The All Party Parliamentary Group on Agroecology

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Land management, soil quality and flood prevention

INTRODUCTION:

In the light of recent extreme weather and severe flooding across large parts of the UK, there has been much debate about how to prevent similar problems in the future, how to manage rivers and waterways and discussion on the future of farming in areas such as the Somerset levels, which are prone to flooding.

One way of addressing multiple issues at the same time is to ensure that the type of farming that does take place works to decrease rather than exacerbate flooding. In particular, the health of the soil has a great effect on how much water it can hold, how much water runs off, and how much the soil itself is eroded – silting up rivers and streams. In most rural areas the key determinant of the health of the soil is the way that land is farmed.

RELATION BETWEEN FARMING, SOIL AND FLOODING:

There are several ways that farming affects both soil quality and the reaction of the land to flooding:

1. Compaction.
Compaction is caused by the use of heavy machinery and by over-intensive grazing, which cause the soil to become compressed. The result is that soils are less able to absorb water and release it slowly over time. Instead, water runs off the land and moves elsewhere.

Water run-off depends on both the rate at which water enters the soil (infiltration) and the rate at which it moves through the soil (transmission), when these rates are both high, the soil can absorb large quantities of water.

2. Soil erosion
Soil erosion is in part a result of water run-off, caused by the inability of the soil to hold water. As the water runs off the surface it takes with it large quantities of top soil, which is washed downstream causing bottlenecks and water to back up. In addition, it also removes vital soil fertility from the land especially phosphates.

Intensive arable crop production continuously degrades the soil quality and thus land used for this purpose is more susceptible to soil erosion. As has been pointed out recently[1], the rapid expansion of maize production in the UK since the 1970s, largely produced to feed cattle and

[1] http://anewnatureblog.wordpress.com/2014/02/06/lost-in-the-drainage-maize/

for use as fuel, is an example of exactly the sort of system that leads to run-off and erosion.[2] The stubble is left over autumn and winter without being ploughed into the ground allowing fine soil to be swept downstream over this period. The South West including the catchment draining into the Somerset levels have some of the highest concentrations of maize crops in the UK. A 2010 study estimated that 50% the sediment in the Rivers Tone and Culm was soil eroded from maize fields used to feed very high production dairy herds.[3]

3. Uplands
Well-managed uplands can absorb large amounts of water, if they do not then this causes flooding down-stream. Increased cover with trees and shrubs can help to reduce excess water flowing downstream.

4. Wetlands
Floodplain areas around river valleys have traditionally flooded at certain times, spreading the water across an increased area onto wetland soils, which could absorb some or all of the water. These areas were traditionally grassland (hence water meadows) but as these areas have become more populated human intervention has eradicated large areas that used to be wetlands. Where such flooding does occur it is no longer in meadows but in built-up areas.

USING FARMING TO IMPROVE WATER MANAGEMENT

Grazing and Pasture:
While intensive grazing over an extended period can lead to compaction, loss of vegetation and soil erosion, when managed well, low-level year-round grazing can help lessen the impact of flooding by improving the soil structure and quality.

Initial research has shown the importance of building carbon content in the soil. Carbon is naturally absorbed by plants from the atmosphere and when these plants break down they remain in the soil as organic matter. This organic matter fuels an underground ecosystem of bacteria, fungi, earthworms and insects. Increasing soil carbon improves the structure of the soil and its ability to hold nutrients. More importantly, it also improves the ability of the soil to retain water, with research showing that high soil carbon content can drastically increase the holding capacity of soil and that loss of carbon increases compaction.[4]

There are also other benefits to increasing soil carbon and organic matter content, including producing higher quality forage for grazing animals and reducing the amount of chemical fertilizer required. Land managed in this way is also more resilient to drought as large amounts of water can be stored deep underground and then released for use by plants when needed.

Intensive farming has caused substantial reductions in soil carbon and losses of topsoil in most vulnerable soils and has also disrupted the water cycle and affected drainage. Replacing grazing or mixed farmland with intensive crop production, which relies on fertilizer and heavy machinery drastically reduces the soil organic matter. Crop production of any sort

[2] R. C. Palmer & R. P. Smith 'Soil structural degradation in SW England and its impact on surface-water runoff generation', *Soil Use and Management*, December 2013, 29, 567–575
[3] Jaafar. M, 2010 PhD Thesis, Unversity of Exeter, Soil erosion, diffuse source pollution and sediment problems associated with maize cultivation in England. http://hdl.handle.net/10036/98234
[4] http://www.amazingcarbon.com/PDF/JONES-Carbon&Catchments(Nov06).pdf

tends to extract nutrients from the soil unless well managed, but at the levels seen in current industrial agriculture, the process is occurring far more rapidly. The result is a vicious circle, with intensive farming causing flooding, soil erosion, run-off and nutrient leeching, with the proposed solution being ever-higher levels of chemical use to maintain production.

Farming that is expressly designed to maintain or improve soil structure and carbon provides a solution. As well as directly adding to soil carbon, for example by adding compost, it can also be improved biologically, using cover crops to prevent erosion or through species-rich grasslands, which increases soil carbon through the root structure of pastures.[5]

Agroforestry
As mentioned above, planting trees upstream can help the land absorb more water and so prevent drastic flooding downstream. Agroforestery, which combines agricultural crops with trees in a mixed production system, could also has a role to play here but currently Defra do not permit it to be funded through CAP payments.

POLICIES TO HELP GUARD AGAINST FLOODING:

The incentives for the type of farming in the UK stem from a number of sources, but few of them are helping avoid the type of land management that exacerbates flooding.

Maize, for example, is heavily incentivised by the government subsidy given to biofuels produced from maize (as a low-carbon fuel) in anaerobic digestors. Maize is also grown as high energy animal feed but if the same land could be used to feed animals directly through pasture the land would be multifunctional –feed, moisture retention and flood prevention.

In addition the UK application of the Common Agricultural Policy could do far more to encourage well-managed farms, permanent pasture and more crop rotation. This could be achieved within the existing framework of the Environmental Stewardship schemes, by making flood prevention a priority for example.

More research is also needed to quantify the effects of different land management practices on the propensity of land to flooding and soil erosion.

[5] Rob Richmond, *The benefits to agriculture and the environment of rebuilding soil carbon,* Nuffield Farming Scholarship Report, March 2011.