FOR BIO

Fostering Sustainable Feedstock Production for Advanced Biofuels in Europe: Italian experience of growing agroenergy crops on marginal lands

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crea
Consiglio per la ricerca in agricoltura
e l'analisi dell'economia agraria

OUTLINE

✓ Location of the Italian case study

✓ Agronomic feasibility of no-food crops

✓ GIS-based evaluation of suitable lands

✓ Results

Location of the Sulcis case study

- The case study area is the Sulcis district located in the South–west Sardinia, Italy (Mediterranean semi-arid climate)

- Located in the largest Contaminated Sites of National Interest (SIN) in Italy (about 22,000 ha), polluted by industrial flumes derived from coal power generation, bauxite and aluminum production, and previous mining activities

- High levels of heavy metals in the topsoil (mainly Pb, Cu, Cd, Co and Zn)

Industrial area of Portovesme
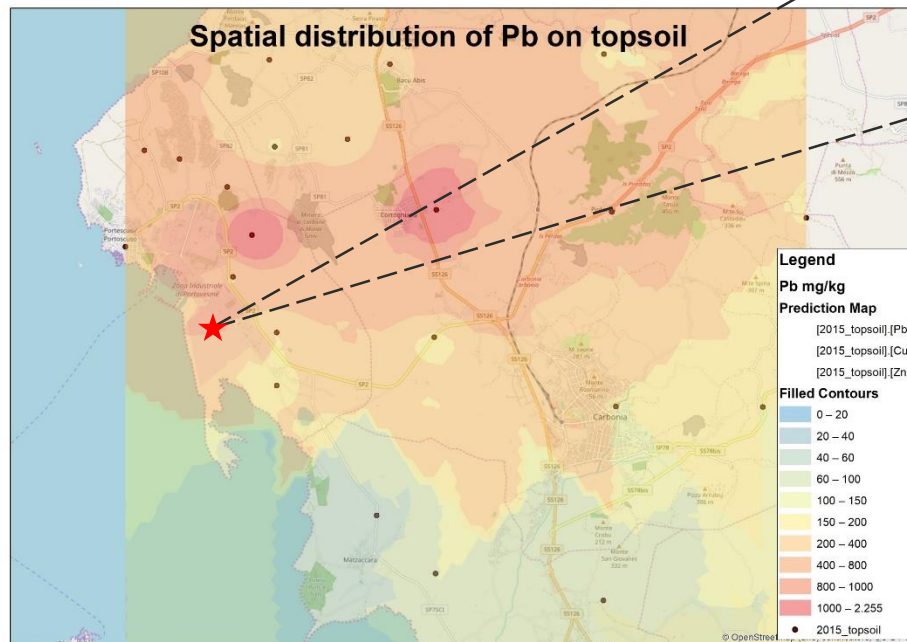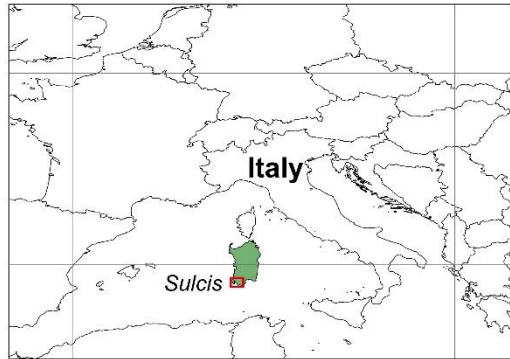
Spatial distribution of Pb on topsoil

Main challenges

- Which crops are more suitable on these environments?
- Where to grow them by meeting sustainability and environmental protection?

Agronomic feasibility

- Analysis of **field trials** and scientific studies on **bioenergy crops** conducted in Sardinia
    - ➢ Cultivation protocols, crop inputs (N, P, K, water), pedologic data, **biomass yield**
- Output: Short-list of most promising bioenergy crops

TYPOLOGY	HERBACEOUS PLANTS		TREE PLANTS
	ANNUAL	PERENNIAL	
LIGNOCELLULOSIC CROPS	GLOBE-ARTICHOKE MILK THISTLE	GIANT REED MISCANTHUS SWICHGRASS SMILO GRASS TALL FESCUE RYEGRASS COCKSFOOT CARDOON	EUCALIPTUS
OLEAGINOUS CROPS	RAPESEED	ETHIOPIAN MUSTARD	
SUGAR CROPS	SWEET-SORGHUM		
STARCH CROPS	MAIZE DURUM-WHEAT TRITICALE		

Agronomic feasibility

- Specific field trials on **Arundo Donax** in Sardinia were started in 2013 by Biochemtex

- Three field study locations:
    - Experimental design: 18 blocks 6 m x 36,6 m
    - 3 propagation methods: micropropagation, rhizomes, stem cuttings
    - H - High density vs L - Low density
    - Different time of plantation (autumn vs spring)

Type of data: **Yield** in function of the above parameters and fertilization doses

GIS-based evaluation of suitable lands

- GIS-based evaluation on marginal and contaminated land potentially suitable for biomass production within existing land use patterns

- The land suitability modelling follows a multicriteria decision-making approach by considering diagnostic criteria based on the literature reviewed and results of field trials

GIS-based evaluation: data sources

| INPUT DATA	RESOLUTION	CONSTRAINTS	DATA SOURCE
Land use	~ 1:10,000	orchards, forestry	CREA
Corine Land Cover	1:25,000	orchards, forestry	EEA
Natural areas	1:10,000	whole areas	RAS
Restricted areas	1:10,000	whole areas	RAS
Soil data	1:250,000	1st - 2nd capab. class >5th capab. class	RAS
DEM	10 m	>10%	RAS
Meteorological data	~ 1 km	<300 mm $year^{-1}$ <15° C $year^{-1}$	WorldClim
Hydrography	1:10,000	150 m buffer	RAS
Roads	1:10,000	150 m buffer	RAS
Built up areas	1:10,000	150 m buffer	RAS
Irrigation borders	1:10,000	150 m buffer	CREA

GIS-based evaluation
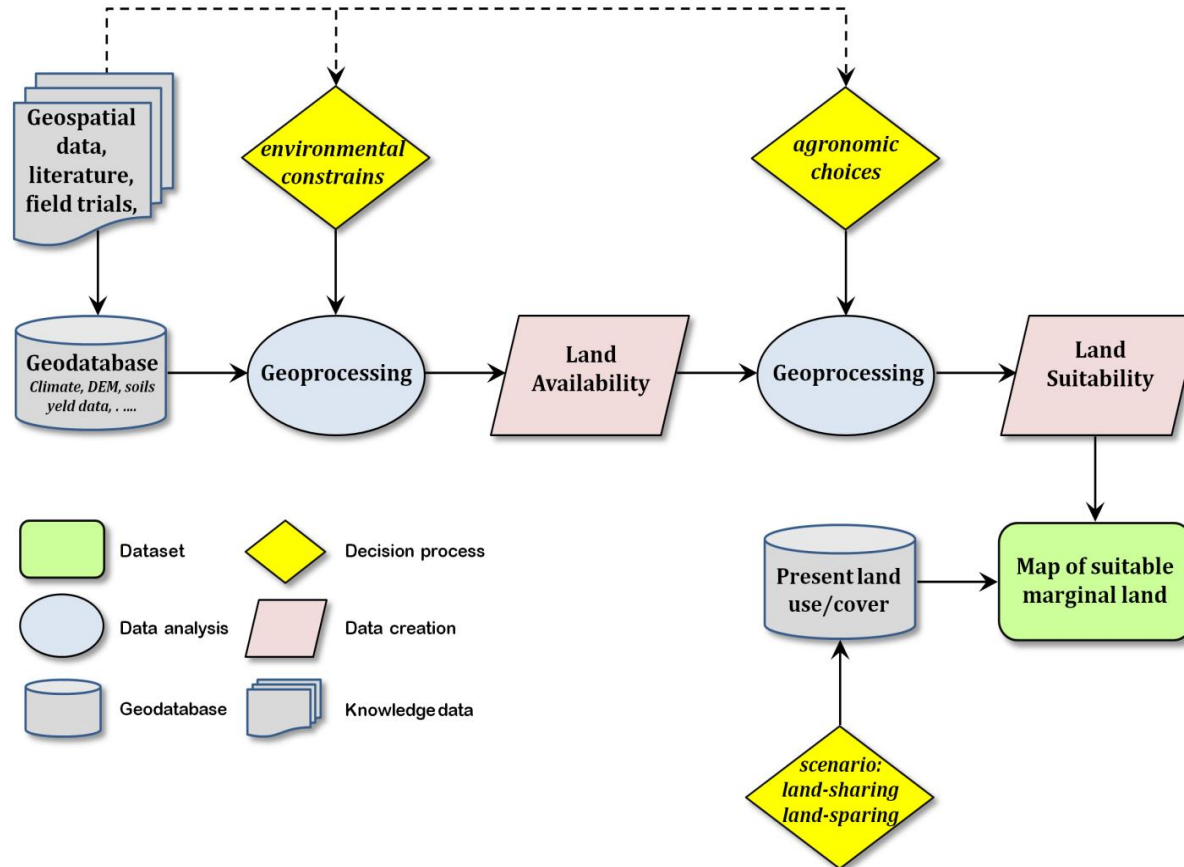
Results

- ## Which crop(s)?

➢ The results of the study suggests some good candidates for a large-scale regional deployment

➢ **Giant reed** (*Arundo donax* L.) shows high level yields (up to 25 t/ha), low nutrient input, water use efficiency, carbon storage potential. Potential disadvantages are related to invasiveness

➢ Native perennial grasses such as **Smilo grass** (*Piptatherum miliaceum* L.) and **Cocksfoot** (*Dactylis glomerata* L.) have recorded higher yields but need further data

➢ Among annual crops, **Milk thistle** (*Silybum marianum L. Gaertn.)* shows high yields (20 t/ha) and adaptability for Mediterranean environments (**rainfed**)

Results

- ## Where to grow?

➢ The results indicate that about **51.000 ha** could be available hypothesizing a supply radius of 70 km to the biorefinery

➢ In the most contaminated area approximately **1.000 ha** are available. The area is unequipped for irrigation, thus most suitable for rainfed crops such as those identified in this study

➢ GIS-based evaluation suggest a potential to increase the production of 2G biomass crops without impacting significantly on food crop production
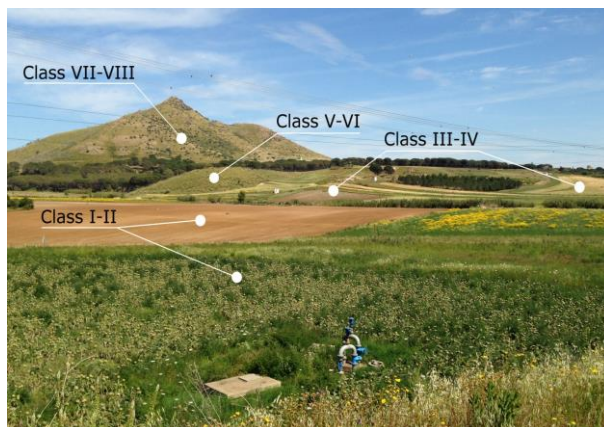
THANK YOU FOR YOUR ATTENTION!

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