

Identifying and evaluating the implementability of value chain and webs based on crops cultivated on marginal lands in Southern and Central Europe – an early stage approach

25.06.2024
EUBCE

Valentin Schlecht
Ricardo Vargas-Carpintero
Moritz von Cossel
Iris Lewandowski



UNIVERSITÄT
HOHENHEIM

Midas

MARGINAL LANDS. INDUSTRIAL CROPS
AND INNOVATIVE BIO-BASED VALUE CHAINS



This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101082070.



Our aim for the Bioeconomy is to design and develop novel (more sustainable) biobased systems

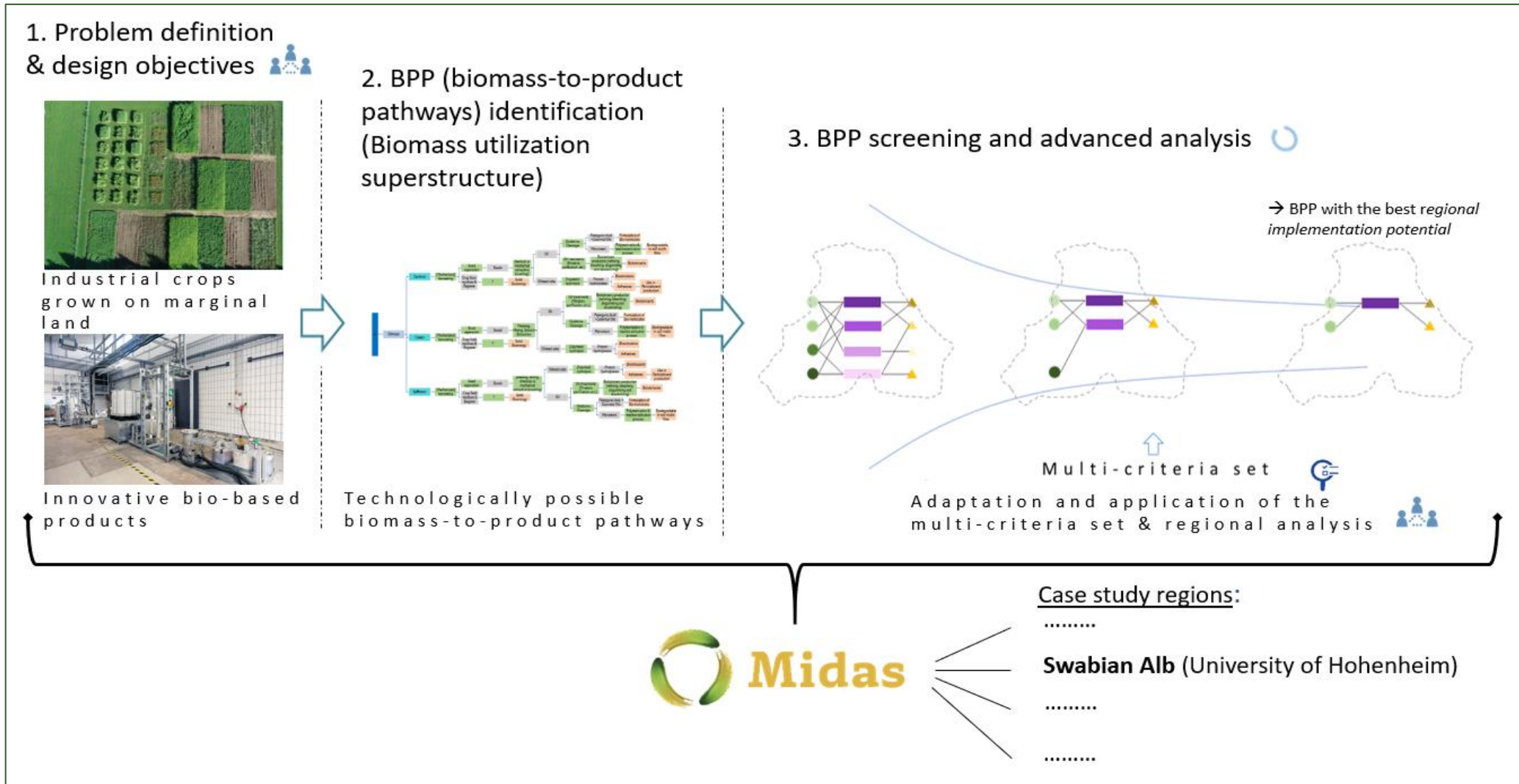
Multipurpose industrial crops grown on marginal lands (unused, abandoned or severely degraded) are able to **provide low-iLUC feedstock** for the biobased industry

But...

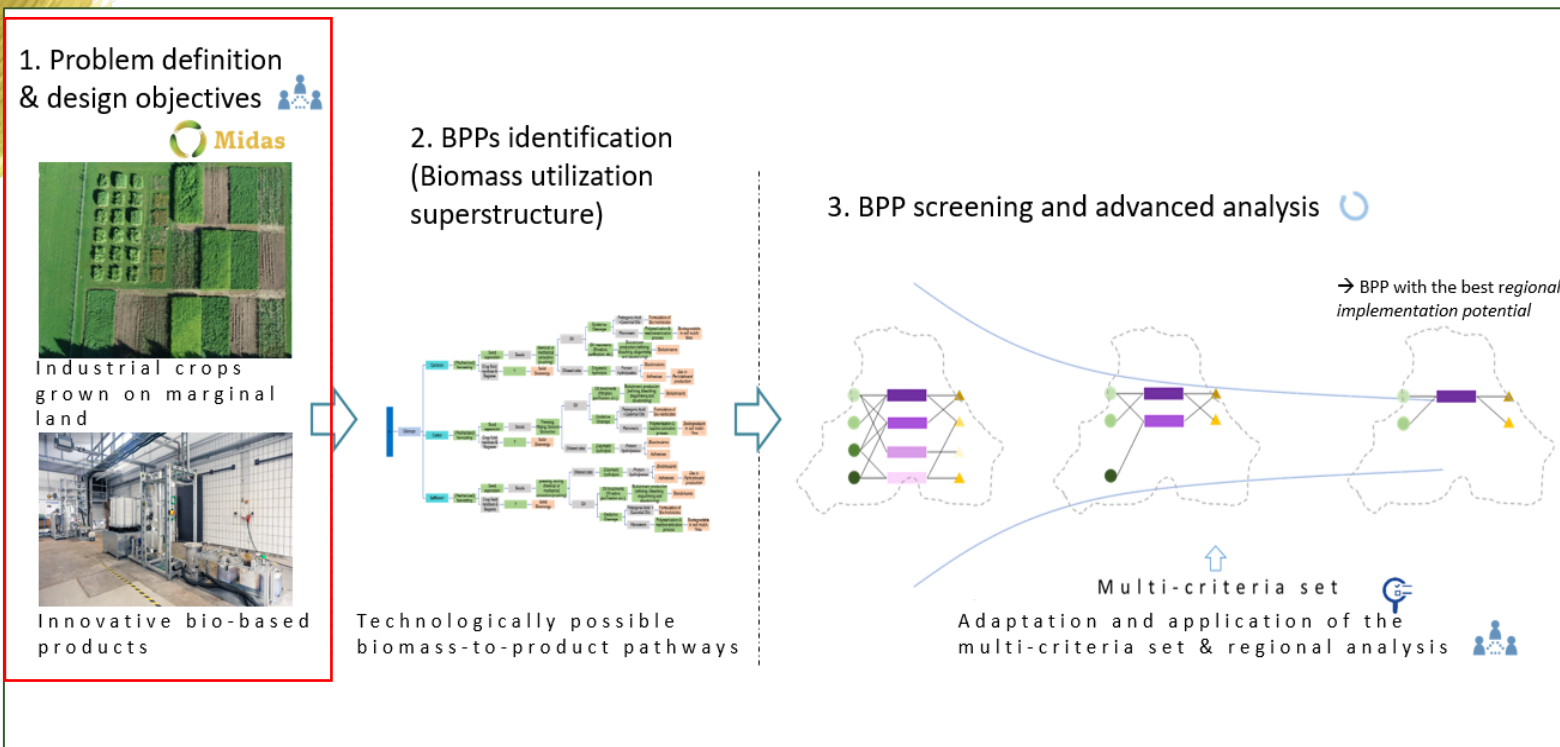
- It is not yet clear how farmers and other value-chain and web actors can be connected and rewarded for the deployment of marginal land
- How do we identify promising value chains opportunities and guide their design?
- How can we decide on matching combinations of region, crop and biobased product?
 - Context specific: dependencies a.o. on climate, soil, land availability, market

Need of system perspective → operationalization of integrated multi-criteria framework

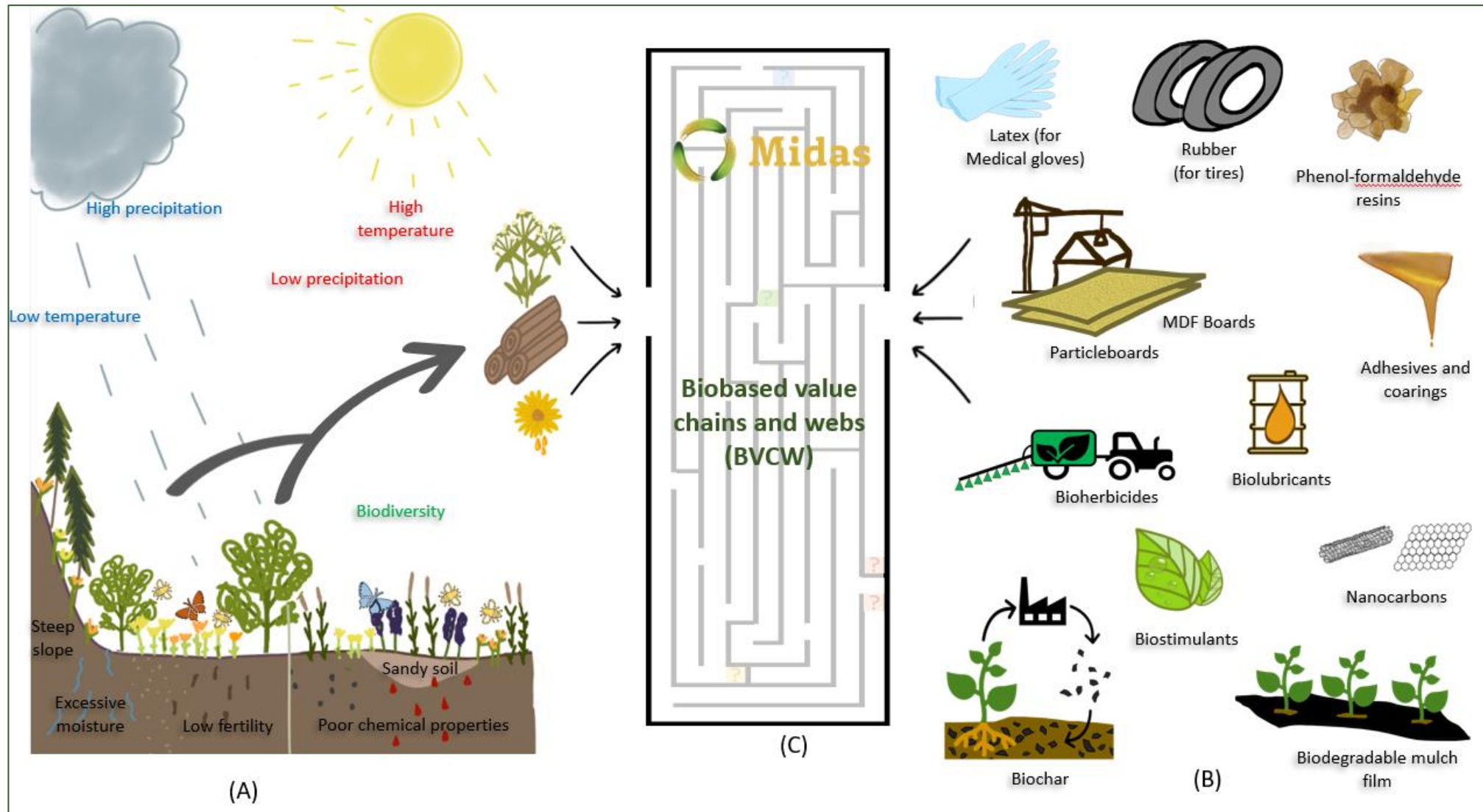
Methodological Approach



Multi-step design and development funnel – operationalized integrated multi-criteria framework adapted from Vargas-Carpintero 2024 (in review) (Schlecht et. al. in progress)



Step 1: Identify and understand the system components and stakeholders involved



Complexity of the selection of suitable value chain components.

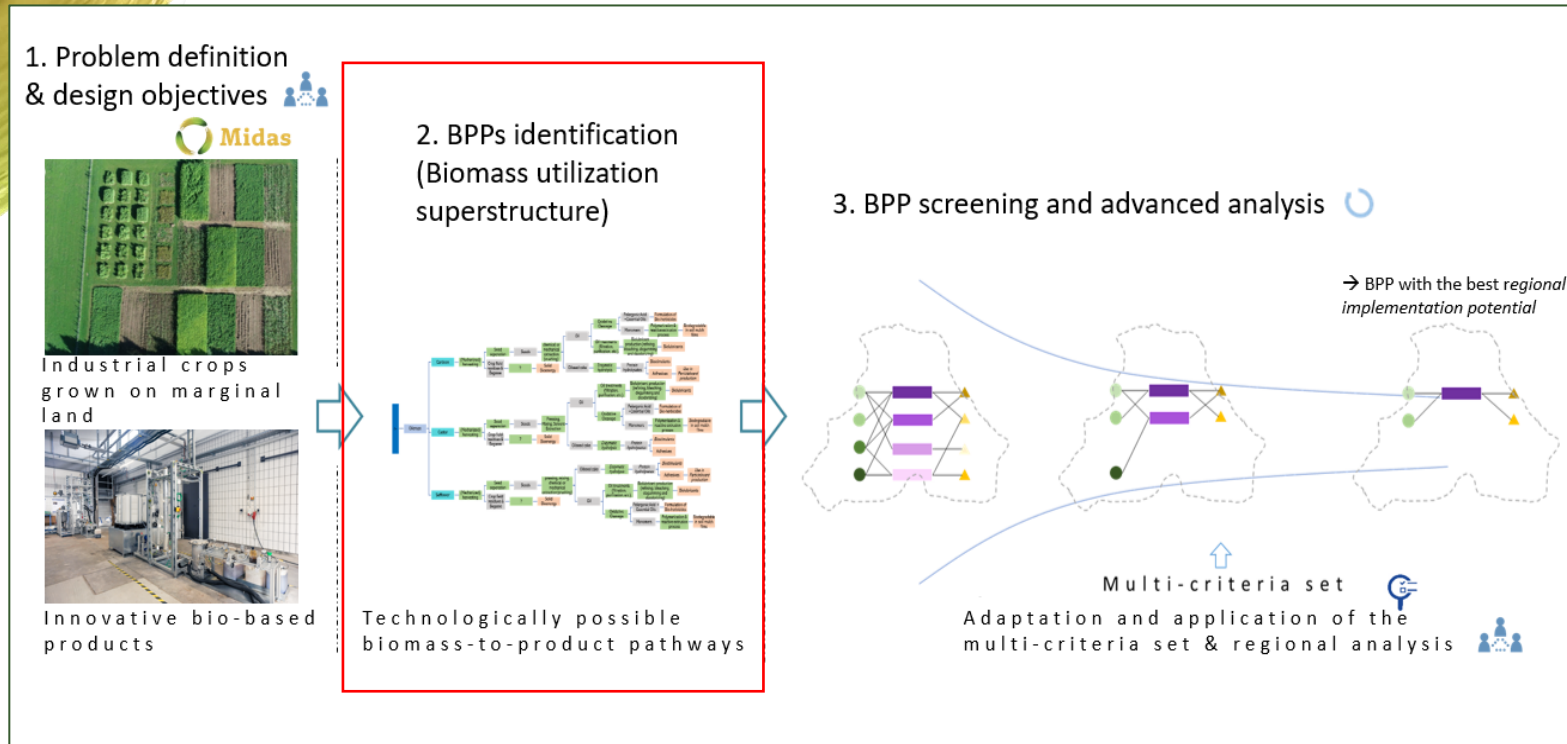
(A): Biomass production on marginal land in several regions with different marginalities, crops and cropping systems

(B): Bio-based product opportunities in the MIDAS project: Produced from cultivated feedstock on marginal land

(C): Aim = Identification of **novel BVCW with a regional implementation potential** - prioritization of BPPs. Schlecht et. al. in ⁵ progress

Understanding the system – problem definition

- Identification of the status quo
 - define goals and the starting situation
 - existing knowledge and expertise
 - data availability → low: early stage of the project and value chain design
- Identification and description of all elements in MIDAS:
 - region (and stakeholders involved – RAG)
 - Climate, land availability, land use in the region
 - biomass resources
 - general description of the crops, cycle, current uses, agronomic needs,...)
 - regional specific factors (case study design, size, soil, marginality, cultivation,...)
 - processing technologies (steps, scale, requirements, inputs, outputs,...)
 - products (general description, usability, market, alternative to...)



Step 2: Identify and map all possible systems
→ preliminary connect stakeholders

Mapping the system

Identification of technologically possible opportunities:

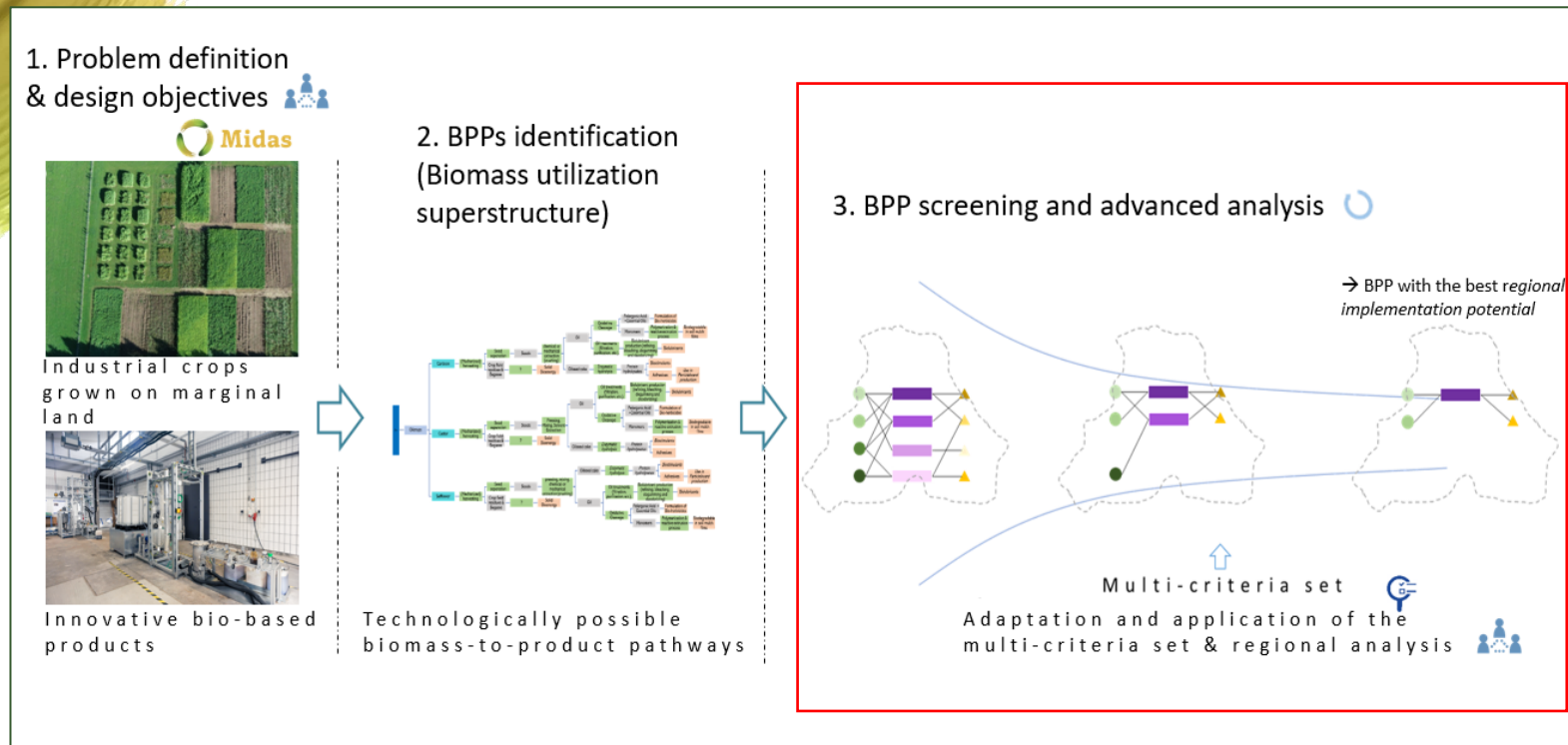
→ Biomass-to-product pathways
(in biomass use superstructures)

Defining these pathways in the case of MIDAS means combining:

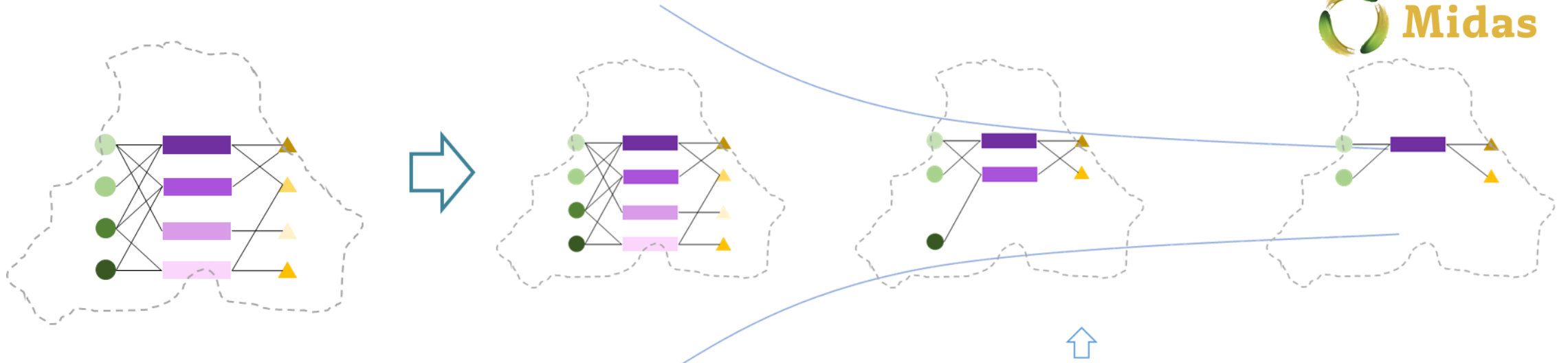
- feedstocks (industrial crops from marginal lands)
- biobased products
- for a specific region

→ Validation and completion based on stakeholders' input:





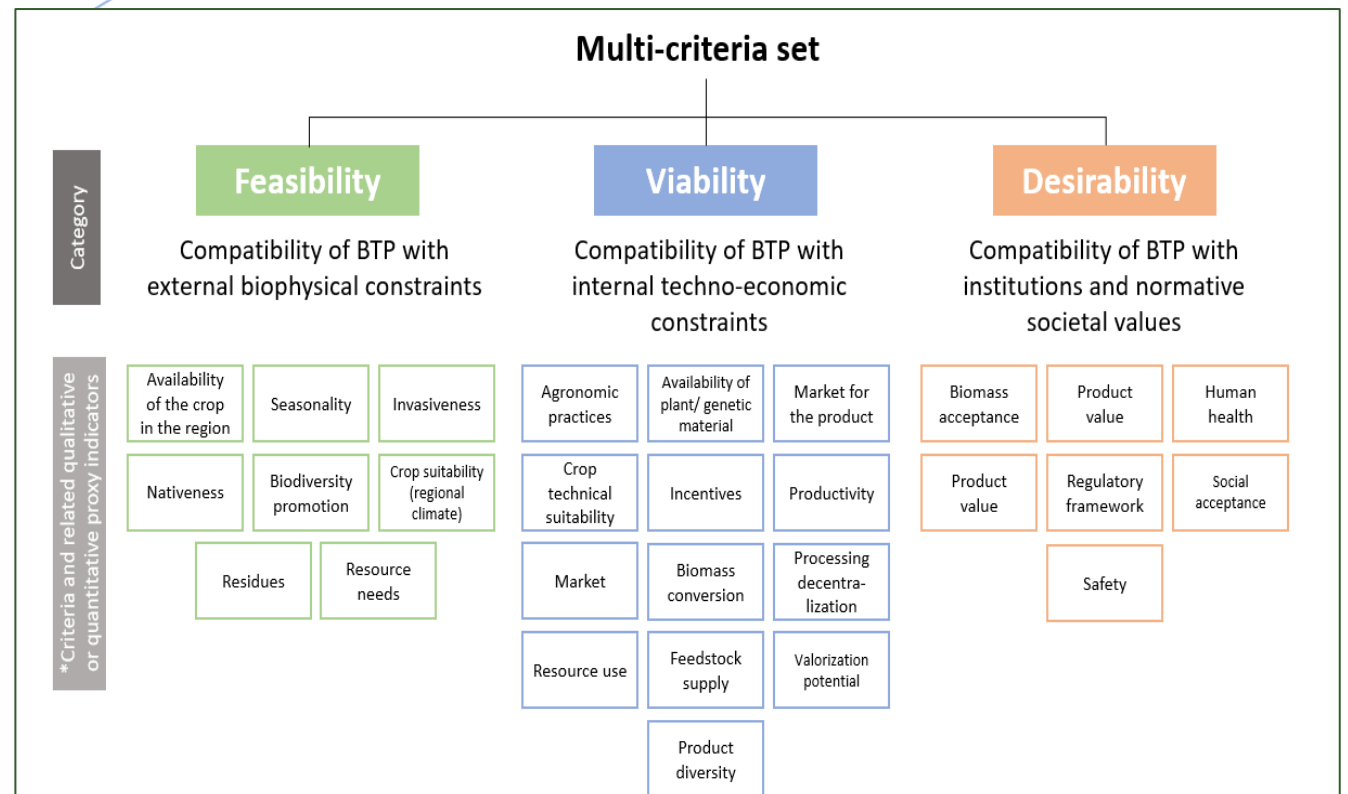
Step 3: Evaluate the systems and identify regionally promising pathways (iterative process)



Biomass use superstructure as starting point

Adapted a multi-criteria set

- MIDAS goals
- design objectives
- challenges (i.e. data availability)



What we did:

→ Developed two separated criteria sets:

a) **Crop** implementation potential in the region

b) Potential of the **biobased products** and crop suitability for the conversion technologies

→ Context specific → „Expert“ approach

→ **Simplified approach** for early stage design and development:

Defined simple questions with respective scoring logic (0-1)

Feasibility criteria	Questions related to the criteria	Scoring				
		0	0.25	0.5	0.75	1
Crop suitability related to the regional climate (temperature, precipitation etc.)	Is the crop adapted to the climatological conditions of the region?	No		Required adaptations (e.g. shading)		Yes
	Does the crop requires irrigation for its cultivation in the region?	Yes		Only in extreme drought conditions		No

Combining crop suitability with the region and products: Exemplary assessment results for Swabian Alp region

		Potential of the biobased products and applications and the crop suitability for these different conversion technologies (b)						
		Particle-boards	Biochar	Biolubricants	Biostimulants	Soil-biodegradable mulch film	Phenol formaldehyde adhesives	Carbon nanofilaments (CNF) and graphene
Crop implementation potential in the region (a)	miscanthus 0.66	0.68	0.73	-	-	-	-	0.46
	hemp 0.66	0.70	0.76	-	-	-	-	0.46
	melilot 0.66	TBI (0.66-0.71)	TBI (0.67-0.78)	-	-	-	-	-
	crambe 0.59	-	-	TBI (0.6-0.66)	TBI (0.66-0.69)	TBI (0.67-0.71)	0.60	-

→ Average of scores was calculated to obtain results

→ Combining crop suitability in the region (a) with crop suitability for the different products (b)

→ TBI = to be investigated (range of results from other crops)

→ **Early-stage results:** Can give indication of regional promising pathways as baseline to develop value chains and webs)

Conclusions

- Site-specific environmental and socio-economic conditions are influential in the development of biobased value chains and webs
 - The applied and adapted framework can showcase biomass-to-product pathways that have a **regional implementation potential** → mutual understanding
 - Evaluating the (regional) implementability of potential value chains and webs requires **multidimensional, holistic and site-specific assessment** approaches
- This work sets a **baseline for the further and detailed design and analysis**
 - LCSA, TEA, Biodiversity impact assessment,
 - Evaluation = iterative process
 - Realistic **quantitative data** e.g., biomass yields and qualities, is imperative

Midas

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

 midas-bioeconomy.eu

 [midas-project](https://www.linkedin.com/company/midas-project)

 [@MIDAS_EUProject](https://twitter.com/MIDAS_EUProject)

 [MIDAS Project](https://www.facebook.com/MIDAS-Project)

 info@midas-bioeconomy.eu

Thank you



ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
AGRICULTURAL UNIVERSITY OF ATHENS



WAGENINGEN
UNIVERSITY & RESEARCH



UNIVERSITY OF
HOHENHEIM

etaflorence
renewable
energies

UCLM Universidad de
Castilla-La Mancha
CAMPUS DE EXCELENCIA INTERNACIONAL

RE-CORD

NOVAMONT

Università
di Catania



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

NOVA
NOVA SCHOOL OF
SCIENCE & TECHNOLOGY

SCOLTUB

EUROPEAN CARBON
FARMERS

Investwood



ΕΑΠΕ
ανάπτυξης

UDS Université de
Sherbrooke

kaiima® Guatecs

CHIMAR.

CZEHEMP

ITAP
INSTITUTO TECNICO AGRARIO DE ALBACETE S.A.



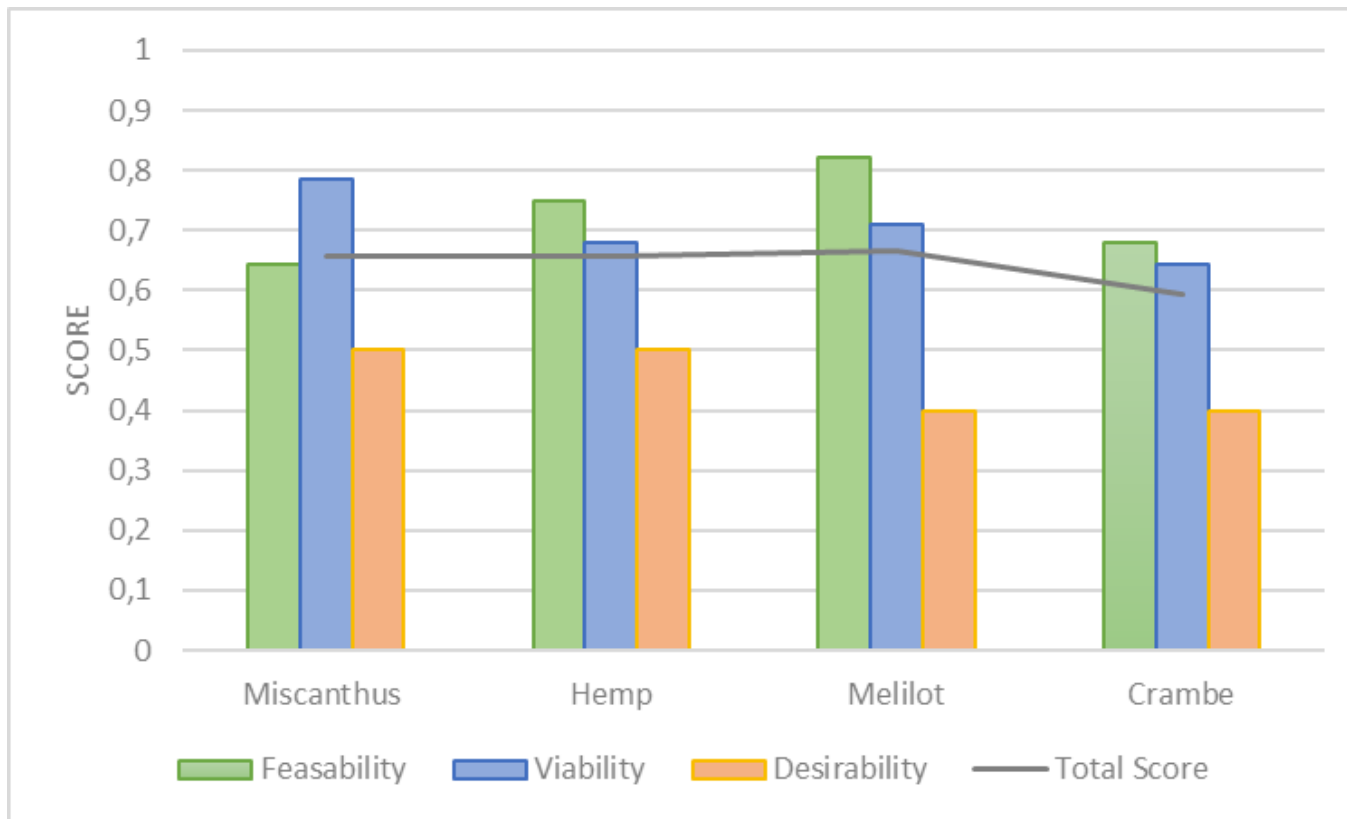
nokian
TYRES



Funded by
the European Union

This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101082070. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or REA. Neither the European Union nor the granting authority can be held responsible for them.

Exemplary assessment results for the crop suitability in the Swabian Alp region



Crop suitability in the region (a):

- Average of scores was calculated to obtain results per crop i.e., from the questionnaire,
- Additionally, regionally specific data was collected and discussed with the local experts.