

# Chapter 7

## Commentary: Mr. Pitek's Land from a Perspective of Managing Hydrological Extremes: Challenges in Upscaling and Transferring Knowledge



Mark E. Wilkinson

**Abstract** This chapter views the case of Mr. Pitek by looking at the role of NBS in managing hydrological extremes. By viewing the case from a hydrological sciences perspective, we can begin to investigate whether these measures would have an impact in mitigating these extremes (e.g., reducing and delaying a flood peak). Therefore, this chapter gives some suggestions on what information we might need to make this assessment and the challenges and uncertainties in upscaling this approach. Also, the chapter explores if this type of privately funded land management approach is likely to be utilised by other land managers to give a greater density of measures at larger scales.

### The Use of Nature-Based Solutions to Manage Hydrological Extremes

Evidence suggests that a warming climate is affecting the timing of river floods in Europe, and projections suggest that climate change will also affect the frequency of floods (IPCC 2012; Bloschl et al. 2017). Similarly, drought risk is also projected to increase over the next decade across most of Europe (Spinoni et al. 2018). Different catchment management approaches can play a role in mitigating these hydrological extremes, for example, using Nature-Based Solutions (NBS), alongside and complementing traditionally engineered approaches. Our catchments also need to provide

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M. E. Wilkinson (✉)  
James Hutton Institute, Aberdeen, Scotland, UK  
e-mail: [mark.wilkinson@hutton.ac.uk](mailto:mark.wilkinson@hutton.ac.uk)

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other services, such as food production. Intensive agriculture is known to play a role in increasing runoff rates, potentially resulting in flooding and wider water management issues (O’Connell et al. 2007) (this is a common point raised by Mr. Pitek). Many European catchments share an intense focus on farming, a range of environmental issues such as pollution and degraded habitat, highly regulated governance regimes and vulnerability to climate and demographic changes. Hence, agricultural management can become a strategy for managing hydrological extremes but only if the right co-ordination, guidance and compensatory mechanisms are in place. Usually funding is required from public sources to implement catchment-wide NBS over larger scales (e.g., see [www.nwrm.eu](http://www.nwrm.eu)).

This chapter views the case of Mr. Pitek by looking at the role of NBS in managing hydrological extremes. By viewing the case from a hydrological sciences perspective, we can begin to investigate whether these measures would have an impact in mitigating these extremes (e.g., reducing and delaying a flood peak). Therefore, this chapter gives some suggestions on what information we might need to make this assessment and the challenges and uncertainties in upscaling this approach. Also, the chapter explores if this type of privately funded land management approach is likely to be utilised by other land managers to give a greater density of measures at larger scales.

It is unusual that, as in Mr. Pitek’s privately funded approach, a landowner is motivated to invest their own resources to implement NBS measures that additionally lead to a reduction in their farmland’s productivity. It is unlikely that many other landowners can spare resources aside from immediate farm business needs; they must instead be motivated by agri-environment subsidies (e.g., funded by the EU Common Agricultural Policy [CAP]). Holstead et al. (2017) found that, in a survey of Scottish farmers, 53% had not installed measures as they considered their land too valuable in its current form, and 38% stated that they did not have measures because of insufficient funding. Other than economics, some other well-established barriers hinder measures at the farm level, as summarised by Holstead et al. (2017):

- Availability of guidance and advice to implement measures.
- Public perception: that a farmer maybe seen as a “slipper farmer”.
- Joined-up policy: for example, that installation of new measures may affect the farmer’s single farm payment.
- Catchment planning: some landowners are critical of urban planning (e.g., building on floodplains) and see this as contradicting plans to increase the uptake of NFM.
- Traditions: for example, farmers don’t favour land rewetting measures relying on previous generations’ practice to drain land to increase productivity.

However, these barriers to uptake are not just limited to farmers, and further barriers can be seen in wider institutional bodies (see Waylen et al. 2018).

Nevertheless, the use of pools and wetlands, as presented in this case, is a common option where catchment management schemes have been implemented with a primary aim for FRM (see European Commission 2016). Wetlands and ponds can provide many ecosystem services (Nagabhatla and Metcalfe 2018), whilst temporary storage ponds are starting to become more popular in areas such as North-West

Europe as a means of storing water on agricultural land without impacting productivity too much (Environment Agency 2017) and mitigating the impact of soil erosion by collecting sediments (Evrard et al. 2008). Wetlands have been said to help to alleviate flood risk within catchments (Environment Agency 2017); floodplain wetlands have greater potential for managing floods (Acreman and Holden 2013).

## Spatial Complexities and Challenges in Upscaling

Mr. Pitek has been creating pools and wetlands on his land to improve low flows whilst delivering other ecosystem services (e.g., biodiversity enhancement, FRM). If the primary function were to increase groundwater recharge, then the first discussion point would be the optimal placement of these measures in terms of how they connect with the subsurface hydrology. Wetlands may be present in the natural landscape because of impermeable underlying soils or rocks, thus little interaction with the groundwater system occurs. A literature review by Bullock and Acreman (2003) found that, out of 69 literature statements referring to wetland groundwater recharge, 32 assumed without detailed investigation that recharge occurred and 18 suggested no recharge. Finally, six studies found wetlands recharge more, and nine found wetland recharge less than other land types. Therefore, this critical hydrological connectivity of a wetland intending to recharge groundwater systems is suggested by literature to be uncertain, complex and varying from site to site. Wider knowledge is required to understand this spatial complexity, for example, information on geology, soil type and land use.

When considering the role of such pools and wetlands in FRM, the available storage prior to and during a flood event is a key aspect. If a pond is full prior to an event, then it has little available storage to help mitigate the flood runoff (see Quinn et al. 2013). Therefore, one example would be to add a soil bund around the measure to create new “freeboard” storage (i.e., temporary storage). This would allow the pond to store more water during a flood event that could be designed to slowly drain away after the event (e.g., through an outfall or infiltration). This temporary storage approach can be implemented on floodplains and hillslope fields through the creation of bunds (see Environment Agency 2017). This was a common approach applied in the Belford catchment (6 km<sup>2</sup>), UK (Wilkinson et al. 2010; European Commission 2016). However, a larger volume of extra storage would be required at larger catchment scales. Metcalfe et al. (2017) suggested that, in a 29 km<sup>2</sup> UK catchment, 168,000 m<sup>3</sup> of extra storage would be required to attenuate peak flow to prevent flooding in a 1.5% Exceedance Probability flood. Mr. Pitek notes that the planning procedure for implementing larger ponds (e.g., 2,000–3,000 m<sup>2</sup>) requires greater consent. This suggests that there is a need to review planning procedures to implement larger volume areas (1,000–10,000 m<sup>3</sup>) of storage using more natural engineering without falling into the categories of traditionally engineered reservoirs (e.g., >10,000 m<sup>3</sup>), where detailed reservoir planning requirements need to be considered, increasing project costs and timescales (see Wilkinson et al. 2013).

As scale increases, the evidence of NBS effectiveness decreases owing to limited empirical studies at larger scales. However, it is at these large scales where policy and planning are more interested in overall combined system performance. In this case, the current plan of the PLA České Středohoří suggests further pools and wetlands are needed to increase the retention capacity of the landscape. Therefore, effective planning and coordination are required to ensure the measures are correctly placed and to minimise any disadvantages at larger planning scales. For example, for FRM, this can involve ensuring measures don't add to the synchronicity of flood peak levels in adjacent tributaries joining a main downstream river but instead try to decouple them (see Lane 2017).

## Reflecting on Comparable International Cases

Compared to ponds and wetlands supported by agri-environment and other public funding (e.g., via EU CAP or LIFE funding), those privately funded are likely to be far fewer. However, for different measure types the number of privately funded measures may be greater. For example, a survey in England during the 2013/14 crop year found that 44% of surveyed holdings (and totalling 450,000 ha) had some sort of land in management actions taken from a list of 22 environmental measures that were undertaken without any funding (this includes measures such as grass buffer strips next to a watercourse, fertiliser free permanent pasture, over-wintered stubbles etc.) (DEFRA 2014). Therefore, if the measures generally do not interfere (or show positive coherence) with farming practices, then unpaid measures could be supported by farmers. DEFRA (2014) highlighted that 79% of surveyed farmers responded that protecting soil and water is a primary factor in their land management. However, other studies have noted this motivation alters with different measures, especially those which change land use permanently or impact farm productivity, such as the blocked drains and ponded areas in the Pitek case. Spray et al. (2015) emphasized concerns of farmers in Southern Scotland over potential loss of capital and annual values due to loss of workable land now and in the future. The research suggested that measures involving a reduction in yield or useable land area are not favoured unless a payment mechanism is in place (preferably of annual income, as opposed to one-off compensation).

The notion of privately funded NBS depends on having land available to implement the measures. Therefore, Mr. Pitek is limited not only in regard to his financial resources but also as to when land is available to buy. The approach is not widespread in the case study area, as Mr. Pitek has been unable to motivate his local neighbours. The case stresses a landscape mosaic with many different landowners with measures generally dispersed only on Mr. Pitek's land. How land is owned and managed varies from country to country. In Scotland around 50% of Scotland belongs to 432 owners, including private and conservation charities/trusts (McGuire 2017). These trusts are generally focused on multifunctional landscapes and consider many aspects of land management as opposed to the Pitek case. He noted that conservation trusts are

usually focused on one agenda. So, for the case of Scotland, if one of these other large-scale private landowners were to consider investing their own resources into the natural landscape, then the scale of restoration could increase significantly. This is the case with one such landowner who owns over 80,000 ha of Scotland (one of the largest private landowners in Scotland). This owner is creating high-end, nature-based experiences and is interested in the social as well as the ecological needs of the Highlands of Scotland. However, how he and conservation trusts manage the landscape (like Mr. Pitek) may not be “traditional” to some local communities in terms of their management for landscapes to support local livelihoods (going back to the point of traditions mentioned by Holstead et al. 2017).

Globally, in some cases, local communities see water holding measures as an integral part of past traditions and have been reviving historical knowledge and traditions about water management. For example, Rajasthan, India has suffered from extensive drought periods. In the 1980s many of the region's rivers were dry and degraded, where many of the traditional water holding measures were not functioning. Since then over 10,000 Johads (a temporary storage area within a river system designed to hold and infiltrate water) have been constructed by local people to increase recharge into the local aquifer and the river systems are now flowing more regularly. Before the construction of the measures, only ~5% of runoff made it into the aquifer; this has now increased to ~20% (Sisodia 2009). This community-driven initiative has been paramount to the coordination and success of the project (Sisodia 2009).

More empirical evidence is necessary on the effectiveness of catchment approaches for managing hydrological extremes at the catchment scale (Schanze 2017). Therefore, further long-term monitoring of case studies is needed. However, a challenge remains in attaining robust evidence of managed catchments compared to a local control catchment where no management has taken place but where background (e.g., climate) factors can be assessed, and additionally comparing both before and after interventions (see Chap. 6 in Environment Agency 2017). In Mr. Pitek's case, to begin hydrological monitoring after the interventions have been installed may cause challenges in interpreting the evidence.

## Concluding Remarks

Currently, the use of catchment-wide NBS in most parts of Northern Europe are focused on flood rather than drought management. However, some catchment planners are now starting to give more consideration to low flow management (e.g., Holt 2018, describes how Slovakia is currently looking at national plans to drought management through NBS). Therefore, the Pitek case offers useful insights into the process of constructing pools and wetlands on the ground (using private funds) to manage low flows and provide wider benefits. If the case were monitored alongside a suitable control area, this could present a useful empirical evidence case study. However, to upscale, researchers would need to gain an understanding how many water holding measures might be needed to influence low flows. The case also highlights

the need for central coordination, support and planning for implementing measures over larger scales. The use of decision support tools and opportunity maps could allow for complex information to be used more easily and readily by landowners, implementors and planners (Mackay et al. 2015). For privately funded cases, accessible support mechanisms are needed to allow landowners to access advice on matters such as (a) working in the optimal places, (b) ensuring the measure is designed correctly to deliver its desired ecosystem service, (c) suggesting how measures could be adapted to deliver wider ecosystem services. Mr. Pitek's case also suggests a need to improve the legislative and administration process (e.g., the licencing paperwork) so that it is not seen as a burden that puts people off from implementing measures. In summary, it is vital that these initiatives are supported by offering accessible guidance and acknowledgement given to those who wish to use their private finances in helping to improve the environmental and ecological qualities of our landscapes. For that, it is only fitting that Mr. Pitek has been acknowledged with prestigious awards.

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**Mark Wilkinson** is a senior research scientist in catchment hydrology at the James Hutton Institute. The focus of his work is designing and investigating the impact of NBS with the main aim to reduce and attenuate flood peaks. He is also interested in the multiple benefits associated with these measures.

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