

## **PE1720/E**

The James Hutton Institute submission of 8 August 2019

The following is in response from the James Hutton Institute is to the invitation to comment, received from Scottish Parliament Petitions Committee on 15<sup>th</sup> July 2019. The materials were compiled by Mark Wilkinson, Kerry Waylen, Marc Stutter and David Miller.

**We thank the Public Petitions committee for the opportunity to comment on petition number PE01720 entitled ‘Natural Flood Alleviation Strategy for Scotland’.**

We agree that there are opportunities for better use to be made of Natural Flood Management (NFM) techniques in Scotland. In Scotland, over 100 NFM actions have been identified (Scottish Government, 2019). Numerous field studies have examined the effectiveness of specific NFM interventions at local scales.

Key points from our submission are:

- NFM could play an important role in mitigating flooding. However, evidence is currently focused at the local scale, and suggests challenges in mitigating extreme events at larger scales. Further research is required into its use at larger scales and for more extreme events.
- A wide range of NFM measures should be considered in a catchment management plan as part of a portfolio of flood risk management techniques. Such measures can support the provision of multiple public benefits (e.g. biodiversity, landscapes).
- Most measures are likely to be installed on private land (e.g. farmland), so co-constructing solutions with land managers and communities is essential. Often this will be most effective through the use of trusted intermediaries.
- Consideration should be given to coordinating elements of existing Scottish Government strategies and policies which can deliver or support NFM. Such coordination should be viewed as part of the challenge of enabling adaptive management, with account taken of the rights and aims of public and private actors.

Under the following headings we draw to the attention of the Committee some of the available scientific evidence with respect to NFM of relevance to the petition.

### **Natural Flood Management**

Natural Flood Management (NFM) is a method which can reduce the risk of flooding through the alteration, restoration or use of landscape features. It offers the potential for managing runoff by targeting flow pathways, improving infiltration and utilising floodplains and riparian zones. Dadson *et al.* (2017) summarise evidence concerning catchment-based NFM in the UK. Examples of techniques which have been applied are: targeted tree planting, river and floodplain restoration, leaky barriers, upland and peatland management, agricultural land and surface runoff management.

Evidence from case studies conducted under the Scottish Government Strategic Research Programme (2016-2021) demonstrates that NFM measures can be used to manage the impact of flooding in smaller scale catchments (Wilkinson *et al.*, 2019).

However, there is a need for evidence at the scale of larger catchments and for extreme events (Wilkinson *et al.*, 2019). Research is ongoing at the Eddleston Water, Scottish Borders, but this is at too early a stage for peer-reviewed results to be available.

**Noting the wording of the petition, the following observations may be of assistance to the Committee.**

- **The petition states that the ‘... case for comprehensive application of these initiatives is overwhelming, ...’**

Whilst NFM measures can help to alleviate flooding they should not be seen as the ‘silver bullet’ to flood risk management (FRM), and need to be considered alongside a range of other FRM techniques. Currently, NFM is more appropriate for managing small to medium sized floods. Managing extreme flood events such as Storm Frank (2015/16) would require significant amounts of water to be held in catchments. For example, for a 29 km<sup>2</sup> catchment in England, Metcalfe *et al.* (2017) suggest that 168,000 m<sup>3</sup> of extra storage would be required to attenuate peak flow to mitigate flooding for a flood which is of a 1.5% annual exceedance probability (i.e. a flood that has a 1.5 in 100 chance of occurring or being exceeded in any given year). This could be achieved but will require reconsideration about how catchments are managed, and the use of a wide range of different techniques (Wilkinson *et al.*, 2019).

NFM measures carry many other benefits to society (Environment Agency, 2017). For example, there is growing interest in the whisky industry for using certain NFM measures to hold and infiltrate water into the groundwater system to potentially improve low flows and manage water temperature (Fennell *et al.*, 2018; Wilkinson *et al.*, 2019). There is a case for the comprehensive application of these measures when considering the wider multiple benefits these measures may bring.

- **The petition states that ‘There are significant opportunities here in terms of public education and engagement ...’**

We agree with the suggestion that there are benefits to be gained from wider involvement of communities in the creation of improvements in local environments for the benefit of local people and future generations. A number of mechanisms enable engagement with the public regarding the benefits of approaches to FRM.

In Scotland, there are good examples of such engagement, which is inclusive and leads to positive outcomes in reducing risks of flooding. For example, the Natural Flood Management Network Scotland ([www.nfm.scot](http://www.nfm.scot)), and its online platform, has been set up to share knowledge and best practice amongst those working with this approach. The online web platform facilitates sharing of knowledge amongst users involved in similar projects, research or activities. It has an increasing profile in Scotland and internationally. Other initiatives run awareness raising activities for members and local populations (e.g. the Dee Catchment Partnership). In addition, current work being undertaken by Scotland’s Centre for Expertise in Water (CREW; [www.crew.ac.uk](http://www.crew.ac.uk)) is assessing the attitudes of communities at risk of flooding to NFM, the findings of which will inform this discussion in due course.

## Land managers

Holstead *et al.* (2015) identified six key criteria that Scottish farmers consider when implementing NFM: economics, availability of advice and support, public perception, joined-up policy, catchment planning and traditions. While these criteria are consistent with the wider agri-environment literature and other flood management studies, the study particularly emphasises the need for one-to-one advice from a trusted facilitator and long-term financial incentives that compliment other types of farm income. Liaison with individual farmers should also be combined with a catchment approach to flooding, to highlight catchment processes and build shared responsibility for reducing flood risk.

Key conclusions by the Centre of Expertise for Waters (CREW) report on 'Learning from community led flood risk management' (McLean *et al.*, 2015) were that:

- While FRM policy in Scotland requires the consideration of NFM, many landowners do not yet support their implementation. Since many measures to support NFM can only be carried out with the support and participation of land-managers, it is particularly important to understand the perceptions of these stakeholders.
- Many land-managers would consider implementation of NFM measures only if they were compatible with farm business strategies, financially viable and conformed to concepts of 'good' farming. Despite strong political drive to implement NFM to complement traditional approaches to FRM downstream, limited uptake of these measures by landowners still remains. Traditional approaches such as dredging and drainage are perceived as the most desirable options.

From this and other studies we know that land-manager attitudes may differ towards different types of NFM measure, so affecting their uptake. At present we have little understanding of attitudes to beavers in the context of flooding.

## Strategy for Natural Flood Alleviation

We acknowledge that there is no specific Strategy for NFM in Scotland, but note that Scotland is often considered to be a forerunner in supporting NFM, a concept that has received policy support, i.e. through the FRM (Scotland) Act 2009. The statutory agencies of SEPA and SNH have also provided significant public support and innovative guidance for NFM<sup>1</sup>, which is reflected in past and ongoing public funding for multiple research and communication activities<sup>2</sup> to build understanding of NFM.

Several of the techniques identified as part of NFM would align with current Scottish Government strategies and policies, such as the Land Use Strategy and Scottish Planning Policy, or those emerging such as a Scottish Environment Strategy. As such, consideration could be given to means of coordination of the elements of existing strategies which can deliver or support NFM. However, coordination should be considered in light of the broader challenge of adaptive management and the appropriate mixes of public and private actors that can 'steer' processes such as NFM.

As Scotland is accruing experience of NFM, we suggest that in the coming years it will be useful to reflect on the existing policy mix, and the value of any change to this such

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<sup>1</sup> <http://media.sepa.org.uk/media-releases/2016/sepa-publishes-guidance-on-natural-flood-management.aspx>

<sup>2</sup> <https://www.nfm.scot/>

as the introduction of a new strategy on NFM. This may be particularly valuable if the post-Brexit context provides opportunities to reconsider the basic premise and scope of agri-environment schemes incentives and practices that affect land-manager decision-making.

Key challenges are reported regarding NFM which include difficulties in its coordination, and the requirement for new skillsets for practitioners, and resources (Waylen *et al.*, 2017). Tackling these challenges is not a matter solely of providing more evidence: enabling NFM is primarily a challenge for governance. Our current governance systems do not cope well with uncertainty and lack of control, and hence can discourage the implementation of NFM. This is despite evidence that existing ways of controlling rivers and flood risk are, by themselves, inadequate. Understanding how any governance arrangements can cope better with uncertainty is an unresolved research priority. Addressing this would, in turn, support the appraisal of the flood-related consequence of beavers in the landscape.

This requires attention at every level, ranging from land-managers through to how flood-related objectives are enabled by professionals working in public bodies and consultancies. In doing so it would be appropriate to pay particular attention as to how approaches to NFM are guided by the 'Environmental Principles and Governance', the subject of recent consultation by the Scottish Government.

- **Potential of targeted tree planting schemes**

Trees can play an important role in mitigating flood peaks if planted and managed in the correct locations (Environment Agency, 2017), whilst also providing other benefits. Woodlands helps improve infiltration, thereby improving water storage in the soil (Bathurst *et al.*, 2018; Stratford *et al.*, 2017).

Trees are one element of the restoration of river corridors, which are well recognised in Scotland and internationally. In many landscapes, especially those dominated by use for agriculture and built development, river corridors and riparian space have become degraded of beneficial structures such as trees and minimised so that rivers are restricted from their natural form. Restoration of the river corridor can improve habitat in this interface between land and water, buffer pollution from the land (riparian buffer strips) to improve water quality, increase river resilience to climate change by shading and slowing runoff. It may also give space for access for public recreation alongside rivers via footpaths.

The benefits of this restoration are widely appreciated and some form of action from basic buffer strips against farmed or developed land to improved riparian buffer zones with tree planting, all the way up to river channel restoration to re-meandering straightened channel sections, is part of the growing actions for integrated catchment management. Benefits arising from these actions are often driven by aims of improved water quality and habitat but increasingly it is recognised that flood management is a key benefit and motivator for actions.

Outcomes from NFM measures of slowing runoff, trapping eroding soils and leaving more diverse soil wetness also have wider benefits (Stutter *et al.*, 2019). In farmed and developed landscapes features in the river corridor space, and associated benefits, can be 'designed' as part of catchment planning; buffer zones can be targeted to key runoff interception points, riparian tree planting and wetland re-establishment is applied for different purposes at different headwater and downstream river zones and the actions are planned and strategic. However, there is seldom the

space and stakeholder support for large areas of rewilding as relevant interventions are often of greatest effect in landscapes that provide other services such as food production, housing and other infrastructure. In effect, the planning is done by groups such as river partnerships and catchment intermediaries (The Dee Catchment Partnership, the Tweed Forum, etc.) using evidence generated, outcomes achieved and lessons learnt.

The RiverWoods initiative, led by the Scottish Wildlife Trust, is aiming to pool public and private investment into river corridor restoration through several significant example projects of large scale riparian tree planting as a means to push the scales of restoration and demonstrate clearly the multiple benefits of larger-scale actions on major river systems in Scotland. This is a demonstration of the commitment of organisations in Scotland to come together to deliver coordinated actions of riparian restoration for multiple benefits outcomes and engender a step-change in investment nationally into such ecosystems based upon demonstration of benefits through significant pilot projects in the near future.

As with other NFM measures, there is good evidence of the effectiveness of the role of woodlands at local scales, but further evidence is needed at the catchment scale and under extreme events (Stratford *et al.*, 2017; Soulsby *et al.*, 2017). Woodland creation needs to be considered alongside other NFM techniques. They take time to establish and therefore effectiveness, such as their ability to intercept rainfall (depending on species and landscape in which it is located), generally increases with maturity (Stratford *et al.*, 2017; Wilkinson *et al.*, 2019). This compares with the immediate impacts obtained using offline storage areas and leaky barriers which are point based measures designed to work from the moment they are constructed (Wilkinson *et al.*, 2019). At larger scales, consideration is required of the targeting of woodland towards sub-catchments which help to desynchronise flood peaks (Lane, 2017).

- **Translocation of the Eurasian beaver (*Castor fiber*)**

Recent trials in England have shown that the Eurasian Beaver can have small scale (~20 ha) impacts on attenuating flood peaks (Puttock *et al.*, 2017). However, there is uncertainty as to whether these impacts are scalable to large catchment areas, and for extreme events (Kelmanson *et al.*, 2019). As with other NFM measures, such as woodland creation, evidence-based planning is required to ensure that beavers are in the correct sub-catchments to help 'desynchronise', and therefore mitigate, flood peaks and to avoid such synchronisation of flood peaks (Lane, 2017).

The James Hutton Institute will welcome the opportunity to expand upon any of the points made in this submission if that would be of assistance to the Committee. The James Hutton Institute is one of the collective of six organisations which collaborates to deliver the Scottish Government funded Strategic Research Programme 2016-2021 on agriculture, environment, food and land (sefari.scot).

## References cited

- Bathurst, J., Birkinshaw, S., Johnson, H., Kenny, A., Napier, A., Raven, S.,... Stroud, R. (2018). Runoff, flood peaks and proportional response in a combined nested and paired forest plantation/ peat grassland catchment. *Journal of Hydrology*, 564, 916–927.
- Dadson, S.J., Hall, J.W., Murgatroyd, A., Acreman, M., Bates, P., Beven, K., Heathwaite, L., Holden, J., Holman, I.P., Lane, S.N., O’Connell, E., Penning-Roswell, E., Reynard, N., Sear, D., Thorne, C. and Wilby, R. (2017). A restatement of the natural science evidence concerning catchment-based ‘natural’ flood management in the UK. *Proc. R. Soc. A* **473**: 20160706. <http://dx.doi.org/10.1098/rspa.2016.0706>
- Environment Agency. (2017). Working with natural processes – evidence directory in Environment Agency for England and Wales (ed.). Bristol, UK.
- Fennell, J., Geris, J., Soulsby, C., Daalman, R. and Wilkinson, M.E. (2018). Exploring nature-based strategies in upland landscapes for managing low flows and stream temperatures. In *Geophysical Research Abstracts*, ed. EGU General Assembly 2018, 2018 Vienna.
- Holstead, K.L., Kenyon, W., Rouillard, J.J., Hopkins, J. and Galán-Díaz, C. (2015). Natural flood management from the farmer's perspective: criteria that affect uptake, *Journal of Flood Risk Management*, 102(2), 205-218. <https://doi.org/10.1111/jfr3.12129>
- Kelmanson, M., Bokhove, O., Kent, T., Piton, G., Tacnet, J-M., (2019). Using flood-excess volume to assess and communicate flood-mitigation schemes. In EGU General Assembly Conference Abstracts.
- Lane, S.N. (2017). Natural flood management. *Wiley Interdisciplinary Reviews: Water*, 4(3), e1211.
- McLean, L., Beevers, L., Waylen, K., Wright, G. and Wilkinson, M. (2015). Learning from community led flood risk management. CREW report CD2014-12. Available online at: [crew.ac.uk/publications](http://crew.ac.uk/publications)
- Puttock, A., Graham, H.A., Cunliffe, A.M., Elliott, M. and Brazier, R.E. (2017). Eurasian beaver activity increases water storage, attenuates flow and mitigates diffuse pollution from intensively-managed grasslands. *Science of the Total Environment*, 576, pp.430-443.
- Scottish Government (2019). Implementation of the Flood Risk Management (Scotland) Act 2009 Report to the Scottish Parliament, February 2019. <https://www.gov.scot/binaries/content/documents/govscot/publications/publication/2019/02/implementation-flood-risk-management-scotland-act-2009-report-scottish-parliament/documents/00546042-pdf/00546042-pdf/govscot%3Adocument/00546042.pdf>
- Soulsby, C., Dick, J., Scheliga, B. and Tetzlaff, D. (2017). Taming the flood – how far can we go with trees? *Hydrological Processes*, 31, 3122–3126.
- Stratford, C., Miller, J., House, A., Old, G., Acreman, M., Duenas-Lopez, M. A., ... Tickner, D. (2017). Do trees in UK-relevant river catchments influence fluvial flood peaks? A systematic review. In: NERC/Centre for Ecology & Hydrology (ed.). Wallingford, UK.
- Stutter, M., Kronvang, B., OhUallachain, D. and Rozemeijer, J. (2019). Current insights into the effectiveness of riparian management attainment of multiple benefits, and potential technical enhancements. *Journal of Environmental Quality*. 8<sup>th</sup> March 2019. 236-247.
- Waylen, K.A., Holstead, K.L. Colley, K. and Hopkins, J. (2018). Challenges to enabling and implementing Natural Flood Management in Scotland. *Journal of Flood Risk Management*, 11(2), S1078-S1089. [doi.org/10.1111/jfr3.12301](https://doi.org/10.1111/jfr3.12301)
- Wilkinson, M.E., Addy, S., Quinn, P.F. and Stutter, M. (2019). Natural flood management: small-scale progress and larger-scale challenges. *Scottish Geographical Journal*, [doi.org/10.1080/14702541.2019.1610571](https://doi.org/10.1080/14702541.2019.1610571).