

The summer floods of 2012 and the North Wyke Farm Platform capability

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- 18 million litres of rain fell on 68 ha grassland on the North Wyke Farm Platform over a period of just 24 h in July 2012
- Precision-engineered flumes revealed that 5 million litres of water were lost to surface or sub-surface drainage
- Silage yields were reduced by 50% in 2012, as compared with 2011
- New grasses that may reduce flooding are being trialled on the North Wyke Farm Platform in 2013

How will climate change affect farming (livestock production and grassland management) in the UK? Meteorologists have forecast that, for the foreseeable future, there will be more extreme weather events, including very heavy rainfall and periods of droughts (UK CPO9). The extreme rainfall in the South West in 2012 fits with this prediction - the amount of rain that fell in early July in parts of Devon exceeded that which would be expected from a 1-in-100 year event^a (Fig. 1).



Figure 1. Flooding of farmland in Devon in July 2012. Photo: Devon County Council.

Rainfall records from the official Met Office Weather Station at Rothamsted Research North Wyke extend back for 31 years. They show that the mean 10 year annual rainfall until 2011 was 909 mm. This increased by one-third in 2012. In total for 2012, nearly 1 billion litres of water fell on the total area (68 ha) of the North Wyke Farm Platform. Of this, some 70%, or 700 million litres, was lost as surface or subsurface (30 cm) drainage.

Hydrology and cutting-edge technology



Figure 2. An instrumented flume on the North Wyke Farm Platform. Water levels are recorded every 15 min and used to calculate water flow in litres per second.

When the storm hit in July 2012, the North Wyke Farm Platform was in its establishment phase. The precision-engineered, fully-instrumented flumes (Fig. 2) on 15 hydrologically isolated fields, which range in size from 1.5 to 11 ha, automatically recorded every litre of water that left each field every 15 minutes, and transmitted the data back to a central data system, using telemetry (Fig. 3). This information was used to calculate the amount of water in litres per second.

During the storm, the dedicated met stations on the 15 fields recorded that 18 million litres of rain fell on the North Wyke Farm Platform, and 5 million litres of water poured through the 15 flumes in 24 hours. This is the first time this level of detail has been recorded at the farm scale in the UK.

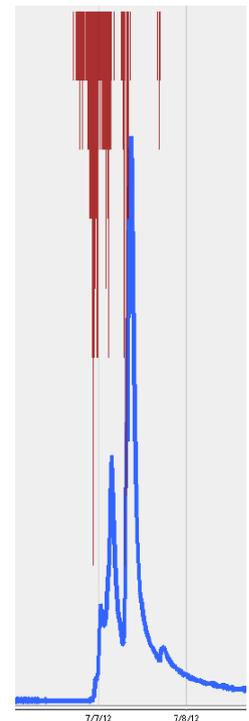


Figure 3. Live data from the flumes on July 7th 2012. Key: rainfall (red); water flow (blue).

^a Flood Investigation Report, Devon Sumer Floods 7th – 8th July 2012, Final Report, Devon County

The bigger picture

Although the summer storm in July was devastating for many, the data from the 15 met stations on the North Wyke Farm Platform show that that total rainfall in July (84 mm) was less than half of that in December (230 mm; Fig. 4). However, 30% of the monthly average rainfall fell in just 24 hours on July 6th and 7th, 2012, showing the importance of short, intense storm events for increased flood risk.

The relationship between the amount of rainfall and water draining from the fields changed throughout the year, with drainage flow tracking rainfall much more closely in the winter months when the soils were already wet, and when evapotranspiration losses from growing plants were low.

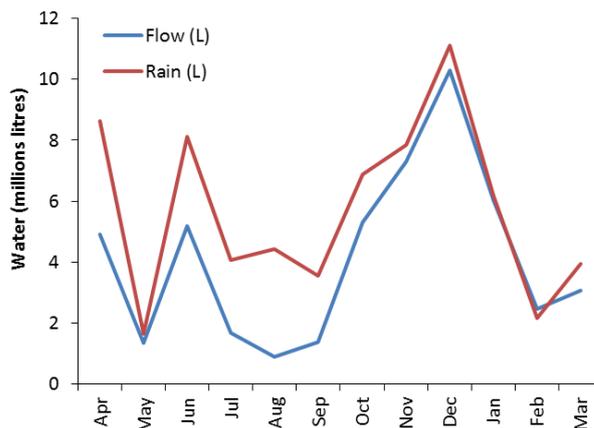


Figure 4: The total amount of rainfall (red) and water that drained through the flumes (blue) on the North Wyke Farm Platform for each month in 2012.

The effect of extreme weather on the economy of livestock farming



Figure 5: Cattle on the North Wyke Farm Platform.

The longest continuous dry period recorded on the North Wyke Farm Platform was only 7 days during 2012. The poor summer weather translated to fewer grazing days. This did not impact on the liveweight gain of the cattle, which were housed for nearly 3 weeks in April/May to protect the soil and swards, but at the cost of using precious silage reserves. The silage yields were also 50% lower in 2012 than in 2011 due to lack of sunshine. This highlights the fragility of farming systems to climatic variability and the need for longer-term farmscale research. Indeed, the effect of longer-term climatic effects on livestock production will be a key outcome of the North Wyke Farm Platform project.

The future: using new plant genotypes to manage flood risk?

New grass hybrids, developed at the Institute of Biological, Environmental and Biological Research (IBERS) that may reduce risk of flooding, are being planted on the North Wyke Farm Platform in spring 2013. In recent small plot trials at North Wyke, the hybrid of perennial ryegrass and meadow fescue called '*Festulolium* cv. Prior' (Fig. 6) reduced run-off by 51% as compared with a leading UK nationally recommended perennial ryegrass cultivar^b.

The North Wyke Farm Platform will measure the difference in water flow from fields that have been planted with *Festulolium* and compare them to fields planted with conventional grass mixtures. The effect of the grasses on other factors important to both farmers and to the environment will also be tested, - these include measuring greenhouse gas emissions, losses of fertilisers to water, monitoring increasing soil carbon, and live weight gain of grazing animals.

^bMacLeod et al., 2013; Nature Scientific Reports; doi:10.1038/srep01683



Figure 6: *Festulolium* cv Prior has a very large and deep rooting system. Photo: IBERS.