Innovations in lignocellulosic biomass production:
effects on costs, sustainability and acceptance

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Background

ADVANCEFUEL

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Removing barriers to renewable transport fuels

Poplar miscanthus black locust eucalyptus lupine switchgrass sorghum willow lucerne giant reed hemp black pine paulownia sunn hemp triticale wheatgrass

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.° 764799.

Objective

Identification and evaluation of promising innovative cropping schemes of lignocellulosic crops in Europe

- ✓ Biomass production cost
- ✓ Environmental impact
- ✓ Innovation acceptance by farmers and the public

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Fields of innovation

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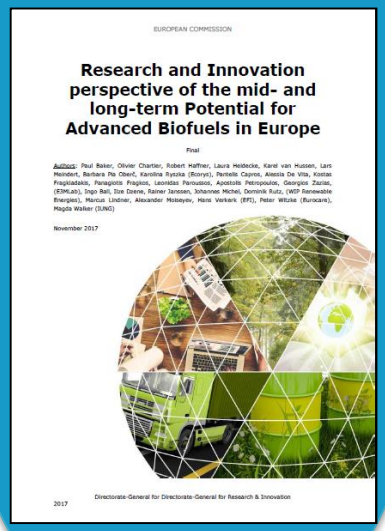
European Commission 2017



EUROPEAN COMMISSION

Research and Innovation perspective of the mid- and long-term Potential for Advanced Biofuels in Europe

Final

Authors: Paul Baker, Olivier Chartier, Robert Haffner, Laura Heidecke, Karel van Hussen, Lars Meindert, Barbara Pia Oberd, Karolina Rynzka (Ecorys), Pantelis Capros, Alessia De Vita, Kostas Fragiadakis, Panagiotis Fragkos, Leonidas Paroussos, Apostolis Petropoulos, Georgios Zazias, (E3MLab), Ingo Ball, Ilze Deene, Rainer Janssen, Johannes Michel, Dominik Rutz, (WIP Renewable Energies), Marcus Lindner, Alexander Moiseyev, Hans Verkerk (EFI), Peter Witzke (Eurocare), Magda Walker (IUNG)

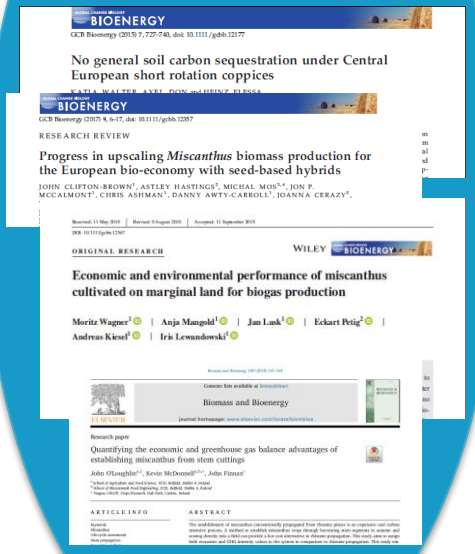
November 2017

Directorate-General for Directorate-General for Research & Innovation

2017

Workshop 7 EU-projects

Literature review



BIOENERGY

GCB Bioenergy (2015) 7, 727–740, doi: 10.1111/gcbb.12177

No general soil carbon sequestration under Central European short rotation coppices

BIOENERGY

GCB Bioenergy (2017) 9, 6–17, doi: 10.1111/gcbb.12357

RESEARCH REVIEW

Progress in upscaling *Miscanthus* biomass production for the European bio-economy with seed-based hybrids

JOHN CLIFTON-BROWN[1], ASTLEY HASTINGS[2], MICHAL MOS[3,4], JON P. MCCALMONT[3], CHRIS ASHMAN[3], DANNY AWTY-CARROLL[3], JOANNA CERAZY[4],

ORIGINAL RESEARCH

WILEY BIOENERGY

Economic and environmental performance of miscanthus cultivated on marginal land for biogas production

Moritz Wagner[1] | Anja Mangold[1] | Jan Lask[1] | Eckart Petig[2] | Andreas Kiesel[1] | Iris Lewandowski[1]

Biomass and Bioenergy

Research paper

Quantifying the economic and greenhouse gas balance advantages of establishing miscanthus from stem cuttings

John O'Loughlin[a,c], Kevin McDonnell[b,c,*], John Finnan[c]

ARTICLE INFO

ABSTRACT

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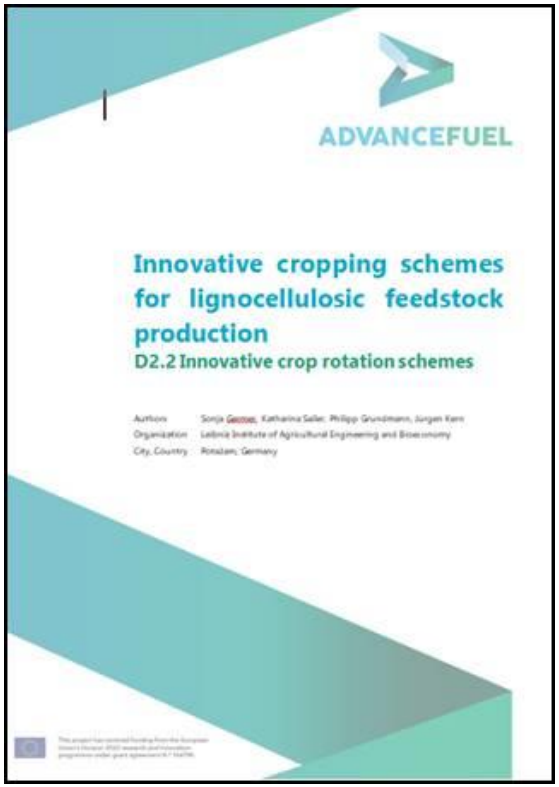
Fields of innovation

ADVANCEFUEL

European Commission 2017

Literature review

Workshop



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Fields of innovations

Agricultural management

Crop selection

Multi-purpose cropping

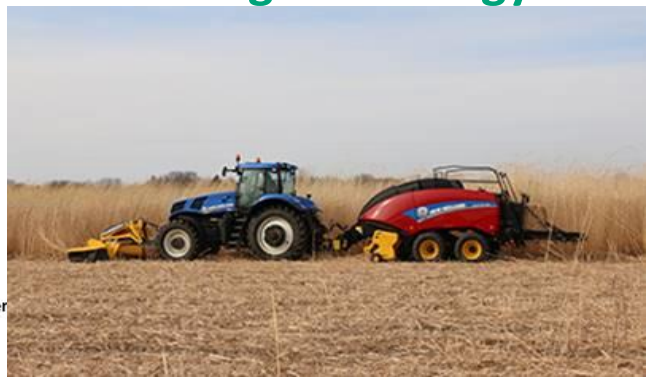
Crop rotation

Cropping on marginal land

Breeding

Intercropping

Harvesting technology

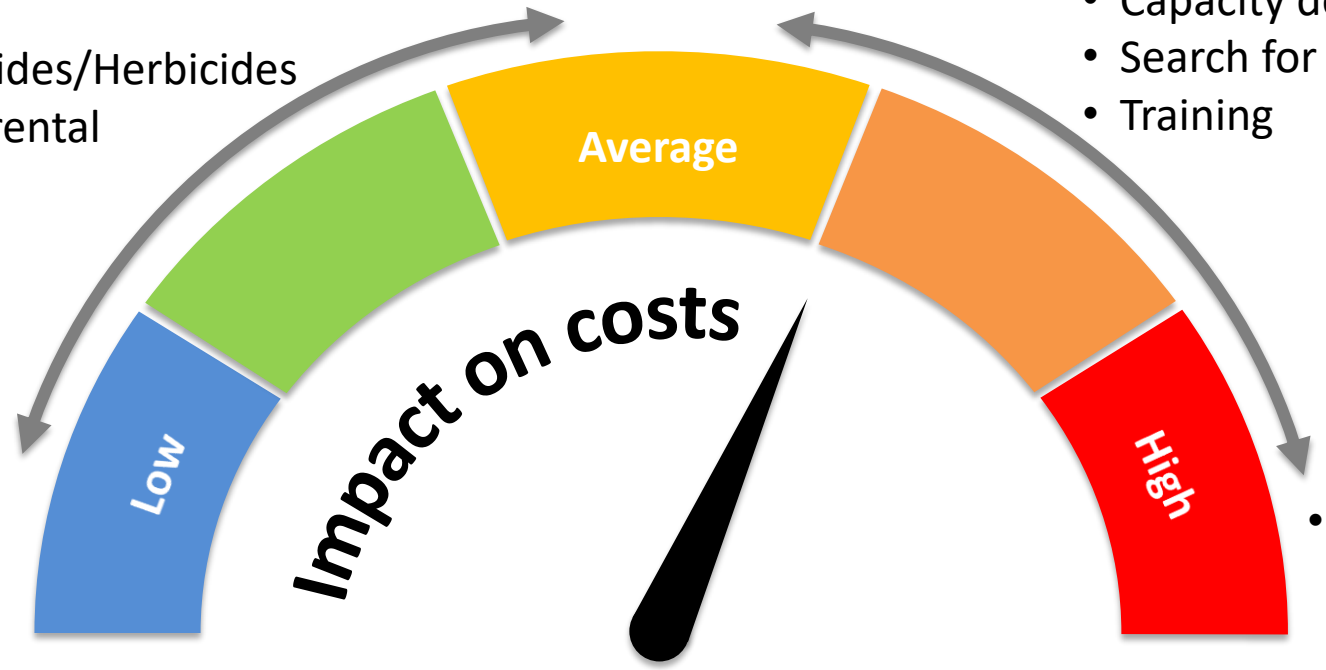


This project has received funding from the European Uni

Evaluation – Biomass production costs
Workshop results

- Pesticides/Herbicides
- Land rental

- Capacity development
- Search for information
- Training



- Irrigation if needed

Can be low or high depending on case:

- planting material (rhizomes vs. seeds)
- work force
- fossil fuel
- new machinery

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Evaluation – Biomass production costs
Literature & own calculations

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Changes in biomass production costs

Crop	Innovation					*Other effect*	
	Breeding (seed-based propagation)	Propaga-tion by stem segments	Planting density increase by 3 times	Sewage sludge application	Cropping on marginal land	*Upscaling cropping area*	*Learning effects*
Miscanthus	**7-16**[1)]	**9**[1)]	**7**[1)]		**-11**[4)], **-44**[5)]		
Switchgrass					**-10**[4)]		
Willow SRC						***10***[3)]	***25***[3)]
Giant Reed					**-17**[4)]		
SRC				**7**[2)]			

Data source: [1)] method described in Box 1 of D2.2, [2)] (Dimitriou and Rosenqvist, 2011), [3)] Sweden (Rosenqvist et al., 2013), [4)] (Soldatos, 2015), [5)] former mining site compared to average of 6 agricultural sites (LfULG, 2014)

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Evaluation – Biomass production costs
Literature & own calculations

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Changes in biomass yield that lead to production cost changes

Crop	Innovation				*Other effect*	
	Breeding for yield increase	Breeding for quality increase	Irrigation with waste water	Cropping on marginal compared to agricultural land	*Cropping on large fields compared to small plots*[3)]	*Learning effects*
Miscanthus	+	-	+	-70[3)], -37[5)], -31[4)]	***-80***	+
Switchgrass	+	-	+	-31[3)], -42[4)]	***-74***	***50***[6)]
Willow SRC	+	-	+	0[3)]	***-38***	+
Poplar SRC	+	-16 - -24, >-30[1)]	+	-39[3)]	***-91***	+
Giant Reed	+	-	+	-37[4)]	-	+
SRC	+	-	25, 30[2)]	-	-	+

Data source: [1)] (Van Acker et al., 2014), [2)] (Dimitriou and Rosenqvist, 2011), [3)] (Searle and Malins, 2014) , [4)] (Soldatos, 2015), [5)] (LfULG, 2014), [6)] (Karp and Shield, 2008)

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Evaluation – Environmental Impact
Workshop results

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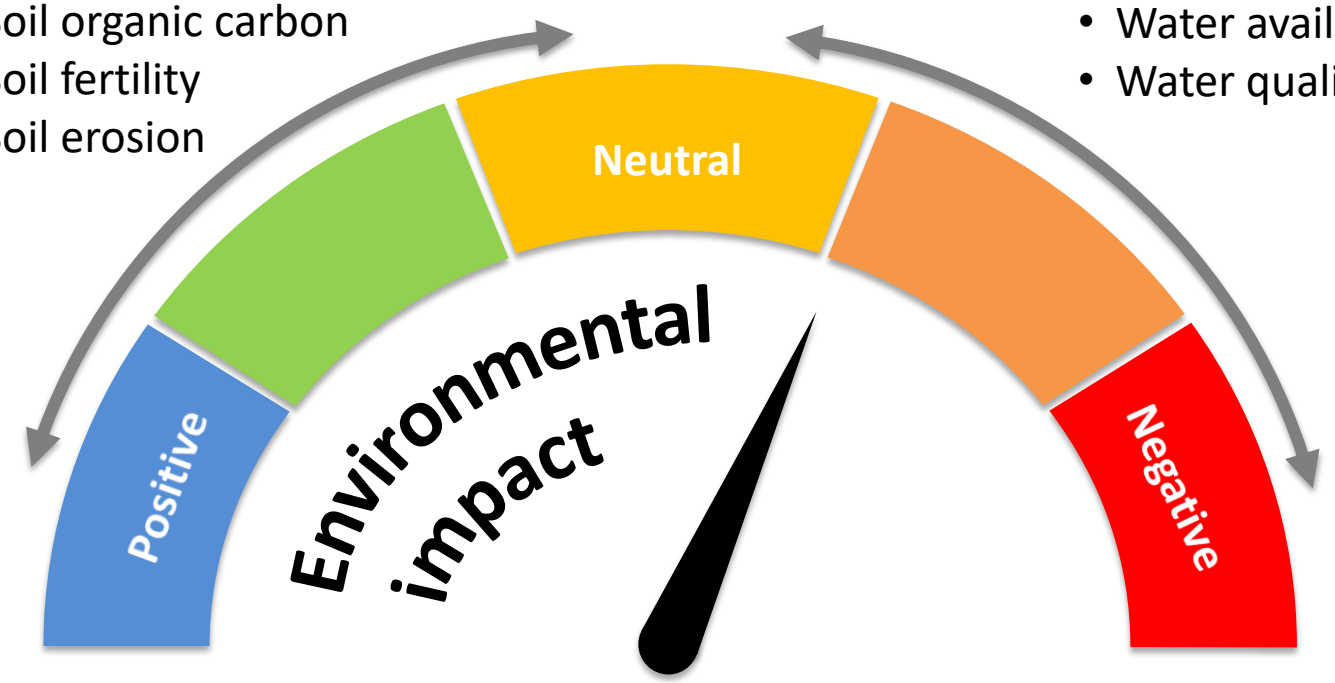
- Soil organic carbon
- Soil fertility
- Soil erosion

- Water availability
- Water quality



Can be low or high depending on case:

- Biodiversity
- Nutrient retention
- GHG emissions

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Evaluation – Environmental Impact

Literature review

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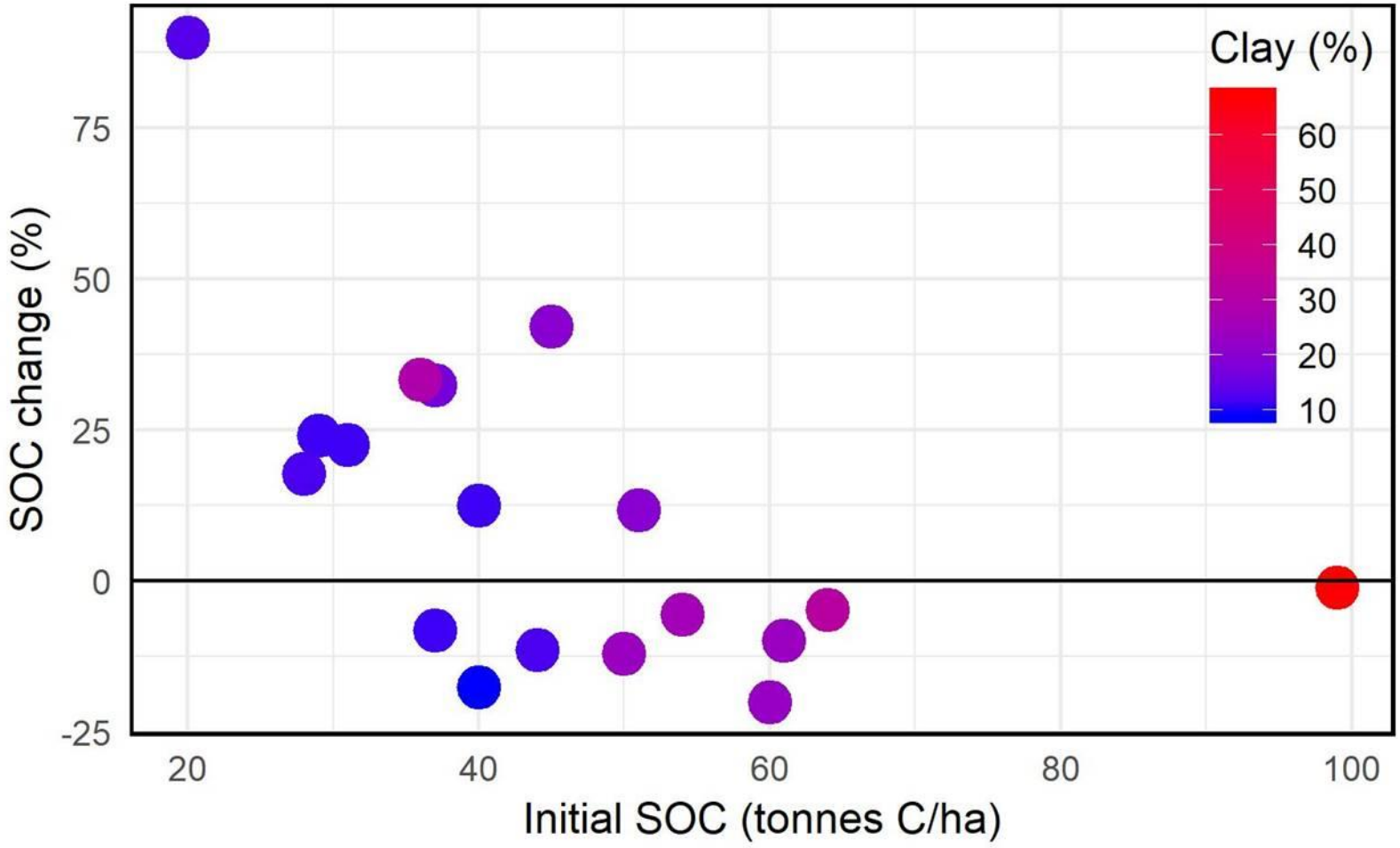
Short rotation coppice topsoil

(Data source: Walter et al., 2015)



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Evaluation – Innovation acceptance
Workshop results

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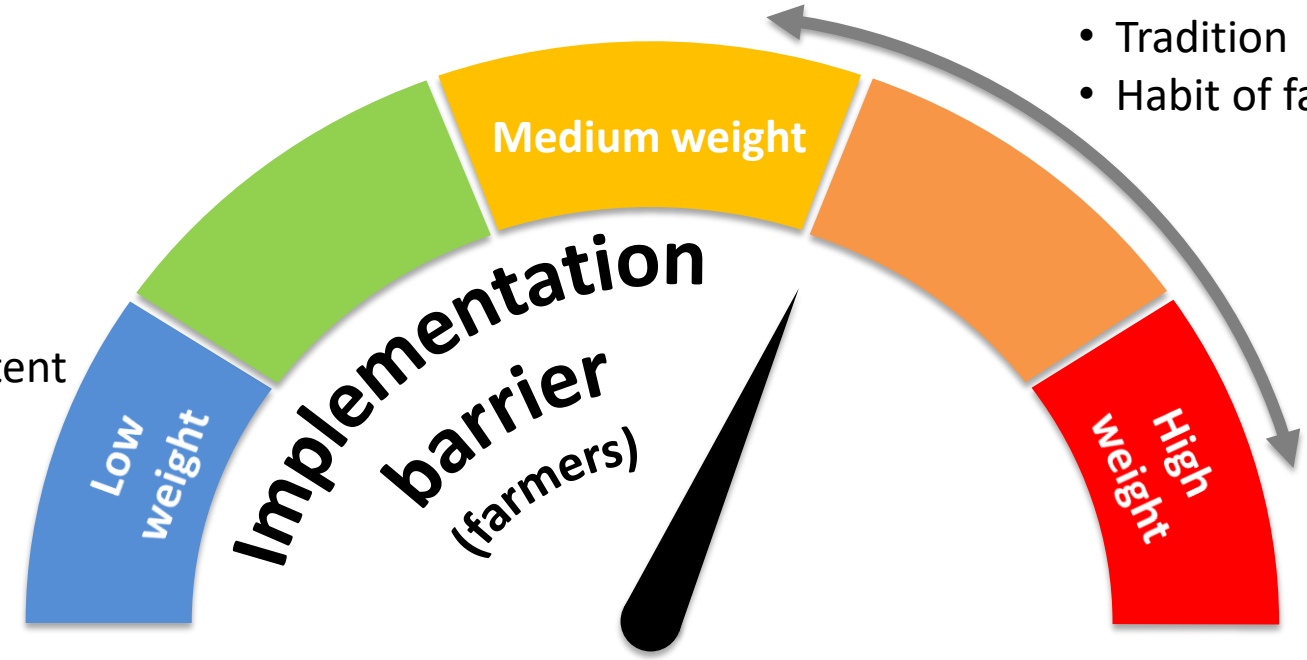
- Lack of standards and regulations
- Lack of knowledge of environmental constraints

OR

- Lack of knowledge of environmental constraints
- Lack of standards and regulations



- Consistent quality

- Tradition
- Habit of farmers

- Low profitability
- No market
- Biomass cost
- Required investment

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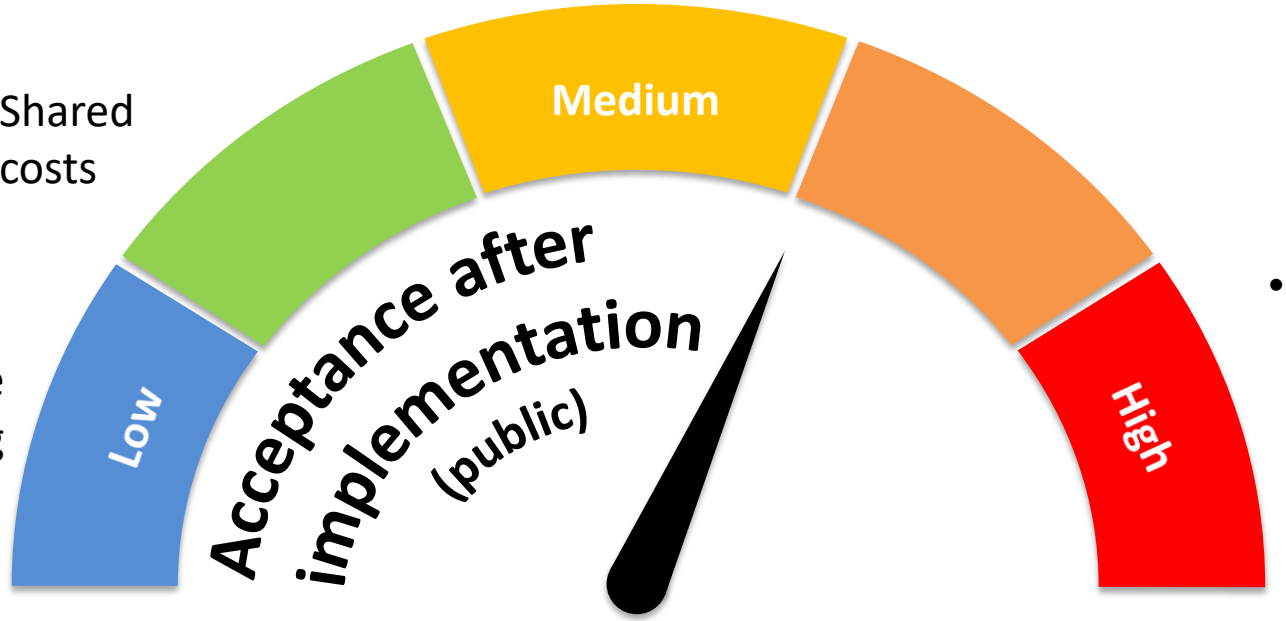
Evaluation – Innovation acceptance
Workshop results



- Shared costs
- Lack of knowledge
- Competing interests
- Shared benefits

Can be low or high depending on case:

- Visual landscape change
- Environmental values

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Conclusion and recommendations

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Conclusion

Highest potential to reduce biomass costs by several innovations at once

Recommendation

Acceleration of the learning effect
(availability of info, training, consultancy)

http://www.panacea-h2020.eu

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Conclusion and recommendations

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Conclusion	Recommendation
Highest potential to reduce biomass costs by several innovations at once	Acceleration of the learning effect (availability of info, training, consultancy)
Evaluation of cropping innovations is complex and highly case specific	DSS not only for crop selection: costs, sustainability, social aspects

http://magic-h2020.eu/

This project h
me under grant agreement N.° 764799.

Conclusion and recommendations

Conclusion	Recommendation
Highest potential to reduce biomass costs by several innovations at once	Acceleration of the learning effect (availability of info, training, consultancy)
Evaluation of cropping innovations is complex and highly case specific	DSS not only for crop selection: costs, sustainability, social aspects
Assessment & storage of standard data per study case is needed	Free accessible database for study cases data

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Conclusion and recommendations

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Conclusion

Recommendation

Highest potential to reduce biomass costs by se

Acceleration of the learning effect

Evaluation complex

Assessme data pe

www.nature.com/scientificdata

SCIENTIFIC DATA

OPEN

Data Descriptor: A global yield dataset for major lignocellulosic bioenergy crops based on field measurements

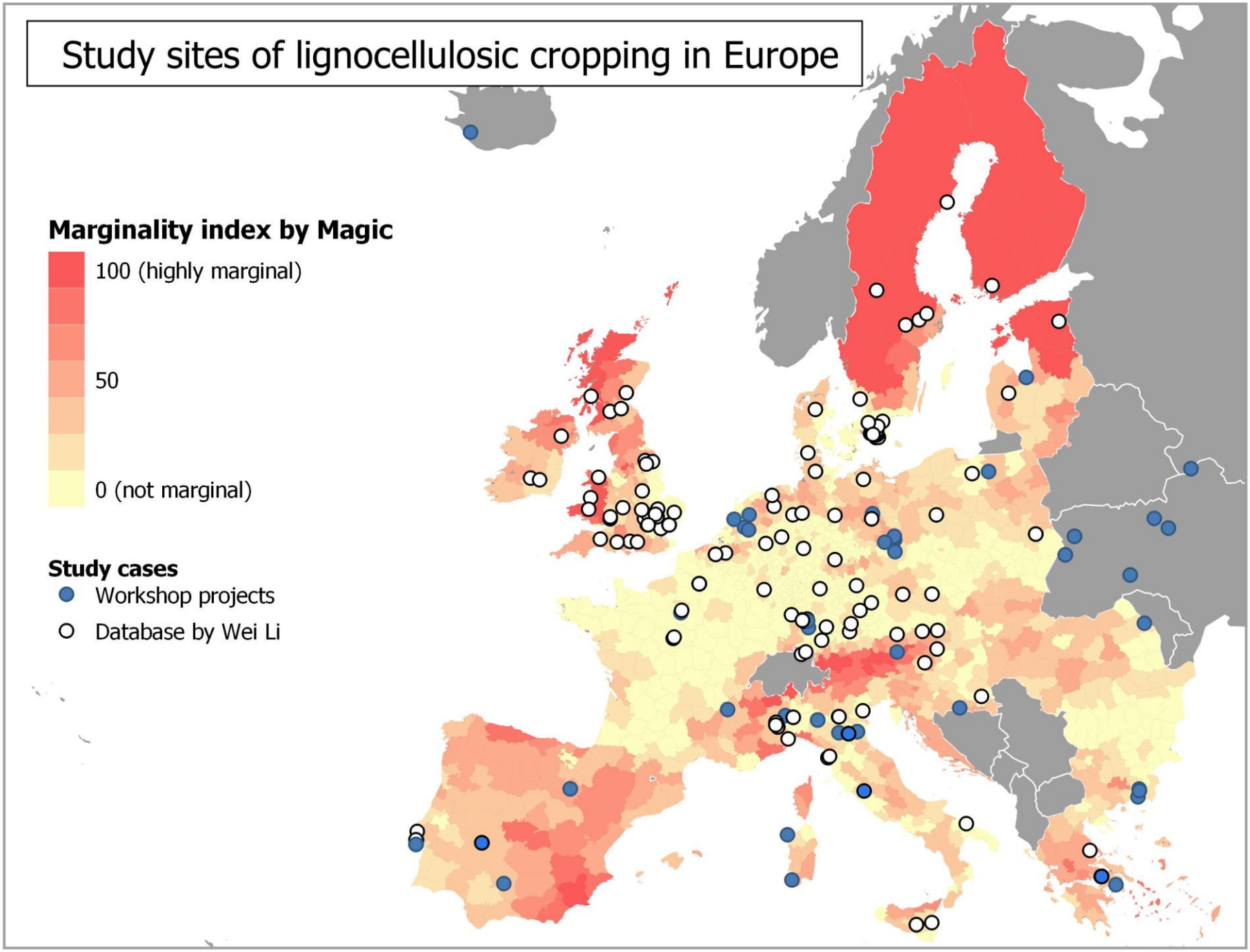
Received: 13 December 2017
Accepted: 26 June 2018
Published: 21 August 2018

Wei Li[1], Philippe Ciais[1], David Makowski[2] & Shushi Peng[3]

Reliable data on biomass produced by lignocellulosic bioenergy crops are essential to identify sustainable bioenergy sources. Field studies have been performed for decades on bioenergy crops, but only a small proportion of the available data is used to explore future land use scenarios including bioenergy crops. A global dataset of biomass production for key lignocellulosic bioenergy crops is thus needed to disentangle

This project has re

Study sites of lignocellulosic cropping in Europe



Thank you for your attention