Report for Era-Net project Clearance, WP 6.3.1, March 2020[1]

Assessment study of barriers and opportunities regarding Wetland Buffer Zones and Wet Agriculture

This study assesses barriers and opportunities regarding wetland buffer zones (WBZ) and wet agriculture based on three regional workshops in Aarhus (Denmark), Greifswald (Germany) and Warsaw (Poland) as part of the Clearance project, work package six, during 2018 and 2019.[2]

Paludiculture is the productive use of wet and rewetted peatlands. A peatland is an area with a naturally accumulated peat layer (organic soil) at the surface (it can be dry or wet, with or without vegetation); a mire is a peatland where peat is currently being formed and accumulating, and for this formation it has to be wet (Joosten and Clarke 2002, 172). Wetland buffer zones (WBZ) are "sections of natural or restored riparian areas forming a transition between terrestrial and aquatic environments, and are well-known to remove agricultural water pollutants such as nitrogen (N) and phosphorus (P). (Zak et al. 2020). When present in excess, these nutrients cause eutrophication and subsequent ecological degradation of freshwater and marine waterbodies, such as rivers, lakes, and coastal areas. WBZ cover peatlands and other, also mineral soils. "Wet agriculture" here refers to the productive use of WBZ.

---

[1] Author: Rafael Ziegler, GETIDOS, University of Greifswald, Greifswald, Germany; rziegler@uni-greifswald.de. This research is funded as part of the H2020 ERA-NET Cofund WaterWorks 2015 research project CLEARANCE – Circular Economy Approach to River Pollution by Agricultural Nutrients with Use of Carbon-Storing Ecosystems. The report has benefitted from feedback of the co-organizers of the respective workshops, further comments by Christina Lechtape and Wendelin Wichtmann, and in general from the work with Michael Bender working together throughout on this work package, and last but not least from the many stakeholders participating in the workshops. For a research article corresponding to this report see Ziegler 2020. For the Clearance project homepage see : https://www.moorwissen.de/en/paludikultur/projekte/clearance/index.php.

[2] Details on the workshops and respective programs are available from here: http://www.wrrl-info.de/site.php4?navione=angebote&navitwo=seminare&content=seminare. The workshop in Greifswald was organized in co-operation with the project Morgen, the Greifswald Mire Centre and the town of Greifswald.

For the three catchments discussed at the workshops, this study arrives at the following general conclusions and associated barriers and opportunities for WBZ and wet agriculture:

- Wet agriculture in spite of its climate and water protection benefits is a marginalized option in current agricultural use, and even more so for wet agriculture on WBZ.
- Central barriers are institutional: There is no even-handed funding for wet agriculture options on WBZ; the EU common agricultural policy and associated national policies continue to prioritize intensive agricultural options on dry and drained soils. Funding options via the water management plans of the European Water Framework Directive (WFD) are also not currently used, not least due to insufficient knowledge and monitoring of WBZ co-benefits. Nature conservation policy, while not opposed to WBZ with wet agriculture as such can, be in tension with the approach, especially where species have to be protected. Further taking into account technical path-dependency created by established melioration or land-drainage systems, WBZ development with wet agriculture faces high institutional barriers.
- A central knowledge challenge is the particularly complex role of WBZ, which may have both organic and mineral soils, thus simultaneously stretching paludiculture on organic soils to a more general wet agriculture (covering also mineral soils), and increasing complexity due WBZ both serving nutrient removal functions but sometimes also releasing nutrients (such as phosphate).
- A further challenge is the widespread absence of suitable networks and positions that can coordinate between land-owners, users (especially farmers) and governmental agencies (the one Danish exception notwithstanding, see below).
- Central opportunities for WBZ and wet agriculture emerge where
    - government from the municipal level up takes long-term responsibility to create systemic catchment solutions that create security for users to experiment with new options and associated valued changes and that fosters partnerships with public, communal and private actors;
    - users such as farmers can explore new options in opportunity contexts (e.g. drainage already does not work/is no longer economic, there is municipal and/or scientific support), while potentially continuing to exploit established uses to meet short-term economic ends on other lands;
    - WBZ protection without agricultural use is simultaneously pursued and communicated as an important alternative option, as depending on context agricultural wet use might not be desirable (f. ex. nature conservation) or economically viable (f. ex. size of land).
    - WBZ protection with wet agriculture is clearly contextualized in the general policy context, i.e. in particular the upstream requirement of fertilizer and pesticide restrictions in respect of nature conservation and WFD requirements.
    - Knowledge brokers such as applied scientists or specialized consultants accompany site scoping and WBZ development with or without wet agriculture.
    - Paludiculture and wet agriculture on WBZ are better communicated as innovative land use options for circular economy.

1. Method

Workshops were analysed based on the social grid approach to the study of innovation dynamics (Beckert 2010, Nicholls and Ziegler 2019). It analyses social change in terms of an interplay of three social forces: social networks, institutions and cognitive frames. *Social networks* are the structures of social relations and relational patterns in society, particularly at the field level. Fields are comprised of the specific structures of social networks that create power differences between actors and status hierarchies. *Institutions* are the constraining and enabling rules and norms of a society. *Cognitive frames* are the shared meanings and interpretations which make sense of society and its functioning. Taken together, these three social forces constitute a social grid that shapes the formation of fields, their stasis and change.

Innovators (i.e. here advocates of wetland buffer zones and paludiculture) seek to change the dynamics in the field exploiting institutional opportunities and incompatibilities between institutions, drawing on cognitive frames for the interpretation of rules, creating and influencing social networks. Other stakeholders might draw on these social forces to defend other options or the status quo and ensure the reproduction of rules, ways of thinking and social networks that protect and advanced their established interests, business plans and identities.

The report is based on the presentations at the three Clearance workshops, workshop protocols, the workshop reports of Grüne Liga, and subsequent personal communication with individual participants were questions emerged. A first draft was sent to the respective workshop co-ordinators, and on this basis the final report was written. The report presents the three workshops in the chronological order of their organization.

The presentation of the material is based on the social grid approach. First opportunities are presented in terms of cognitive frames, institutions and social networks and their relevance for change in direction of WBZ protection/creation with or without wet agriculture. Then barriers to such change are presented following the same sequences, followed by a discussion of interrelations between social forces. Due to the importance of normative ends for sustainability innovation, the analysis of cognitive frames is further differentiated into cognitive frames relating to normative ends and those relating to ideas of social change.

2. Aarhus Workshop[3]

Opportunities

Cognitive frames. The normative vision included two cognitive frames: 1) *Wetland restoration as a tool for meeting water protection and nature protection goals*: Wetland restoration has been recognized within the national water action plan as a way to reduce nitrogen already in 1998, in recognition of the failure to reduce nutrient inflow from agriculture and against the historical trend of 7460 km^2 of wetland reduced to 569 km2 during the modern agricultural transformation (see Hoffman et al. 2007). 2) *Wetland restoration as an approach with multi-functional benefits (N and P reduction, improved hydrology, climate adaptation, biodiversity) from a scientific perspective*: Wetland restoration is a way to establish green corridors that improve the biological-hydrological interplay in the valley, remove N and P, promote climate adaption (not least via peat formation), and contribute to species/habitat preservation/creation (Hoffmann 2018). In addition, the Danish discussion highlighted a distinct cognitive frame of social change: 3) *Land use change is to be implemented on a voluntary basis.* Land swaps for wetland restoration are based on a principle of voluntariness and this is said to improve buy in and participation in wetland restoration (Blaabjerg 2018).

Institutions. Of central importance for wetland restoration are the Danish Action Plans for the Aquatic Environment (Hoffmann et al 2007). The government plans to rewet 113 000 hectares of drained wetlands by 2021, and for this has allocated 1,6 billion DKK (about 210 million Euro) (Blaabjerg 2018). Local authorities are obliged to reduce nutrient leaching to the coastal zone; however, the land is often owned by farmers (Moth 2018). The Danish Nature Agency and local communities identify areas and pre-investigate technical feasibility and land-owner interest. Within the Danish Ministry of Agriculture there is a land consolidation division: it organizes a process that allows farmers to sell or swap land in a way that they see as an improvement for them, and in this way facilitates restoration process (for details of this process see Blaabjerg 2018, Moth 2018). There is also a *Danish Wetland Monitoring Program.* A long term research focus on wetland restoration in Denmark has resulted from the fact that wetland restoration is co-funded via the *EU regional development plans.* For this, the European Union requires monitoring of effectiveness (see Audet et al 2019 for results on nitrogen and phosphate removal).

Social Networks. The Danish workshop pointed to an organisational innovation: an intermediary position created by the municipality of Kommune Ringkøbing-Skjern and vestjysk (an advisory farmer service). The position allows to facilitate the wetland restoration effort. Facilitation includes a) informing stakeholders such as farmers and local consultants (for example regarding the type of measurements needed to meet WFD requirements), b) built trust and improve cooperation between the municipality and the farmers via public meetings

[3] Materials used for the analysis: Grüne Liga Workshop summary; presentations during the workshop (including subsequent discussions); follow-up correspondence where questions emerged.

and individual meetings in frequently multi-year restoration projects (Moth 2018). According to Moth, "the idea of a joint employee arose from the local farmer advisory organization. In 2008, it became clear that in order to fulfil the water management plans and the Water Framework Directive it would be necessary to involve the landowners. Sixty-six percent of the land is cultivated in Denmark and the short distance more or less from anywhere in Denmark to the coastal waters would affect many farmers. Besides, in 2008, the economy was [still] good and the expectation was that it was the right time to address farmers with initiatives. Unfortunately, the economy changed the next couple of years and the incentive to participate in environmental initiatives decreased somewhat. Even so, the position has still been a success and has helped in knowledge sharing and the daily contact has established a trust within colleagues on both sides." There has also been some nation-wide uptake: the national farmer advisory organisation Seges has appointed 20 catchment officers in 2016 to implement constructed wetlands and other smaller environmental initiatives. These officers provide support for the construction of the wetland and the application process (Moth 2018. However, the positons are based with the local farmer advisory service only, and not a co-hire with the municipality.

Barriers

Cognitive Frames. The workshop also pointed to cognitive frames reinforcing the status quo. 1) *Nature as an economic resource.* Stakeholders sometimes view unused nature as 'wasted nature', and wetland restoration as nothing but a potential loss of income. This purely economic focus on restoration fosters high land compensation demands. It can be reinforced by a perception that wetlands are 'bad' (Blaabjerg 2018). In addition to this normative point, there are also cognitive barriers to change. 2) *Government distrust*. Many farmers distrust government, not least if it lacks time and possibility to listen. Moreover, a past buffer strip implementation policy is still remembered as a top-down and unsuccessful imposition by government (Ensslin and Bender 2018). In addition, there is 3) *Lack of knowledge* about wetland restoration and its benefits for the public good (Moth 2018, Ensslin and Bender 2018). 4) Scepticism with respect to wetland buffer zones with or without wet agriculture being sufficient to remove nitrogen and phosphate in the long-term. Therefore, a technical solution might be better (Hoffmann 2018).

Institutions. An *informal* institutional barrier is competing habits that are perceived as in competition with wetland restoration, such as hunting. A specific barrier for wet agriculture on wetland buffer zones is *a lack of responsibility* for wetland management after conversion (Ensslin and Bender 2018). This leads the government agency not to consider wet agriculture on such zones so far, as this would require monitoring. Finally, the important first pillar of the European CAP ties subsidies to environmental minimum standards, whereas the small second pillar actively encourages maintenance and construction of natural ecosystems on agricultural land (Bender et al. 2019, 15). This subsidy structure tends to promote continued high use of fertilisers and pesticides, thereby materially enforcing the scepticism noted above regarding the possibility of natural solutions.

Social networks: As noted above, there has been some diffusion of the idea that wetland restoration requires facilitating work to build trust and cooperation between farmers, municipalities and further stakeholders. However, so far a truly hybrid position as realized in

the municipality of Kommune Ringkøbing-Skjern and co-funded by municipality and the farmer advisory service remains unique.

Interrelations in the social grid

The major positive lesson of the Aarhus workshop is the importance of the land consolidation process and associated intermediary positions (such as municipality of Kommune Ringkøbing-Skjern and vestjysk, an advisory farmer service) to create space and time to improve trust and knowledge and to create local social networks for the implementation of restoration projects and practical organization of responsibility.

However, this possibility remains limited in the face of continued subsidies for conventional agricultural on drained land (and thus high fertiliser input). This in turn threatens the sufficiency of nature-based solution and might require more technical ones to ensure sufficient nitrogen and phosphate removal. Improved nitrogen and phosphate removal via wet agriculture has so far not been considered moreover due to a lack of monitoring responsibility for restored wetlands (with wet agriculture). Thus ecological land consolidation without and even more so with wet agriculture remains a marginalised niche.

3. Greifswald Workshop[4]

Opportunities

Cognitive frames. The normative vision included three cognitive frames. 1) *Ecological-functional perspective on nature*: This frame highlights the climate benefits from rewetting mires due to reduced greenhouse gas emissions (Wichtmann 2018, Reichelt 2018), adding biodiversity, reduced land subsidence and water quality improvements as further co-benefits. Closely related is the metaphor of mires as kidneys of the landscape (Zak 2018) as they reduce the outflow, especially of nitrate, into rivers and coastal waters as well as regulating the water balance. The frame aligns with perceived instrumental and some intrinsic value opportunities seen by various stakeholders: for the protection of the oceans, climate protection, and drinking water protection, for agro-ecology and biodiversity. 2) *Rivers as places of life quality*: Historically in central and northern Europe, mires and wetlands tend to be perceived negatively (Deickert and Piegsa 2016). However, this seems to change somewhat if mires are associated with rivers. In this case the frame aligns with a relational value of rivers as places of life quality: a place that people are already 'in', with historical and cultural uses important for life quality (Lerm 2018). This value and the perception of 'our river' extends to other living beings: the healthy river as providing kid room for fish' (Kühn 2018, see also Wilke 2018). 3) *Property obliges*: The town of Greifswald and the university along with other land owners have a responsibility for their property: it should be used in a way that is beneficial or at least not detrimental to the public good.

A cognitive frames of social change also emerged from the workshop: *Money rules the world*: People change their behaviour when there is a monetary benefit. 'Without economic incentives nothing happens' said one participant, 'it must be profitable' another one. Paludiculture is an economic strategy and sustainable economy model: productively use renewable resources (i.e. paludiculture plants) without reducing the ecosystem functioning (i.e. peat preservation). The focus is on new value chains and with it jobs and regional development (Oehmke 2018, Bork 2018). Workshop participants from research and innovation promotion emphasise paludiculture-*innovation* as a factor of national prestige ('made in Germany') and argued that to achieve major innovations, a bio-technical research infrastructure is required.

Institutions. The consideration of WBZ with and without wet agriculture is chiefly legitimated 1) by the water law and the WFD and its water quality goals. According to WFD standards the river Ryck which flows through Greifswald, is in an unsatisfactory to bad condition (Kühn 2018, Meyer 2018). Accordingly, water management plans can consider measures to tackle pollution, and this in principle can also subsidise WBZ, constructed wetlands and paludiculture measures, both for retention of nutrients from agriculture and from settlements (Kühn 2018). There are also specific subsidies for the creation of WBZ along rivers. The

[4] This section is based on the following materials: The workshop presentations at the Greifswald Workshop, 28.11.2018, including protocols of the discussion and subsequent internal group meeting with stakeholders, the Grüne Liga summary report of the workshop, follow-up correspondence where questions emerged. For a longer version, additionally drawing on interviews with stakeholders see Ziegler 2020.

Strukturelementerichtlinie of the province Mecklenburg-Vorpommern supports the taking out of use of agricultural land for the improvement of natural and economic conditions of production (§1.1) with 610 Euro per hectare for buffer zones ("Gewässerrandstreifen") of 5 to 30 metres width, plants growing there can be used (§6.2., Richtlinie 2016). However, the qualifications for re-wetting have to be considered (see institutional barriers below). 2) The protection of WBZ is legitimated by nature conservation law. For example, grassland on mires can be recognized for nature conservation and landscape care in protected areas such as Natura 2000.

Social Networks. Social networks have the collective power to shape institutions and cognitive frames, and to diffuse cognitive frames. Proponents of paludiculture are aware of, and in touch with, various stakeholders: farmers and their associations, potential users of the harvest (energy, construction, new materials, fodder etc.), recreational visitors and people living in the area, (agro)-scientists, public and private funders, agricultural coaches and consultants and the water associations responsible for managing drainage systems. However, there is no social network among members within these various groups nor across groups, in the sense of established and habitual interpersonal or intergroup relationships. Rather, the paludiculture innovators seek to advance such networks via international conferences and action groups. For example, the paludiculture project Morgen has established an action group consisting of members from the Greifswald city assembly, town hall administration the office for construction and nature conservation, the lower water authority and the university to advance practical pilot projects on mires in the catchment of the Greifswald river Ryck.[5] Due to the contested nature of land use change, a challenge for group formation is constructive and inclusive dialogue. One farmer stressed that it is important to 'talk with each other, and not about each other'; and another participant said that he feels that 'there is no network yet but mutual recognition' has been achieved.

Barriers

Cognitive frames. There are normative frames reinforcing the status quo. 1) *land drainage as achievement*: 'Melioration' is seen as an engineering achievement. In such a framing, there has been progress, and the time before melioration was much worse. 2) *nature conservation, not nature use!* In this view, nature (rivers and wetlands) are valuable and/or in good shape; they should be conserved, not used.[6] Nature has adapted to the new landscapes, species have found their habitats there – and their protection has priority. One participant asked if wetland buffer zones with wet agriculture would not be a threat to the landscape and mean 'that the stork will not come back'.

The cognitive frames of social change, 3) *money rules the world*, also reappeared as a barrier. On some views, 'the [paludiculture] vision is not economic'. As one participant from farming clearly put it 'I am an idealist but not a suicidal idealist' (Rindler 2018). The novel is risky (for example calculation of profit, demand and value chains). This is not only a matter of economic expectation but also of consequences of re-wetting. Will the water table rise and flood basements, was a question raised in discussion. This different take on the economic

[5] http://www.succow-stiftung.de/morgen.html, accessed 5.04.2019.

[6] An associated cognitive frame, which clearly emerged from the interviews, is the landscape with drained mires as home and source of identity (Ziegler 2020) with people enjoying and appreciating the landscape as is.

cognitive frame. Is supported by the perception that people are forced to think in the short-term, but this is a topic that needs long-term thinking through, while sustaining economic feasibility in the present (Rindler 2018)[7]. In addition, there was cognitive disagreement and a different perspective on what would achieve change in direction of water protection. On this 4) cognitive frame, *the problem should be solved at source* (Meyer 2018). The wet agriculture potential is limited, and the real issue is to reduce fertiliser and pesticide use.

Institutions. Institutions also act as barriers supporting the status quo. They do so for a variety of reasons. First of all, they provide funding for competing goals.

1) Agriculture: The CAP is an important source of funding for agriculture via the direct payments of its first pillar, also on drained mires.[8] This means that for example some extensive grass land use on drained mires and other wetland types would not be profitable without such subsidies. By contrast, wet agriculture with production of biomass from Common Reed or Cattail on restored mires currently do not receive these direct payments; cultivating reed and other plants hence means a loss of direct payments (Oehmke 2018). Second, there is the risk that land that is not in agricultural use (German "Feldblock") loses in property value, and farmers might also feel that it is important to have the land so recognized (Risse 2018). Third, land that has been used as grassland for more than five years cannot be converted into arable land ("EU Gründlandumbruchverbot"), and according to this logic can also not be converted into wet agricultural use by cultivation of Paludicrops where this would require ploughing ("Umbruch" – so this point does not hold for wet grassland land use). Fourth, a further implication of subsidise for intensive agriculture and with it the use of large amounts of fertiliser and herbicides, is to create various costs downstream: as already noted, nature-based wetland solutions might be insufficient to remove large amounts of fertiliser and pesticide; in addition, pesticides and herbicides re-appear in biomaterial harvested from such wet agriculture sites, reducing the potential value of these materials as bio-materials. Even without this complication, some paludiculture value chains might only be profitable with subsidies, whereas others such as reed cultivation for construction, might be profitable even without subsidies (Risse 2018).

2) *Water*: Land use change, especially linked to water, is strongly regulated. On a case by case basis, this therefore requires an assessment of the intensity of the rewetting projects in wetland buffer zones with or without wet agriculture.[9] In addition, even if the rewetting with or without wet agriculture, would advance the WFD goals, the principle of voluntariness applies: as a result owners can block measures and effectively question their acceptability (Kühn 2018). This may result in great problems, as rewetting cannot be realised for single fields but must always consider at least sub catchments/hydrological units. The success of a

[7] This includes the point that economic actors have long-term commitments (for example due to investments in machines) that make changes in the present difficult, especially where these are based on uncertain future benefits.

[8] Overview of subsidies here: https://www.service.m-v.de/foerderfibel/?sa.fofi.kategorie_id=108, last accessed 7.07.2019.

[9] For the respective issues in planning approval and environmental impact assessment see Schäfer and Yilmaz 2019.

rewetting measure is dependent on the acceptance of all land owners respectively farmers within one hydrological unit.

3) *Nature conservation:* Rewetting WBZ with or without wet agriculture will affect the prevailing flora and fauna. “Will forage areas of the spotted eagle and the stork be negatively affected by such measures?”, asked one participant. In the pilot area Heilgeisthof at the Ryck, such considerations yielded a conclusion against a project of rewetting with a reed/cattail plantation, as a subsequent nature conservation assessment confirmed that reed would have reduced the forage area of storks in the area (and hence would require a compensation area).[10] Thus there can be tensions between the protection of individual animals, species and biotopes on the one hand, and the restoration of an ecosystem on the other hand.[11]

4) *Technology*: A history of complex melioration, as in the Ryck upper catchment, means that even for experts the draining system and order of tubes is difficult to track, and therefore technically demanding (Zak 2018). As it will often not be possible to take out a “part” of the system without affecting the rest, there is a strong path-dependency that makes change technically demanding and financially expensive (Ziegler 2020).

5) *Finance and contracts*: The above complications with subsidies and value chains means that investment in wetland is perceived as a risky investment to be avoided by municipalities (who are often owners of the zones). At any rate, rewetting with wet agriculture likely requires changes to rental contracts (Risse 2018) or a more systemic solution at the municipal level.

Social networks. There are social networks with collective power to reproduce institutions and cognitive frames. Agricultural, engineering, and industrial networks have business models and habits based on the status quo, and are likely to use their resources to protect them. This includes the use of peer-pressure against network members wanting to try out new things. Institutionally complex and knowledge-intensive change in land use supports stasis where staff in public authorities lack time and resources to understand alternative options. Even if a municipality top-down decides in favour of rewetting with or without wet agriculture various public authorities might still speak in “different voices”, some supportive, some feeling overwhelmed, others being opposed.

There is also the effect of science as a network of organised scepticism. For example, nitrate can be removed in drained mires too (Meyer 2018[12]), thereby complicating the kidney-thesis above. Citizen scientists can add to the confusion, for example if they take one-time measurements: seemingly arriving at different results if they confuse a point value with an

[10] Source: Project Morgen, Succow Foundation.

[11] Note, however, that a legal assessment comes to the conclusion that at least for the assessment of the initial intervention (rewetting with or without paludiculture) in most cases such conflicts should not result in compensation measures if the overall ecological impact of such rewetting measures is positive (Schäfer and Yilmaz 2019). See also Schäfer and Lechtape 2020.

[12] For a detailed discussion see Zak et al. (under review), and specifically on methane emissions from rewetted peatlands used for cotton tail cultivation see Vroom et al. 2018.

annual or seasonal average value (Kühn 2018). Last but not least, there is not organized citizens' or farmers' movement for paludiculture.

Interrelations in the social grid

The major positive lesson of the Greifswald workshop is the importance of social network building at an early state of rewetting with or without wet agriculture. Due to the controversy causes by such interventions – resulting from different perceptions of drainage and rewetting and their contribution to economy and the environment, as well as from institutional complexity and associated fractured responsibilities – the formation of collaborations is very important, even if only to create a space for discussion based on mutual recognition (German: "auf Augenhöhe reden").

Due to path-dependency resulting from melioration systems and institutional complementarity (not least due to current agricultural subsidies and a highly diverse institutional landscape that make socio-ecological change demanding), WBZ with wet agriculture is a pathway at the margin of intensive agriculture and river management (Ziegler 2020). Changing this requires a multi-year effort with likely leadership by the state to promote security for multi-year testing of new value chains, possibilities for farmers to explore new options while sustaining revenue in the present, time for authorities to include rewetting and wet agriculture in long-term planning (notably river management plans of the WFD) and facilitation by applied science or other knowledge brokers. This can draw on the shared cognitive frame 'money rules the world' to advance a long-term rather than short-term perspective on economic feasibility (Lechtape and Ziegler 2018).

In addition, the repeated disagreement on the 'nature' of the problem suggests that beyond WBZ and wet agriculture, and in accordance with the polluter pays principle of the WFD, good agricultural practices (including limits to fertiliser use) have to be defined and effectively enforced in implementation (Clearance 2018).

4. Warsaw Workshop[13]

Opportunities

Cognitive Frames. The normative vision included two cognitive frames. 1) *Ecological-functional perspective on nature*: This frame highlights the benefits from rewetting wetland buffer zones for local water cycling (and local cooling), water retention, and water quality due to nitrogen and phosphate retention (Grygoruk 2019, Kotowski 2019). Rivers are the "bloodstream of the Earth", a multifunctional system with many co-benefits rather than canals for draining waste (Kotowski 2019). 2) *Looming ecological catastrophe*: Rivers and water systems from source to oceans are under heavy pressure from human activities. This is for example testified by bans of swimming in lakes and coastal waters of the Baltic Sea due to algae blooms. A cognitive frame of change also was emphasized in the workshop: 3) *Working together*: Water crosses agricultural land and rivers, therefor water managers, farmers and ecologists must work together (Kotowski 2019).

Institutions. Workshop participants identified three institutional opportunities. 1) *EU Strategy for the Baltic Sea Region (EUSBSR).* This strategy has three objectives that wetland buffer zones with wet agriculture can contribute to the strategy's objective 1 "Save the sea" (including water cleaning), objective 2 "connect the region" (with wet agriculture as local source of energy) and objective 3 "Increase prosperity" (with climate adaption as a sub-goal)[14]. However, there are currently no specific resources for wetland buffer zones and wet agriculture within this strategy (Dawidowicz 2019). 2) *EU-Energy Efficiency Directive:* It demands more energy efficiency in housing. Paludiculture products (van Weeren 2019) such as typha might be an attractive alternative to the styrofoam and glass wool used in Poland, also because typha is fire proof. 3) As in the prior workshops, participants pointed to the *EU Common Agricultural Policy* and its reform as an opportunity to create funding for WBZ. In relations to this, the Polish Rural Development Programme could be used to support WBZ development via subsidies. Cross-sectoral mechanisms should be developed in the form of new legal guidelines and implementation acts between the Ministry of Agriculture and Rural Development, the Ministry of Maritime Economy and Inland Navigation, the Ministry of Environment, and the Ministry of Entrepreneurship and Technology. In particular, the Ministry of Agriculture and Rural Development and the Ministry of Maritime Economy and Inland Navigation (responsible for water management) could find a way for financial support of WBZ development and to establish mechanisms guaranteeing effective fund absorption. The formulation of legal solutions enabling proper management of these funds should be prioritised (e.g. implementation of subsidies for water retention in meadows, and a tax for emissions of nutrients to surface waters). Spatial planning should be developed to support WBZ creation by making their creation obligatory in spatial planning law. Finally, construction and material legislation could be changed in such a way that use of bio-materials such as Typha is possible without obtaining certificates for the materials in advance.

[13] Materials used for the analysis: Presentations and protocol of group workshops in Warsaw; workshop summary Michael Bender (as of 18.3.2019); notes from presentations by Polish participants in Danish workshop (see above).

[14] See https://www.balticsea-region-strategy.eu/about/implementation, last accessed 7.7.2019.

Specific proposals were also made: 1) Additional payments for landowners for water retention in riverine meadows or systemic purchase of land located along watercourses. 2) Tax emission of biogenic substances to groundwater; if polluter develops WBZ effectively (capturing nutrients) the tax will be reduced. 3) Obligatory establishment of WBZ as a compensation for investments affecting the environment. 4) Flood protection: moving embankments from the river as far as possible (more space for rivers and floodplains), banning any infrastructural development in floodplains, resettlement of people living in floodplain areas. 5) State Forests take into account the need for WBZ development and functioning: no clear cuts along watercourses, protection and restitution of wetland habitats. 6) Promote soft mowing, e.g. mowing every 4-5 years in August as a practice to move towards richer biodiversity in wet meadows of small, lowland river plains (Kolos et al 2018). 7) Approach the assembly of Wooden Frame House Builders with proposal of using typha or other paludiculture products as filling material.

Social Networks. There is currently no dedicated network for WBZ and wet agriculture. However, workshop participants emphasized that various actors already can take action anyway in their respective roles. 1) Scientist can a) pilot projects on different variants of WBZ implementation to demonstrate the most effective and simplest solutions adjusted to local socio-environmental conditions, b) offer training for school and pre-school teachers, for example as a part of post-graduate studies, c) prepare materials describing the role of wetlands for the humans and environment (incl. benefits provided by WBZ and practical aspects of WBZ establishment) for teachers, journalists, entrepreneurs, priests, agricultural advisors and other stakeholders. 2) Teachers can a) participate in trainings on WBZ and organize the knowledge transfer to students, b) organize field trips for students to visit river valleys as well as to farms in order to make young people aware of problems caused by using fertilizers in agriculture, and c) organize environmental scouting. 3) Journalists can a) report in the mass media about WBZ, the pressure on them and their various benefits for humans and the environment; b) more generally promote a more positive image of ecologists and those promoting nature protection (rather than framing them as 'eco-terrorists'). 3) Entrepreneurs can a) lobby for widespread marketing of wet agriculture products, and b) finance ads to promote WBZ development. 4) Priests can bring the subject of environment protection, necessity of taking care of the environment to Sunday sermons and parishes. 5) Directors and managers of National Parks and Centres of Ecological Education can prepare and implement demonstration projects to present and explain how WBZ look like and work, and what wet agriculture is. 6) Members of non-governmental environmental organisations can a) campaign and organize educational projects on necessity of WBZ development, and b) participate in public consultation of plans, programmes and policies on spatial development, water management, forestry etc. to assure including WBZ solutions. 7) Agricultural advisers and consultants can a) inform and reason with farmers on necessity of WBZ development and benefits coming from wet agriculture, b) individually meet with farmers, provide information and promote activities on WBZ development during public events (carnivals, harvest festivals, firemen competitions etc.), c) organize study trips for interested farmers to Denmark, Germany and the Netherlands, where WBZ exist and wet agriculture is carried out, to show how these solutions work in practice. 8) Farmers can a) apply for support of agricultural advisor and indirectly of scientists or non-governmental organizations to prepare

a demonstration project of WBZ on their land, and b) take part in Baltic Sea Farmer of the Year contest. 9) Authorities can develop legal regulations leading to support farmers in WBZ development via financial mechanisms (subsidies, tax reliefs etc.).

Barriers

Cognitive Frames. There are normative frames reinforcing the status quo. 1) *Land drainage as achievement*. There is a modernist policy focus, not least in government, that views rivers primarily as an economic resource with a renewed priority of regulating and channelling rivers (Kotowski 2019). As for cognitive frames of social change, 2) *money rules the world*, also appeared again as a barrier. Rational environmental policy on this view requires economic use value clarification and communication. But wetlands and their ecosystems services currently have no use value or market price. Accordingly, the economic value has to be estimated (on cost estimate approach within Clearance see Giergiczny 2018). 3) *Lack of education and knowledge*: It views education as a prerequisite of change, but finds it mostly lacking, for example insufficient ecological knowledge of river continuity, water and nitrate cycles and rivers being more than 'points', insufficient practical knowledge about use possibilities of (wet) agricultural plants and so forth. The first cognitive framework above together with this one in turn make it possible to present ecologists and nature conservation advocates as 'eco-terrorists' or insinuate as criminal intention. 4) *Scepticism regarding WBZ and wet agriculture as an effective solution*. During spring pulse, WBZ might be ineffective and spring water bypasses them. More technical solutions might be needed (Banaszuk 2018).

Institutions. Institutions also act as barriers supporting the status quo. They do so for a variety of reasons. In addition to points already emphasized in prior workshops, participants in Warsaw emphasized: 1) *Property distribution*: In Poland property holdings are frequently very scattered, this makes WBZ restoration additionally difficult. 2) *Lack of dedicated funding and regulation*: There is no dedicated funding for wetland buffer zones in Poland, nor is there a dedicated regulation. 3) *Lack of supportive ecosystem for paludiculture products*: There is insufficient regulation for the use of paludiculture products. For example, in construction, formal requirements for synthetic materials are less restrictive than for natural materials such as those from paludi-plants. There is also no suitable certificate for their use as building material, thus reducing their use options. There is currently no market demand for wetland products, and as long as there is only a very small production of paludiculture products, such as cattail used for construction, these remain expensive with no economies of scale. In addition, environmental pollution produces added cost for paludiculture products. A plant such as cattail also accumulates pollutants, e.g. herbicides, as a result these contaminate construction materials; moreover, there are therefore further costs resulting from testing for herbicides/pesticides (van Weeren 2019).

Social Networks. There is no social network for the development and maintenance of WBZ with or without wet agriculture. Rather state authorities, such as the Ministry of Maritime Economy and Inland Navigation, see water protection and resource provided via the water management plans of the WFD as a stimulus for local economy focused on channelization and 'dredging' of rivers.

Interrelations in the social grid

It seems too early to speak of positive enforcement relations regarding WBZ development with or without wet agriculture in Poland due to an apparent lack of pilot projects coupled with a countervailing, strong modernist tendency to remake rivers as an economic resource for transport. This in turn legitimizes the use of resources, such as from WFD, for 'dredging' policies that go against WBZ restoration. However, increased awareness of environmental danger for rivers and coastal waters of the Baltic Sea might serve as a stimulus for better exploring the co-benefits of wetland buffer zones, both for new wet agriculture options (such as an input for construction or for energy[15]) but also for old recreational and other uses such as fishing.

[15] For the area of the Narew National park, a recent study of bioenergy production finds that the most productive community with the highest biomass yield was a reed bed, followed by tall sedges and by sedge moss communities (Banaszuk et al 2019.). The study also notes this approach would help closing the loop via the recovery of nutrients and organic matter for reuse in agriculture.

References

Audet, Joachim; Zak, Dominik; Bidstrup, Jørgen; Hoffmann, Carl Christian. 2020. Nitrogen and phosphorus retention in Danish restored wetlands. Ambio 49 (1) 324–336.

Banaszuk, Piotr. 2018 Transport of contaminants in an agricultural catchment during snowmelt buffer strips vs preferential flow paths. Presentation Clearance Workshop, Aarhus, March 2019.

Banaszuk, Piotr; Kamocki, Andrzej K.; Wysocka-Czubaszek, Agnieszka; Czubaszek, Robert; Roj-Rojewski, Slawomir. 2020. Closing the loop - Recovery of nutrients and energy from wetland biomass. Ecological Engineering Vol. 143, 105643.

Beckert, Jens. 2010. How Do Fields Change? The Interrelations of Institutions, Networks, and Cognition in the Dynamics of Markets. Organization Studies 31 (5) 605–27.

Bender, Michael, Janko Lenz, Vlatko Vilovic, and Laura Köppen. 2019. "Economic Principles and instruments to support restoration of Wetland Buffer Zones (WBZ) and paludiculture in a circular economy approach." Clearance Deliverable Workpackage 6. Grüne Liga, Berlin.

Blaabjerg, Jesper. 2018. Land consolidation and wetland restoration as regional development. Presentation Clearance Workshop, Aarhus, September 2018.

Bork, Ludwig 2018. Zukunftsfähige Energiegewinnung im Naturpark Mecklenburgische Schweiz – das Biomasseheizwerk Malchin. Präsentation Clearance Workshop. Greifswald, November 2018.

Clearance. 2018. Brussels Declaration 12.9.2018. Restoring riparian wetlands for clean water and agriculture –policy recommendations for the European Water Framework Directive, Fitness Check and review process, as well as the Common Agricultural Policy review process. Online available at: http://wrrl-info.de/docs/seminar56_ClearancePolicyRecommendations_12_9_BrusselsDeclaration_Final.pdf, last accessed 7.7.2019.

Dawidowicz, Magdalena. 2019. Strategia UE dla regionu Morza Bałtyckiegoobszar tematyczny Biogeny. Presentation Clearance Workshop, Warsaw, March 2019.

Enßlin, Kläre and Michael Bender. 2018. Clearance Aarhus Workshop Report. Online available at: http://www.wrrl-info.de/docs/seminar57_Aarhus%20final%20report.pdf, last accessed 7.7.2019.

Giergiczny, Marek. 2018. Estimation of cultural services and non-use values related to different wetland buffer zones scenarios. Presentation Clearance Workshop, Aarhus, March 2019.

Grygoruk, Mateusz. 2019. Nutrient capture abilities of wetland buffer zones. Presentation Clearance Workshop, Warsaw, March 2019.

Hoffmann, Carl and Baattrup-Pedersen, Annette. 2007. Re-establishing freshwater wetlands in Denmark. Ecological Engineering (30) 157–166.

Hoffmann, Carl 2018. The functioning of wetland buffer zones and their capacity for nutrient removal. Presentation Clearance Workshop, Aarhus, September 2018.

Joosten, Hans, and Clarke, Donal, eds. 2002. Wise Use of Mires and Peatlands. Saarijärvi: Saarijärven Offset Oy.

Kołos, Aleksander, and Banaszuk, Piotr. 2018. Mowing may bring about vegetation change, but its effect is strongly modified by hydrological factors. Wetlands Ecol. Manag., 26 (5)879–892.

Kotowski, Wiktor. 2019. Introduction to the CLEARANCE Project and the Concept of Wet Agriculture. Presentation Clearance Workshop, Warsaw, March 2019.

Kühn, Ilona. 2018. Impulsbeitrag Podiumsdiskussion. Clearance Workshop. Greifswald, November 2018.

Lechtape, Christina and Rafael Ziegler. 2018. Wiedervernässung und nasse Landwirtschaft - Akteurs(motivationen), Netzwerke und Institutionen. Präsentation Clearance Workshop. Greifswald, November 2018.

Lerm, Achim. 2018. Begrüßung im Rathaus der Universitäts- und Hansestadt Greifswald. Introduction to the Clearance Workshop. Greifswald, November 2018.

Meyer, Tammo. 2018. Nährstoffabbau im Grundwasser der Polder – eine Hilfe für den Ryck? Präsentation Clearance Workshop. Greifswald, November 2018.

Moth, Lene. 2018. Municipality and Farmer Experience with land consolidation and wetland restoration. Presentation Clearance Workshop, Aarhus, September 2018.

Nicholls, Alex, Ziegler, Rafael. 2019. Creating Economic Space for Social Innovation. Oxford: Oxford University Press.

Oehmke, Claudia. 2018. Paludikultur auf flussnahen Moorflächen – Synergien zwischen Biomassenutzung und Nährstoffaustrag. Präsentation Clearance Workshop. Greifswald, November 2018.

Reichelt, Felix. 2018. Treibhausgasemissionen aus entwässerten Niedermooren – Einsparpotentiale durch nasse Nutzung. Präsentation Clearance Workshop. Greifswald, November 2018.

Ministerium für Landwirtschaft, Umwelt und Verbraucherschutz. 2016. Richtlinie zur Förderung der Bereitstellung von Strukturelementen auf dem Ackerland (Strukturelementerichtlinie), 2. Juni 2016. Schwerin.

Rindler, Lorenz. 2018. Impulsbeitrag Podiumsdiskussion. Clearance Workshop. Greifswald, November 2018.

Ringenberg, Christoph. 2018. Impulsbeitrag Podiumsdiskussion. Clearance Workshop. Greifswald, November 2018.

Risse, Johanna. 2018. Umstellung auf Paludikultur am Ryck – gesellschaftlicher Nutzen und betriebswirtschaftliche Perspektiven. Präsentation Clearance Workshop. Greifswald, November 2018.

Schäfer, Judith and Yilmaz, Yasin. 2019. Aktuelle Hemmnisse und Weiterentwicklungsoptionen im Ordnungs- und Planungsrecht zugunsten der Moorrevitalisierung als Umsetzung von Klimaanpassungs- und Klimaschutzmaßnahmen. Rechtwissenschaftliche Studie. Greifswald Moor Centrum-Schriftenreihe. ISSN 2627-910X.

Schäfer, Judith and Christina Lechtape. 2020. Paludikultur als naturschutzrechtlicher Eingriff –Wertungswidersprüche im Naturschutzrecht? Zeitschrift für Umweltrecht 2020 (3) 150-156.

Van Weeren, Aldert. 2018. Impulsbeitrag. Clearance Policy Workshop. Brüssel, November 2018.

van Weeren, Aldert. 2019. Tourism, construction and paludiculture. Presentation Clearance Workshop, Warsaw, March 2019.

Vroom, Renske J.E.; Xie, Fuju; Geurts, Jeroen J.M.; Chojnowska, Aleksandra; Smolders, Alfons J.P.; Lamers, Leon P.M.; and Christian Fritz. 2018. Typha latifolia paludiculture effectively improves water quality and reduces greenhouse gas emissions in rewetted peatlands. Ecological Engineering. Vol. 124, 88-98,

Wichtmann, Wendelin. 2018. Kurzvorstellung des Greifswald Moor Centrum und der Veranstalter. Presentation Clearance Workshop, Aarhus, September 2018.

Wichtmann, Wendelin, Schröder, Christian and Joosten, Hans eds**.** 2016. Paludiculture - productive use of wetpeatlands - Climate protection - biodiversity - regional economicbenefits. Schweizbart Science Publishers.

Wichtmann, Wendelin, Susanne Abel et al. 2018. Gute fachliche Praxis der Bewirtschaftung von Moorböden. Natur und Landschaft 93 (8) 391.

Wilke, Winfried. 2018. Impulsbeitrag Podiumsdiskussion. Clearance Workshop. Greifswald, November 2018.

Zak, Dominik. 2018. Nährstoffretentionspotenzial wiedervernässter Niedermoore: erste Ergebnisse aus Teilflächen des Ryck. Präsentation Clearance Workshop, Greifswald, November 2018.

Zak, Dominik, Craig Walton; Joachim Audet; Rasmus J Peterson; Jelena Lange; Claudia Oehmke; Wendelin Wichtmann; Jürgen Kreyling; Mateusz Grygoruk; Ewa Jabłońska; Wiktor Kotowski; Marta M Wiśniewska; Rafael Ziegler; Carl C Hoffmann. 2020, under review. Wetland buffer zones for nitrogen and phosphorus retention: impacts of soil type and vegetation. Science of the Total Environment.

Ziegler, Rafael. 2019. Water innovation for a circular economy – the contribution of actors from the grassroots. Water Alternatives 12 (2) 725-738.

Ziegler, Rafael. 2020 (forthcoming). Paludiculture as a critical sustainability innovation mission.Research Policy. https://doi.org/10.1016/j.respol.2020.103979