

Seeking multiple benefits from natural carbon stores in the uplands



SRUC

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Introduction

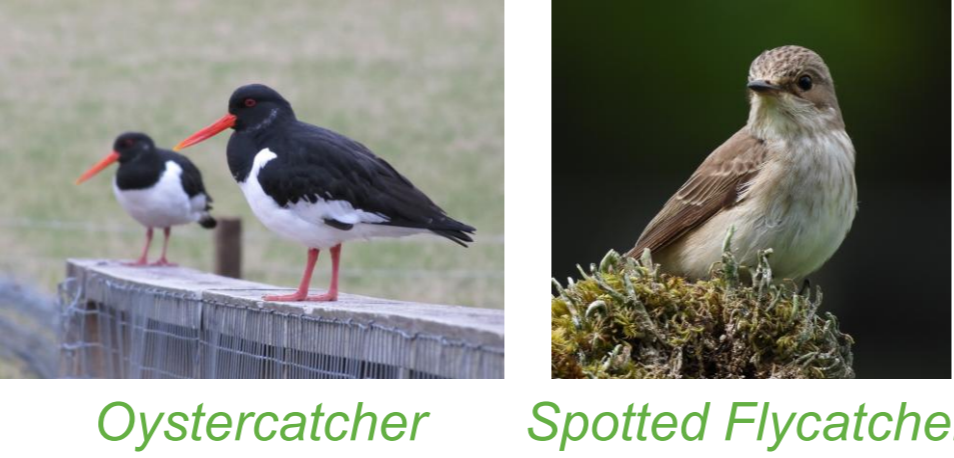
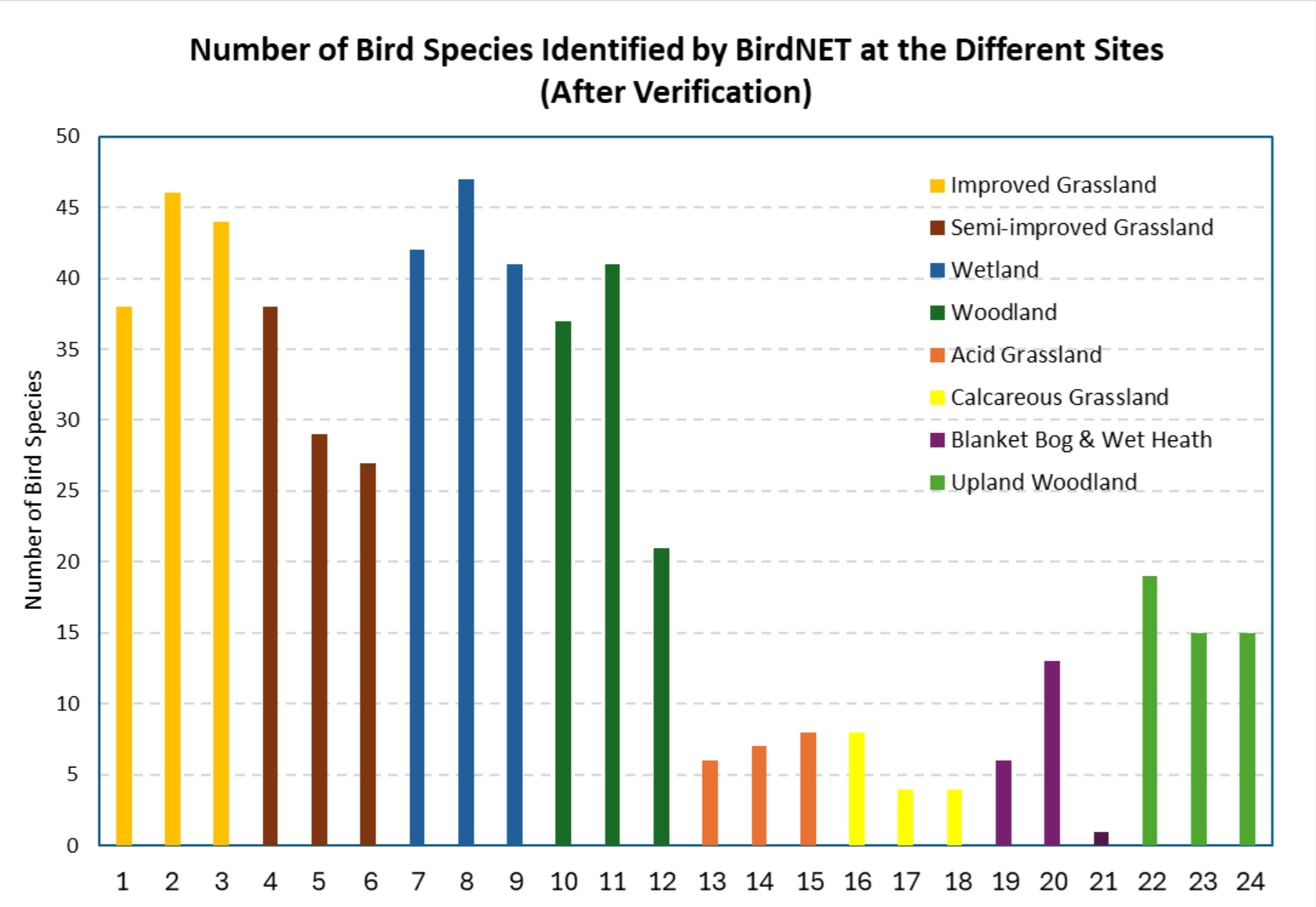
This project brings together data on biodiversity, soil carbon stores and flood mitigation potential from a range of farmland and semi-natural habitats at SRUCs upland research farm at Kirkton & Auchtertyre. A particular focus has been put on the innovative use of acoustic sensors and camera-traps to assess biodiversity and digital sensors to monitor water levels.

Biodiversity Monitoring

Birds, bats and small mammals have been the focus of the biodiversity monitoring across a range of upland and lowland habitats. Digital audio devices (AudioMoths), in conjunction with computer software, have been used to identify the bird and bat species. While baited trail camera boxes have been used to identify the small mammal species.

Birds

The audio files from the AudioMoth deployments have been analysed using BirdNET Analyzer software (1). A total of 65 species have been identified, following manual verification of the results. The lowland wetland habitat had the highest number of species.



Oystercatcher Spotted Flycatcher

Bats

Kaleidoscope Pro software (2) has been used to analyse the ultrasonic files and to automatically identify the bat species present. The lowland woodland habitat had the highest bat activity.



AudioMoth (Digital Audio Device)

Bat species identified in the different habitats using the Auto ID function of Kaleidoscope Pro. The colour formatting indicates the bat activity (Red - high; Yellow - medium; Green - low)

		Common Pipistrelle	Soprano Pipistrelle	Brown Long-eared Bat	Daubenton's Bat	Noctule
Lowland	Improved grassland	152	418	94	25	17
	Semi-improved grassland	378	337	43	23	21
	Wetland	262	451	36	20	24
	Woodland	1243	779	92	36	148
Upland	Acid Grassland	30	17	1	1	1
	Calcareous Grassland	2	1	1	1	1
	Blanket Bog & Wet Heath	477	110	8	17	4
	Upland Woodland	146	96	18	7	64

Mammals

Trail cameras placed at the end of boxes baited with sunflower seeds, peanuts and dried mealworms have been used to monitor small mammal activity across the different habitats (3).

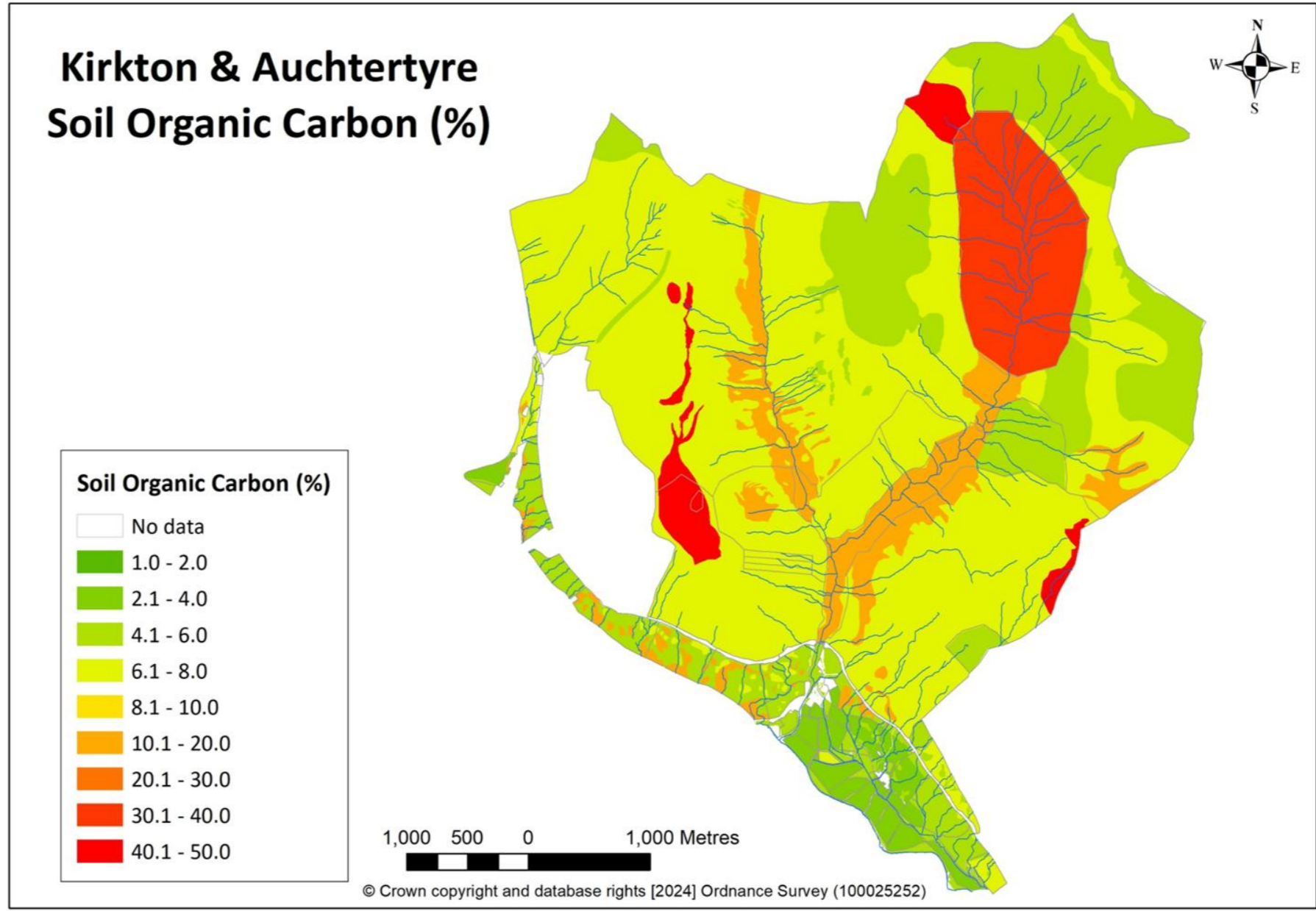
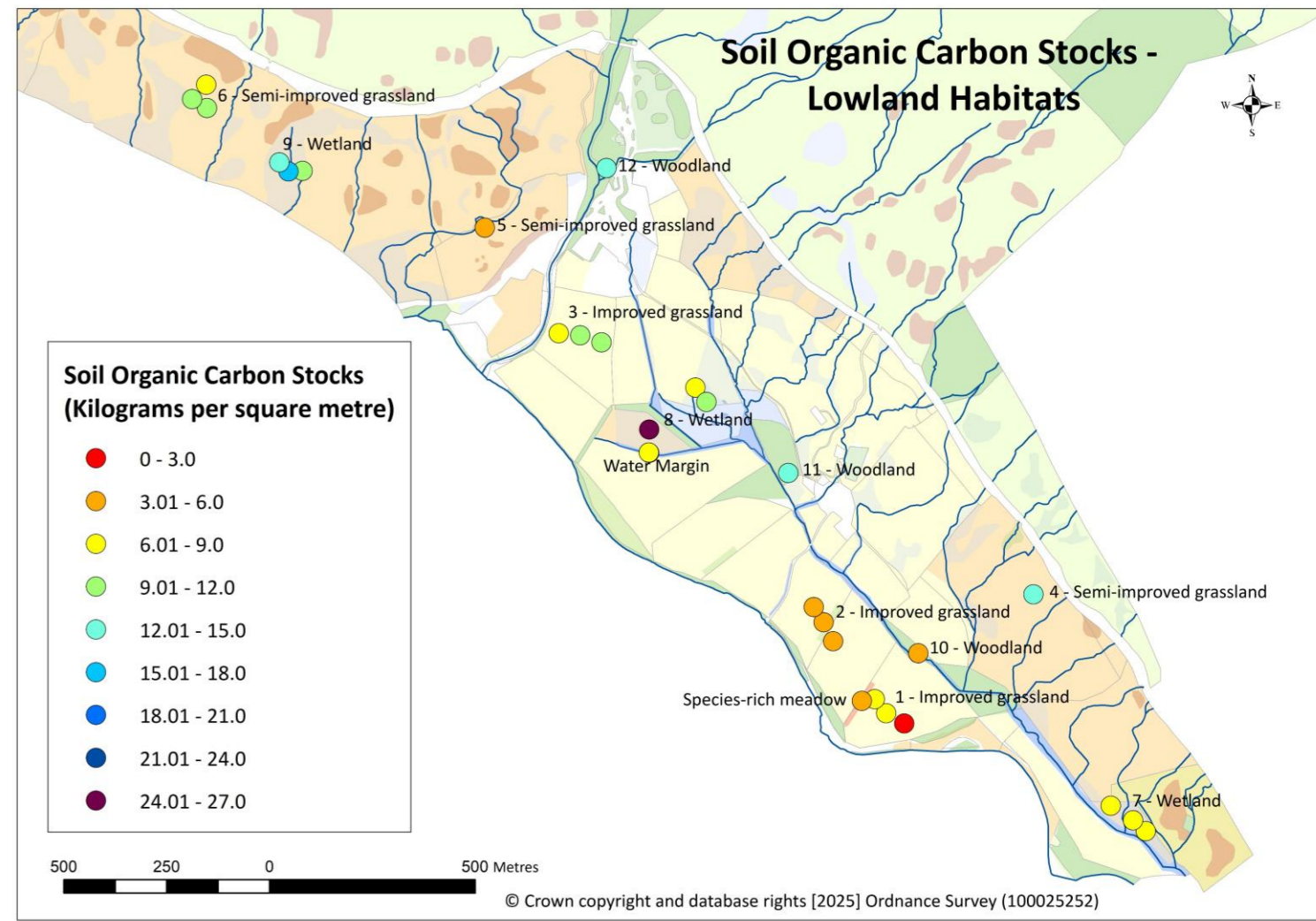
Mammals identified from the trail camera footage in the different habitats. The colour formatting indicates the number of videos (Red - many; Yellow - several; Green - few)

		Wood Mouse	Shrew spp.	Field Vole	Badger	Red Squirrel	Rabbit	Weasel	Red Deer	Pine Martin	Fox	Hare	Roe Deer
Lowland	Improved Grassland	1523	230	16	37		2	1					
	Semi-improved Grassland	741	268	531	45			1					
	Wetland	1095	1093	549	20							2	
	Woodland	3434	305	393	18	17	8	1		2	1		1
Upland	Acid Grassland	27	15	7									
	Calcareous Grassland	138	50	22	5				2				
	Wet Heath	7	13		25			1					
	Upland Woodland	345	306	68	13		5	2	1	1			



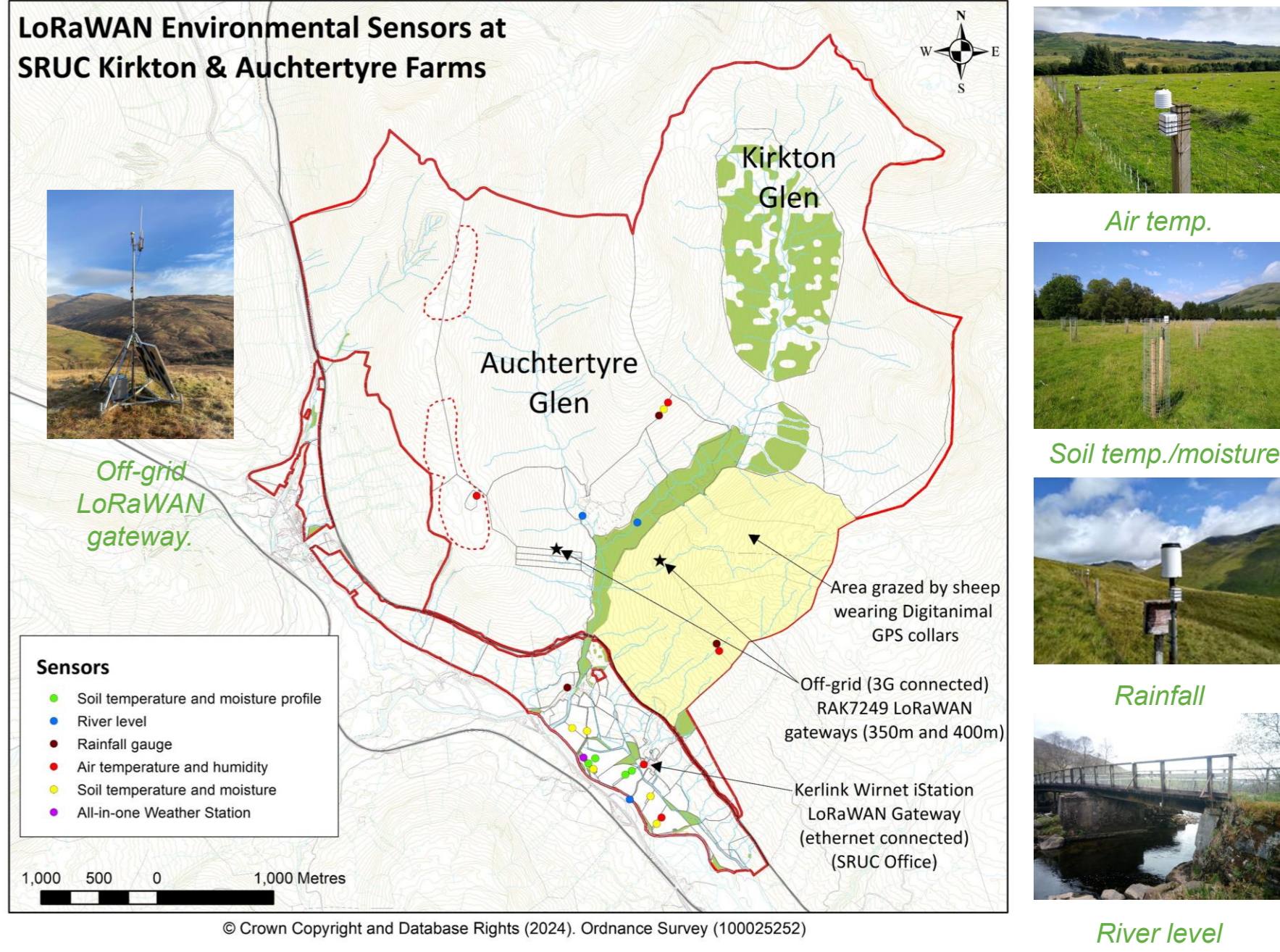
Soil Carbon

Soil samples were taken from the upland and lowland sites and sent for soil organic carbon (SOC) analysis. The percentage SOC values from the different habitats have been used to create an SOC map of the whole farm. The carbon stocks have been estimated using the percentage carbon values and bulk density measurements.



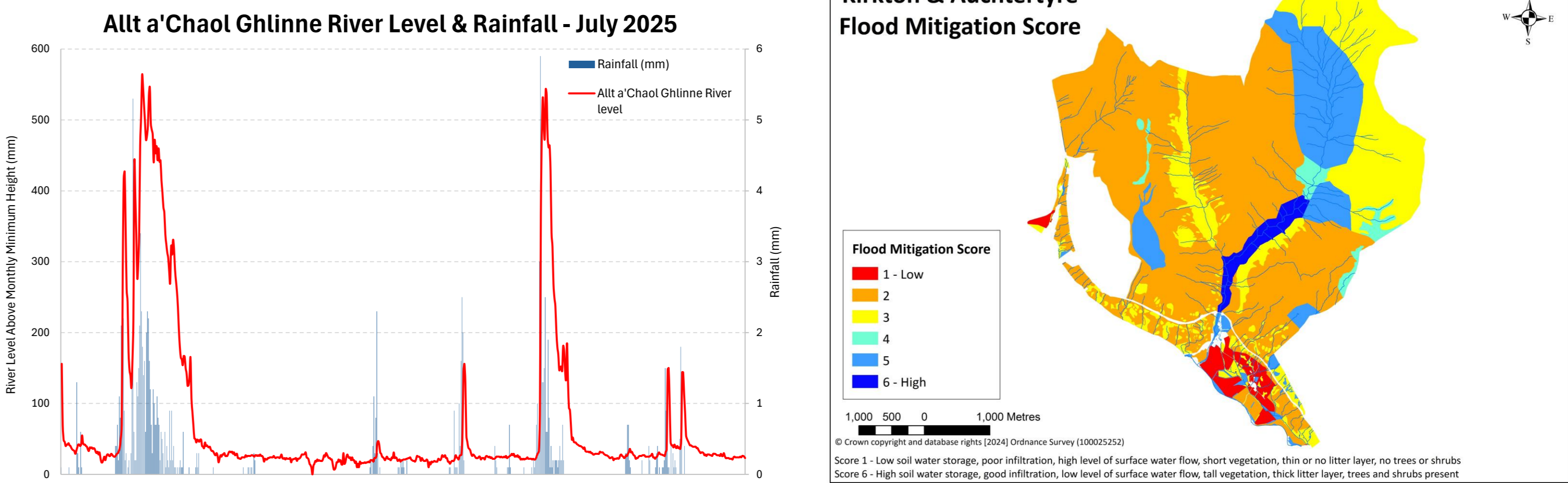
Soil carbon sampling (AgriCarbon)

Sensors



Flood Mitigation

River level monitoring of the streams in the two main glens on the estate, together with rainfall monitoring, has been carried out using LoRaWAN sensors. This data will be used to see whether the different habitat types and land management in the two glens have an impact on the river level profiles. A map of flood mitigation potential has also been produced.



Impact

The value of the approaches used in this study has been recognised by others involved in large-scale habitat restoration (such as Forestry & Land Scotland, the *Wild Strathfillan Initiative* and the *Resilient Farm Network* being established by Loch Lomond & The Trossachs National Park). The RESAS funding has also helped lever complementary UKRI (*Grassland resilience for Net Zero: sustainable practices for shaping the future of UK land use*) and Horizon Europe (*Digital innovation and data technology network for rangeland livestock farming systems*) funded research.

References

- Kahl, S., Wood, C. M., Eibl, M., & Klinck, H. (2021). BirdNET: A deep learning solution for avian diversity monitoring. *Ecological Informatics*, 61, 101236.
- Kaleidoscope Pro (version 5.6.8) by Wildlife Acoustics Inc.
- Littlewood, N.A., Hancock, M.H., Newey, S. et al. (2021). Use of a novel camera trapping approach to measure small mammal responses to peatland restoration. *European Journal of Wildlife Research*, 67, 12.