Marginal lands for Growing Industrial Crops

D1.6 – First prototype of the decision support tool (DSS)

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Type			**Dissemination Level**		
R	Document, report	☐	**PU**	Public	☒
DEM	Demonstrator, pilot, prototype	☐	**CO**		☐

DEC	Websites, patent fillings, videos, etc.	☐	Confidential, only for members of the consortium (including the Commission Services)
OTHER		☒	

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1 Publishable executive summary

Several studies agree on the existence of a considerable extension 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. It has been estimated that as many as 2.5 million potentially contaminated sites exist across Europe, whose management cost (81% only for remediation) is about € 6.5 billion per year. In MAGIC, contaminated and degraded soils will also be included as it is well documented that the proportion of these land-types is increasing due to anthropogenic activities. Contaminated soils cannot be used for food or feed production for sanitary reasons and thus provide great potential for the production of biomass for material or energy use.

MAGIC Deliverable D1.6 – A first prototype of the decision support tool (DSS) aims to provide the information described above and generated within the MAGIC project to the various interested stakeholders across Europe. This first prototype will be improved upon in the next version (July 2020) and the final version (July 2021). All three current information platforms (MAGIC-Maps, MAGIC-Crops and the DSS are available at http://magic-h2020.eu/.

2 Introduction

A first prototype of the 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 the minimum the most promising industrial crops at any geo-location in Europe. MAGIC-DSS will also visualize 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 crops. Additional tools will include (dependent upon the user requirements survey), cost calculators, validation & testing options, mobile functionality and options for reporting issues.

With the last version of the MAGIC-DSS users can go beyond the NUTS3 level to a higher resolution representation of marginal land and associated crops taking account of areas delineated by specific bio-physical characteristics typical for marginal lands. A user needs assessment (farmers and industry) will be the first step in the DSS set up determining its design. The biomass supply's viewer will be further extended and adapted to show specific characteristics of crops cultivated in the different M-AEZ. MAGIC-DSS (prototype 1) will then be tested with end-users. The next two versions of MAGIC-DSS will be built on the accumulation of the data on marginal land (task 2.4) and the MAGIC-CROPS (task 1.2) and will provide more functionalities and interactions to the end-users. The MAGIC-DSS testing will be done in WP8 (national interactive workshops) offering to all relevant stakeholders the opportunity of capacity building. The first prototype of the MAGIC Maps, MAGIC Crops and MAGIC DSS is available on the MAGIC website (Figure 1).

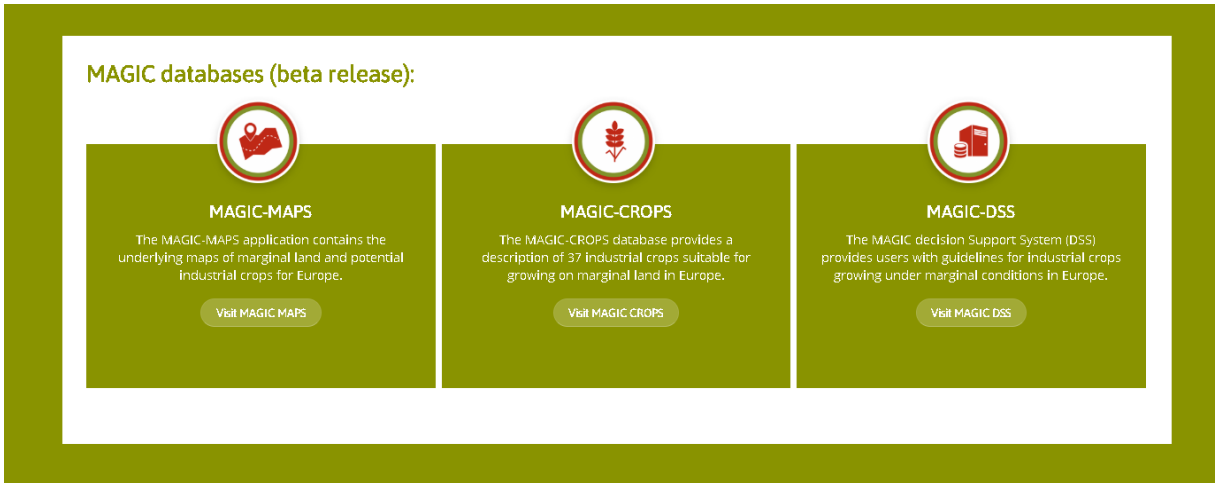

Figure 1: Magic Maps, Crops and DSS on the MAGIC website (http://magic-h2020.eu/).

3 Methods

The first step in the design of the DSS was the completion of a survey. This was sent out via the MAGIC network, receiving a total of 19 responses (Figure 2) The results of this provided a guideline for the development of the DSS prototype, with the following key points:

- A DSS currently only used by 25% of respondents
- People appreciate quick info on crops/species
- Useful for data and map access
- Sometimes too much info, complex
- Must make system simple, intuitive
- Ideally with input from industry

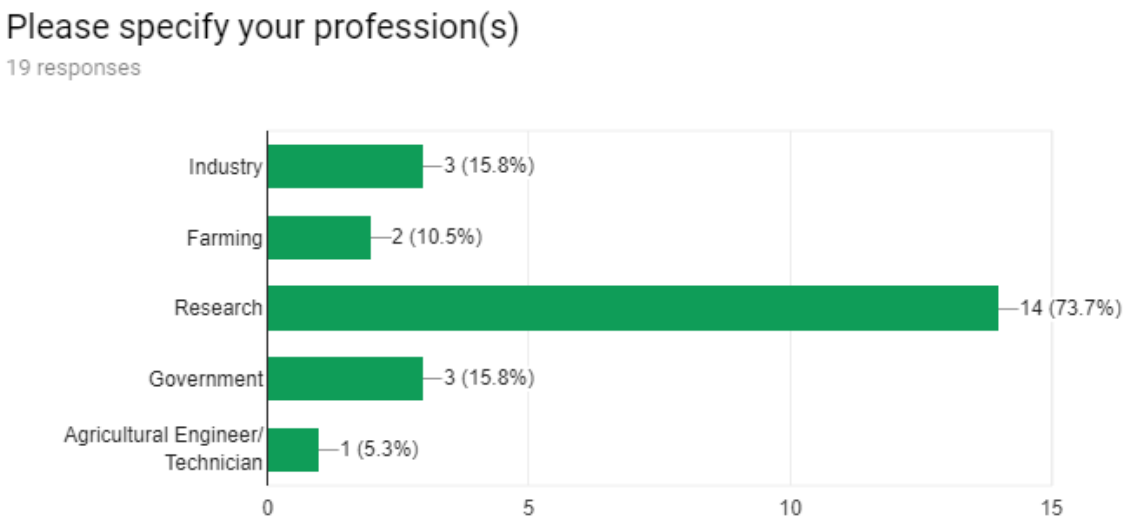

Figure 2: Results of MAGIC DSS survey.

The MAGIC DSS brings together a variety of datasets being developed across the MAGIC project (Figure 3). This includes the MAGIC-Maps, MAGIC-Crops and MAGIC-DSS. Furthermore, a variety of additional datasets are being produced within MAGIC and could potentially linked to the DSS.

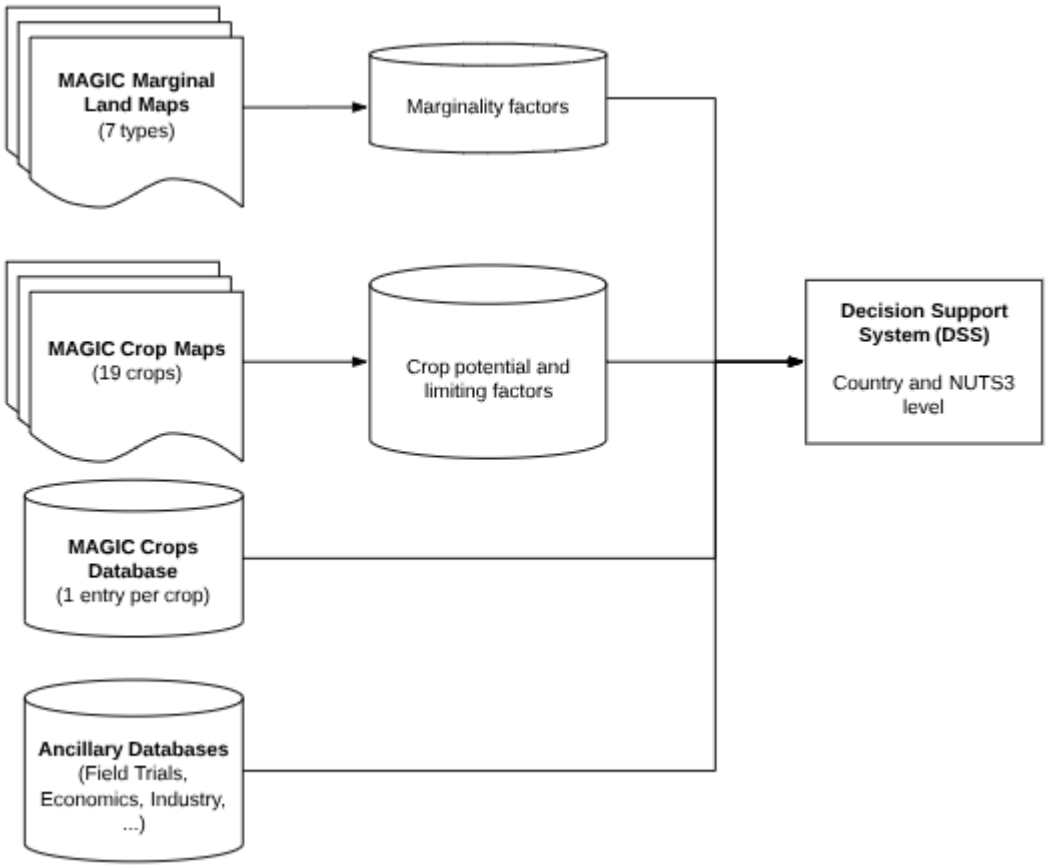

Figure 3: The design of the MAGIC-DSS and related data.

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. Further characteristics on current and future land use opportunities will be made accessible over the next project years through MAGIC MAPS. MAGIC-Maps provide the basic marginal land mapping by marginal land type. In addition, the potential MAGIC-Crops are included in the spatial database. Currently the data is provided at the NUTS-3 resolution, with future plans to refine this.

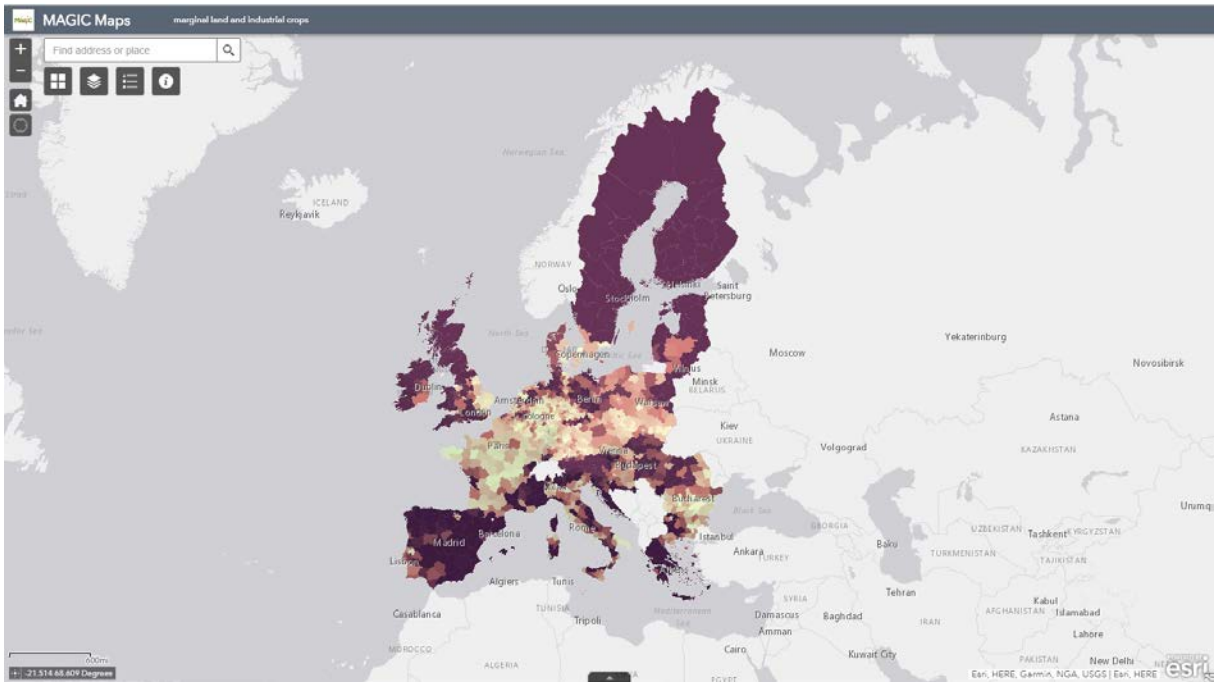

Figure 4: The MAGIC-Maps prootype.

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 over the next project years through MAGIC CROPS.
The MAGIC-Crops database has been put online in an R-Shiny app. This allows for simple viewing and querying of the database, along with downloading. The plan is to potentially add crop photos to the database. Additional features are planned for the future. Additional related tables could also be provided in this format.

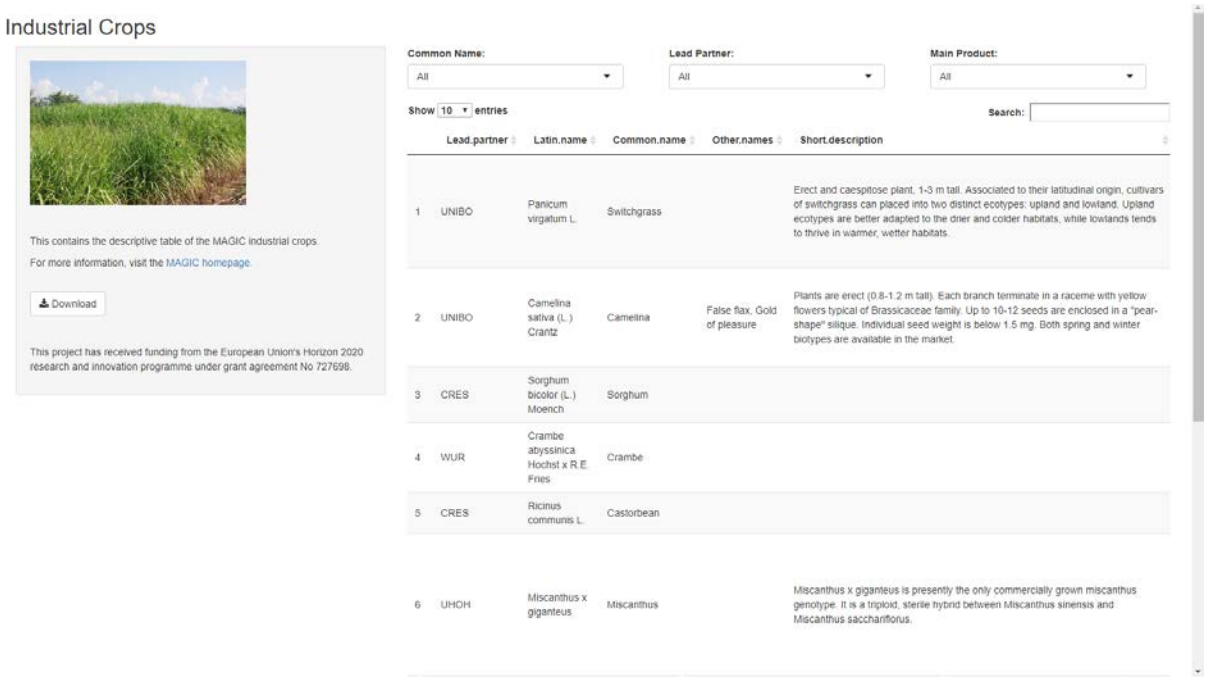

Figure 5: The MAGIC-Crops database.

4.3 DSS

The MAGIC Decision Support System is a culmination of the entire MAGIC information system, and contains the information on the marginal land, marginal crops and related information. The prototype has been developed taking into consideration the feedback from the initial survey, along with experience gained from past projects and previous developed systems.

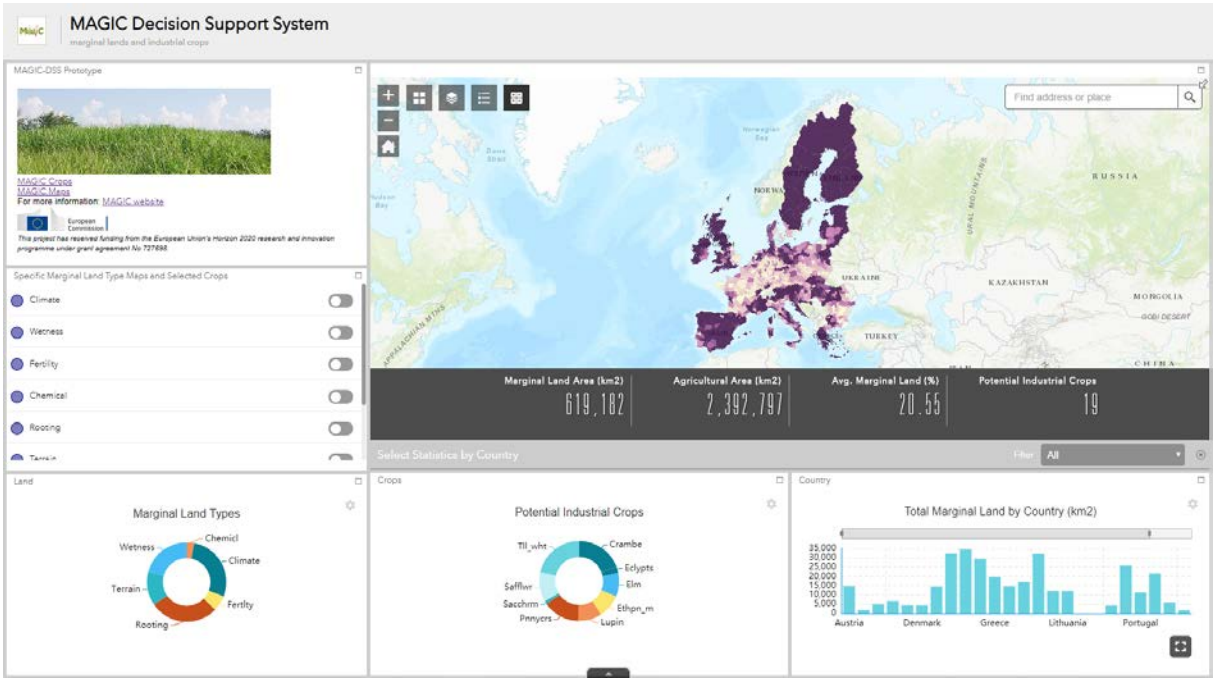

Figure 6: The MAGIC DSS prototype.

The MAGIC DSS combines all MAGIC datasets 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 NUTS3 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. Additional features and an increase in information is planned for the future and all feedback are welcome.

5 Conclusion

The MAGIC-Maps, MAGIC-Crops and MAGIC-DSS have been produced in a prototype version, and placed on the MAGIC website (http://magic-h2020.eu/) since spring 2019. Testing and improvement is ongoing and new data will be added as it comes in. A second prototype version will be produced at year 3 and a final version at the end of the project.