ETIP Bioenergy
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GROWING PERENNIAL CROPS ON MARGINAL LAND IN EUROPE FOR BIOENERGY

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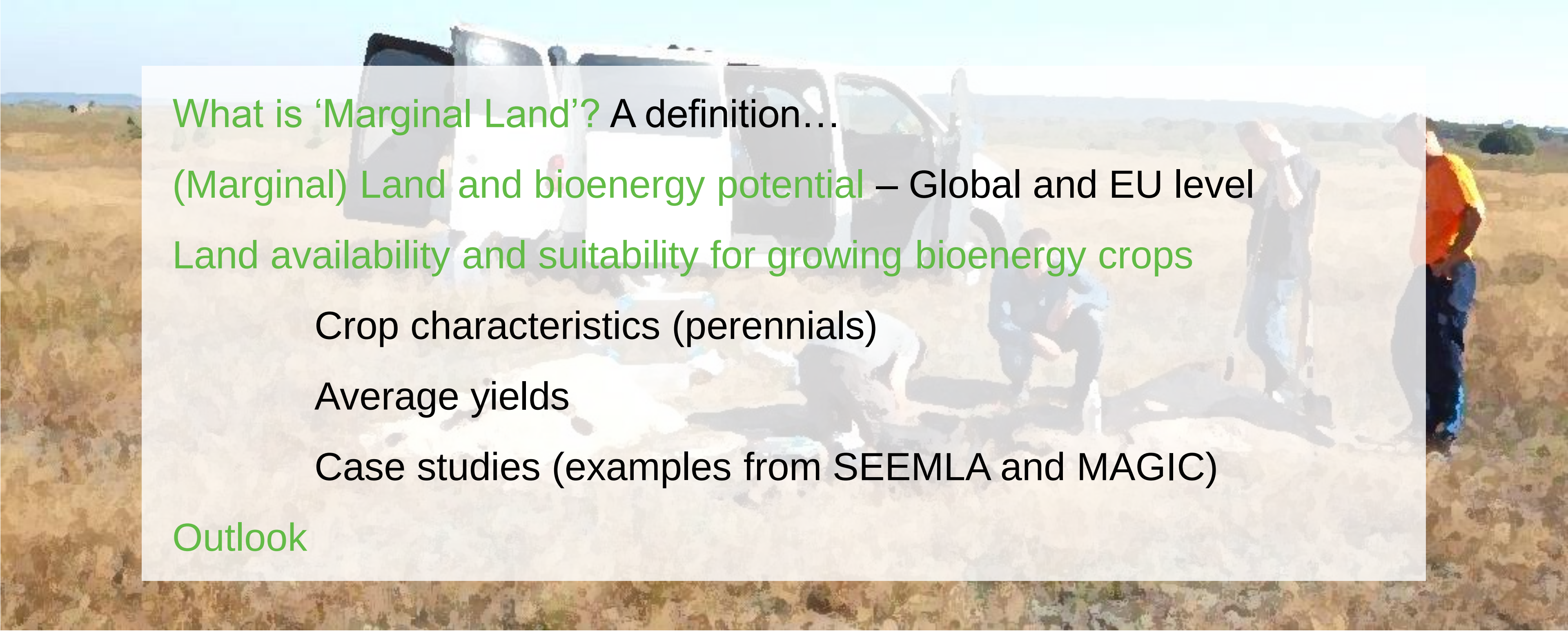
Content



What is ‘Marginal Land’? A definition…

(Marginal) Land and bioenergy potential – Global and EU level

Land availability and suitability for growing bioenergy crops

- Crop characteristics (perennials)
- Average yields
- Case studies (examples from SEEMLA and MAGIC)

Outlook

Definition of Marginal Land (MagL)

Economic definition: that is an area where a **cost-effective production is not possible**, under given site conditions, cultivation techniques, agricultural policies as well as macro-economic and legal conditions" (Schroers, 2006); where **revenue is just equal to costs of production** (Peterson and Galbraith 1932).

Physical and production definition: marginality is **based on soil suitability and restrictions** are often adopted by soil scientists and agronomists for the purpose of land use planning.

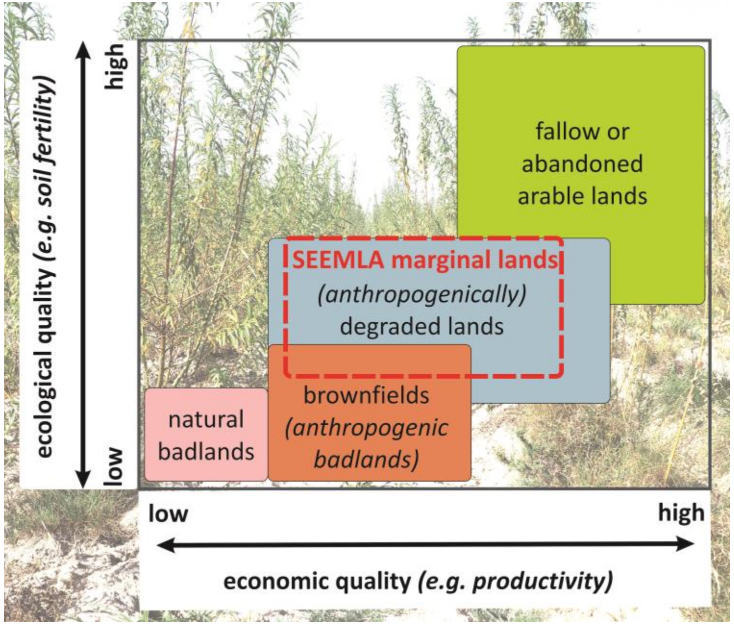
It refers to **land of poor quality for agriculture or susceptible to erosion or other degradation** (Lal 2004).

Schroers, J. O. (2006). Towards the development of marginal land use depending on the framework of agricultural market, policy and production techniques. University of Giessen, Germany.

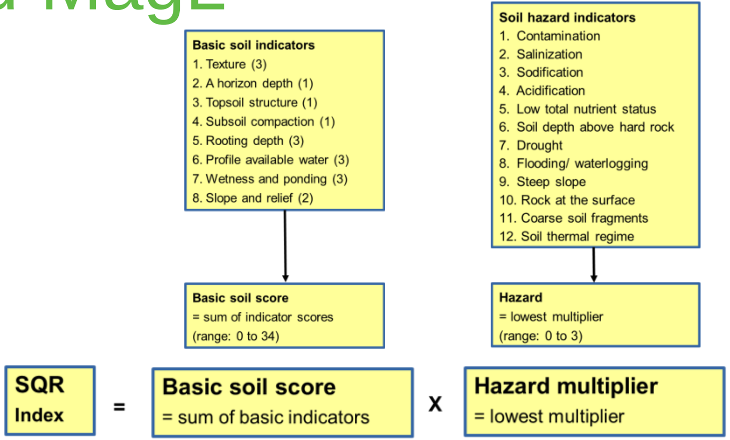
Peterson, G.M., and Galbraith, J.K. (1932). The concept of Marginal Land. American Journal of Agricultural Economics, 1932, vol. 14, issue 2, 295-310

Lal, R. (2004). Soil carbon sequestration to mitigate climate change. *Geoderma, 123*, 1-22. http://dx.doi.org/10.1016/j.geoderma.2004.01.032

Defining marginal lands (MagL) - Soil quality assessment of marginal land MagL



Classification scheme for marginal land in the SEEMLA approach context (developed by BTU) modified after and adapted from Dauber et al. (2012).



SQR range: 0 – 100

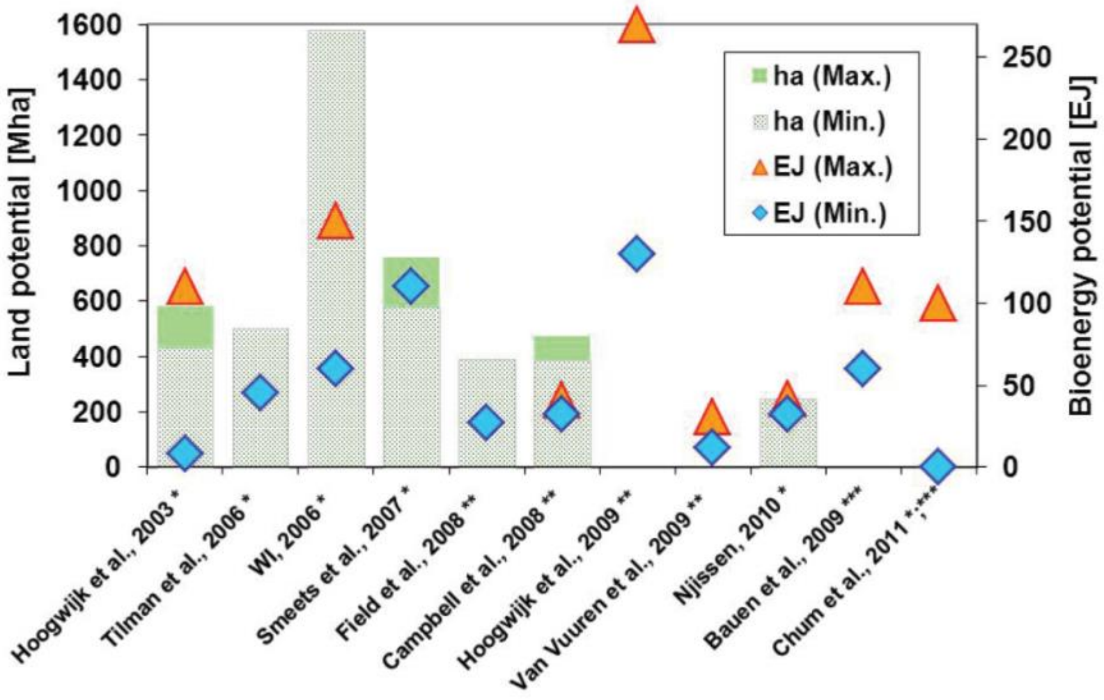
Very poor	Poor	Moderate	Good	Very good
0 – 20	20 – 40	40 – 60	60 – 80	80 – 100

marginal

Source: Mueller et al., 2007, modified.

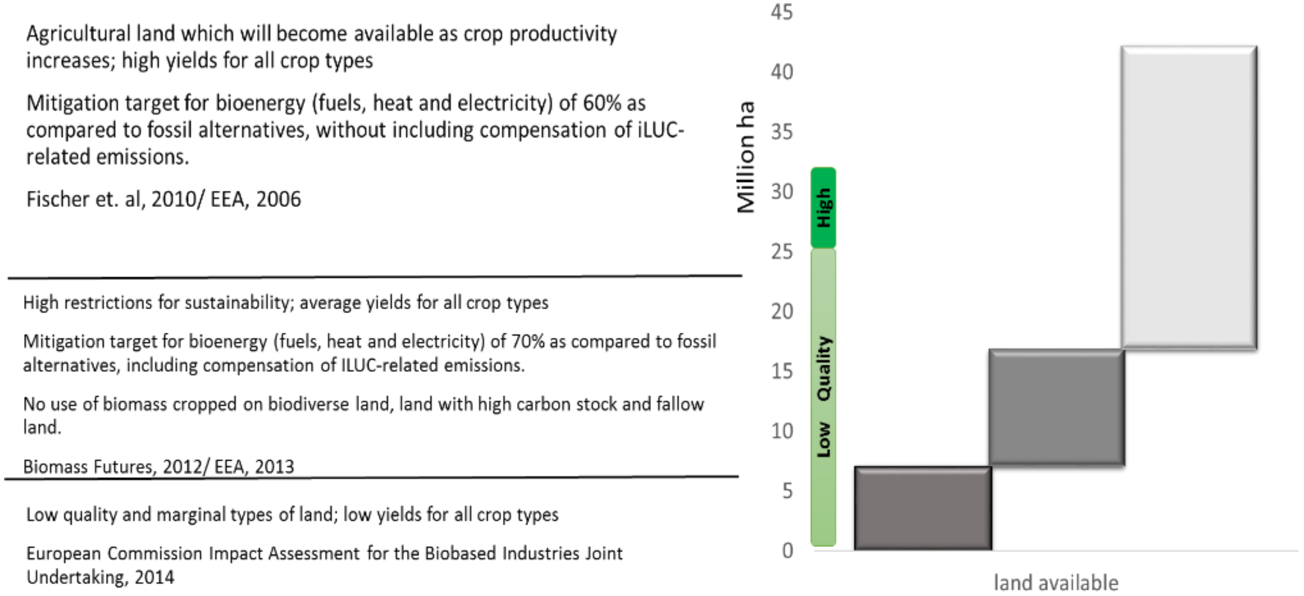
Gerwin et al. 2018. The Potential of Marginal Lands for Bioenergy. BE sustainable No. 9: 10-13

Land and bioenergy potential of different marginal (surplus) land categories on a global scale



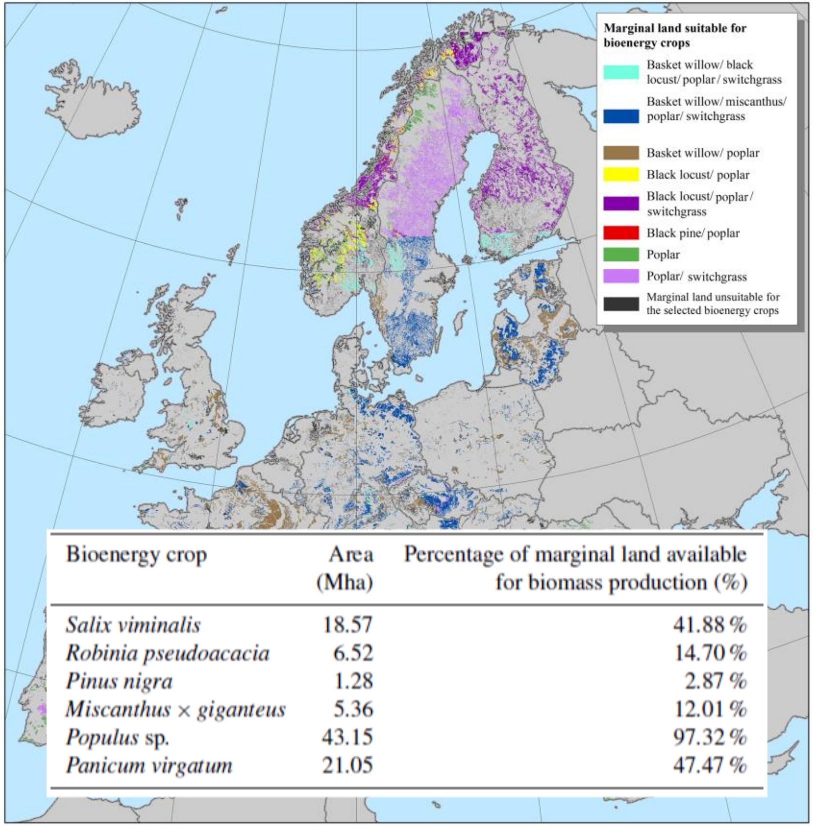
(Dauber et al., 2012, based on IEA, 2011)

Land availability for Non-Food Crops (NFC) in Europe

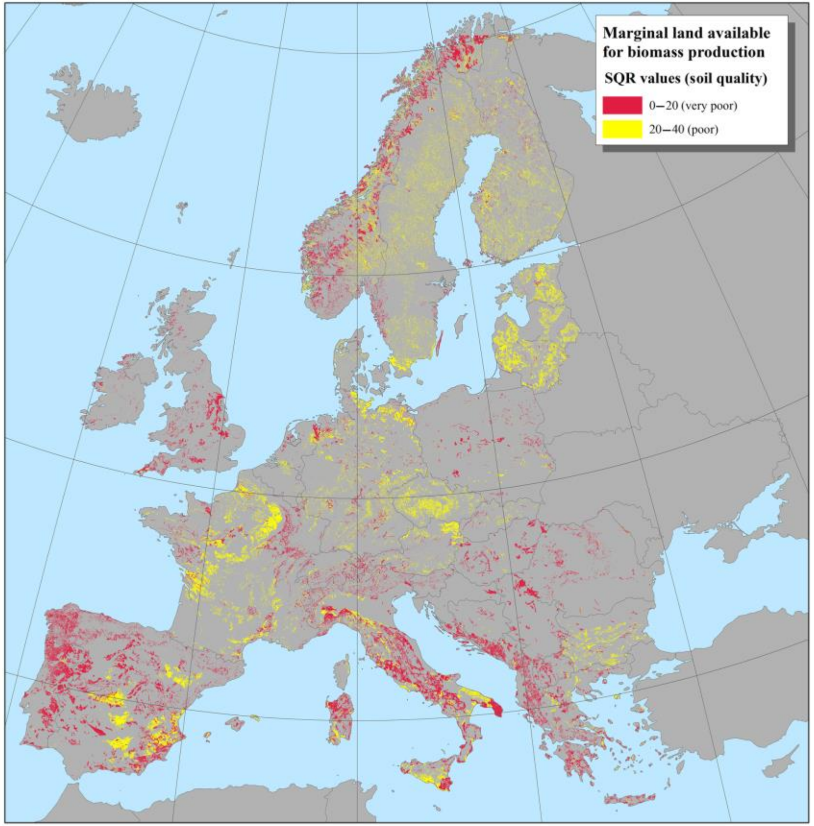


Land availability (in the green column) for dedicated non-food lignocellulosic crops in Europe [EU 28, Western Balkan, UA, MD, TR] (in green the estimates from S2Biom for availability of low (marginal) and high quality land available by 2030)

Marginal land suitability for bioenergy crops

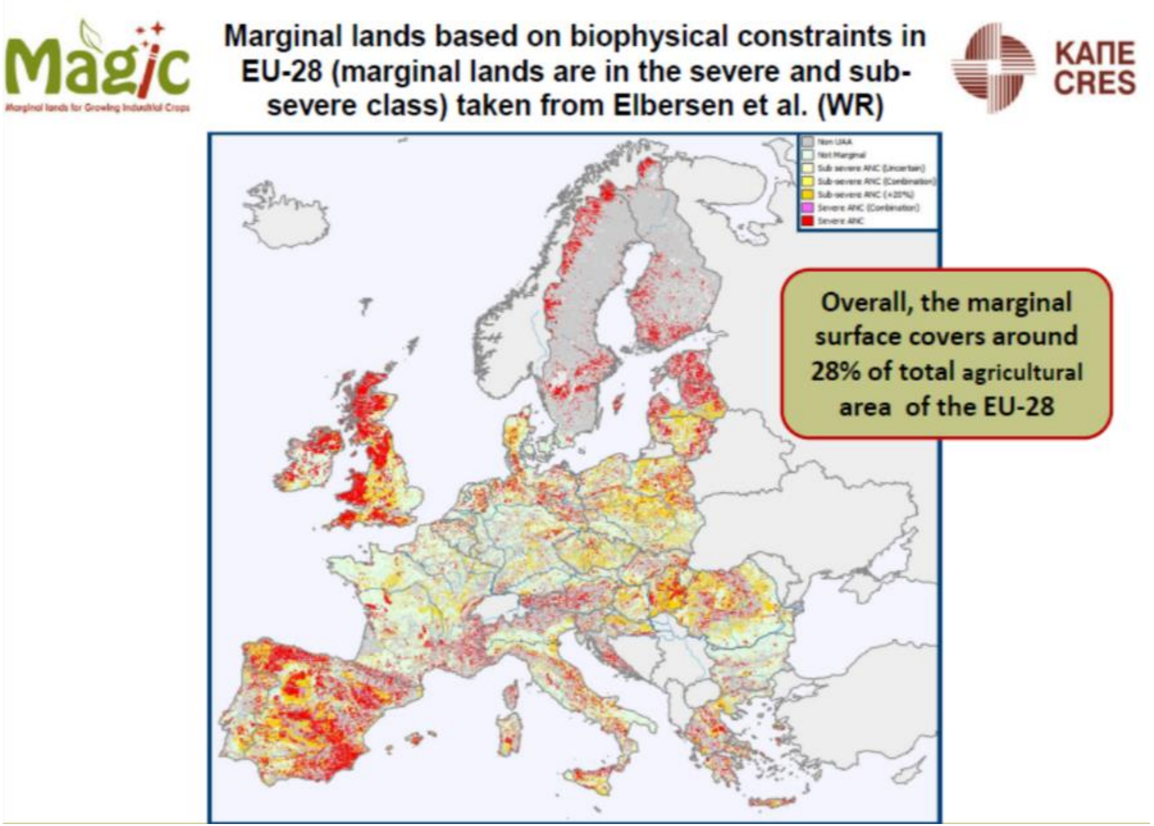


Bioenergy crop	Area (Mha)	Percentage of marginal land available for biomass production (%)
Salix viminalis	18.57	41.88 %
Robinia pseudoacacia	6.52	14.70 %
Pinus nigra	1.28	2.87 %
Miscanthus × giganteus	5.36	12.01 %
Populus sp.	43.15	97.32 %
Panicum virgatum	21.05	47.47 %



Gerwin et al. 2018. Assessment and quantification of marginal lands www.soil-journal.net/4/267/2018/

Marginal land suitability for bioenergy crops



http://magic-h2020.eu/download/28/publications/3250/alexopoulou_promising-oilseed-crops-for-europe-which-could-be-grown-on-marginal-lands.pdf

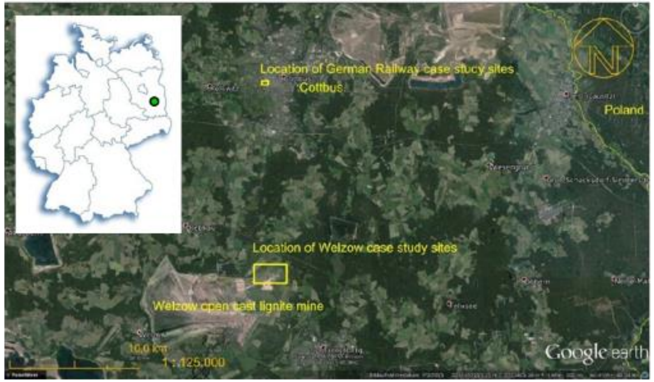
Crop agronomic characteristics

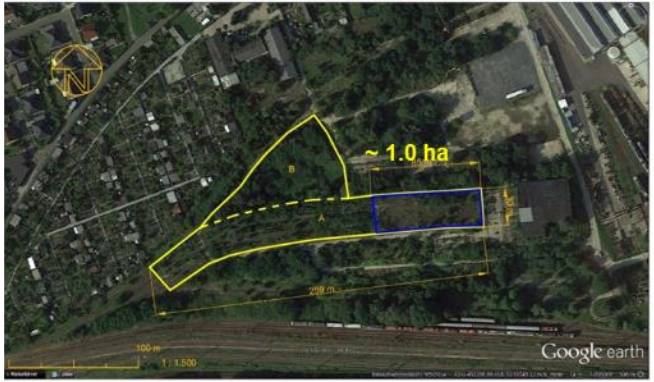
Crop	Structure of the Crop Supply Value Chain			
	Growth Type	Establishment	Harvest	Yield (t/ha)
Oil crops				
Rapeseed [21,22]	Annual (spring), biennial (winter-sown)	Winter crops from late July, spring September;	June	1.5–4.3
Sunflower [22]	Annual/rotation crop	March/April	Sept	1–3.2
Soya [22]	Annual	March/April	Sept	1.40–3.40
Sugar and starch crops				
Sugarbeet [16,23]	Annual/rotation crop	Feb/March	Sept/Nov	50–80
Wheat [16,23]	Annual/rotation crop	Oct/Nov	June	1.4–8
Barley [16,23]				3.0–8
Maize [16,23]	Annual		Sept/Oct	5.5–12
Lignocellulosic crops				
Fiber sorghum [22]	Annual	April/May	Sept/Oct	15–20
Kenaf [16–18,20,22]	Annual	May	Sept/Oct	10–15
Miscanthus [19,24,29,30]	Perennial	Nov/Jan	Nov/Feb	10
Switchgrass [19]	Perennial	May	Nov/Jan	8–10
Cardoon [26]	Perennial	Oct or Feb/Mar	Jun/July	10–15
Poplar [27]	Perennial; Harvested on 6–15 years/(in very short rotations every 2–3 years) (winter)	April	Nov/Dec	7–28
Willow [27]	Perennial; Harvested on 3–4 years rotation (winter)	April	Nov/Dec	10–30

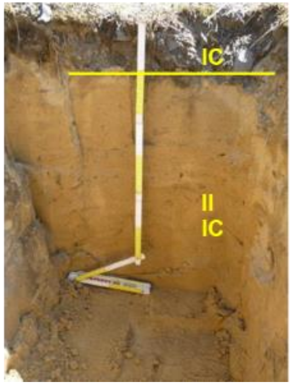
C. Panoutsou and E. Alexopoulou (2020). Costs and profitability of crops for bioeconomy in the EU
Energies 13, 1222; doi:10.3390/en13051222

Case studies (SEEMLA project) I

Germany → Brandenburg → Cottbus → industrial site





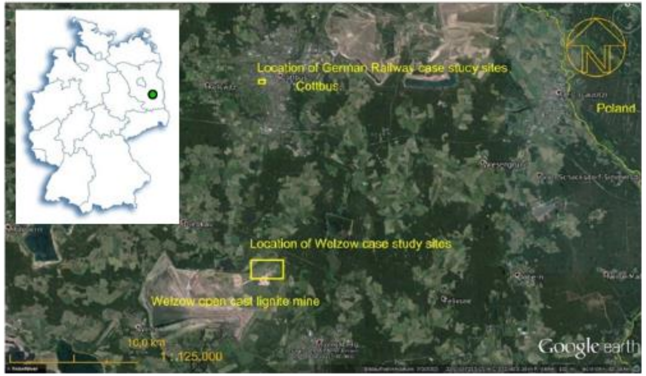


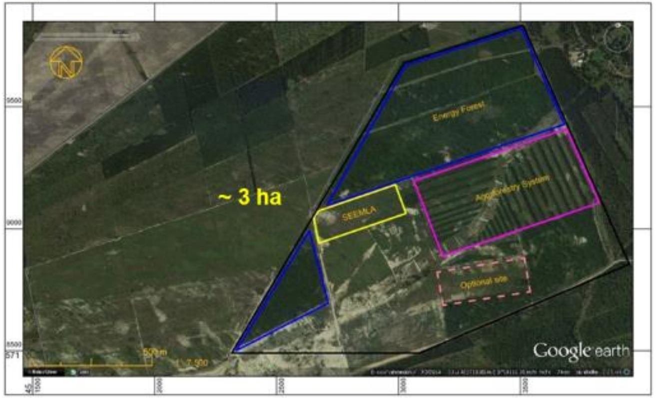
- **Abandoned industrial site**
- Slope 0%; El.: 77 m
- Urbic Technosol (arenic)
- Sand
- No Ah horizon
- Rock on surface: ~ 10% → **0.7**
- Stone content: ~ 50% → **1.5**

- SQR: 9,1

Case studies (SEEMLA project) II

Germany → Brandenburg → Welzow mine



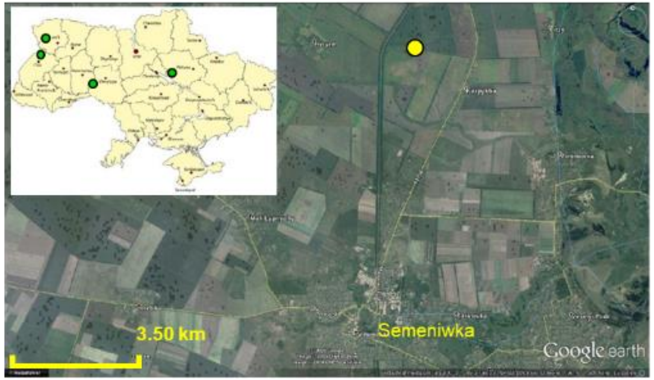


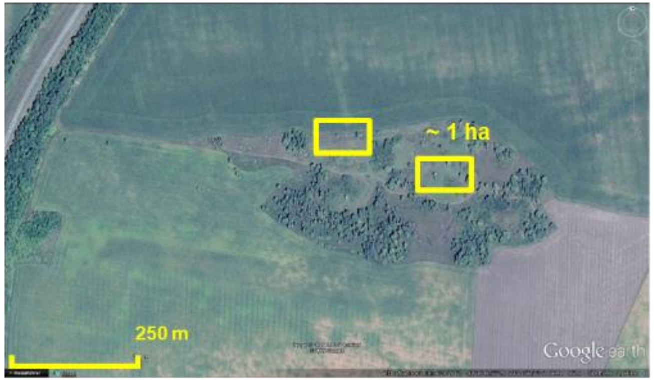
- **Reclaimed land**
- Slope: 1%; El.: 110 m
- Spolic Technosol (arenic)
- Loamy sand
- Shallow initial Ah: ~ 3 cm
- Soil contains coal
- Salinity: up to 40 mS/ cm → **1**
- Acidity: up to pH 3 ~ 4 → **2.1**

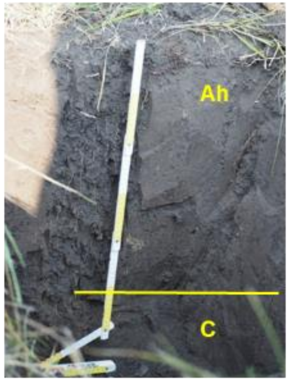
- SQR: 20,5

Case studies (SEEMLA project) III

Ukraine → Poltava region → Semenivka →fallow/ unused







- **Fallow/ unused**
- Slope < 1%; El.: 95 m
- Umbric Gleysol
- Silty clay
- Ah: 50 cm
- Well aggregated
- Frequently flooded: → 0.1
- SQR: 1,7

Average biomass yields at SEEMLA case study sites

Ranges for different degrees of soils marginality

Region	Local site name (village/town)	Cultivated bioenergy crop	Biomass yields (t DM ha^{-1} a^{-1})
		Ukraine	
Poltava	Semeniwka	*Panicum virgatum*/*Miscanthus* × *giganteus*	10.0 … 18.1
Vinnitsa	Yaltushky	*Panicum virgatum*/*Miscanthus* × *giganteus*	12.0 … 15.3
Volyn	Zubylne/Kysylyn	*Salix* sp./*Populus* sp.	5.5 … 6.0
Lviv	Welyki Mosty	*Salix* sp./*Populus* sp.	3.5 … 6.0
		Greece	
East Macedonia & Thrace	Drosia	*Pinus nigra*	7.2 … 8.3
	Pelagia	*Pinus brutia*	2.8
	Sarakini	*Robinia pseudoacacia*	2.3
		Germany	
Lower Lusatia (State of Brandenburg)	Welzow	*Robinia pseudoacacia*	3.0 … 5.0
	Cottbus	*Robinia pseudoacacia*/*Populus* sp.	3.0

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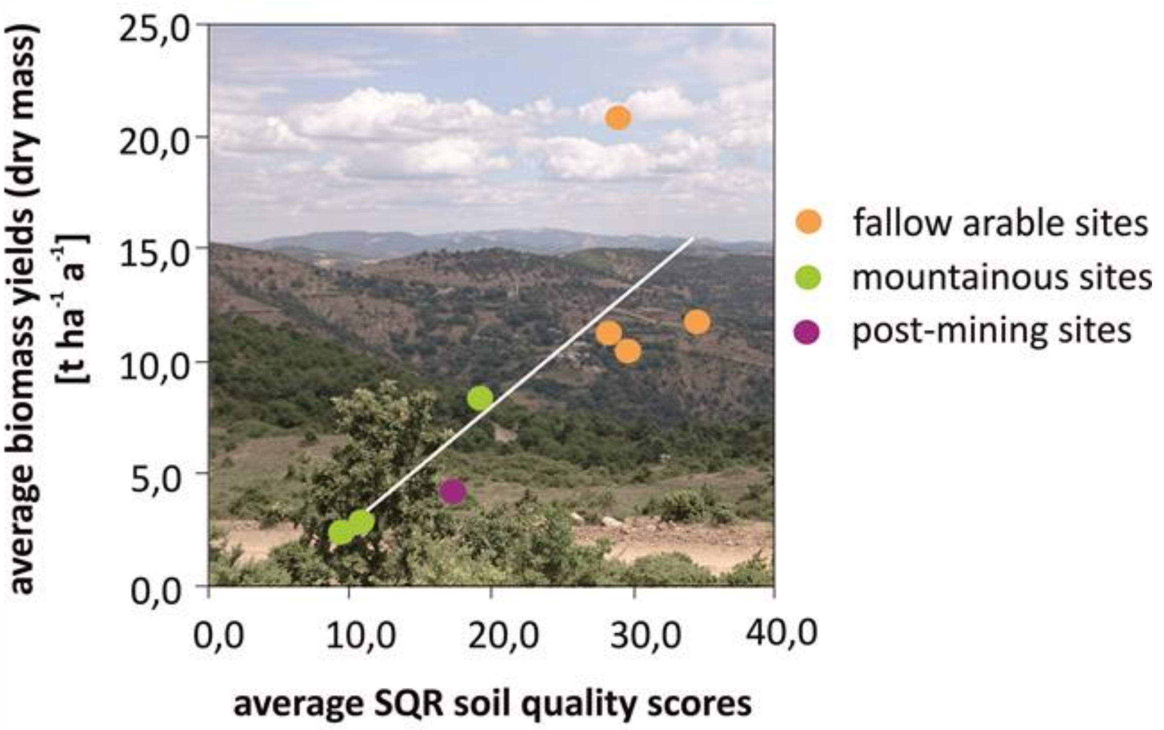
Ranges for different degrees of soils marginality



Gerwin et al. 2018. The Potential of Marginal Lands for Bioenergy. BE sustainable No. 9: 10-13

Case studies (MAGIC)

Cardoon (*Cynara cardunculus* L.)

Family: Asteraceae

Magic – Marginal lands for Growing Industrial Crops

ΚΑΠΕ CRES

Cardoon plantations in Greece and Spain (CRES and UPM) and harvesting of the crop by CREA

- Perennial crop (5-15 years). Established by seeds, it regrowth every autumn and should be harvested in mid-August.
- Drought resistant; it can be grown in whole Mediterranean region.
- In FIRST2RUN (BBI project) it has been grown in a marginal area in Sardinia for its oilseeds.
- It has been tested also in OPTIMA and BIOCARD projects.
- Multipurpose crop and from its seeds: oil, protein flour, active molecules.
- Seed yields: 1-1.2 t/ha
- Oil content: 25% oil with fatty acid profile similar to sunflower.

http://magic-h2020.eu/download/28/publications/3250/alexopoulou_promising-oilseed-crops-for-europe-which-could-be-grown-on-marginal-lands.pdf

Network

- Seventh Framework Programme
- Horizon 2020
- Intelligent Energy Europe – for a sustainable future
- biomasspolicies
- greenGain.eu
- Magic
- S2Biom
- SeemLa
- BIOMASS FUTURES
- FORBIO
- ADVANCE FUEL

Challenges

The main challenges for biofuels from marginal land concern on one hand the **terminology and definitions** of the various land categories as well as the **potential of these land types** to produce biofuels in a **sustainable and cost-efficient** manner.

The use of MagL – An outlook

- **Significant and unused natural asset:** Use of marginal land has gained significant attention due to climate change and the projected scarcity of natural resources in the future: large areas affected already worldwide, land degradation and 'land grabbing' is a global issue. (short term with long-term effect)
- **Avoidance/minimisation of conflicts in the 'food vs. fuel' debate:** growing energy crops in marginal land facilitates reduced competition as compared to agricultural land use for food production purposes. (short term with long-term effect)
- **Increase of biodiversity:** creation of a diverse landscape structure elements ('niche function' | habitat function). (mid-term and long-term)
- **Creation of new jobs** for, e.g. farmers, foresters, engineers and scientists specialised in the use of marginal land for bioenergy purposes. (short and mid-term)
- **GHG mitigation and carbon sequestration** by growing perennial plants on degraded land enrichment of soil organic carbon in the top- and subsoil. (long-term)

Thank you!

Contact


Source: FNR/Dr.Peters

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