



# German feasibility studies – Former sewage irrigation fields and lignite mining reclamation sites for bioenergy production

FORBIO Capacity Building Event, 21 February 2018, Kyiv, Ukraine



Dirk Knoche, Raul Köhler  
Forschungsinstitut für Bergbaufolgelandschaft e. V.  
Brauhausweg 2  
03238 Finsterwalde  
[www.fib-ev.de](http://www.fib-ev.de)

Rainer Janssen, Rita Mergner, Cosette Khawaja  
WIP Renewable Energies  
Sylvensteinstr. 2  
81369 Munich  
[www.wip-munich.de](http://www.wip-munich.de)

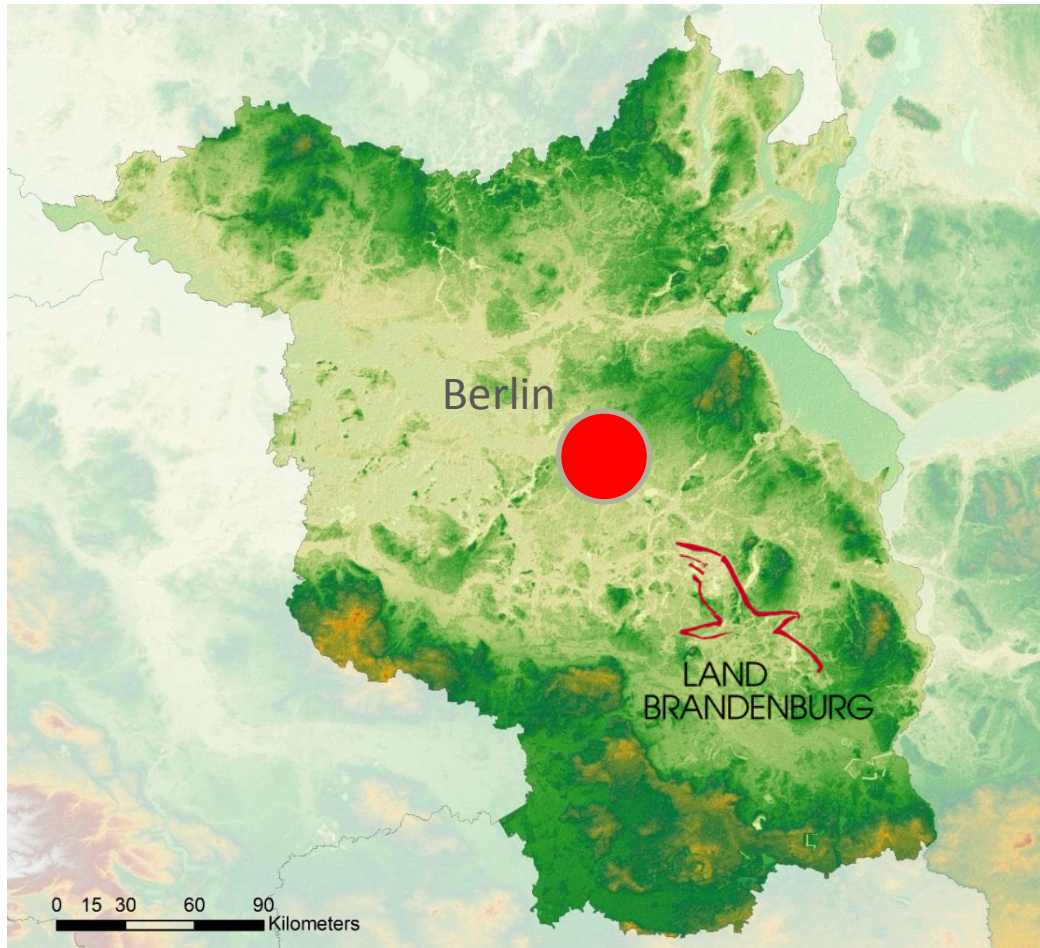


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.


# German Case Study – Metropolis region „Berlin & Brandenburg“

## Feasibility studies

- Agronomic feasibility
  - Techno-economic feasibility
- Potential value chains of bioenergy production on underutilized land







# German Case Study - Part I

## Metropolis Region *Berlin & Brandenburg*

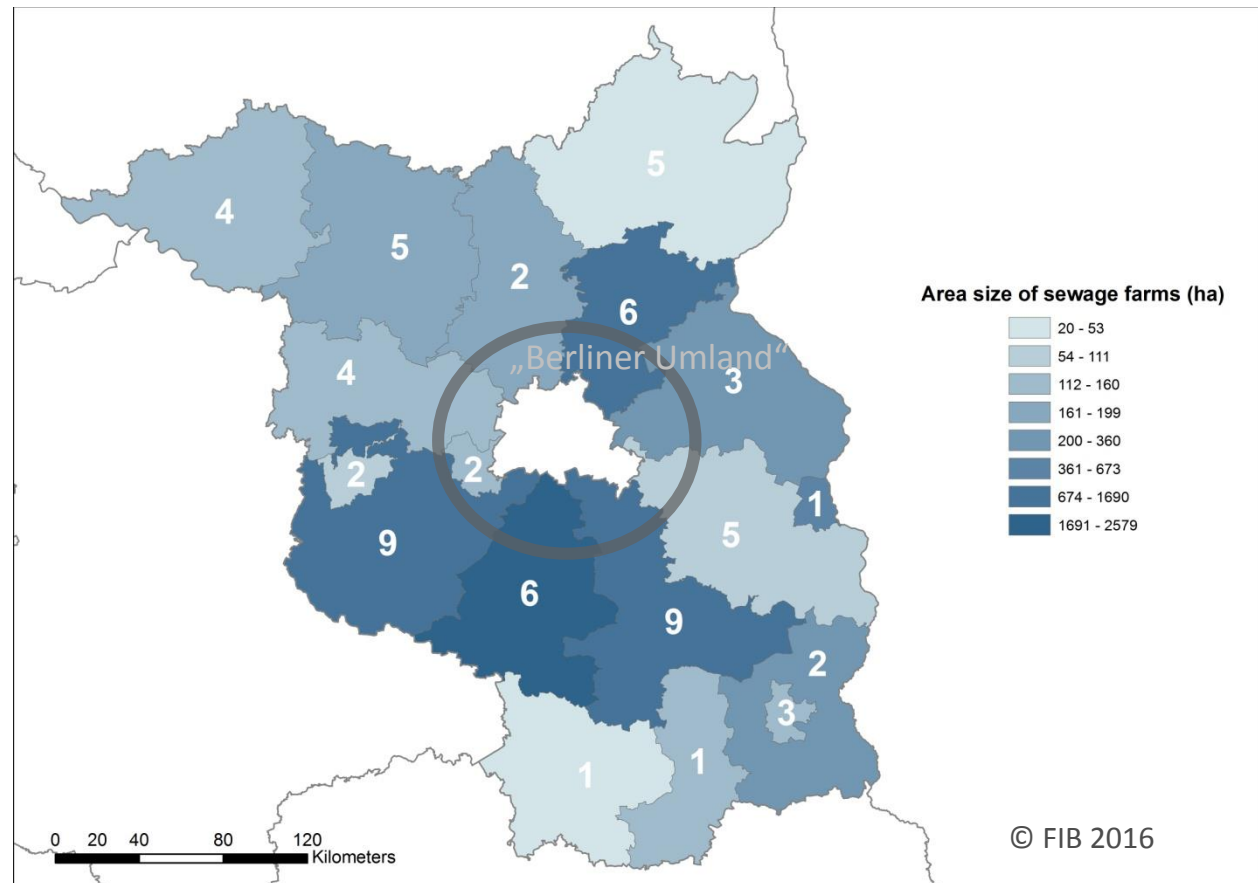
### Disused Sewage Irrigation Fields



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

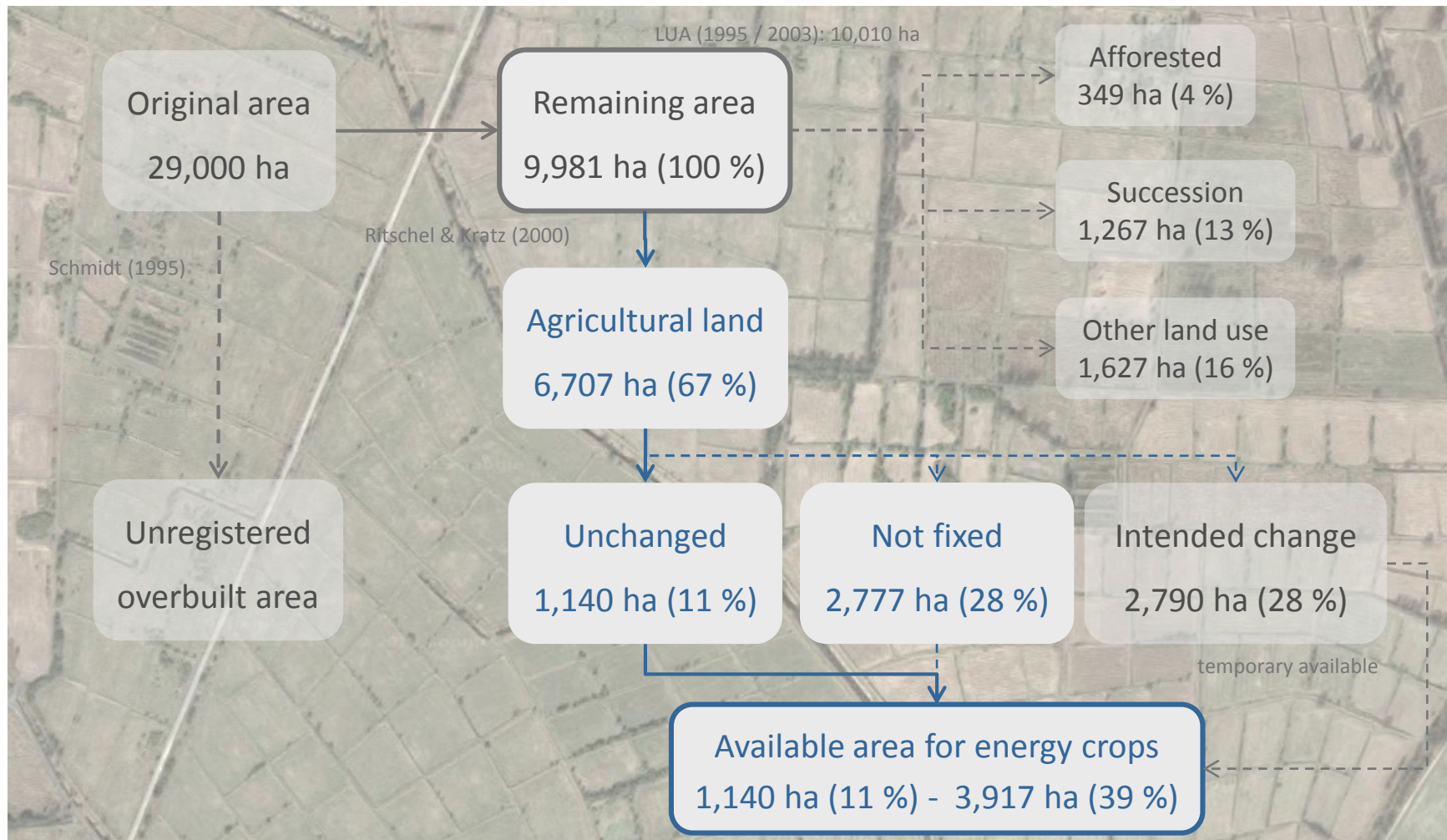
# Disused irrigation fields for urban and industrial waste-water cleaning

Total area:  
9,981 ha  
71 complexes  
(Ritschel &  
Kratz 2000)





# Landuse change and perspectives for energy cropping



# Vegetation aspects and soil dynamics



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.



# Small-scale feedstock production



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

## Promising energy crops (selection)

Species	Biomass yield (Mg DM ha <sup>-1</sup> yr <sup>-1</sup> )	Comments on usage, experience and cultivation
<i>Sorghum bicolor/ sudanense</i>	3-16	In practice on common agricultural land in Brandenburg; first, quite promising cultivation test on a disused sewage irrigation field
<i>Miscanthus x giganteus</i>	5-25	No cultivation on disused sewage irrigation fields, but promising to be tested due to the high biomass yield on low-yielding agricultural soils
<i>Silphium perfoliatum</i>	13-18	No cultivation on disused sewage irrigation fields, but promising to be tested due to the high biomass yield
<i>Populus x spec.</i>	0.1-12.9	Experience with cultivation in field trials and SRC on disused irrigation fields; site preparation and weed control needs to be done consequently; problems with heavy metal (Zn) induced micronutrient deficits (Fe)





# Value chain: Miscanthus for heat/electricity

## Estimation of costs and income (20 years)

Costs		EUR/20 a
<b>Establishment of plantation</b>	1,140 ha (3,208 EUR/ha)	3.7 M
<b>Annual maintenance</b>	Maintenance services (24 EUR/ha)	0.5
<b>Logistics</b>	Harvesting (chipping) (278 EUR/ha)	6.3
	Transportation (from the field to the final customer), distances 3 km – 14 km	2.6 – 7.2
<b>Overall costs (for 20 years)</b>		13.1 – 17.7 M

Income		EUR/20 a
<b>Option 1</b>	Selling miscanthus chips (80 EUR/ha)	26.4 M
<b>Option 2</b>	Selling miscanthus chips (50 EUR/ha)	16.5 M
<b>Total income (for 20 years)</b>		



# Obvious barriers for energy cropping

Barrier	Comments	Measure/Response
<i>Legal aspects</i>	<ul style="list-style-type: none"> <li>• soil protection in case of remediation of contaminated soils</li> <li>• nature and water preservation</li> <li>• ploughing up of grassland and succession areas</li> </ul>	multistage approval procedures according to soil, water and nature protection legislation
<i>Site properties</i>	<ul style="list-style-type: none"> <li>• anthropogenic soil types (Anthrosols)</li> <li>• nutrient imbalances, e.g. Fe deficit and excess supply of Zn)</li> <li>• sometimes with a multiple heavy metal pollution (Cd, Zn, Pb, inter alia)</li> </ul>	basic amelioration (liming, loosening) is required, choice of undemanding and quite competitive feedstock crops, heavy metal tolerant annual and perennial crops
<i>Agronomic</i>	<ul style="list-style-type: none"> <li>• high spatial and vertical soil heterogeneity and contamination</li> <li>• leading to contrasting yielding properties</li> </ul>	tillage and additional mineral fertilisers, establishment of low-input management systems, self-regenerating perennial feedstock crops, e.g. <i>Miscanthus</i> , mixed silphie
<i>Agro-technical</i>	<ul style="list-style-type: none"> <li>• small-scale use structure, mostly small management units (0.25 ha)</li> <li>• higher management requirements for the agricultural practice</li> </ul>	land consolidation & reshaping, forming management units of >20 to 30 ha, establishment of alley-cropping systems





# Miscanthus ... First promising cropping experiences on marginal soils in Brandenburg

FORBIO-Trainings-Event: Miscanthus (07.04.2018)

- Information about planting & maintenance
- Field demonstration (harvesting)
- Utilisation (e.g. litter)

© Roberto Töpfer



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.

# Klementinenhof...

## A prime example of Miscanthus cultivation in Brandenburg

1. Fields  
(4 or 6 years, 9.35 ha)
2. Temporary storage  
(400 m<sup>3</sup>, about 40 t)
3. Building with heating  
installation  
(heated base area: 78 m<sup>2</sup>)
4. Residential building  
(heated base area: 360 m<sup>2</sup>)





# Thank you for your attention!



Dirk Knoche, Raul Köhler  
Forschungsinstitut für Bergbaufolgelandschaft e. V.  
Brauhausweg 2  
03238 Finsterwalde  
[www.fib-ev.de](http://www.fib-ev.de)

Rainer Janssen, Rita Mergner, Cosette Khawaja  
WIP Renewable Energies  
Sylvensteinstr. 2  
81369 Munich  
[www.wip-munich.de](http://www.wip-munich.de)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No691846.