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Policy instruments in agriculture guiding towards sustainable use of peatlands in Europe

Sabine Wichmann et al.


Photo: S. Wichmann


Photo: S. Wichmann


Photo: S. Wichmann

Living peatlands (‘mires’) store carbon

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- Water saturation
- Biomass production > decay
- Dead plants accumulate as ‘peat’

Photo: H. Joosten

Peat accumulates during thousands of years
→ stores concentrated carbon in thick layers

A 15 cm thick peat layer contains per hectare more carbon than a High-Carbon-Stock tropical rainforest

On only 3% of the global land area, peatlands contain
> 500 Gigaton of carbon in their peat

Photo: H. Joosten

i.e. twice the carbon stock of the World's total forest biomass (30% of land)

Global peat C-sink is small

equals only 1% of annual C-emissions from burning fossil fuels

Photo: H. Joosten

Drained peatlands = large GHG source

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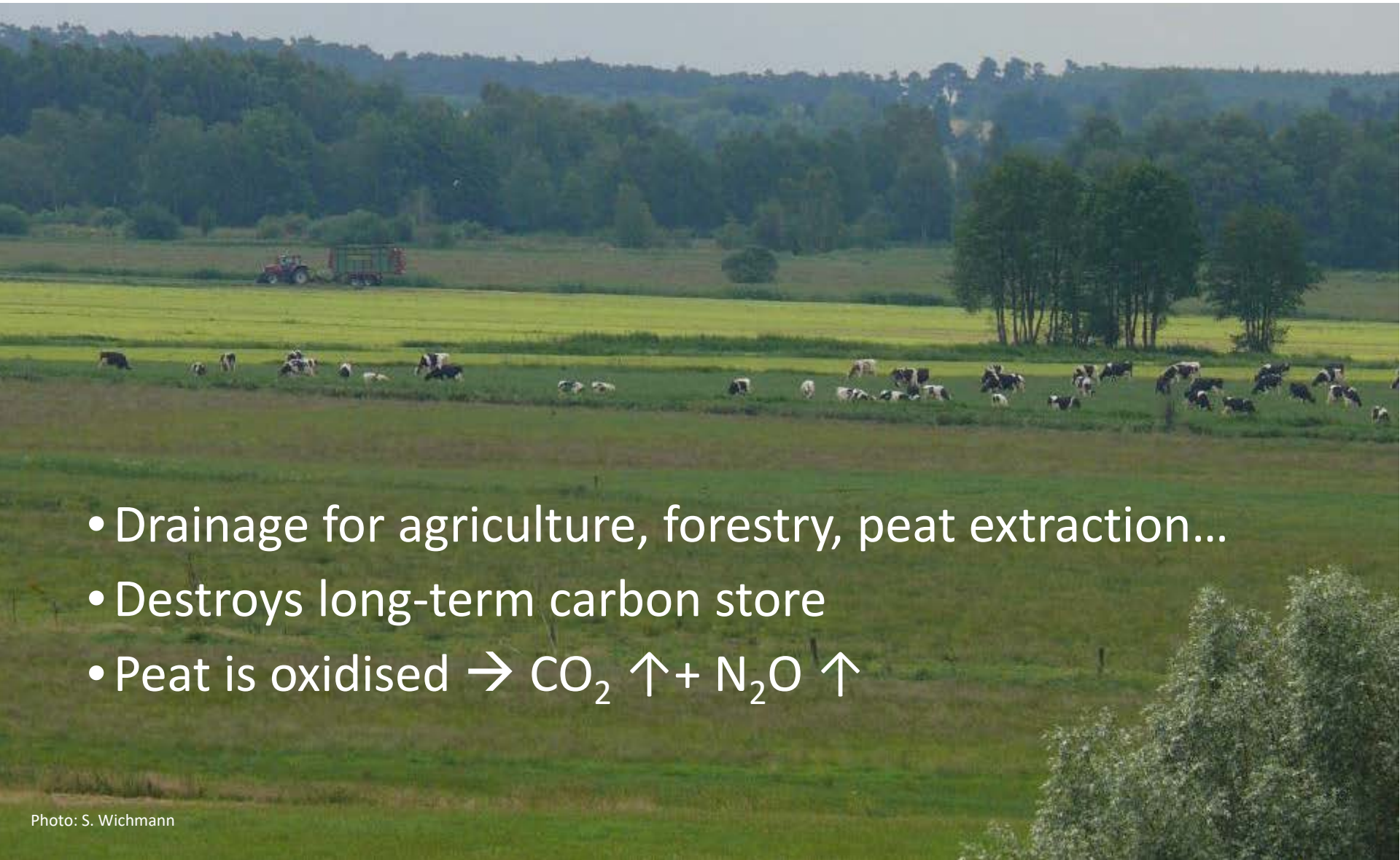

- Drainage for agriculture, forestry, peat extraction…
- Destroys long-term carbon store
- Peat is oxidised → CO_2 ↑+ N_2O ↑

Photo: S. Wichmann

Emissions from drained peatlands

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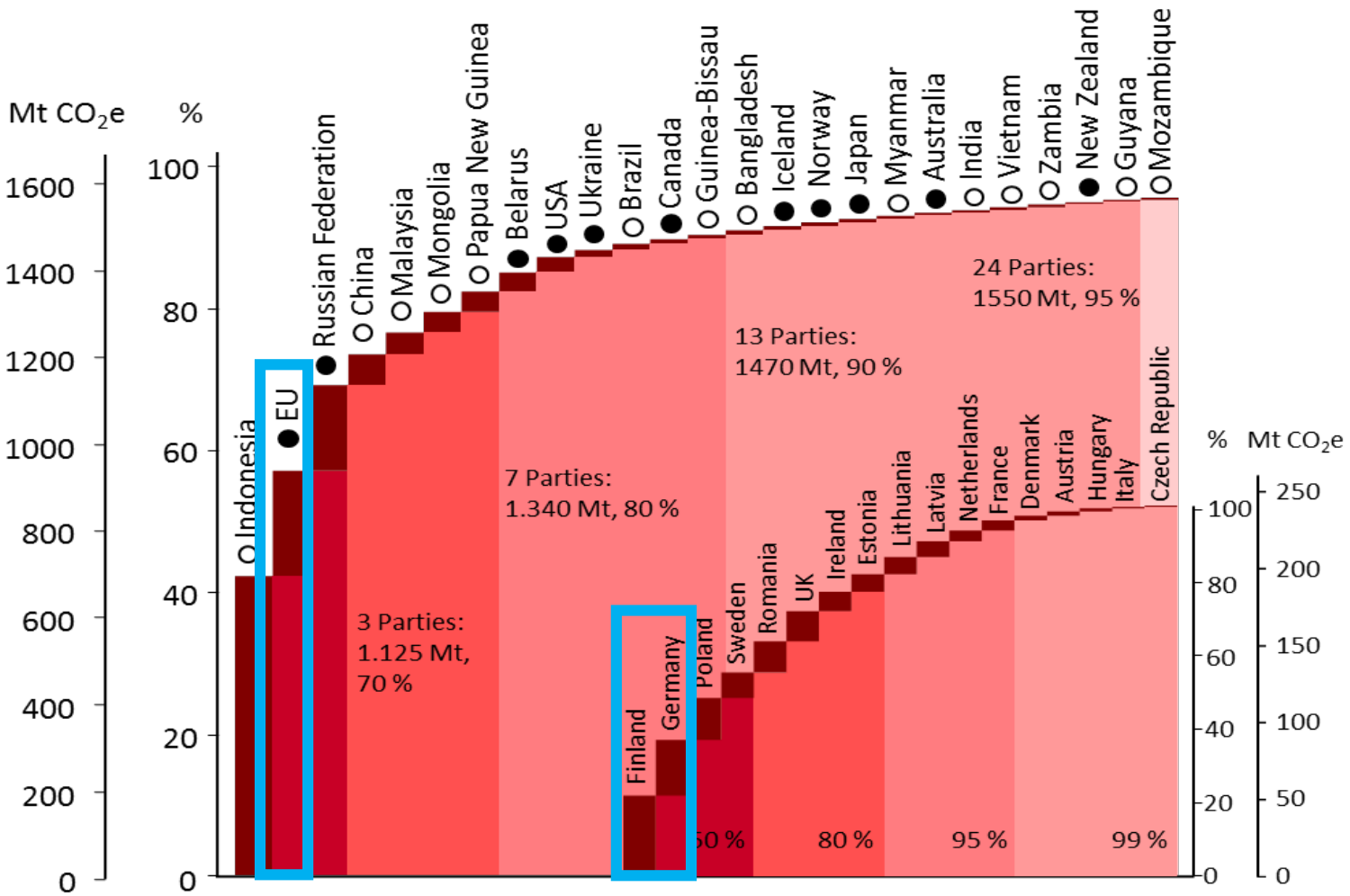
→ Indonesia leads the list of global top emitters, but EU is 2nd

→ within the EU: Finland is 1st and Germany 2nd



GMC 2016

Peatlands in Finland

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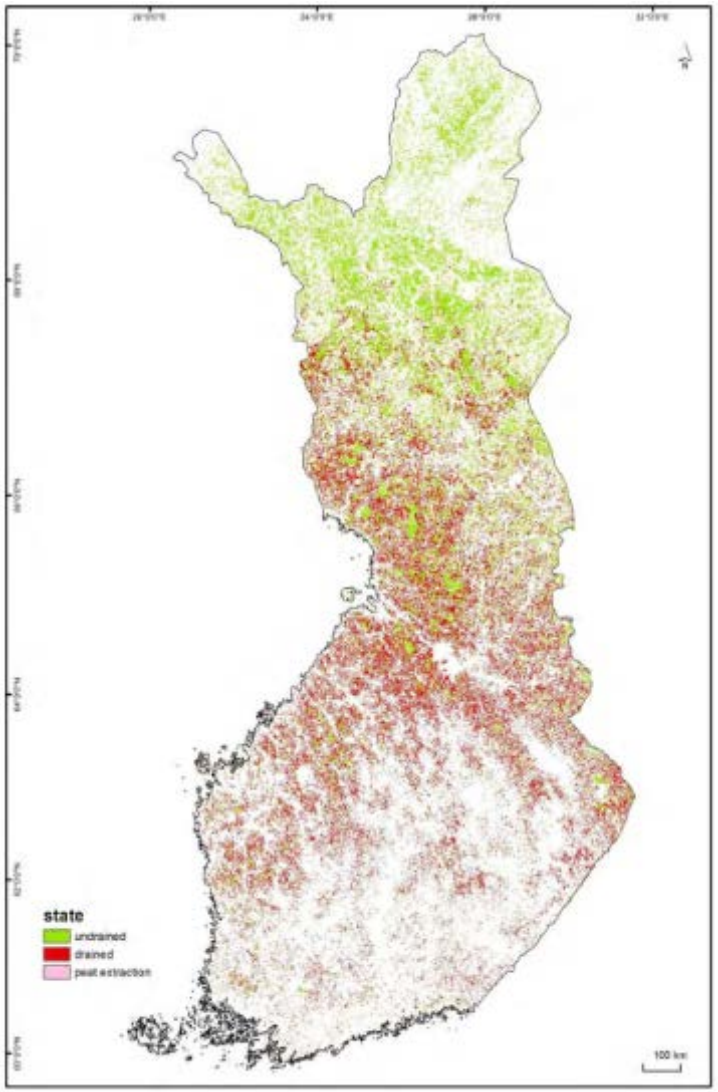
- one of the most peatland rich countries of the world
- maximum extent of “suo” (land with peat-forming vegetation): 10.4 M ha / 104,000 km^2
- pristine “suo” habitats left untouched: 3.5 M ha

- the world’s most extensive programme of draining peatlands, mostly for forestry: ~ 300.000 ha per year (1970s)



Barthelmes et al. 2015

Finland: drainage & emissions

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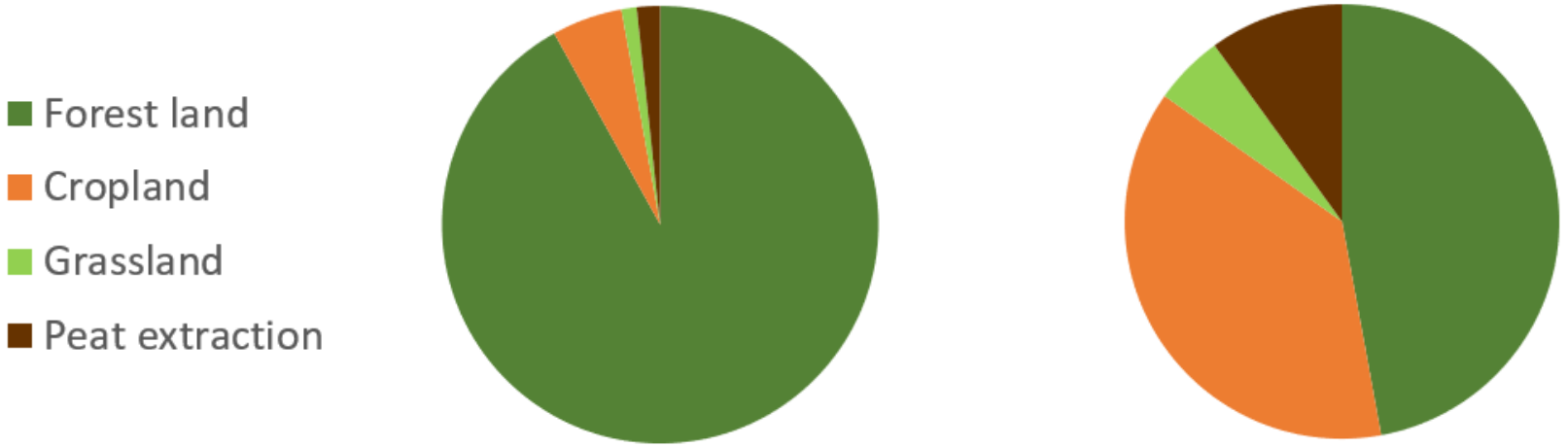
Drained land on organic soils
Total area: ~ 6.5 M ha

Emissions
Total: 16.4 Mt CO_2 / yr



→ Agricultural land: 6% of area, but 43% of CO_2 emissions
→ IPCC (2014) default emission factors: 54 % (total: 20.7 Mt CO_2)

After Barthelmes et al. 2015, based on National Inventory Report of Finland (2014)

Peatlands in Germany

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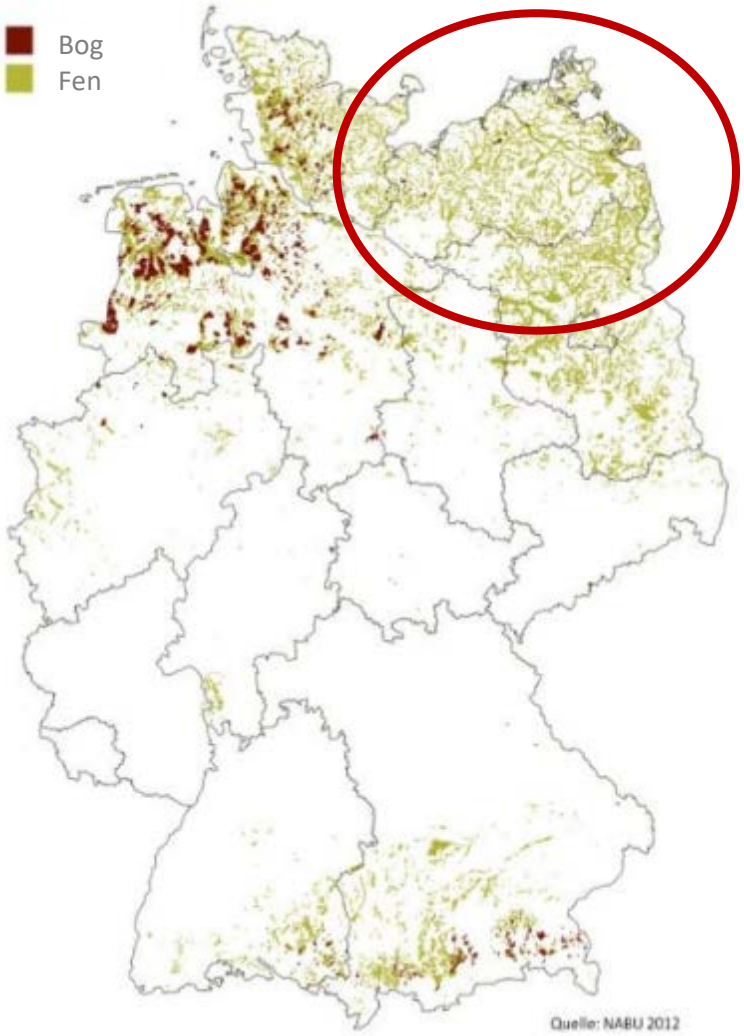
- Area: 1.4 M ha organic soils
  → 98 % drained

- GHG emissions: 47 M t CO_2e
  → 5.4 % of total German emissions

- In peatland rich regions even more…



Mecklenburg-Westernpomerania
→ drained peatlands largest source of GHG emissions

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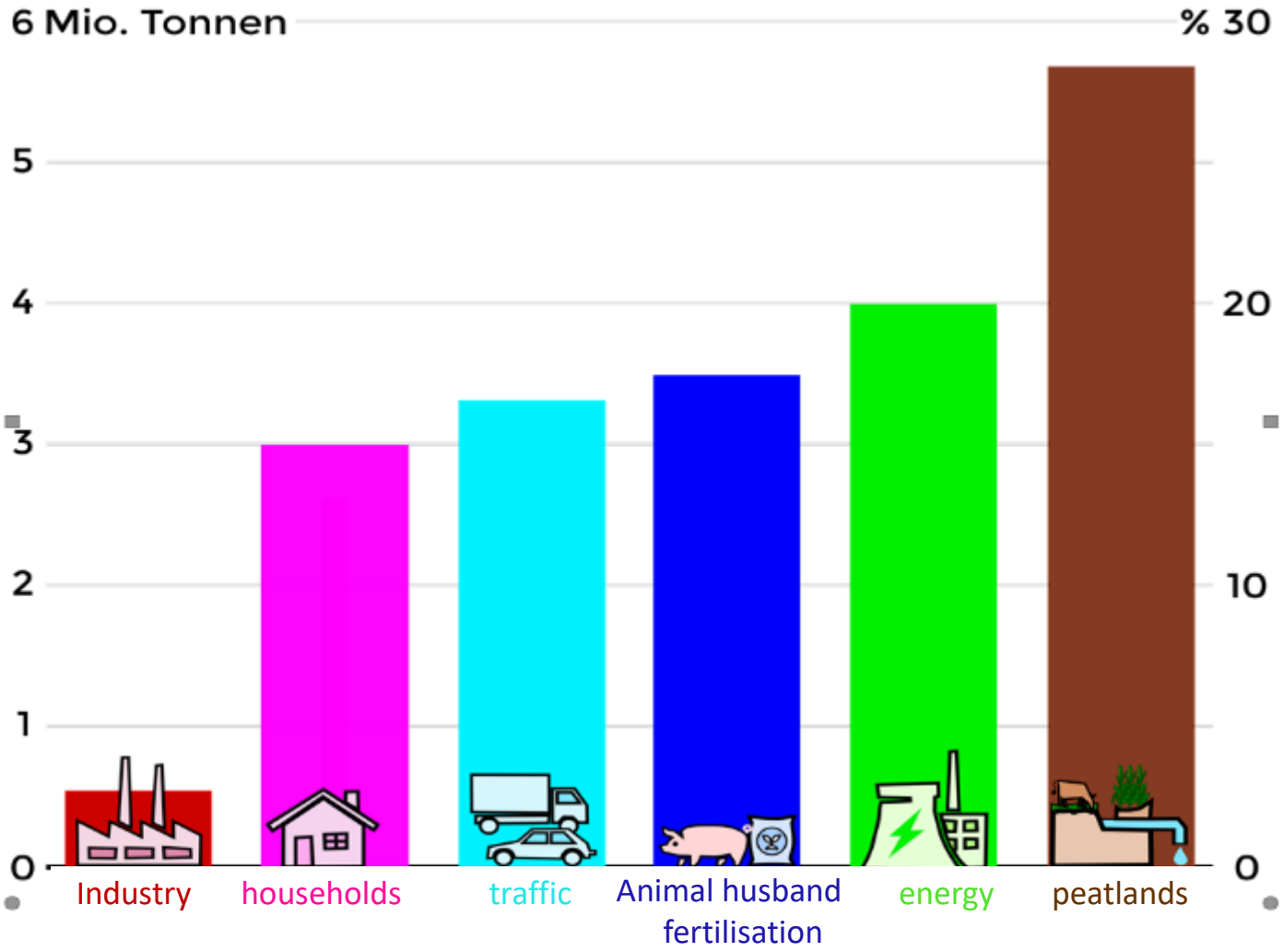

German agricultural GHG emissions

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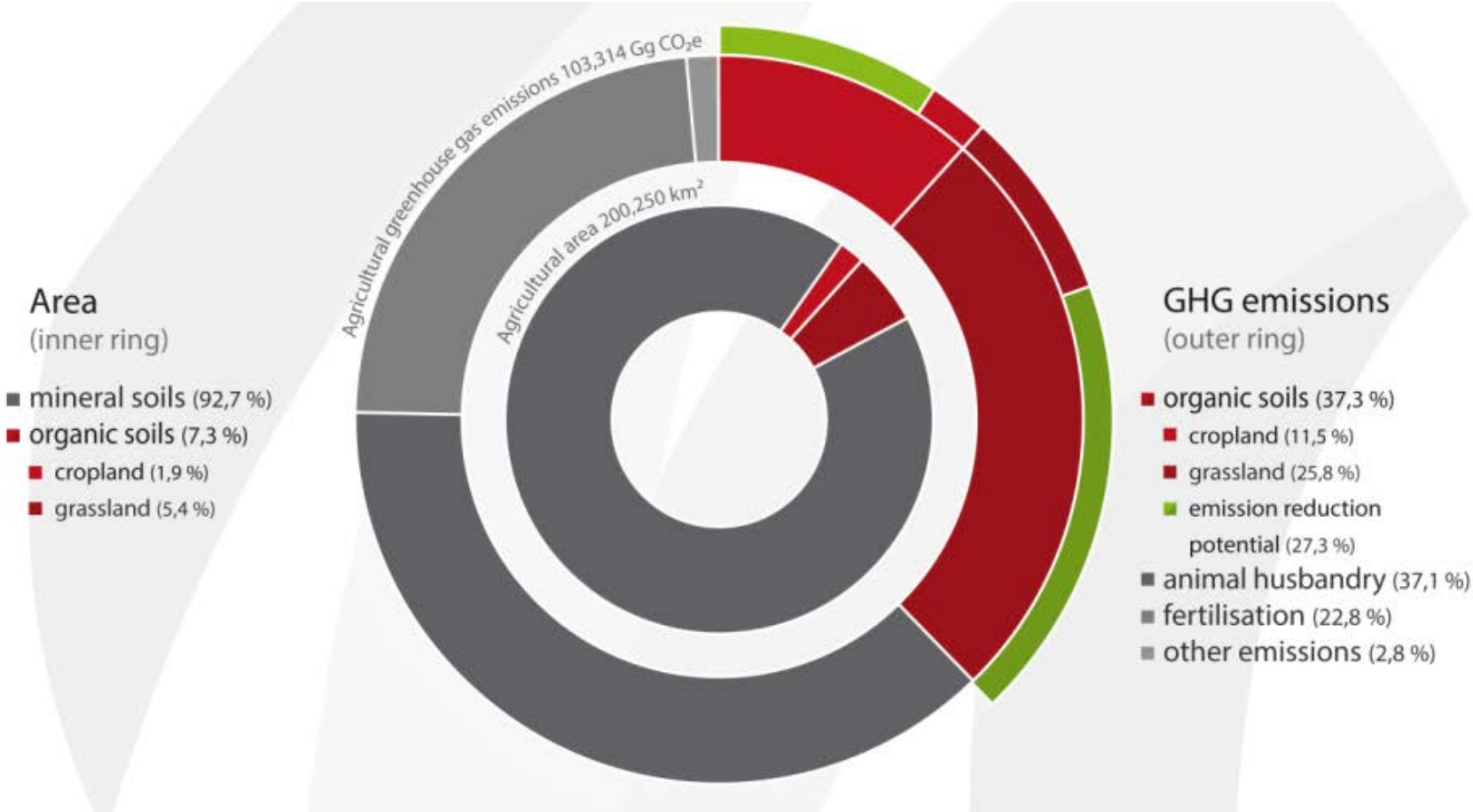
7 % of agricultural area → 37 % of agricultural emissions



GMC 2016, based on NIR (2016) Sector Agriculture + arable land and grassland from sector LULUCF

Deeply drained grassland on peat in Germany emits
29 t CO_2e per ha per year = 145,000 km with middle class car

Photo: H. Joosten

Milk and cheese from peat grassland have a huge emission foot print

1 kg cheese = 55 kg CO_2

1 L milk = 2.4 L petrol

Photo: H. Joosten

A potato field on peat in Europe emits 37 t CO_2e /ha/yr
= more C than the produced potatoes contain…

Potatoes are fossil resources...

Photo: H. Joosten

German peatland agriculture causes a climate damage of € 7.2 billion[1]

= equals the total net value added of German agriculture

and gets ~ € 410 million EU CAP direct payments[2]

Photo: M. Stegmann

[1] 40 M t CO_2e á € 180

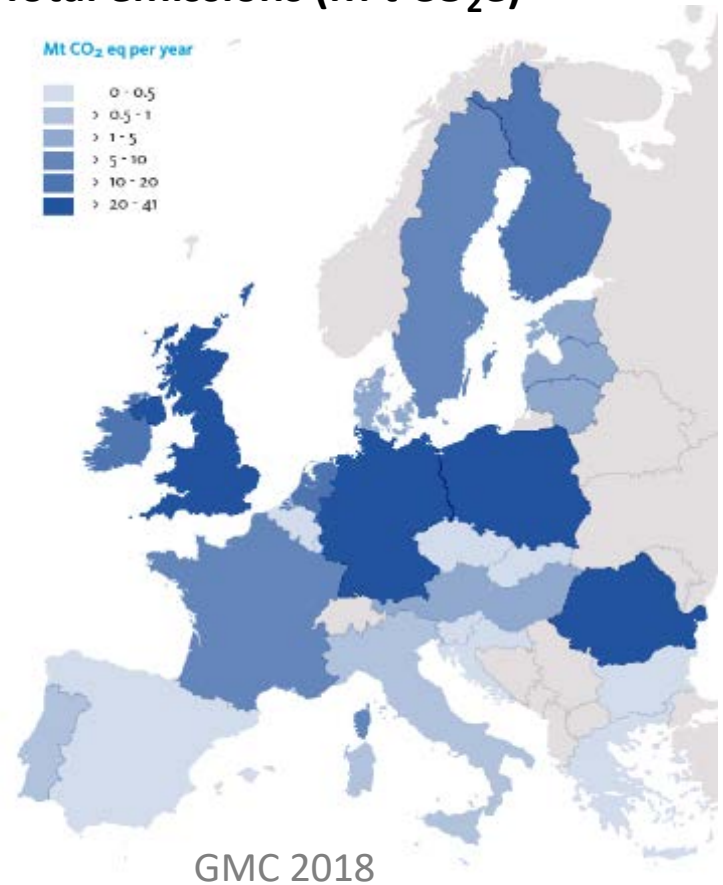
[2] 1.4 M ha á € 281

Peatland agriculture in the EU

→ high GHG emissions from agriculturally used organic soils

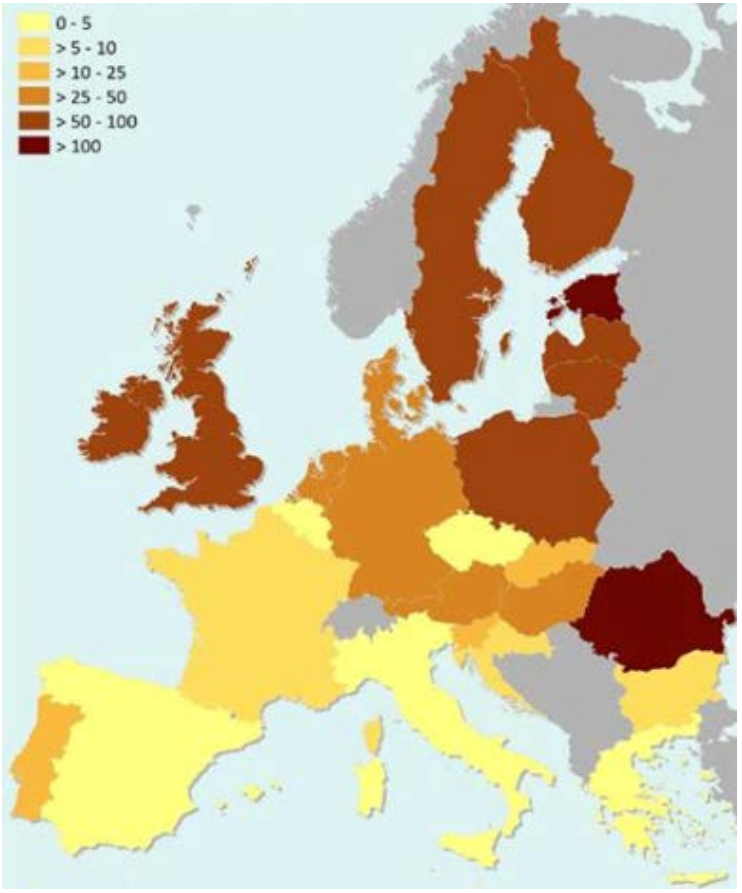
→ CAP: public money for climate damage

Total emissions (M t CO_2e)



GMC 2018

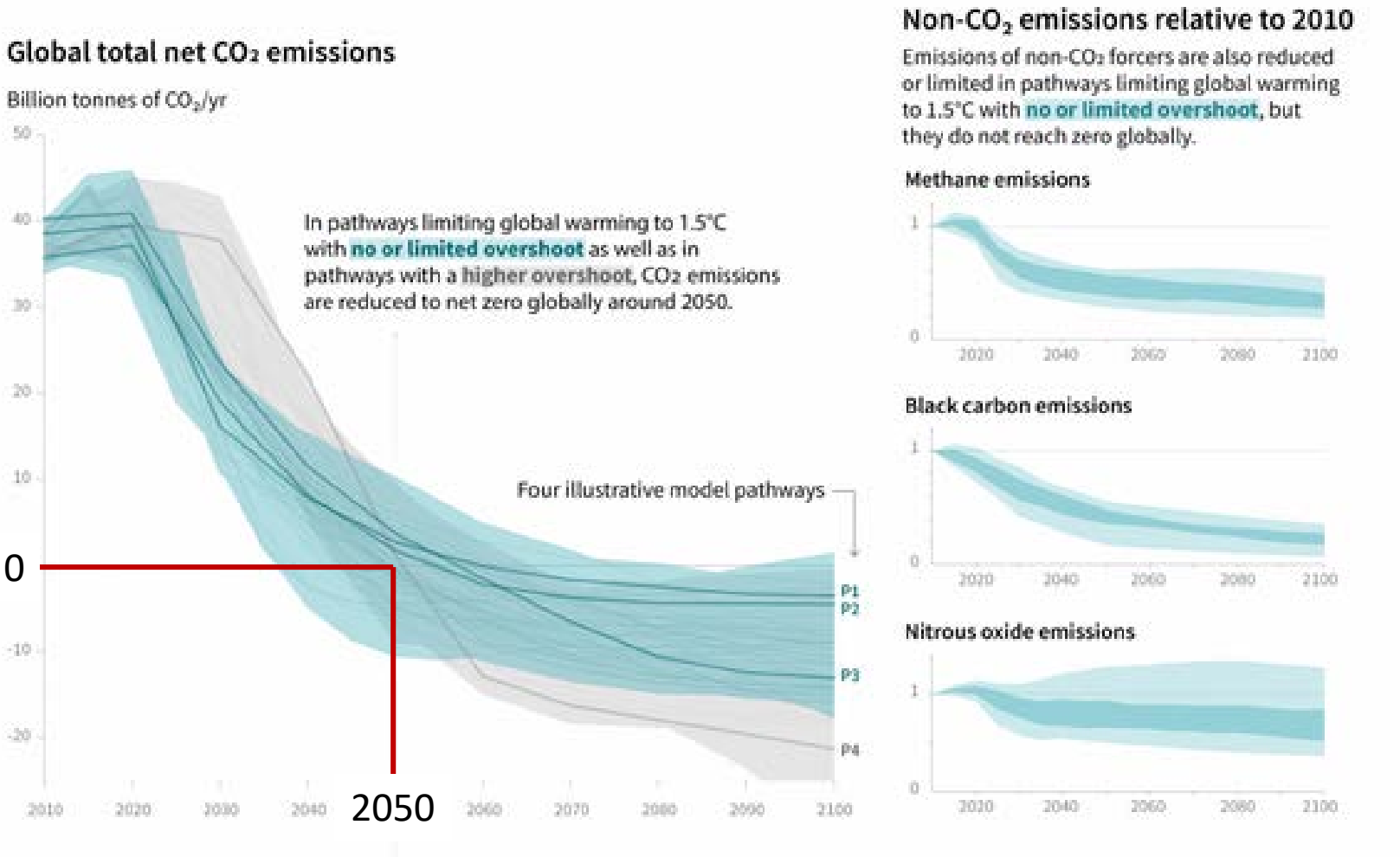
Share of emissions in total agricultural emissions (%)



Globally, drained peatlands emit 2 Gigatonnes CO_2e /yr, i.e. 0.4 % of the land produces 5% of all global emissions

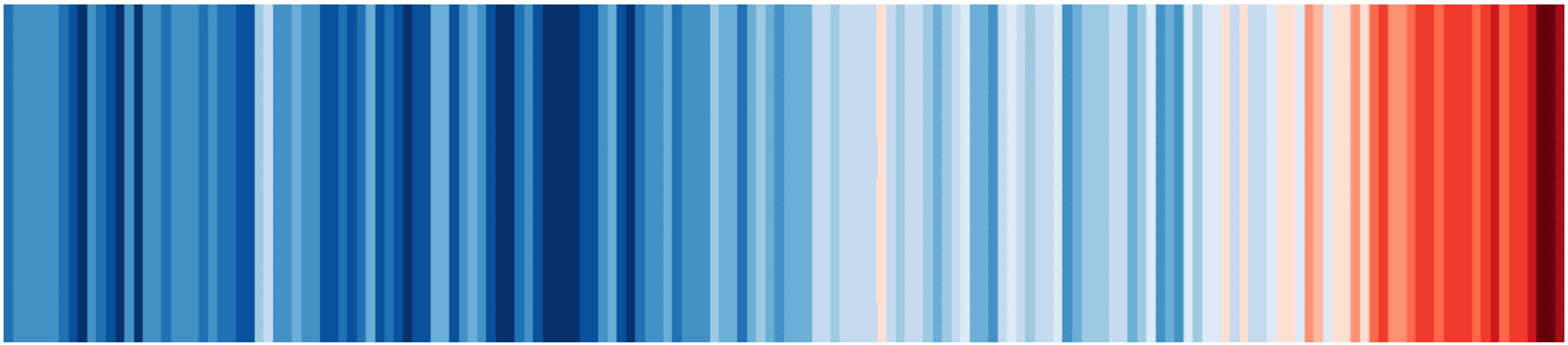
Photo: H. Joosten

Paris Agreement: limit global warming to 1.5 °C
→ net CO_2 emissions: Zero by 2050



IPCC (2018) Special Report on Global Warming of 1.5°C

Climate change is obvious



“Warming stripes”: annual global temperatures from 1850-2017

→ last 20 years included the 19 warmest years on record…

→ break radically with outdated developments from the past, also with respect to peatlands

Photo: H. Joosten

Stop draining peatlands

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Land use category	Emission reduction after rewetting (t CO_2eq ha^{-1} yr^{-1})	
	Temperate zone	*Boreal zone*
Forest land	6	2
Cropland	28	34
Grassland	20	25
Wetlands	9	11

GMC (2018), based on Wilson et al. (2016)

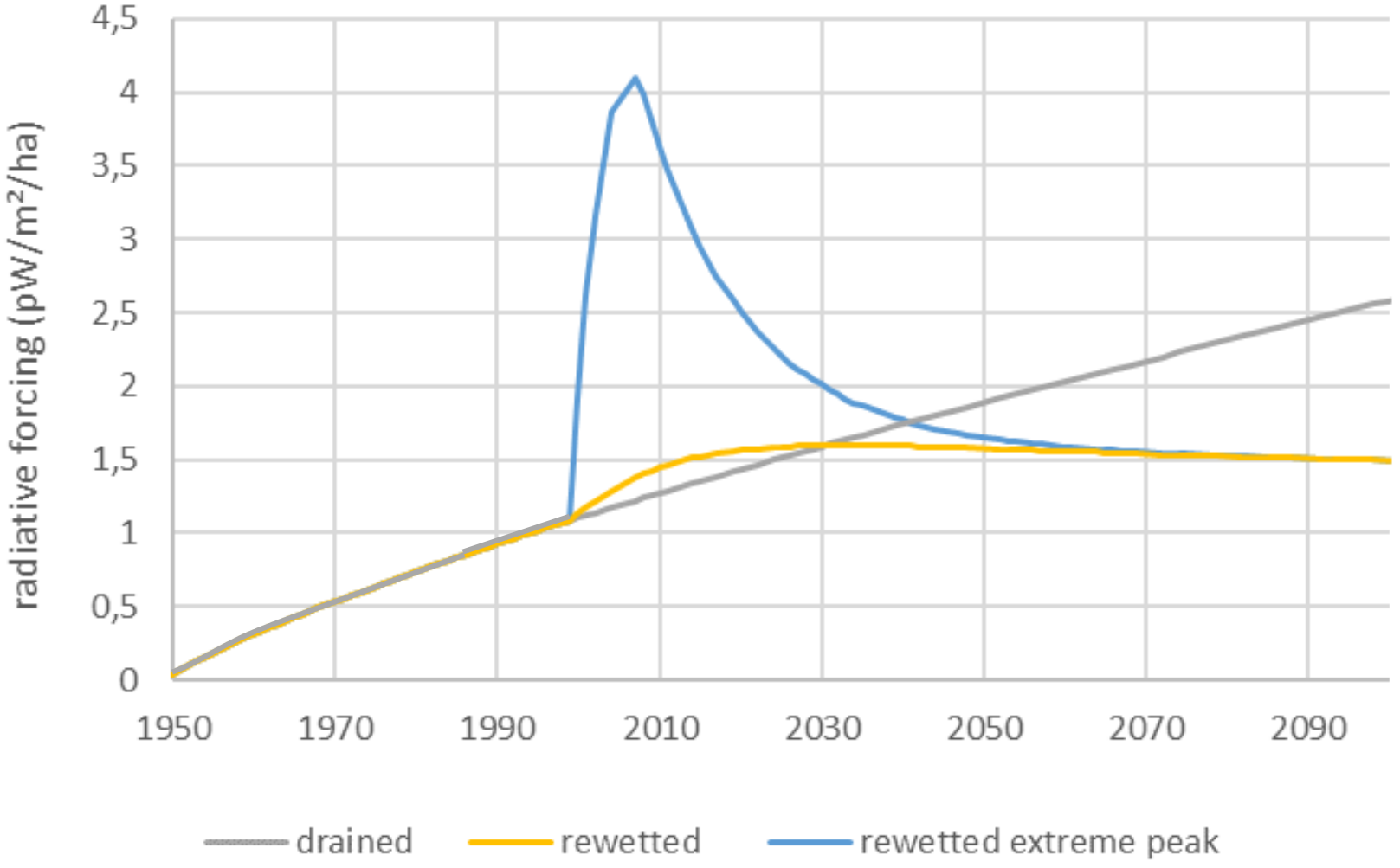
→ High emission reduction potential especially for agricultural land

Peatland rewetting efficiently mitigates CO_2 emissions

→ and don't be afraid of CH_4 emissions

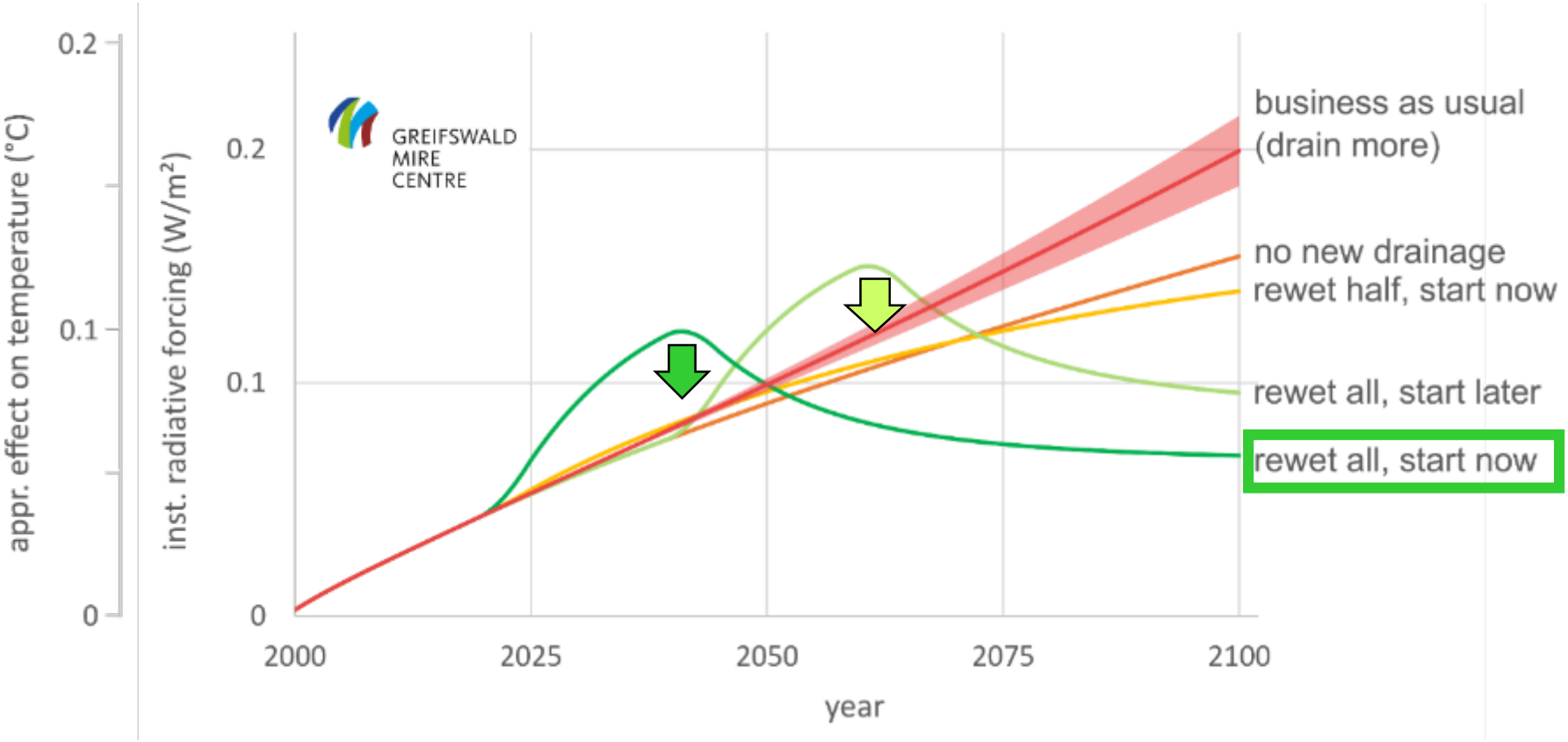
Photo: S. Wichmann

CH_4 is strong but short-lasting, CO_2 weak but persistent and thus accumulative. On longer run, CO_2 is much worse



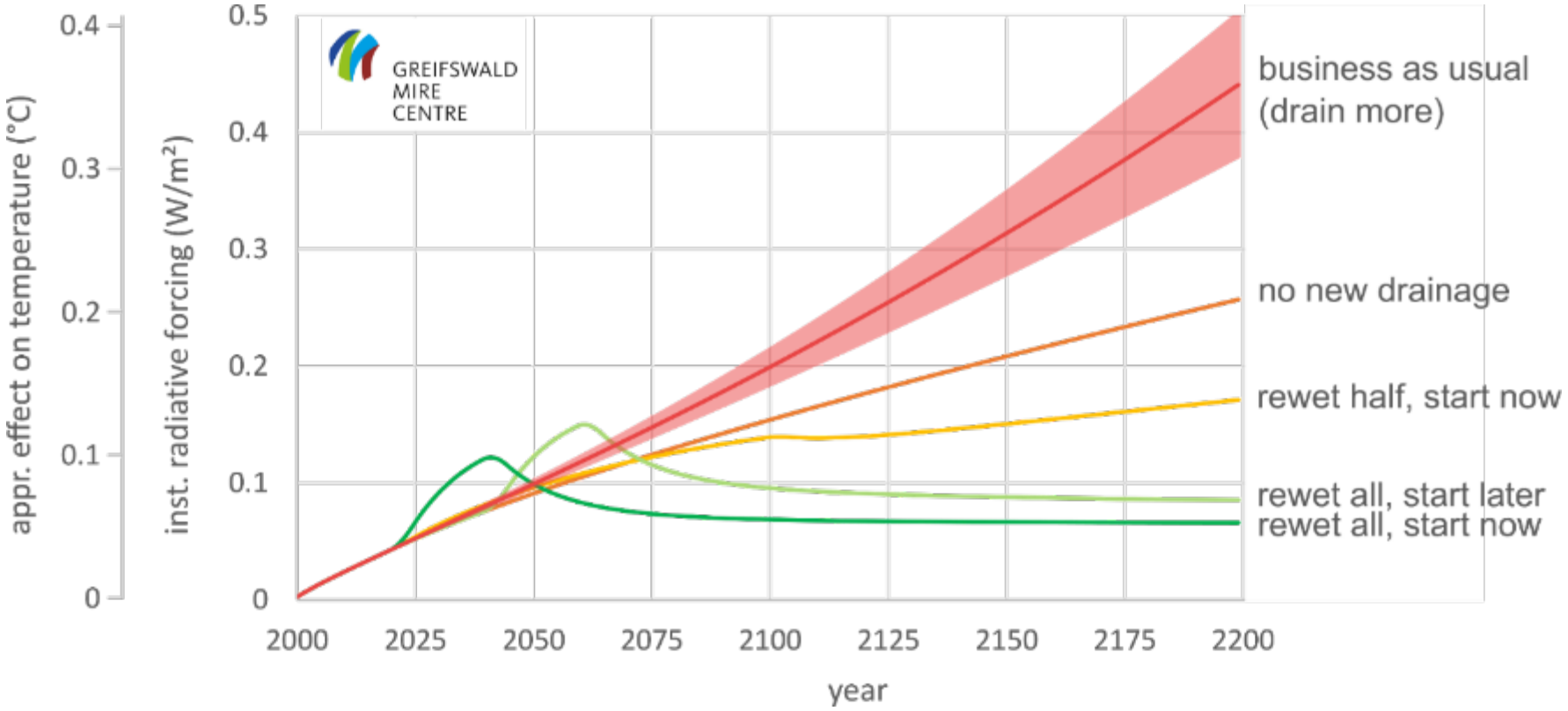
Global scenarios: Full rewetting is the best scenario of all.

Rewet all, start now avoids adding to peak temperature



Cf. Günther et al. (2019) Prompt rewetting of drained peatlands reduces climate warming despite methane emissions. Pre-Print: http://dx.doi.org/10.1101/748830.

Differences become larger in time.



Peatland rewetting
= losing productive land?

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Photo: S. Wichmann

Summer harvest of reed (D)

Paludiculture

„*palus*“ - swamp + „*cultura*“ - cultivation

→ **productive use of wet and rewetted peatlands**

Objectives

- Production → agricultural or silvicultural utilisation
- Maintain peat → stop subsidence and soil degradation
  → reduce GHG emissions

- Optional → peat formation; other ecosystem services

Photo: S. Wichmann

Paludiculture

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Bogs

- Peatmoss
- Sundew

Fens

- Reed
- Cattail
- Sedges
- Reed carnary grass
- Alder
- Willow
- Medicinal plants

→ Wide range of utilisation options

Sphagnum moss: renewable high quality growing media

Photo: S. Wichmann

Sundew: medicinal plant

Photo: S. Wichmann

Alder: furniture

Wet grasslands: biodegradable dishes, panels, bedding, combustion, …

Reed Carnary Grass

Photo: S. Wichmann

Sedges

Photo: T. Dahms

Water buffalos: meat & milk

Reed: thatching, construction, insulation, paper, combustion, biogas…

Foto: S. Wichmann

Foto: F. Tanneberger

Cattail: insulation, construction, fodder, energy, …

www.typhatechnik.com
www.naporo.com

Foto: S. Wichmann

Potential of paludiculture

Climate change mitigation

Efficiently reduces agriculturally GHG emission: 37% from only 7% of the area (D)

Water quality

„kidneys of the landscape“: N & P retention (e.g. DK, S)

Nature conservation

< 1% near-natural state → substitute habitat for endangered species (D)

Soil protection

Stops soil degradation and subsidence (infrastructure costs, risk of flooding, cf. NL)

Rural development

Sustaining peatland use, income, employment, renewable + regional products

→ Paludiculture = prospects for peatlands and for people!

Photo: S. Wichmann

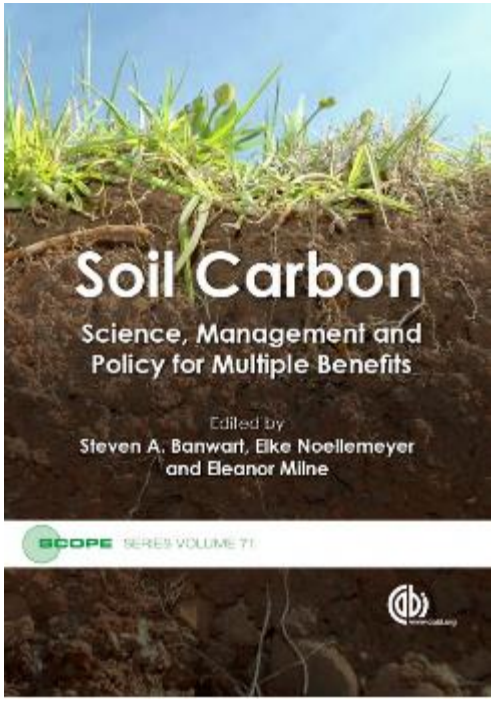
Award winning pilot projects

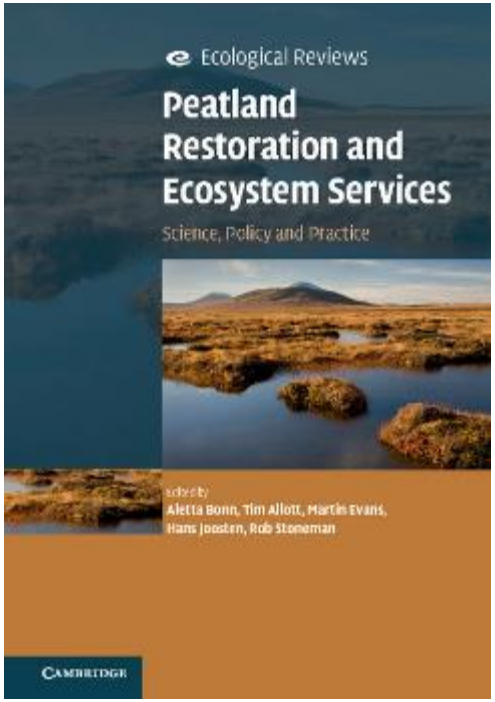
PALUDI KULTUR GREIFSWALD

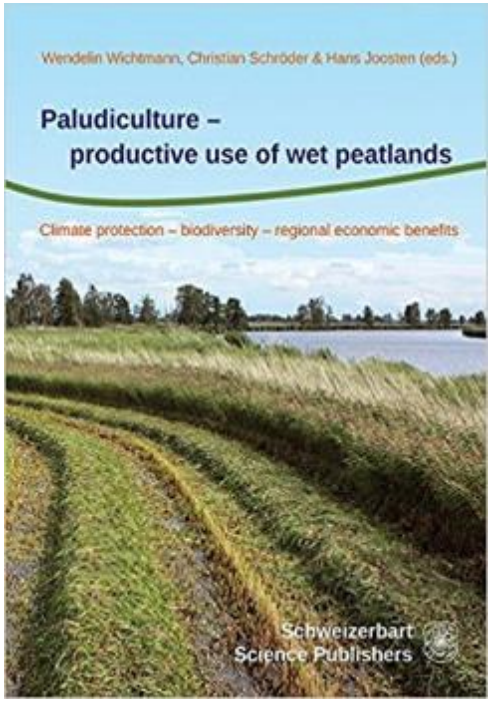
Photo: S. Wichmann

Photo: S. Wichmann

… knowledge is available …

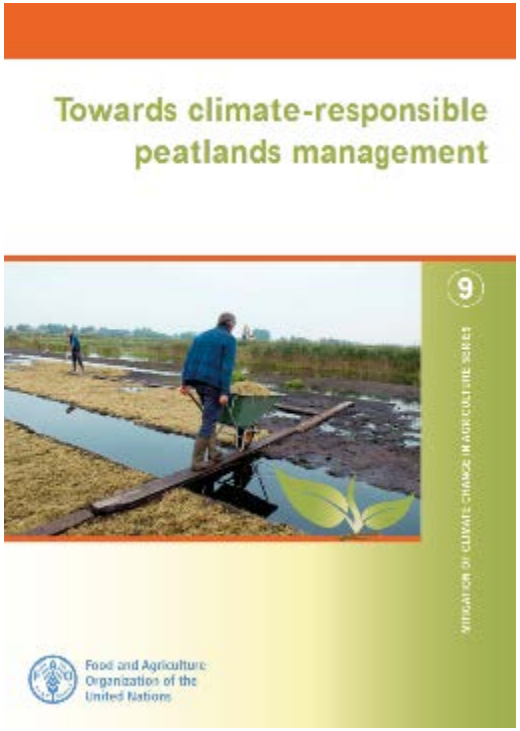




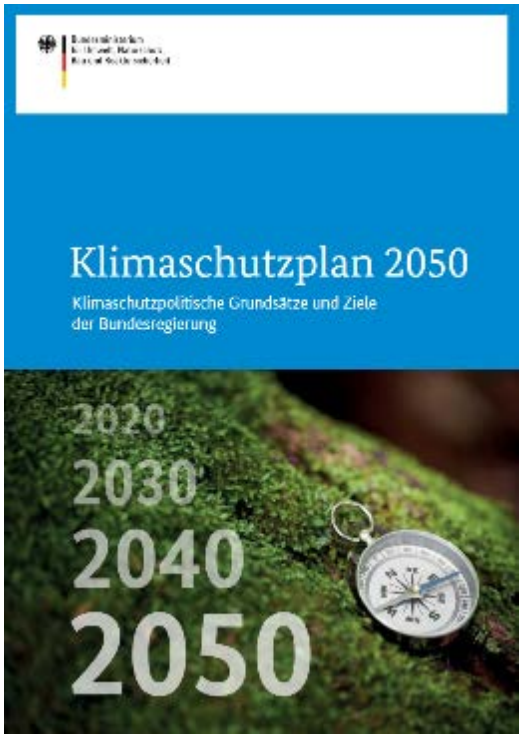


… approval on all levels

international



national



regional

→ Constraints: Why is there no large-scale implementation?

→ Opportunities: Which solutions are feasible?

Photo: S. Wichmann

EU agricultural policies I

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Public money for continued drainage based peatland utilisation

- Pillar I: direct payments
- Pillar II: organic farming, agri-environment-climate measures
- Investment grants with long-term effects (e.g. new stables)
- „biogas“ from peatland

→ Support increases competiveness artificially

Eligibility of paludicultures

- Uncertain / not given / only by exception

→ Uncertainty and discrimination frustrate interested farmers

➔ Approval of paludiculture as agriculture

➔ Phasing out CAP funding for drainage-based peatland utilisation

EU agricultural policies II

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Conversion to paludiculture

- High investment costs: rewetting, planting, adapted machinery
- Revenues generated partly only after several years (peatmoss, alder)
- Pioneers bear higher risks

→ Large barriers for single farmers

→ Compensation through economic incentives for conversion

Demonstration site (8.5 ha): 50,000 Cattail seedlings planted last week

EU agricultural policies II

GREIFSWALD MIRE CENTRE

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➔ Compensation through economic incentives for conversion

- Climate change mitigation & adaptation
- Water protection
- Soil protection
- Biodiversity

→ Large benefits for society are not priced in

➔ Remuneration of services: additional income + long-term perspective

EU agricultural policies / Legal framework

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Maintenance of permanent grassland

- Greening (EU)
- National law (e.g. some German federal states)
- Qualitative reasons, but mainly quantitative area controlled

→ Impedes the rewetting of grassland for permanent paludicultures

➔ Introducing exceptions for paludiculture

e.g. drained bog grassland → Sphagnum farming

Legal framework II

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Regulations for soil protection

- Cross compliance (EU: GAEC* standard 6 „Maintenance of soil organic matter“)
- Codes of good practice (Germany: §17 Soil protection law)
- No differentiation: mineral vs. organic soils

→ Water level targets are missing to ensure low-impact cultivation

➔ Codes of good practice for organic soils would reduce macro-economic damage and promote paludiculture

* GAEC - Good Agricultural and Environmental Condition

Legal framework III

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Agriculture vs. nature conservation

- Raising water levels/ establishing paludicultures
- Creation of protected habitats?
- Occurrence of rare and endangered species?

→ Farmers are afraid of restrictions and prohibitions

➔ Clarification: compensation and principle of free choice, if restrictions are desired for nature conservation.

Rewetting & land availability

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Ownership structure

- High proportion of leased land: user and owner must agree
- Highly fragmented land and parcel structure → many parties involved

Impact on neighbouring sites

- Implementing paludiculture on single parcels is very expensive
- A catchment area based approach is needed

Resistance of local population

- Worries & fears: change, wet cellars, dead trees, mosquitoes, accessibility …
- Acceptance for paludiculture higher than for abandonment

→ Go-it-alones not possible, willingness + time for collective action needed

→ Land consolidation and regional cooperation (e.g. water boards) can be used for hydrological planning of the catchment area

Farm issues I

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Paludiculture = paradigm shift

- Break with family and farming traditions
- Pressure for justification to neighbours and farming community
- Willingness for change and risk-taking are needed

→ Insufficient knowledge of impacts of peatland drainage and alternatives

→ Education, further training, advice

→ Demonstration farms

Farm issues II

Farm A

- Cash crop farm
- No use for peatland biomass
- Mowed for subsidies

Farm B

- Dairy cattle: high quality forage
- New, large stable
- Land + buildings on peat

Farm C

- Vegetable cultivation
- High added-value

→ Operational constraints and opportunity costs are very different

➔ Solutions must be adapted to starting conditions

Processing & markets

Wet meadows

- Low-value: energetic uses
- Biomass: heterogenic, transport limited
- Local solutions, e.g. district heating plant

Cattail (*Typha*)

- High-value: insulation/ construction
- marketable products + high demand
- Only small production plants: lack of biomass

Peatmoss (*Sphagnum*)

- High-value growing media constituent
- Large market: ~ 15 Mio (EU) / 3 Mio (D) m^3 a^{-1}
- Lack of diaspores + high investment costs

→ Mismatch between supply and demand of paludiculture biomass

➔ Purchasing security / support, e.g. laws/regulations

Research, development & demonstration

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- Pilot trial for single species (groups)
- Adapted harvesting machines available (conservation management, thatching reed)
- Future-orientated processing avenues (Bio-economy)

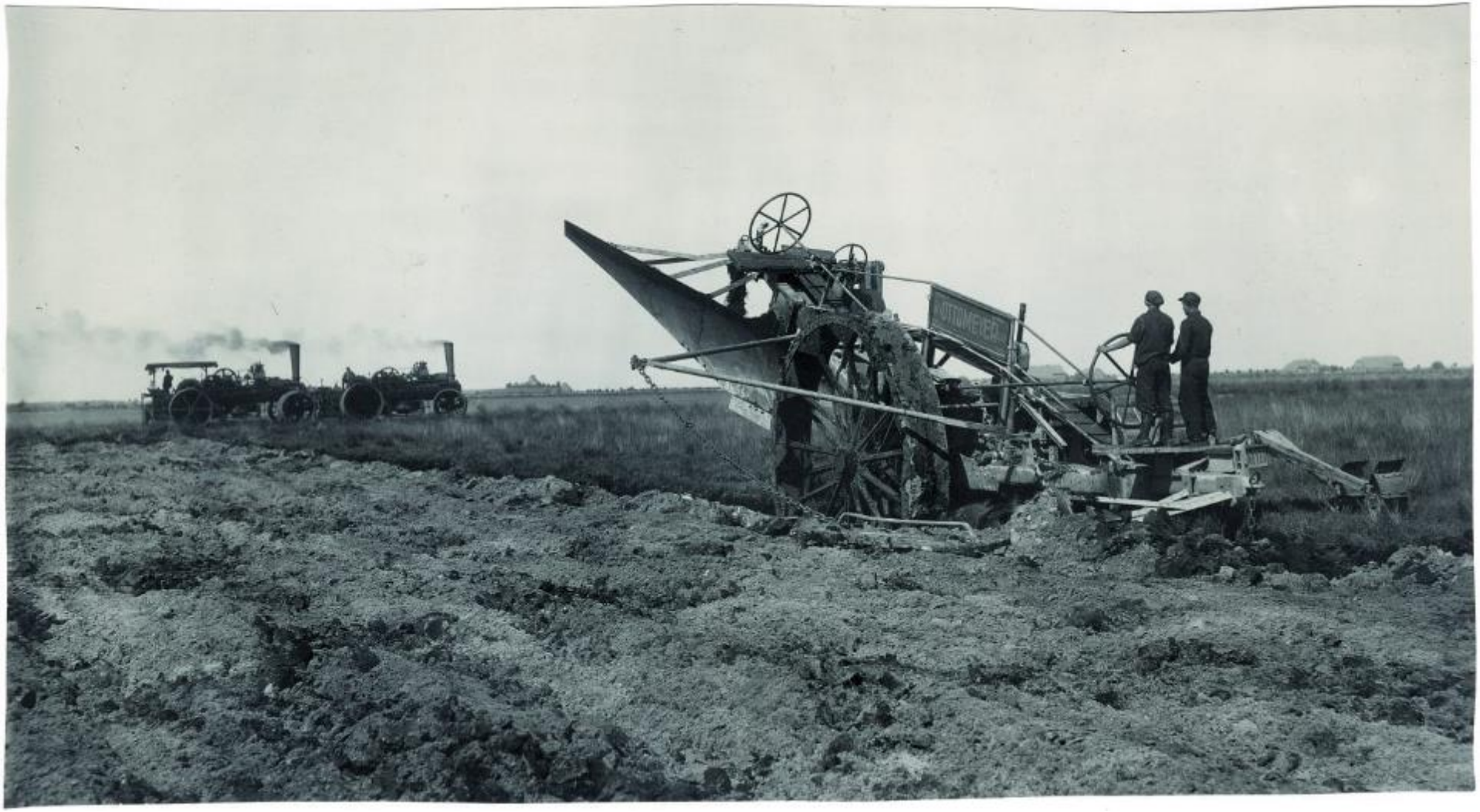
→ Demonstration and adaptation at farm-scale are missing

→ More implementation for optimisation + specific answers

The introduction of potatoes in Prussia required decades … - and several tricks.

Frederick the Great (Friedrich II) inspects the cultivation of potatoes („The king is everywhere“, Robert Warthmüller)

Peatland drainage and reclamation took centuries…



http://klasmann-deilmann.com/unternehmen/ueber-uns/geschichte/

deep ploughing in the 1950ies (Mammut / Co. Ottomeyer), Emsland (Germany)

New challenges – less time

… but many opportunities for action

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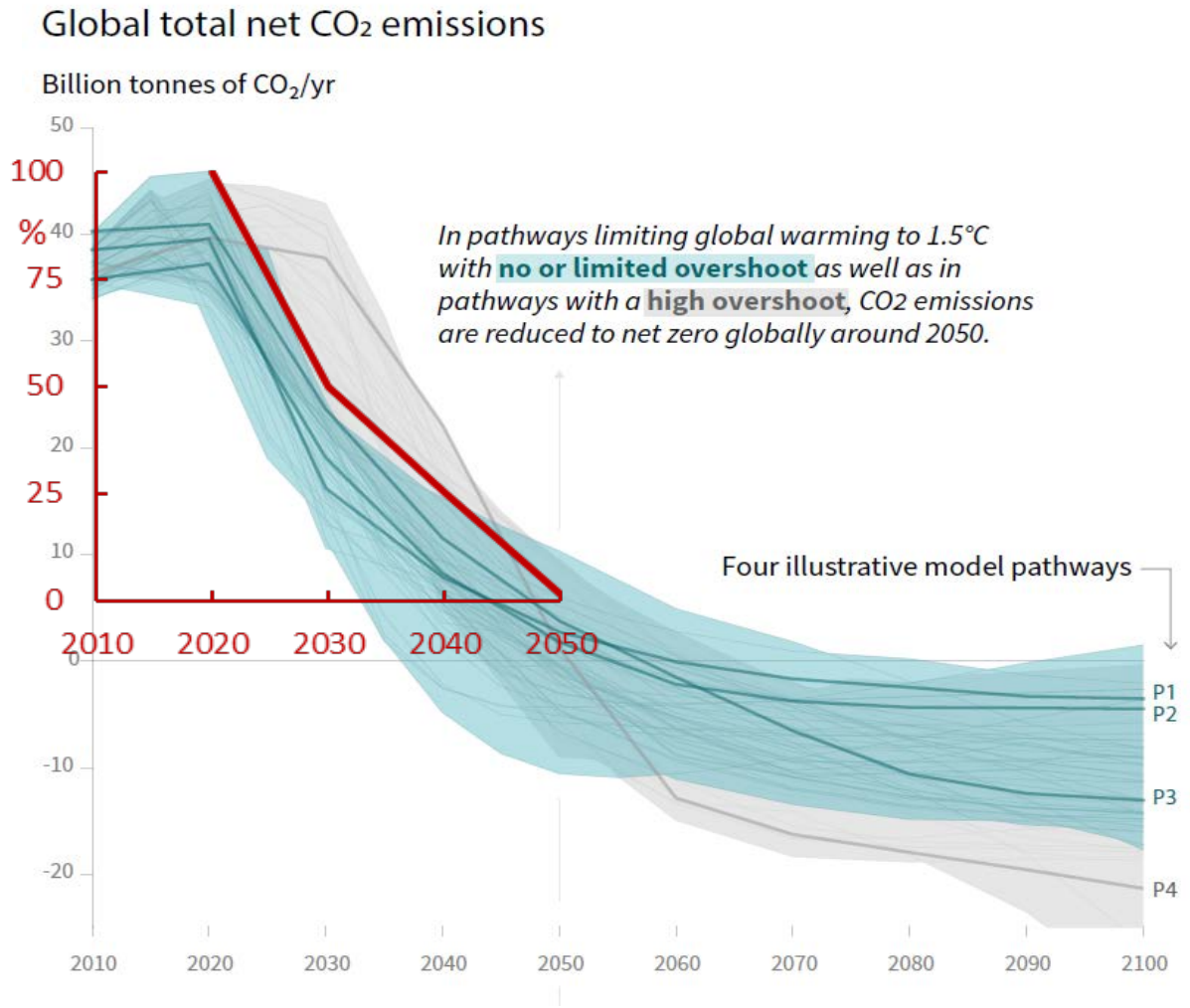
- Agricultural policy
- Legal framework
- Rewetting and land availability
- Farm issues
- Processing & markets
- Research, development & demonstration

→ The society is responsible, not the single farmer.

→ Set the course today to make future peatland utilisation sustainable.

Paris agreement sets clear targets → every sector needs to contribute

→ what does it mean for peatlands?



Transformation pathway for German peatlands based on Paris

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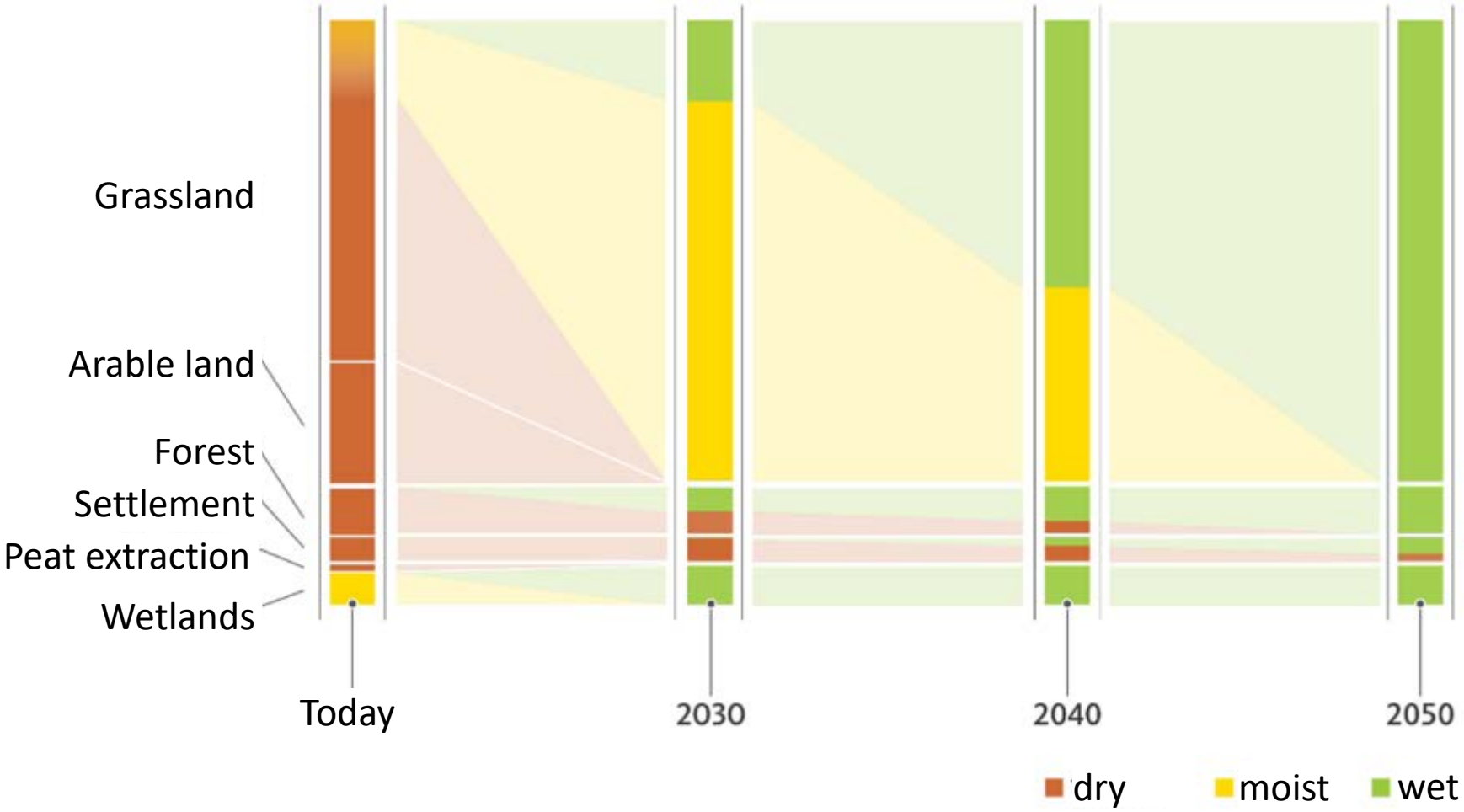


Abel et al. (2019) https://greifswaldmoor.de/files/images/pdfs/201908_Broschuere_Klimaschutz%20auf%20Moorböden_2019.pdf

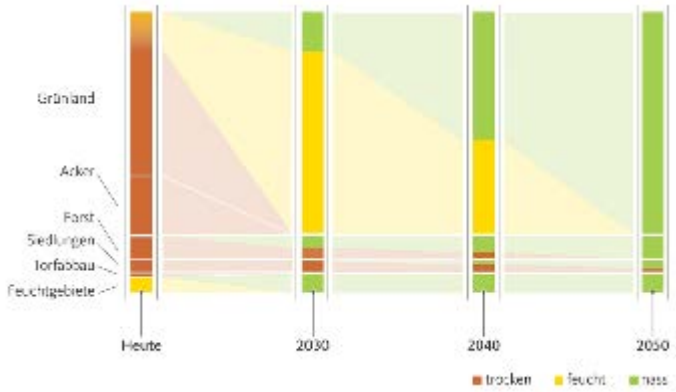
Germany: until 2050 rewet ~50,000 ha per year…

Impossible, naive…?

Finland drained in the 1970s ~300,000 ha every year!

Indonesia has in 2017-2018 rewetted 670,000 ha of peatland, i.e. 3x as much as *entire* Europe in its *entire* history!

Transformation pathway → interim goals for German peatlands until 2030



- Stop subsidies for **arable use** on drained peatlands from 2021
  → phase out arable use
- Raise water levels for all **grassland** on peat soils:
  a) ≤30 cm below surface, b) on at least 200.000 ha (15%) near surface
  + stop subsidies for deeper drainage
- Rewet 50% of **forests** on drained peatlands
- Phase out **peat extraction** + replace peat by renewable alternatives
- Acknowledge **paludiculture** as agriculture and ensure eligibility for CAP payments, introduce investment programs + payments for climate mitigation;
- Stop drainage of all **state owned peatlands** until 2030
  + establish demonstration farms for paludiculture
- **Education** campaign in all peatland rich federal states for rewetting 50,000 ha of peatlands up to 2050.

EU CAP reform
= “window of opportunity”
→ setting a new course for peatlands

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EU level

- Conditionality: preserving carbon rich soils (GAEC 2*)
- Pillar I: eligibility of paludiculture for agricultural payments
  “'eligible hectare' shall be defined in a way that it includes any agricultural area of the holding, including […] rewetted areas used for paludiculture”
  Amendment 91, in April 2019 approved by EP Committees of Environment and of Agriculture → not yet in plenary
- Pillar I: eco-schemes (voluntary for farmers)

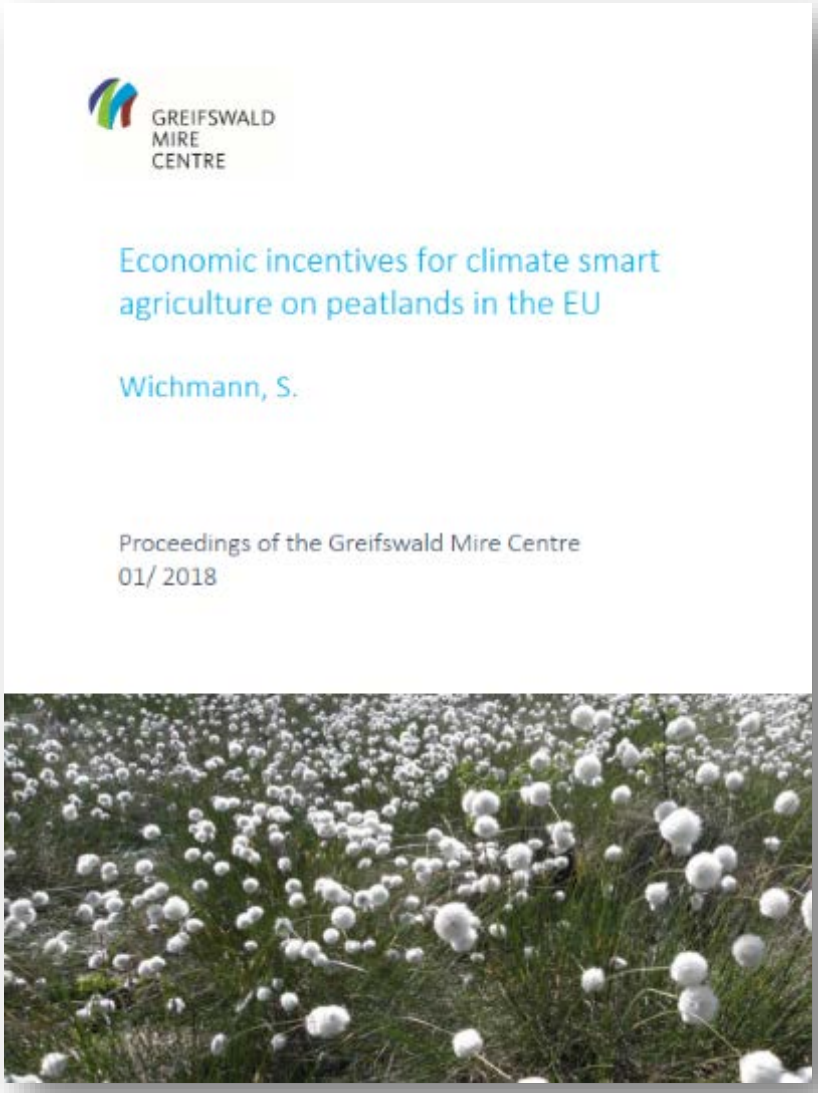
National strategy plans

- Pillar II: plenty of possibilities for tailor-made solutions!

*standards for the Good Agricultural and Environmental Condition

What to learn from current EU funding period?

Review:
Are there any incentives for sustainable peatland use?



PALUDI CULTURE
cinderella

FACCEJPI

Funding was provided by FACCE-ERA-Net+ ‘Climate Smart Agriculture’ (EU)

Report available online at:
https://greifswaldmoor.de/publikationen.html

Review on economic incentives

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EU member states

- selected countries / regions:
  Germany, Netherlands, UK, Denmark, Sweden, Poland, Estonia, …

Financing

- Focus: CAP 2nd Pillar → National Rural Development Programs
- European Fund for Regional Development
- Private: Payments for ecosystem services

→ No incentives for shifting to climate-smart peatland agriculture!

… but a wealth of good practice examples

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a) providing incentives
- to invest in rewetting
- to maintain target water levels
- to adapt management

b) ensuring efficiency
- e.g. target areas
- indicator species
- scoring systems

c) facilitating implementation
- advisory services
- land consolidation
- cooperation at landscape scale

→ Outreach is limited: implemented only partly and in single Member States

Summarising table: incentives addressing peatland or wetland ecosystem services

		Ecosystem service						Financing				Payment			Point along production chain					Scheme		Implementation	
	State - region	Carbon store	Water quality	Water quantity	Biodiversity	Recreation	Others	EU	National	Compulsory	Voluntary	One-off	Short term	Long term	Establishing	Rewetting	Management	Processing	Marketing	Input-based	Output-based	Cooperation	Advice
Rural development programmes – EAFRD (public)																							
(Re-) Establishment and maintenance of wetlands	DK	(x)	x		(x)			x	x			x	x	x		x	x			x	(x)		
Habitat management; conversion to grassland	D-BAV	(x)	x		x			x	x				x			(x)	x			x			
Water retention on peatland, conversion to grassland	D-BB	x	x					x	x				x			x	x			x	(x)		x
Habitat management; rewetting	D-LS	x			x			x	x			x	x			x				x	(x)		x
Habitat management; rewetting; conversion to grassland	D-MW	x	x		x			x	x			x	x			x				x			x
Habitat management; rewetting	D-SH	x	x	x	x			x	x			x	x			x	x			x			
Habitat management; organic soil protection	EST	(x)			x			x	x				x				x			x			
Habitat management; water category	NL		x	x	x		x	x	x			x	x			x	x			x		x	
Construction and restoration of wetlands; cooperation	S	(x)	x	(x)	x	(x)		x	x			x	x			x	x			x	(x)	x	
Adjustable / controlled drainage (control wells)	S + Fi	(x)	x	(x)				x	x			x	(x)			(x)				x			
Habitat management	It				x		x	x	x				x				x			x			
Fen habitats and endangered species	PL				x			x	x				x				x			x	(x)		
Countryside stewardship scheme: uplands and lowlands	UK-E	x	x	x	x	x	x	x	x			x	x		x	x	x			x	(x)	x	(x)
Agri-environment-climate scheme: uplands and lowlands	UK-S	x	x	x	x	x	x	x	x			x	x		x	x	x			x	(x)	x	(x)
Sustainable management scheme 'Glastir'	UK-W	x	x	x	x	x	x	x	x			x	x		x	x	x			x	(x)	x	(x)
Regional development – ERDF (public)																							
Reducing CO_2 emissions from peatlands (pilots)	D-BAV	X						x	x						x	x	x	x		x			
Reducing CO_2 emissions from peatlands (pilots)	D- LS	X						x	x						x	x	x	x		x		x	x
Payments for ecosystem services (private-voluntary)																							
MoorFutures®	D	x	(x)	(x)	(x)		(x)				x	x				x			x		x		
Peatland Code	UK	x									x	x				x			x		x		
Upstream thinking	UK-E	(x)	x	(x)	(x)						x	x	x			x	x		x	x	(x)		(x)
Payments for ecosystem services (private-compulsory)																							
Peatland rewetting financed by water fee	D - SH		x	x	x					x		x	x			x	x			x	(x)		
Payments for ecosystem services (mixed: public & private)																							
Sustainable Catchment Management Programme	UK-E	(x)	x	(x)	x	(x)		(x)			x	x	x			x	x		x	x	(x)		(x)
Pumlumon project	UK-W	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	(x)	x	x
Under appraisal																							
Reducing CO_2 emissions from peatlands (ERDF)	D-BB	x					x	x				x			x	x	x			x	(x)		x
Rewetting agricultural land on organic soils	S	x														x							

DK – Denmark, D – Germany (BAV – Bavaria, BB – Brandenburg, LS – Lower Saxony, MW – Mecklenburg-Western Pomerania, SH – Schleswig-Holstein), EST – Estonia, Fi – Finland, It – Italy, NL – the Netherlands, S – Sweden, UK – United Kingdom (E – England, S – Scotland, W – Wales)

Classification of economic incentives

GREIFSWALD MIRE CENTRE

(a) Ecosystem Services in focus
- predominant: biodiversity, partly also water quality
- rarely carbon, water retention, recreation…

(b) Sources of the financing
- public: EU + national → CAP
- voluntary, e.g. carbon credits for the private market
- compulsory, e.g. water fee used for peatland rewetting

(c) Duration of the payment
- one-off
- short term: usually 5-7 years
- almost no long term: 10-20 years

+ combinations

(d) Points addressed along the production chain

Incentives along production chain

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Establishing paludicultures	• Investment costs: site preparation • Planting permanent crops
Rewetting	• Investment in water management • Remunerating high water level
Management	• Purchase of adapted harvesting machinery • Cutting / grazing of wetlands • Adapted management, e.g. harvest time
Processing	• Investment costs, e.g. for pelleting, combustion • Innovation bonus
Marketing	• Biomass / Products, e.g. bonus for renewables • Ecosystem services: C-store, nutrient retention, water retention, biodiversity, …

→ Current incentives focus on rewetting + management

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} + combinations

(d) Points addressed along the production chain

(e) Payments for actions or results
- action, e.g. covering costs of management measures
- rarely results, only in case of carbon credits
- targeting elements, e.g. a prescribed water level; scoring systems; target areas

(f) Payments supporting general implementation
- cooperation
- advice and/or technical assistance

Example

Agri-environment-climate commitments

GREIFSWALD MIRE CENTRE

Poland – targeted packages for fen species (since 2009)

Facilitating large-scale habitat management

Late mowing of land occupied by Aquatic Warblers 334 €/ha
(similar for sites with typical vegetation indicating potential habitat)

→ about 10,000 ha became mown with adapted machinery

Example

Agri-environment-climate commitments

Germany – state of Brandenburg (2014 – 2020)

Peat conserving water retention (fixed wear)	**387 €/ha**
Raise to or keep high water level	- 10 cm
01.06. - 15.10., up to	- 30 cm

Example

Agri-environment-climate commitments

GREIFSWALD MIRE CENTRE

UK – England: Rural Development Programm (2014-2020)

Wetland commitments

to maintain, restore or create ponds, ditches, bogs, fens, reedbeds

		€/ha
WT 6	Management of reedbed	98
WT 7	Creation of reedbed	404
WT 11	Wetland cutting supplement	550
WT 12	Wetland grazing supplement	380

Example:
Rural Development Programme (EU)

GREIFSWALD MIRE CENTRE

Sweden - **Construction and restoration of wetlands** (since 1996)

→ objectives: biodiversity and retention of nutrients,
peatland rewetting not in focus

- Targeting: ca. 100 different selection criteria at county level, placed on organic soils → may give additional scores
- Investment cost (90%) + maintenance cost (over 5 years)

Photo: S. Wichmann

Example

European Rural Development Fund

GREIFSWALD MIRE CENTRE

Germany - Lower Saxony, Bavaria and Brandenburg

„Climate protection by reducing emissions from carbon rich soils“

- Rewetting of peatlands: planning, preparatory measures, implementation
- Pilot projects on land use options adapted to high water levels: research and development
- ProMoor (Brandenburg, since 2019): adaptation of practices, e.g. purchase of adapted machines or seedlings by farming enterprises

Photo: S. Wichmann

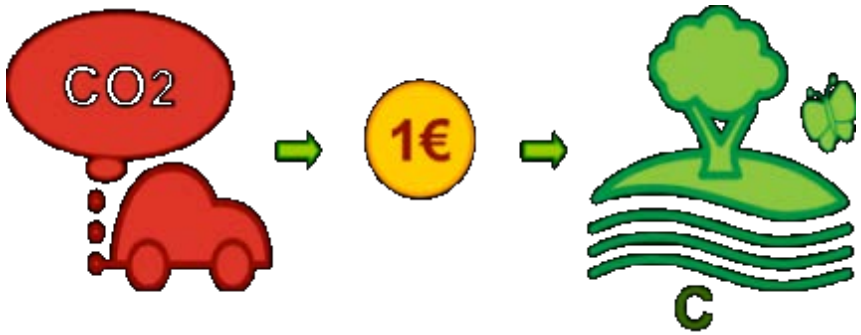
Example

Private sector investment

Germany (MV, SH, BB) – MoorFutures®

Voluntary carbon mitigation

Mitigating 1 t CO_2e 35€ / 54 € / 67€ (site dependent)



Moor Futures

Ihre Investitionen in Klimaschutz

Where does us take the future CAP?

Photo: S. Wichmann

Setting a new course…

GREIFSWALD MIRE CENTRE

1) Overcome current shortcomings

- **Phase out** CAP 1st and 2nd Pillar **support for drainage based peatland use**
- General eligibility of **paludiculture** for agricultural payments
- Provide **attractive incentives** for rewetting, e.g. by remunerating climate benefits
- Run long-term schemes (15-20 years)

2) Apply and refine existing tool box (Pillar II)

- **For all steps**: establishment → management/harvest → processing → marketing
- Knowledge transfer & **advice**
- **Cooperation**: support processes at landscape levels

3) Learn from experiences in other peatland rich region

- **Accepted by stakeholders**: e.g. rewarding instead of compensating; reducing financial risks; basic entry measures + combination with different targeted high-level measures.
- **Result-orientated**: e.g. targeting approaches as carbon priority maps
- **Good value-for-money,** e.g. scoring systems; compare with other measures to reduce agricultural GHG emissions

GREIFSWALD MIRE CENTRE

Align agricultural policy to climate goals

- Keep all wet peatlands wet!
- Rewet all drained peatlands, and do it fast!
- If you use them, use them wet: paludiculture!

Thank you for your attention!

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Photo: S. Wichmann