

Innovative cropping systems for industrial crops on marginal lands facing natural constraints

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Midas aim





MIDAS aims to grow, evaluate and valorize sustainable low-ILUC industrial feedstock by developing selected industrial crops and cropping systems on European marginal agricultural land in a climate-resilient and biodiversity-friendly way to support feasible bio-based value chains.

Midas builds on two pillars: To optimize selected climate-resilient and biodiversity-friendly industrial crops and cropping systems able to tolerate water scarcity and mitigate desertification, while improving biodiversity conservation, particularly in Mediterranean and central European Member States; the optimization will be two-fold through breeding and agronomy

To improve the functional performance of specific value chains and products, taking into account an improved resource use efficiency so as to boost the sustainable use of non-edible industrial biomass in a bio refinery concept

Midas at a glance

Sustainable biomass production on marginal lands (WP2, WP3) by:

- Optimize climate-resilient and resource use efficiency
- **⊃** Applying innovative low ILUC cropping systems on selected non edible (industrial): oilseeds, fibres, dryland shrubs, woody species)



Sustainable bio-based value chains (WP5)

- Biomass-to-products pathways, feasibility, viability
- ⇒ Environmental assessments
- Biodiversity restoration potential
- **○** Integrated strategies

Bio-based products at TRL 7 (WP4)

- **⇒** Biochemicals
- **⇒** Biomaterials
- ⇒ Elastomers aiming at replacing their fossil based counterparts and circular use of biomass



Mapping the marginal land in EU (WP1)

- To be certified as low ILUC
- Towards climate change (increase soil and water scarcity in Med region and central Europe)
- Cope with biodiversity challenges and ecosystems services









MIDAS supports European Green Deal. circular economy action plan and bio economy strategy.

Sustainable business plans in European farms with marginal lands (WP6)

- **⇒** Explore realistic revenue models
- Design sustainable business plans

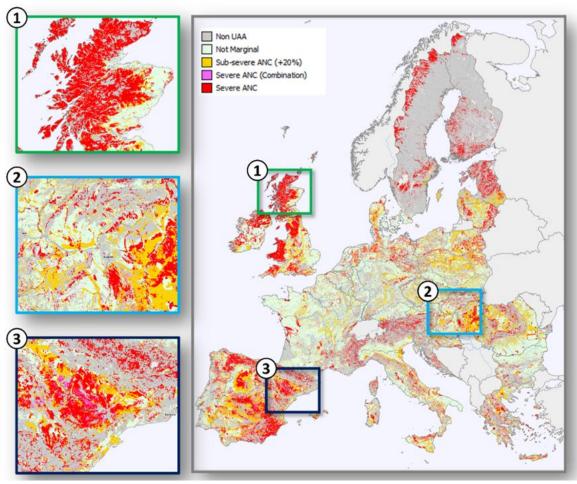
Build on European cooperation (12 EU countries plus Serbia) and international cooperation (Brazil and Canada) to exchange the best practices and to boost win-win scenarios.

Midas will:

- Map and characterize marginal lands for low-ILUC feedstock in the context of current and future expectations on soil erosion, water stress and ecosystem services conditions in Central and South Europe.
- Develop innovative low-ILUC cropping systems on marginal lands (intercropping /agroforestry) in 9 countries and 13 sites at TRL 7.
- Develop 11 innovative bio-based products at TRL 7 following a circular use of biomass.
- Develop 3 innovative sustainable (profitable, low-ILUC, carbon-negative, biodiversity enhancing) value chains and webs.
- Deliver sustainable business plans that ensure overall business case viability as well as improved farm socio-economic resilience
- Engage a multi-actor group (for cocreation) consisting of: farmers' representatives, bio-based industries, research community and civil society.

Mapping of low-ILUC lands (builds on MAGIC work)





Midas will map and characterize marginal lands for low-ILUC feedstock in the context of current and future expectations on soil erosion, water stress and ecosystem services conditions in Central and South Europe. In total 29% of the agricultural area is marginal in EU-27 & UK.

The most common are rooting limitations (12% of agricultural area after correction for improvement), adverse climate and excessive soil moisture (11% and 8% of the agricultural land).

The largest share of marginal lands is defined by one of the six clustered limitations, while in a much smaller share multiple limitations occur.

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain	Marginal	Not marginal
Alpine	40%	21%	0%	2%	45%	47%	61%	39%
Atlantic	4%	14%	1%	1%	12%	5%	26%	74%
Continental	1%	5%	2%	1%	5%	2%	14%	86%
Mediterranean	13%	1%	1%	6%	18%	9%	34%	66%
North	62%	14%	0%	3%	13%	3%	71%	29%
Grand Total	11%	8%	1%	2%	12%	6%	29%	71%

Innovative cropping systems for industrial crops on marginal lands facing natural constraints



Midas cropping systems

To optimize selected industrial crops adapted to marginal lands through modern biotechnology tools and tailored agronomic practices towards low ILUC cropping systems

To develop case studies of low-ILUC cropping systems (intercropping & agroforestry) on marginal agricultural land on farm level for present and future farming systems





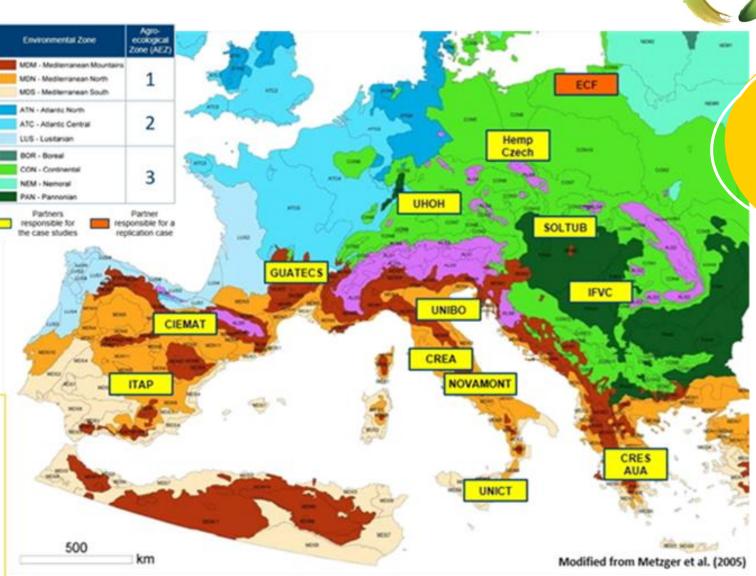
Intercropping and agroforestry



Intercropping:
UNIBO (IT)
UNICT (IT)
NOVAMONT (IT)
CIEMAT (ES)
IT AP (ES)
CRES/AUA (GR)
GUATECS (FR) UHOH
(DE)
IFCV (SE)
HEMPCZECH (CZ)

Agroforestry: CIEMAT (ES) CRES/AUA (GR) CREA (IT) SOLTUB (HU) ECF (PL)

Sites of the field case studies; 16 in total. In the case of CRES/AUA (GR), SOLTUB (HU) & CIEMAT (ES) two field case study have been set up.



16 case studies in 9 European countries

Innovative farming systems acting as case studies in 9 countries will have a central role in Midas (connected with all WPs)



The case studies will be established on marginal lands (facing water scarcity, soil erosion) (WP1)

Optimized crops (nonedible oils, fibres, woody species, etc.) from <u>WP2</u> will be established in the Case Studies

Biomass feedstock from open labs will be used for biobased products (biochemicals, composites, elastomers, etc.) following the concept of cascade use (WP4)

Engage relevant actors (farmers, biobased industry, academia, civil society) on case studies (WP7), creating links with related activities in other research projects. Innovative farming systems (<u>WP3</u>) acting as Case Studies in 9 countries

Develop innovative optimized supply chains for marginal lands based on the best mix of appropriate technical solutions and practices for specific industrial value chains (WP5).

Develop business plans for farmers starting from the case studies, going on national level and finally providing guidelines at EU level (WP6)

Develop key
performance indicators
and life cycle
assessment (LCA)
criteria for operators, or
identifies biodiversity
hotspots along the
value-chains (WP5)

- Two types of cropping systems (12 intercropping and 5 agroforestry) in 9 countries and in 13 sites in total.
- RAGs organized in 9 countries for co-creation of knowledge and planning with relevant stakeholders (mainly farmers).

Non-edible crops for MIDAS and uses

Oilseeds

(crambe, castor, safflower. carinata)

Annual crops (winter / spring) providing seeds (oil & seed meal) and residual biomass

Biochemicals (oleogels, biolubricants. biostimulants, mulch firms) and bioenergy

Oilseeds carinata, (crambe,



Midas

MARGINAL LANDS, INDUSTRIAL CROPS AND INNOVATIVE BIO-BASED VALUE CHAIN

Lignocellulosic crops (fibres, perennial grasses & woody species)

Hemp and sorghum (annual), miscanthus, tansy (perennial crops), willow, poplar and Siberian Elm (woody species)

Biomaterials (mdf panels, insulation materials. nanocarbons, biochar) and bioenergy

Dryland shrubs

(guayule, lavender)

Perennial crops; guayule fits better to South Europe, while lavender has wider coverage

Elastomers (latex for gloves, rubber for tyres), biochemicals (resins, plant protection products)



perennial

Lignocellulosic (woody crops,

hemp, (











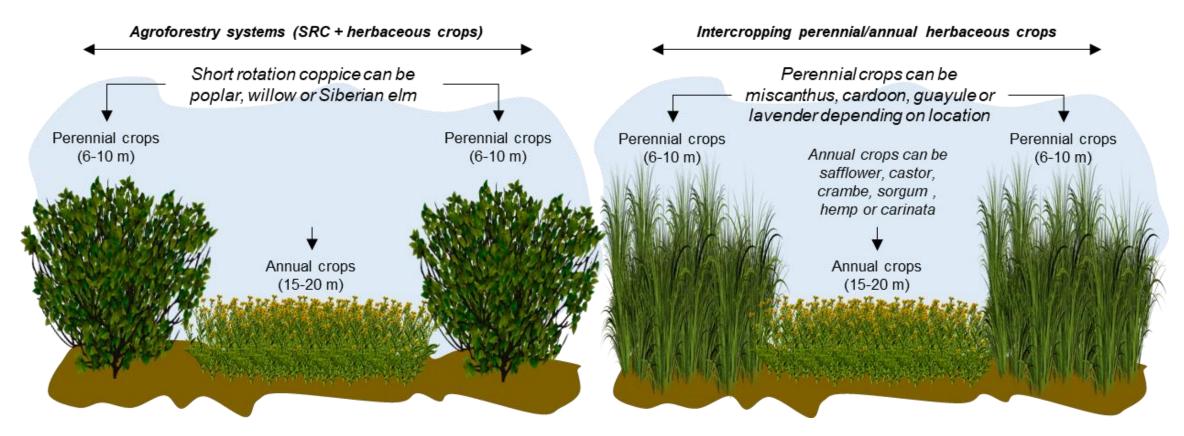






Innovative Cropping Systems (intercropping & agroforestry)





Nine case studies will be developed where the Midas innovative cropping systems will be evaluated; Each case study will be connected with a Regional Advisory Board consisting mainly from practitioners.

Intercropping trials including miscanthus as perennial crop (6 case studies)





UNIBO: near Bologna (IT); annual crops crambe, safflower & hemp



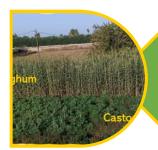
Czech point: near Prague (CZ); annual crops hemp, safflower & sorghum



UHOH; near Stuttgart (DE); melilot, crambe and hemp



Hungary: near Budapest (HU); hemp, sorghum, carinata



CRES & AUA: near Pyrgos (sorghum, castor bean and safflower)



IFCV: near Novisad (SR); crambe, safflower, sorghum

Intercropping trials including cardoon as perennial crop (2 case studies, both in Italy)





Novamont, Umbria/Italy (2 sites with total size 6 ha)

- Perennial crop: cardon
- Annual: Castor bean and safflower



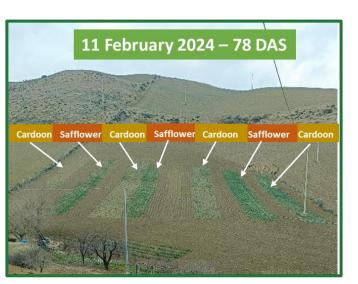




UNICT, Catania/Italy (0.5 ha)

- Perennial crop: cardoon
- Annual crops: safflower, castor bean and industrial hemp





Intercropping trials including guayule as perennial crop (2 case studies, Spain and France)





ITAP, Castilla la Mancha/Spain

- Perennial crop: guayule
- Annual: safflower and industrial hemp







- Perennial crop: guayule
- Annual crops: safflower and industrial hemp







Intercropping trials including lavender as perennial crop (2 case studies, Spain and Greece)





CIEMAT, Soria/Spain

- Perennial crop: lavender
- Annual: crambe, safflower and melilotus







CRES, Chalkidiki/Greece

- Perennial crop: lavender
- Annual crops: safflower and crambe







CREA: near Rome (IT); poplar with crambe and safflower



ECF: north PL; poplar with a mixture of perennial grasses (meadow fescue, timothy and bromus)



CRES & AUA: Chalkidiki (GR); poplar with crambe and safflower



SOLTUB: poplar with 3 annual: sorghum, carinata and hemp



One case study was set up by Ciemat in Soria/Spain where Siberian Elm was established with crambe, safflower and melilotus.

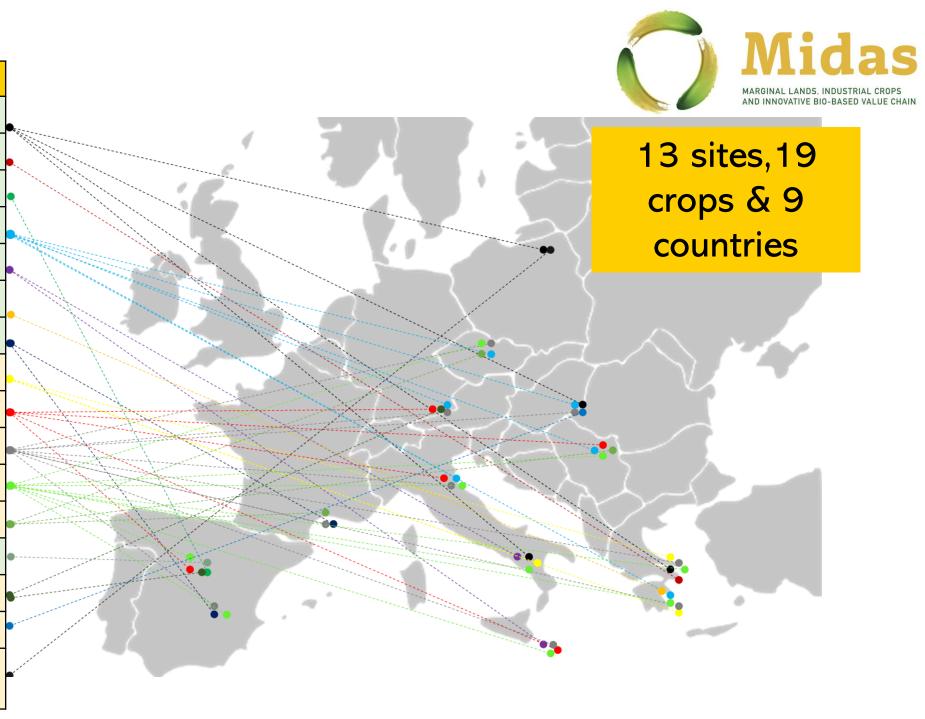








Crop	Sites
Poplar	4
Paulonia	1
Siberian helm	1
Miscanthus	6
Cardoon	2
Switchgrass	1
Guayule	2
Castor	4
Crambe	5
Hemp	9
Safflower	10
Sorghum	3
Lavander	1
Melilotus	2
Carinata	1
Choksfoot, M. fescue, Timothy, bromus	1



Midas case studies



- We are in the 3rd year of field case studies and at the end of this year we will have a full data set of field data (including the rotation of the annual crops) and it yields for the perennial crops (grasses and shrubs) will be reported.
- The yields of the annual crops had some reductions compared to the reported ones on typical agricultural areas and the reduction was connected to the marginality problem.
- In some case studies, establishing miscanthus and switchgrass has presented significant challenges, mainly due to marginal soil conditions and weed competition.
- In each case study a farmers groups has been built having a consulting role.
- Poplar and guayule showed a better adapt- ability to marginal conditions, while lavender demonstrated satisfactory biomass production, although its establishment required careful management in drier locations.

The facilitators of the case studies





































Thank you for your attention, Efi Alexopoulou, ealex@cres.gr