# Catchment-scale restoration for flood risk and sediment management: Pontbren, UK.

Alex Henshaw & Colin Thorne

## Outline:

- **Background**: recent land use change in UK uplands.
- **Impacts**: evidence from Pontbren catchment.
- **Restoration**: Pontbren Rural Care Project.

## Recent land use change in UK uplands

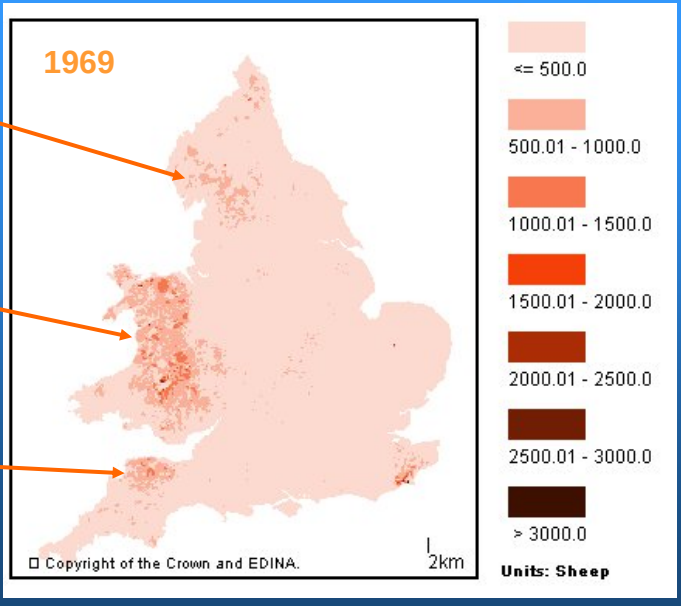
- 1970s: Farm & Horticultural Development Scheme (FHDS) promoted **agricultural intensification**.
- Farm productivity increased through **land drainage** and **grassland creation**.
- **Dramatic rise in sheep numbers** - particularly in upland regions of Wales and northern England.

## Distribution of sheep in England and Wales

Lake District

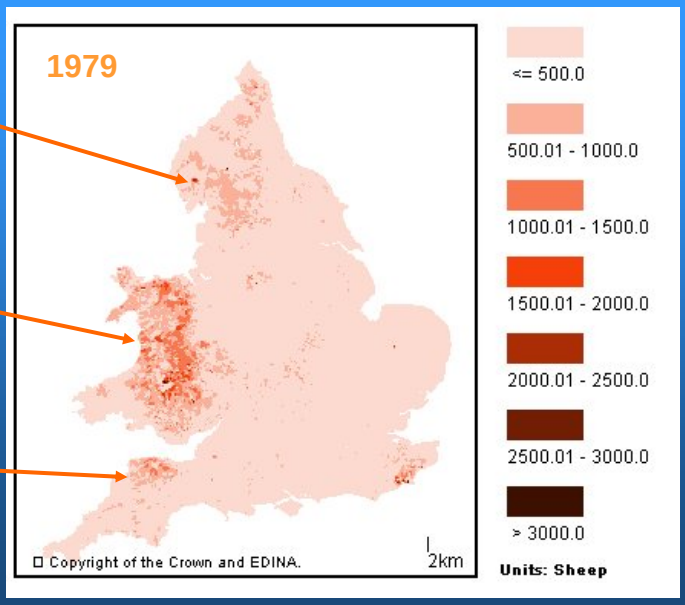
Wales

Exmoor & Dartmoor




*Source: Agricultural and Horticultural Census for England and Wales*

## Distribution of sheep in England and Wales

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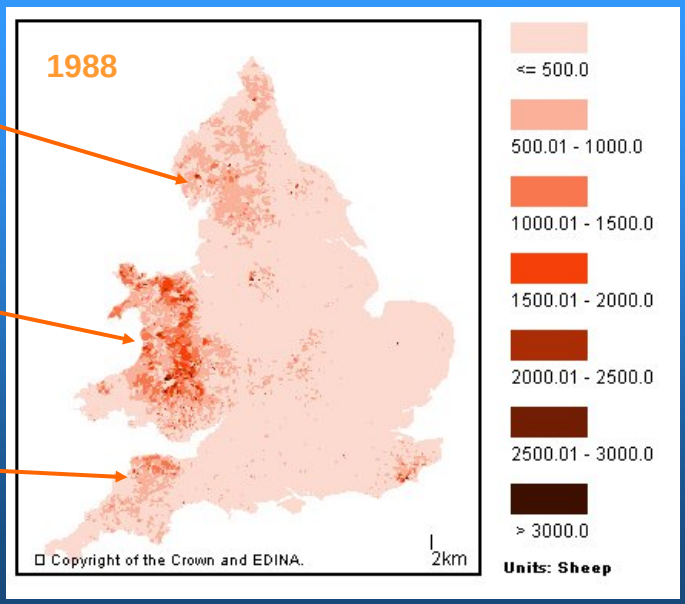
## Distribution of sheep in England and Wales

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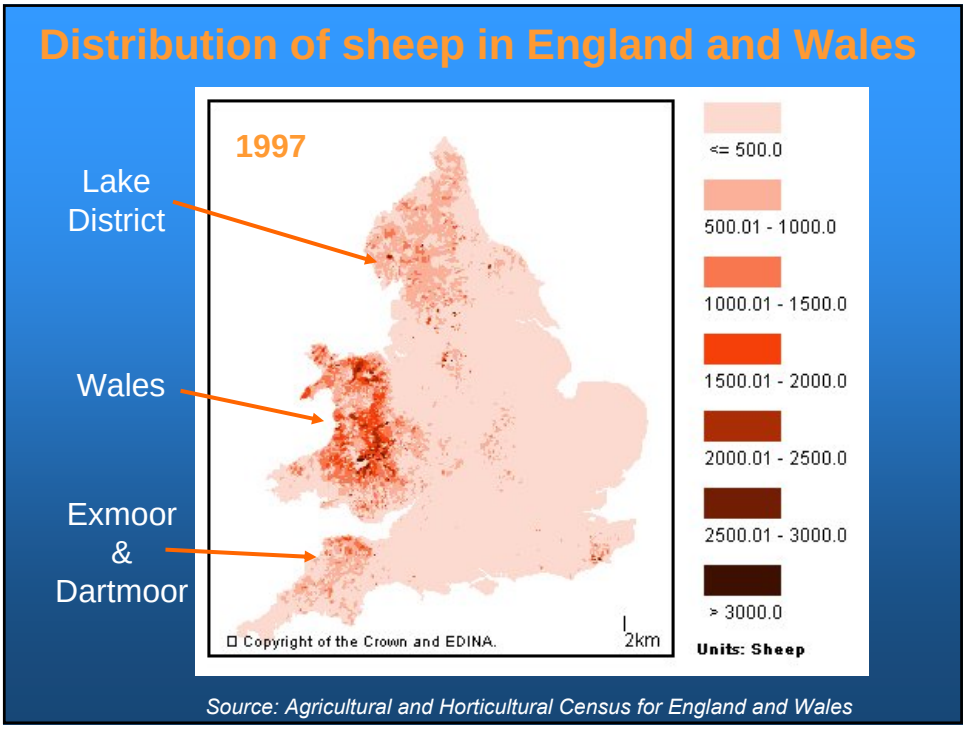
## Distribution of sheep in England and Wales

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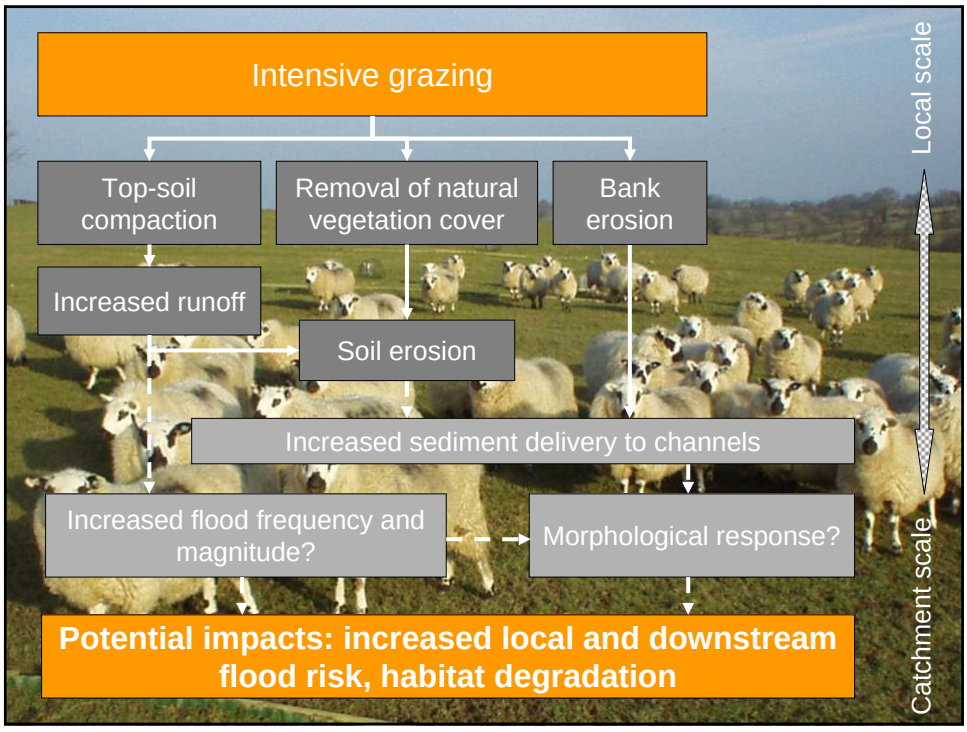
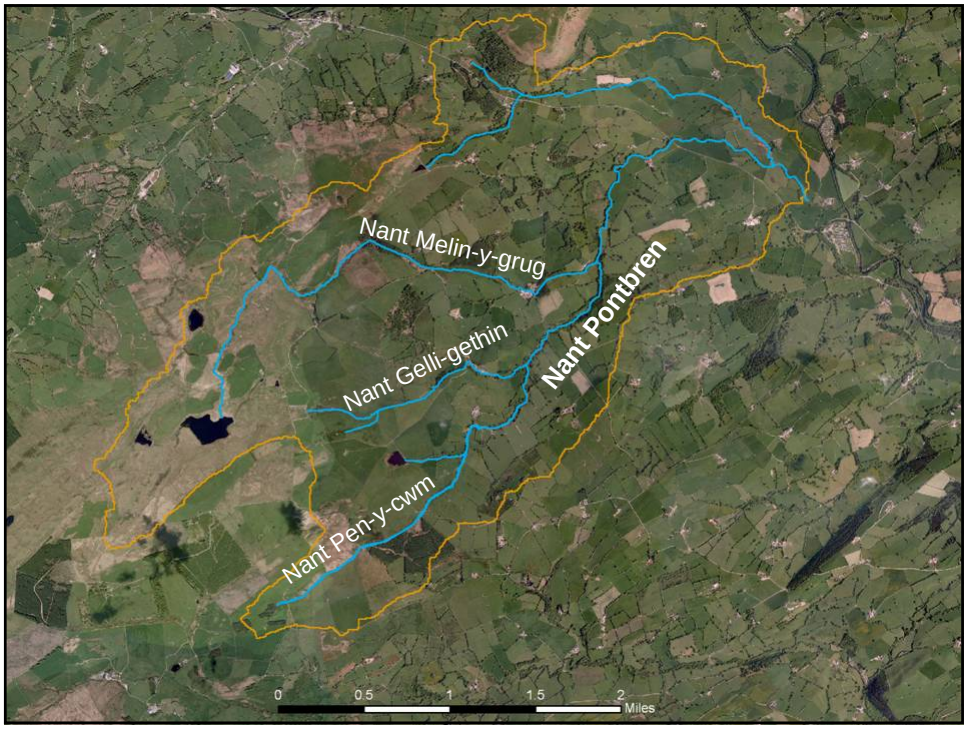


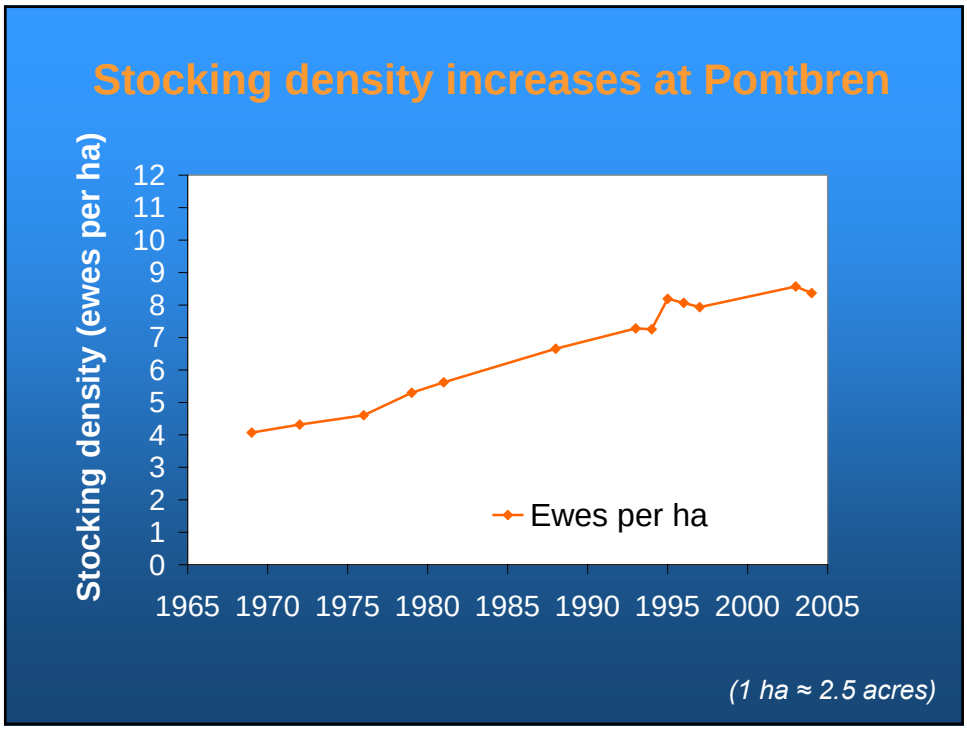
## Research needs:

1) To **quantify** the impacts of upland land management at the **hillslope** and **catchment scale**.

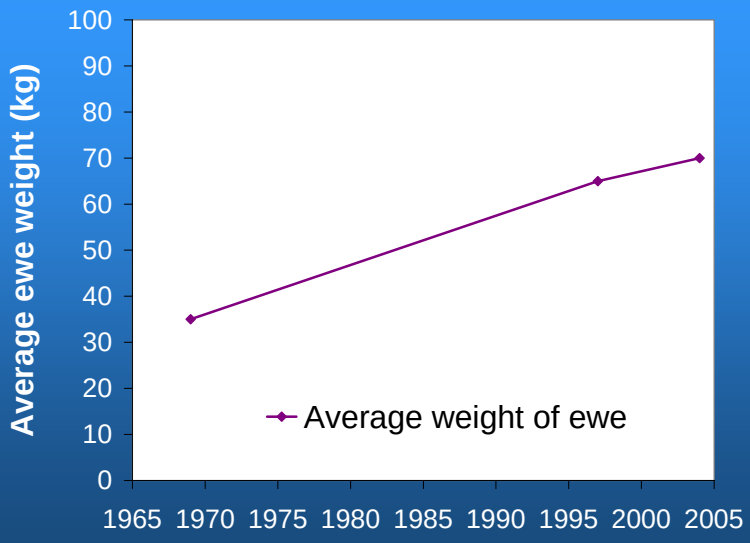
2) To **evaluate** the potential of **restoration measures** to reduce / reverse effects of agricultural intensification.

**Pontbren Experimental Catchment**

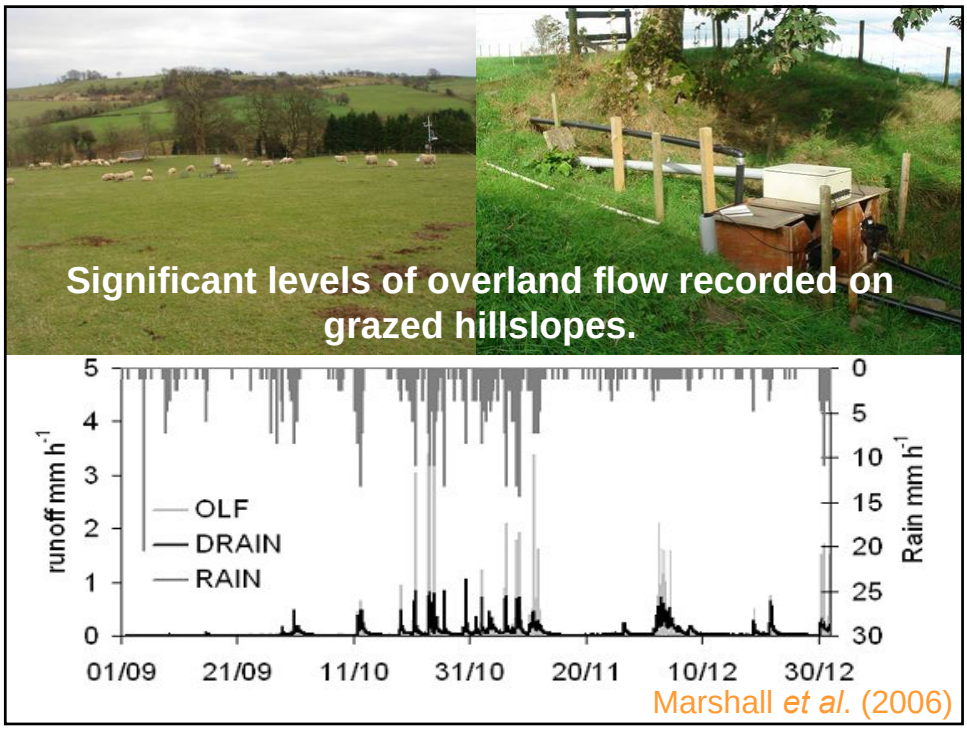

Nant Melin-y-grug
Nant Pontbren
Nant Gelli-gethin
Nant Pen-y-cwm
0
0.5
1
1.5
2
Miles


Stocking density increases at Pontbren
Stocking density (ewes per ha)
12
11
10
9
8
7
6
5
4
3
2
1
0
1965
1970
1975
1980
1985
1990
1995
2000
2005
Ewes per ha
(1 ha ≈ 2.5 acres)

## Sheep size increases at Pontbren

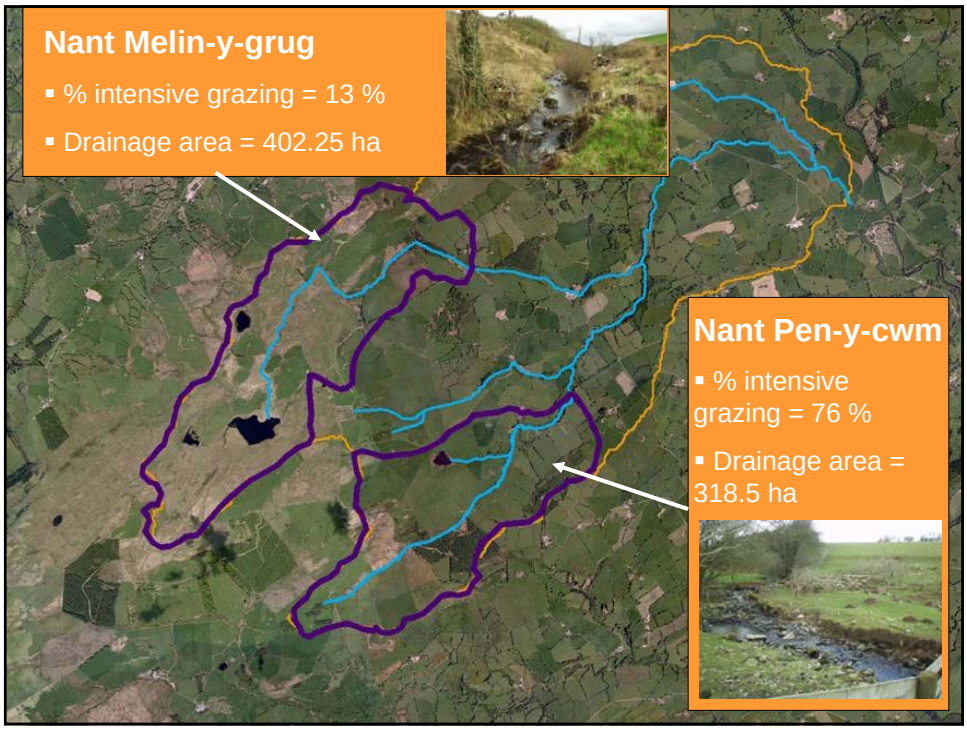


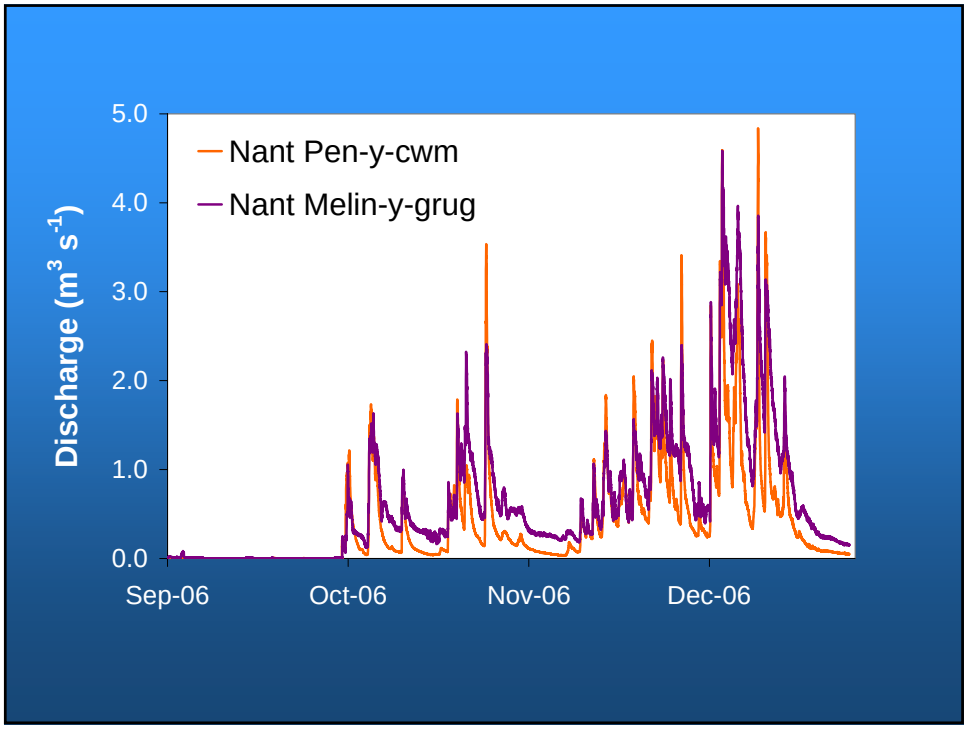

*(1 kg ≈ 2.2 lb)*

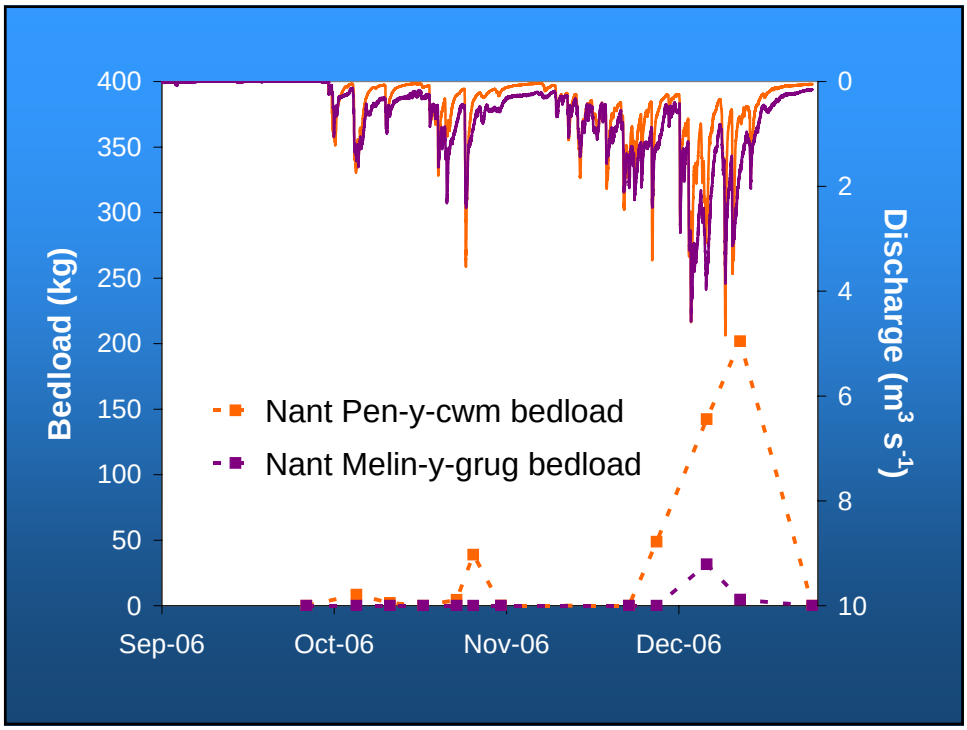


Marshall *et al*. (2006)

Bed level change on
Nant Pen-y-cwm


Nant Melin-y-grug
▪ % intensive grazing = 13 %
▪ Drainage area = 402.25 ha
Nant Pen-y-cwm
▪ % intensive grazing = 76 %
▪ Drainage area = 318.5 ha


5.0
4.0
3.0
2.0
1.0
0.0
Discharge (m3 s-1)
Nant Pen-y-cwm
Nant Melin-y-grug
Sep-06
Oct-06
Nov-06
Dec-06


400
350
300
250
200
150
100
50
0
Bedload (kg)
0
2
4
6
8
10
Discharge (m3 s-1)
Nant Pen-y-cwm bedload
Nant Melin-y-grug bedload
Sep-06
Oct-06
Nov-06
Dec-06

## Pontbren Rural Care Project

Extensive **catchment restoration scheme** established by 3 local farmers in 1997 (expanded to 10 farms in 2001).

Created in response to common problems:

- *Uncertain markets.*
- *Loss of farm support.*
- *Low prices.*
- *Decline of local natural environment.*

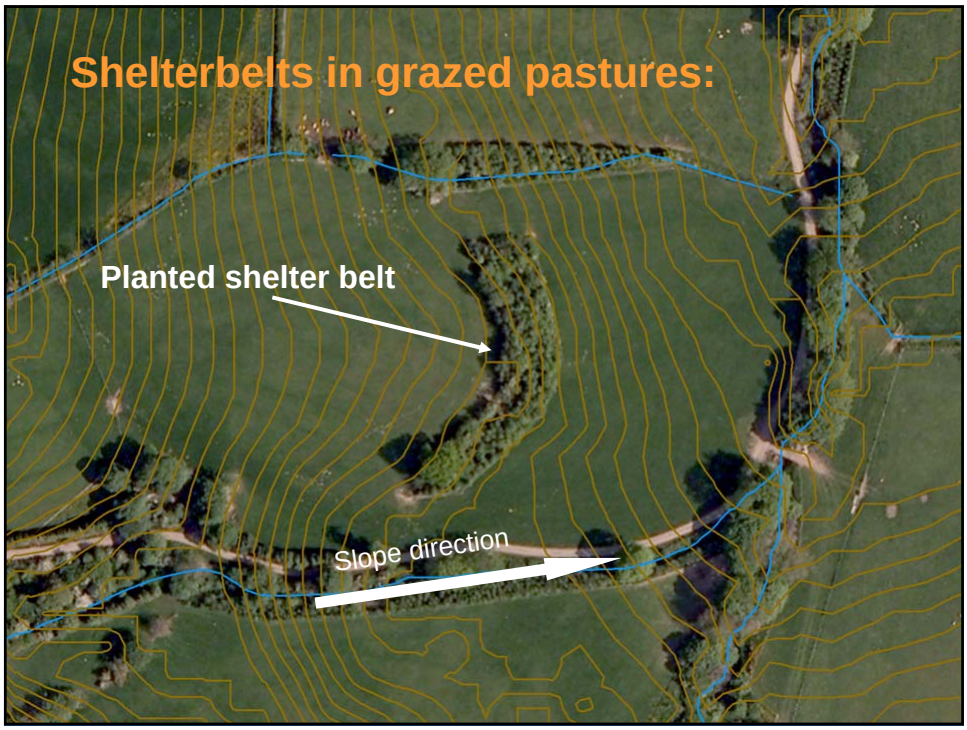
## Project features:

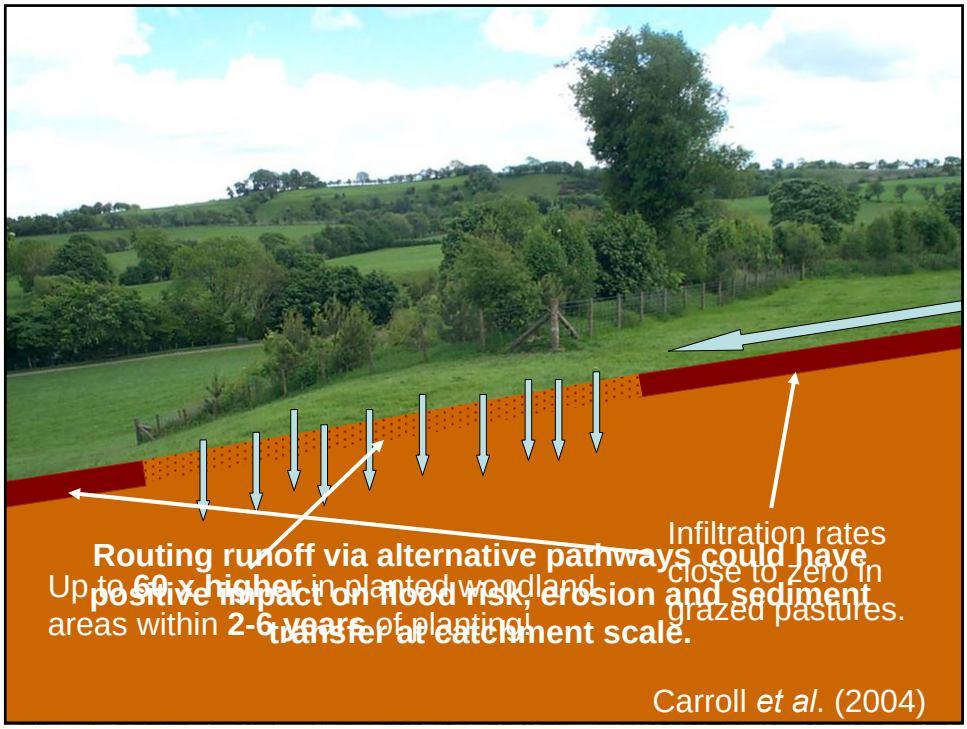
Scheme aims to **increase sustainability** and **improve environment** through:

- *Shift to hardier sheep breeds capable of lambing outside.*
- *Reduced stocking rates.*
- *Restoration of native broad-leafed woodland and hedgerows.*
- *Restricting stock access to marginal land / stream banks.*

## Streambank restoration:

Hillslope stabilisation:


Shelterbelts in grazed pastures:
Planted shelter belt
Slope direction




## Preliminary hydrological modelling results:

- Physically-based, multi-dimensional hillslope model.
- Partially conditioned on data from hillslope and shelter belt monitoring sites.
- 80 m x 15 m shelter belt simulated

**Significant effect on runoff - reduced to approx 22.5 % of that observed without shelter belt!**

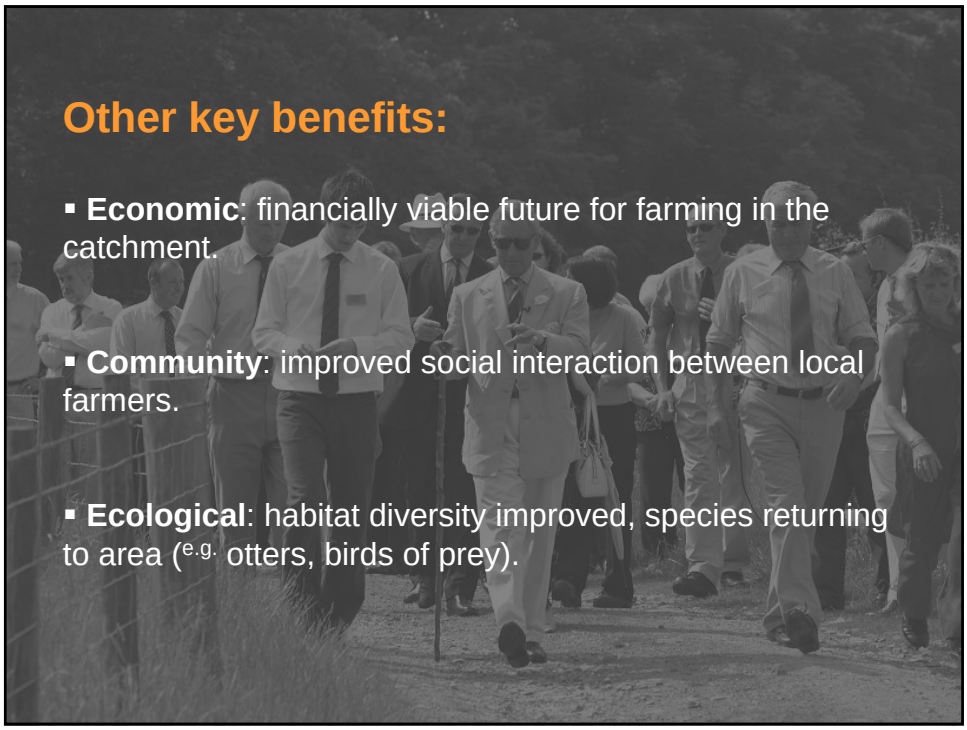
Jackson *et al*. (2006)

## Work in progress:

- **Upscaling hydrological models** from hillslope to catchment scale.

- **Sediment source monitoring** (grazed hillslope, streambanks) for construction of sediment budget.

- Simulation of streamflow and sediment data for **land management scenarios** using above to **predict** effect on future **sediment yield** and **morphological evolution**.



## Other key benefits:

- **Economic**: financially viable future for farming in the catchment.

- **Community**: improved social interaction between local farmers.

- **Ecological**: habitat diversity improved, species returning to area (e.g. otters, birds of prey).

## Summary:

- Agricultural intensification since the 1970s has caused significant hydrological, geomorphological and ecological disturbance in upland catchments in the UK.

- Research at Pontbren indicates many of these problems can be mitigated through restoration measures.

- Community-led, catchment restoration schemes offer a sustainable alternative to current upland land management practices.

## Further information:

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FRMRC website: www.floodrisk.org.uk