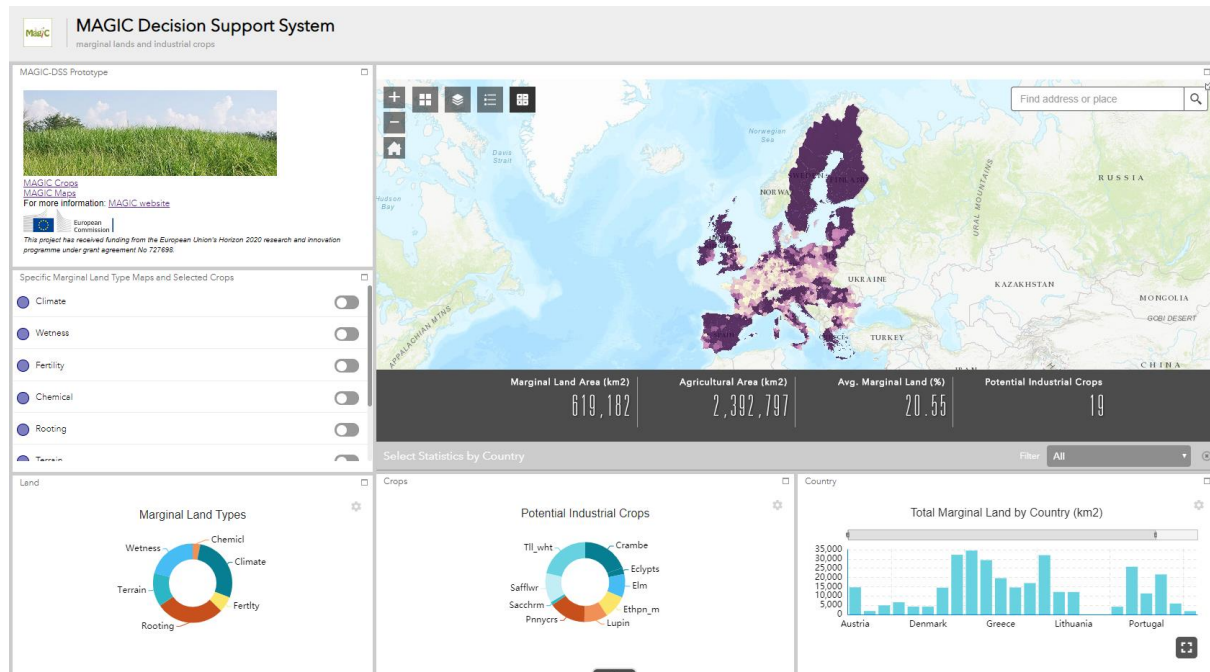


Figure 5: A screenshot of the MAGIC-DSS.

The MAGIC DSS combines elements of all the MAGIC datasets (and auxiliary information) and is designed to allow practitioners, policy-makers and the general public to gain access to information about marginal land and potential industrial crops across Europe. Information is provided at the LAU-2 administrative level. On the map, users can visualize the proportion of marginal land that is estimated to occur within each administrative unit and the main factors determining the marginal conditions. The individual marginal land types are depicted on a graph, as are the potential industrial crops and the amount of marginal land by country. As users explore the map, zooming in and out or select features, the graphs are updated in real-time. Clicking on any administrative unit on the map exposes the full database, which is also available for download. It is also possible to change the underlying base map to add for example satellite imagery as a backdrop. It is also possible to download the spatial information.

4.4 Update and Testing

Initial beta-versions and prototypes of the MAGIC-DSS and related data have been online since the midway point of the Project and have been widely shared and advertised via MAGIC's partners and stakeholders. In addition, the Project has generated press releases and advertised the results online via a variety of channels including conferences, webinars

and online newsgroups. Finally, the MAGIC-DSS has been demonstrated to a variety of farmer stakeholder groups. Based on this variety of feedback, a number of suggestions were received for improvements to the final DSS and its related components. These include but are not limited to: adding download capabilities for all datasets (including spatial data), improved meta-data to accompany the various attribute fields, instructions for use of the platforms and underlying data, yield information to accompany both the MAGIC-CROPS data and the spatial maps and more. As far as possible these recommendations have been followed in the production of the final version of the MAGIC-DSS.

5 Conclusion

The MAGIC-MAPS, MAGIC-CROPS and MAGIC-DSS have been finalized and placed on the MAGIC website (<http://magic-h2020.eu/>). We will continue to monitor the system and ensure that the various platforms are available for the coming years.