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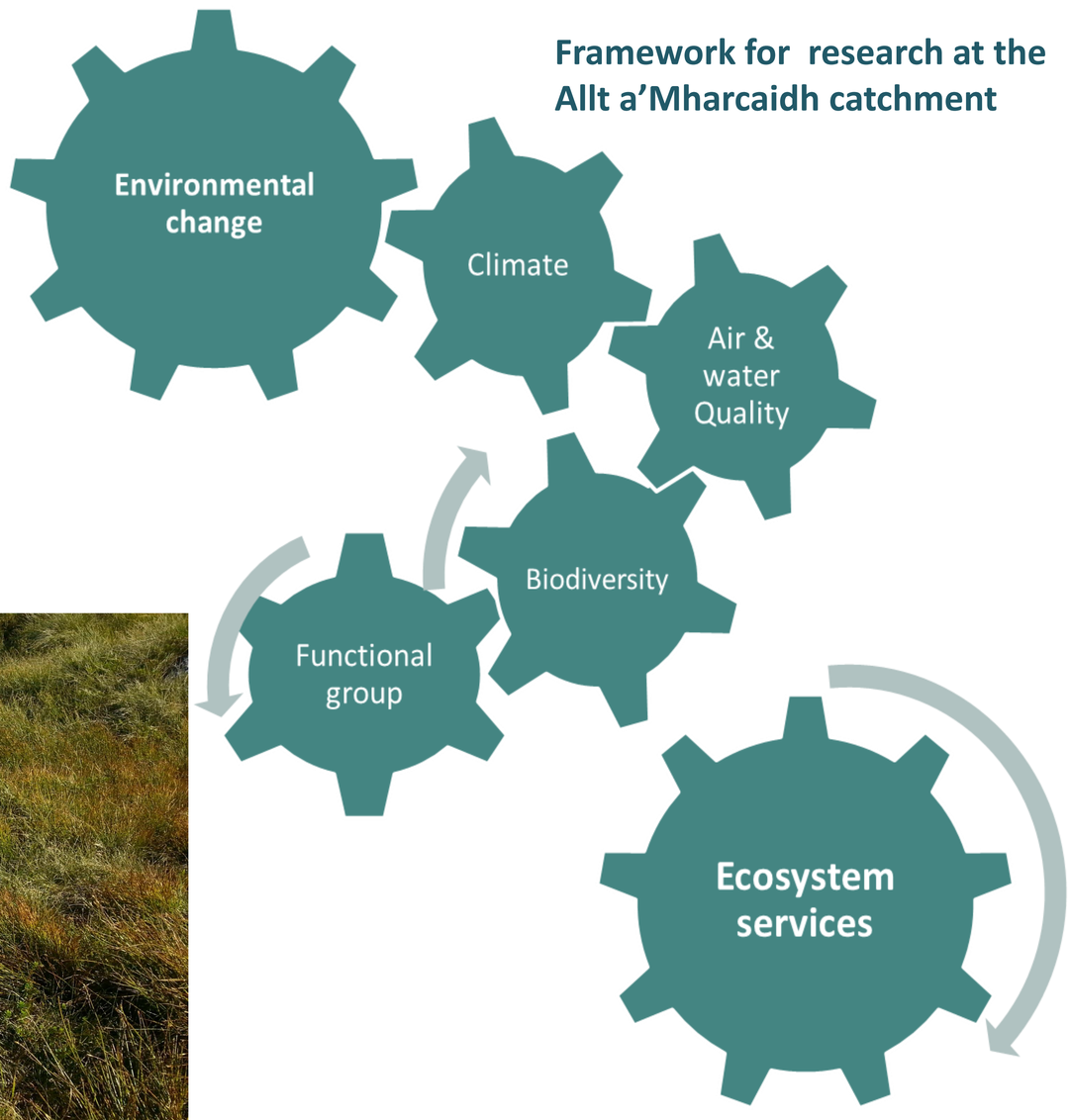
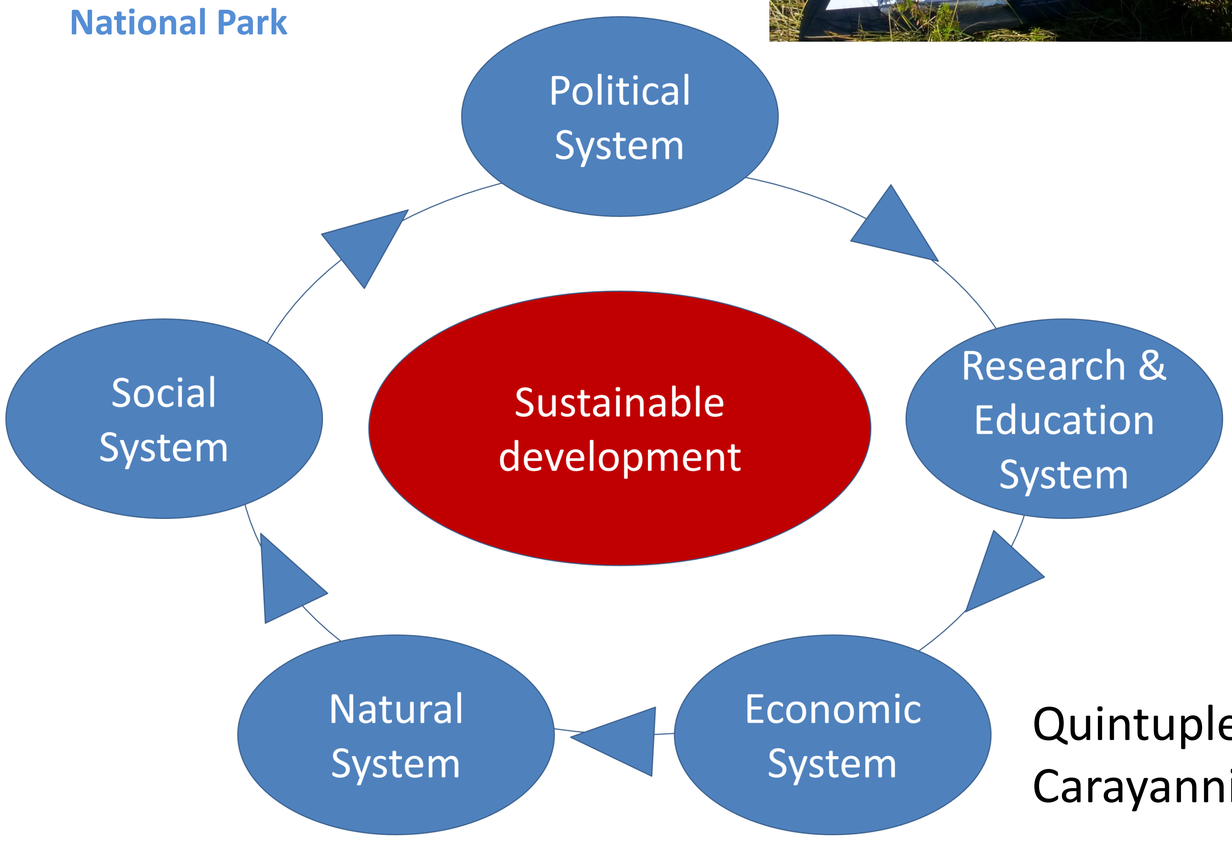
Long term studies of the coupled socio- ecological system in the Cairngorms National Park

Research Strategy

- To enhance our knowledge of environmental change and quantify natural capital and ecosystem services in the region to aid policy and management decision making
- To make biophysical measurements according to standard Environmental Change Network protocols at the Allt a'Mharcaidh catchment
- To actively participate in the newly emerging Scottish community of practice – Ecosystem Service Community (ESCOM)
- To actively participate in the Cairngorms Long-Term Socio-Ecological Research (LTSER) platform
- To contribute and lead UK involvement in national and international long-term monitoring research initiatives



Framework for coupled socio-ecological system research of the Cairngorms National Park



Quintuple Helix Model of innovation
Carayannis *et al*. 2012.

WHY: is long term place based research important?

BECAUSE: data on biophysical, ecological and social factors at the same location enhances integrated science, is cost effective and provides added value to funders

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Projects and programs

Integrated research and monitoring

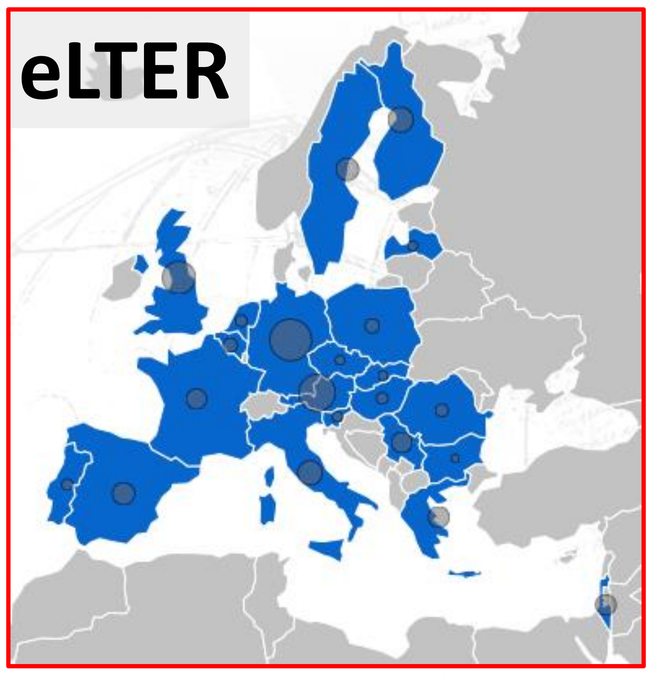
Through ECN the Allt a'Mharcaidh research site currently provides data for nine networks at local, national, regional and global scales (blue arrows), and is further involved in three EU funded projects (red arrows).

Cairngorm LTSER

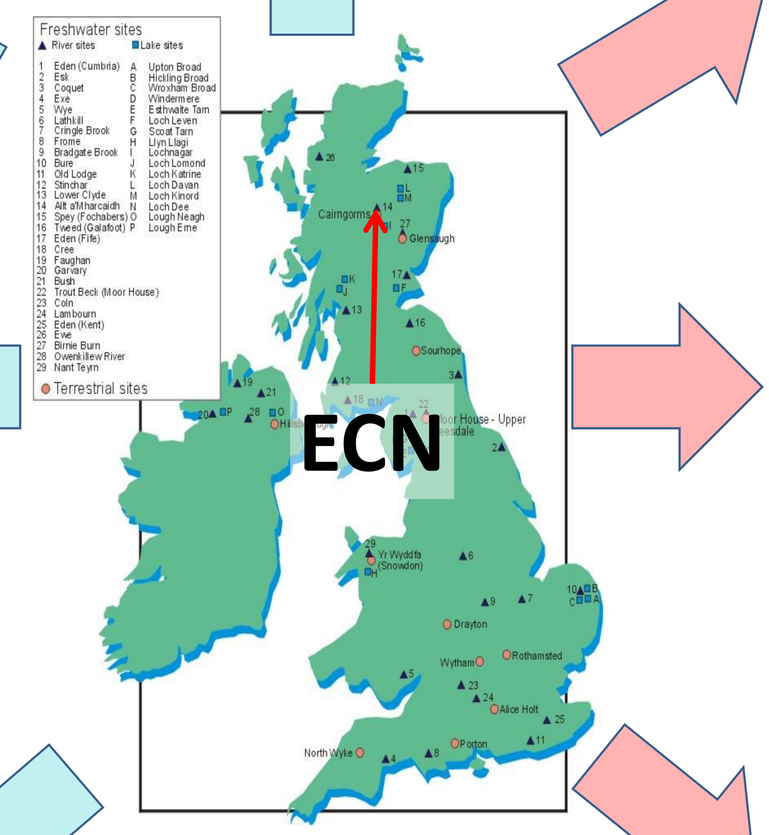
RIS / UKEAP / UWMN / UKBMS

Rothamsted Insect Survey
UK Eutrophying and Acidifying atmospheric Pollutants
Upland Waters Monitoring Network
UK Butterfly Monitoring Scheme

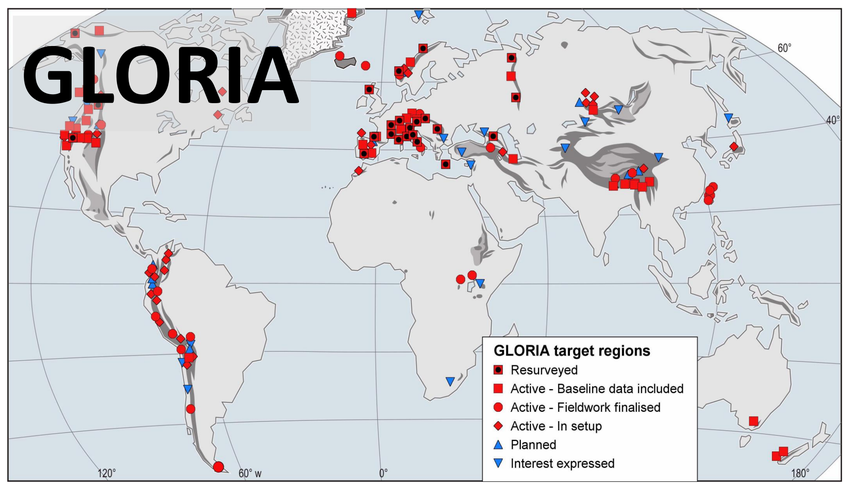
eLTER



H2020 Long term ecological research project

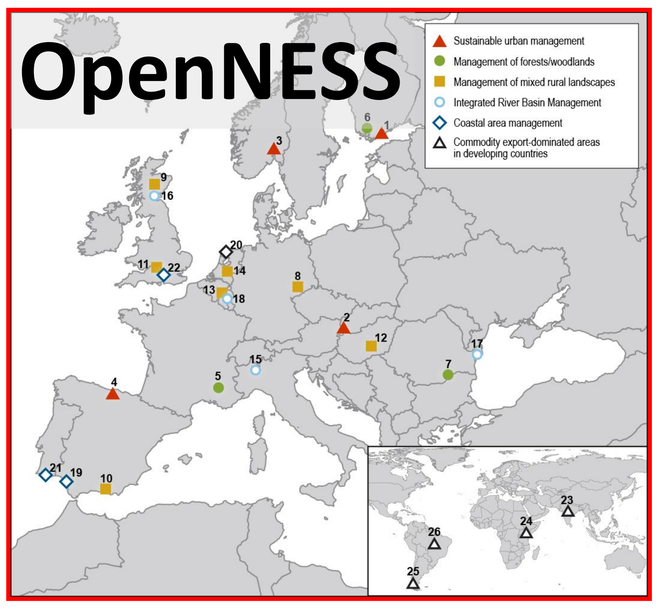


GLORIA



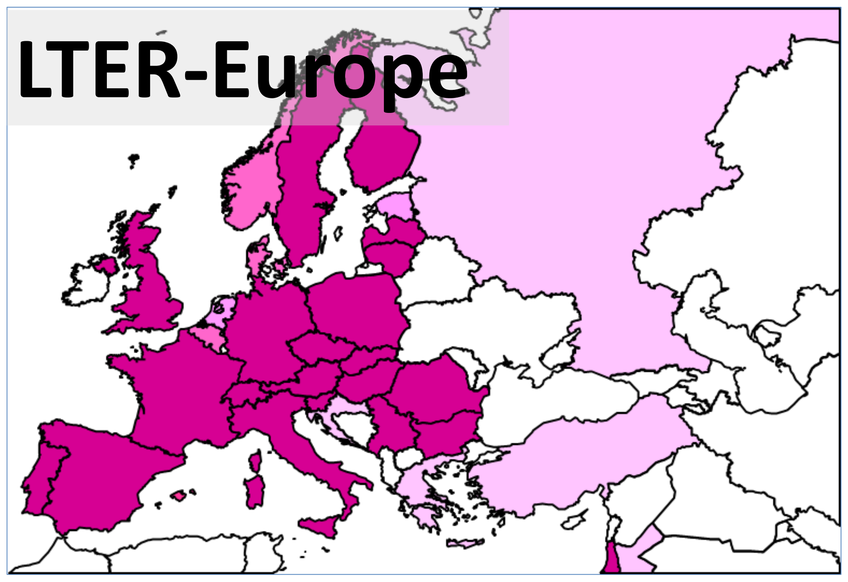
Global Observation Research Initiative in Alpine Environments (led to Nature and Science papers)

OpenNESS



Operationalisation of Natural Capital and Ecosystem Services

LTER-Europe

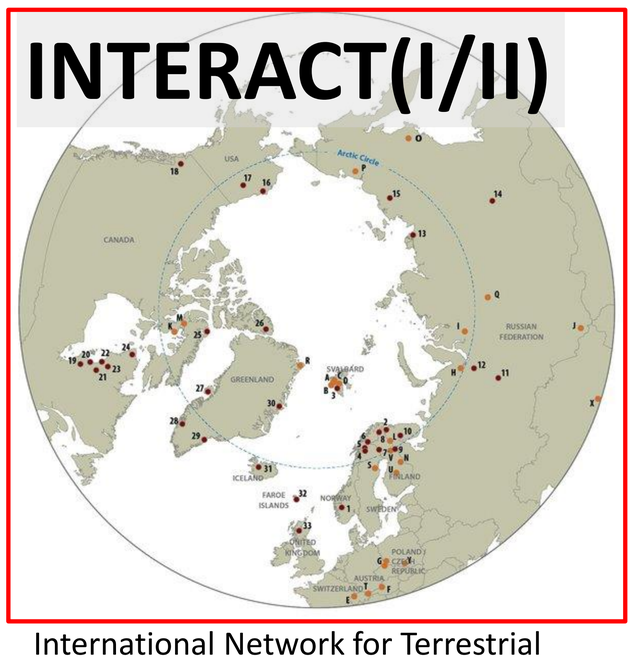


Long term ecological research network - Europe

ILTER

Long term ecological research network - International

INTERACT(I/II)



International Network for Terrestrial Research and Monitoring in the Arctic.

WHY: is it important to be part of networks and projects?

BECAUSE: coming together is a beginning
keeping together is progress;
working together is success Henry Ford

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Publications 2010-2018

Publications in last 8 years :

28 papers – Including 2 in Nature and Science, and 11 first authored by ECN Cairngorms team

Dick, J. et al 2018. What is socio-ecological research delivering? A literature survey across 25 international LTSER platforms. Science of the Total Environment 622–623:1225–1240.

Dick, J. et al, 2018. Stakeholders' perspectives on the operationalisation of the ecosystem service concept: results from 27 case studies. Ecosyst. Serv. 29 (Part C): 552-565.

Carmen, E. et al, 2018. Knowledge needs for the operationalisation of the concept of ecosystem services. Ecosyst. Serv. 29 (Part C):441-451.

Smith, R. et al, 2018. Operationalising ecosystem service assessment in Bayesian Belief Networks: experiences within the OpenNESS project. Ecosyst. Serv. 29 (Part C):452-464.

Zulian, G. et al, 2018. The practical application of spatial ecosystem service models to aid management of nature-based resources. Ecosyst. Serv. 29 (Part C):465-480.

Dunford, R. et al, 2018. Integrating methods for ecosystem service assessment: experiences from real world situations. Ecosyst. Serv. 29 (Part C):449-514.

Barton, B. et al, 2018. (Dis) integrated valuation: narrowing the gap between ES appraisals and governance support. Ecosyst. Serv. 29 (Part C):529-541.

Priess, J. et al, 2018. New EU-scale environmental scenarios until 2050 – scenario process and initial scenario applications. Ecosyst. Serv. 29 (Part C):542-551.

Turkelboom, F. et al, 2018. When we cannot have it all: ecosystem services tradeoffs in real-life planning contexts. Ecosyst. Serv. 29 (Part C):566-578.

Dick, J., Verweij, P., Carmen, E. Rodela, R. & Andrews, C. 2017 Testing the ecosystem service cascade framework and QUICKScan software tool in the context of land use planning in Glenlivet Estate Scotland International Journal of Biodiversity Science, Ecosystem Services and Management, 13: 12-25.

Orenstein, D., Katz-Gerro, T. & Dick, J. (2017) Environmental tastes as predictors of environmental opinions and behaviours, Landscape and Urban Planning. 161, pp. 59-71.

Andrews C., Ives S. & Dick J. (2016). Long-term observations of increasing snow cover in the western Cairngorms. Weather, 71(7), 178-181.

Maass, M., Balvanera, P., Baudry, J., *et al.* (2016). Changes in biodiversity and trade-offs among ecosystem services, stakeholders and components of well-being: the contribution of the International Long-Term Ecological Research network (ILTER) to Programme on Ecosystem Change and Society (PECS). Ecology and Society, 21(3):31.

Dick J., Andrews C., Beaumont D.A., *et al*. (2016). Analysis of temporal change in delivery of ecosystem services over 20 years at long term monitoring sites of the UK Environmental Change Network. Ecological Indicators, 68. 115-125

Monteith D., Henrys P., Banin L., *et al.* (2016). Trends and variability in weather and atmospheric deposition at UK Environmental Change Network sites (1993–2012). Ecological Indicators, 68. 21-35.

Rose R., Monteith D.T., Henrys P., *al.* (2016). Evidence for increases in vegetation species richness across UK Environmental Change Network sites linked to changes in air pollution and weather patterns. Ecological Indicators, 68. 52-62.

Dick, J., Maes, J., Smith, RI., *et al.* (2014). Cross-scale analysis of ecosystem services identified and assessed at local and European level. Ecological Indicators, 38, 20-30.

Dick, J., Smith, R., Banin, L., *et al.* (2014) Ecosystem service indicators: data sources and conceptual frameworks for sustainable management. Sustainability Accounting, Management and Policy Journal, 5(3), 346 – 375

Dick, J., Al-Assaf, A., Andrews, C., *et al.* (2014) Ecosystem services: a rapid assessment method tested at 35 sites of the LTER-Europe network. Eklologia, 33, 217-231.

Vihervaara, P., D'Amato, D., Forsius, M., *et al.* (2013) Using long-term ecosystem service and biodiversity data to study the impacts and adaptation options in response to climate change: Insights from the global ILTER sites network. Current Opinion in Environmental Sustainability, 5(1), 53-66.

Gottfried, M., Pauli, H., Futschik, A., *et al.* (2012) Continent-wide response of mountain vegetation to climate change. Nature climate change, 2, 111-115

Pauli, H., Gottfried, M., Dullinger, S., *et al.* (2012) Recent Plant Diversity Changes on Europe's Mountain Summits. Science, 336, 353-355.

Brooks D.R., Bater J.E., Clark S.J., *et al.* (2012). Large carabid beetle declines in a United Kingdom monitoring network increases evidence for a widespread loss in insect biodiversity. Journal of Applied Ecology, 49, 1009-1019.

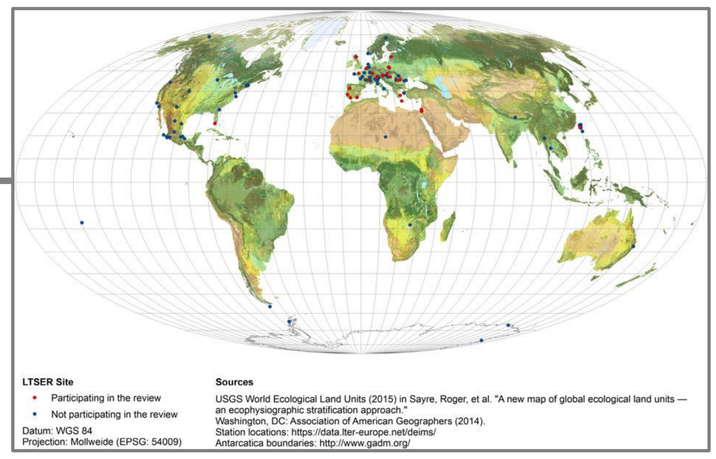
Andrews C., Dick J., Jonasson C., *et al.* (2011). Assessment of Biological and Environmental Phenology at a Landscape Level from 30 Years of Fixed-Date Repeat Photography in Northern Sweden. AMBIO, 40, 600-609.

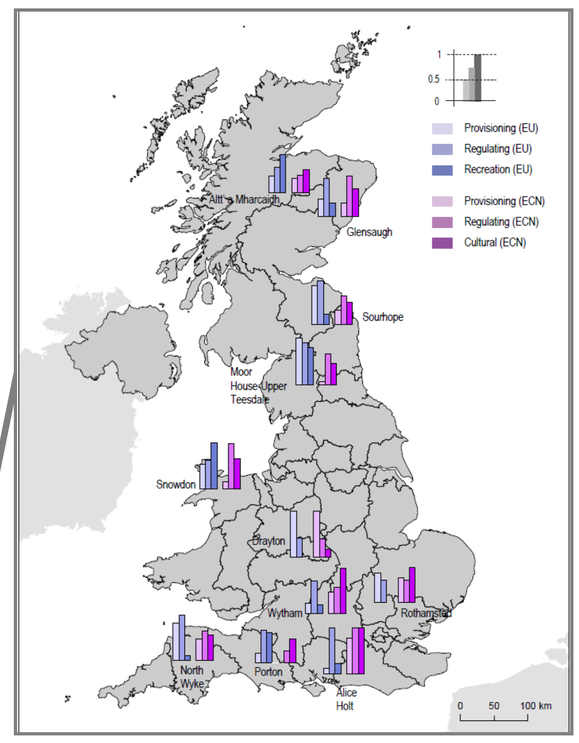
Callaghan T.V., Tweedie C.E., Åkerman J., *et al*. (2011). Multi-Decadal Changes in Tundra Environments and Ecosystems: Synthesis of the International Polar Year-Back to the Future Project (IPY-BTF). AMBIO, 40, 705-716.

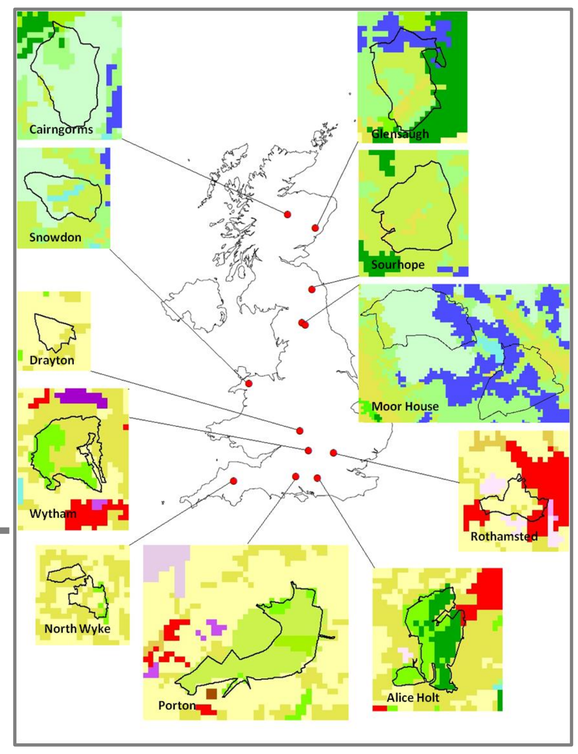
Dick J., Andrews C., Beaumont D.A., *et al.* (2011). A comparison of ecosystem services delivered by 11 long-term monitoring sites in the UK environmental change network. Environmetrics, 22, 639-648.

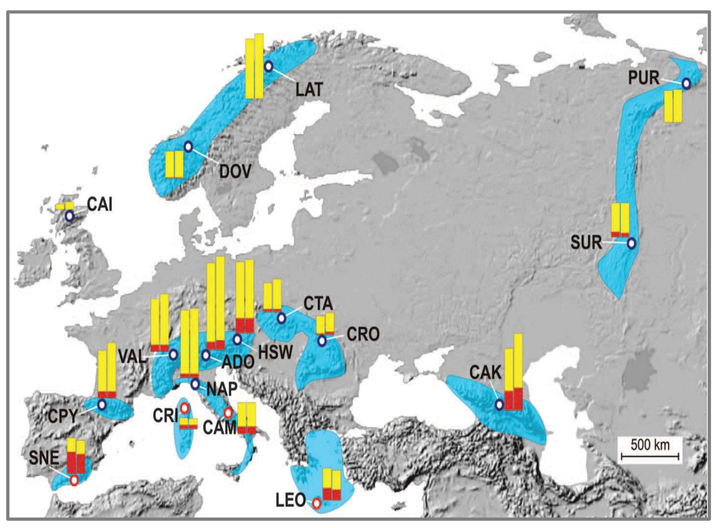
Dick, J., Smith, R.I., Scott, M.E. (2011) Ecosystem services and associated concepts. Environmetrics, 22, 598-607.

Andrews C. & Brooks D.R. (2010). New record of Leistus rufomarginatus (Carabidae) in the Central Highlands of Scotland. The coleopterist, 19, 21-23.









WHY: are publications important?

BECAUSE: data and knowledge must be shared to be valuable to society

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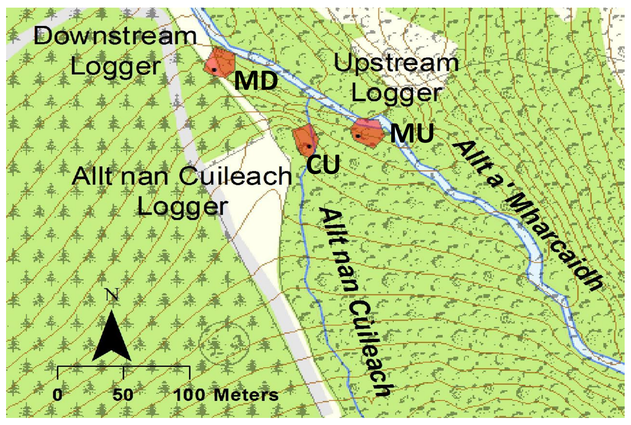
Combining monitoring and curiosity driven science

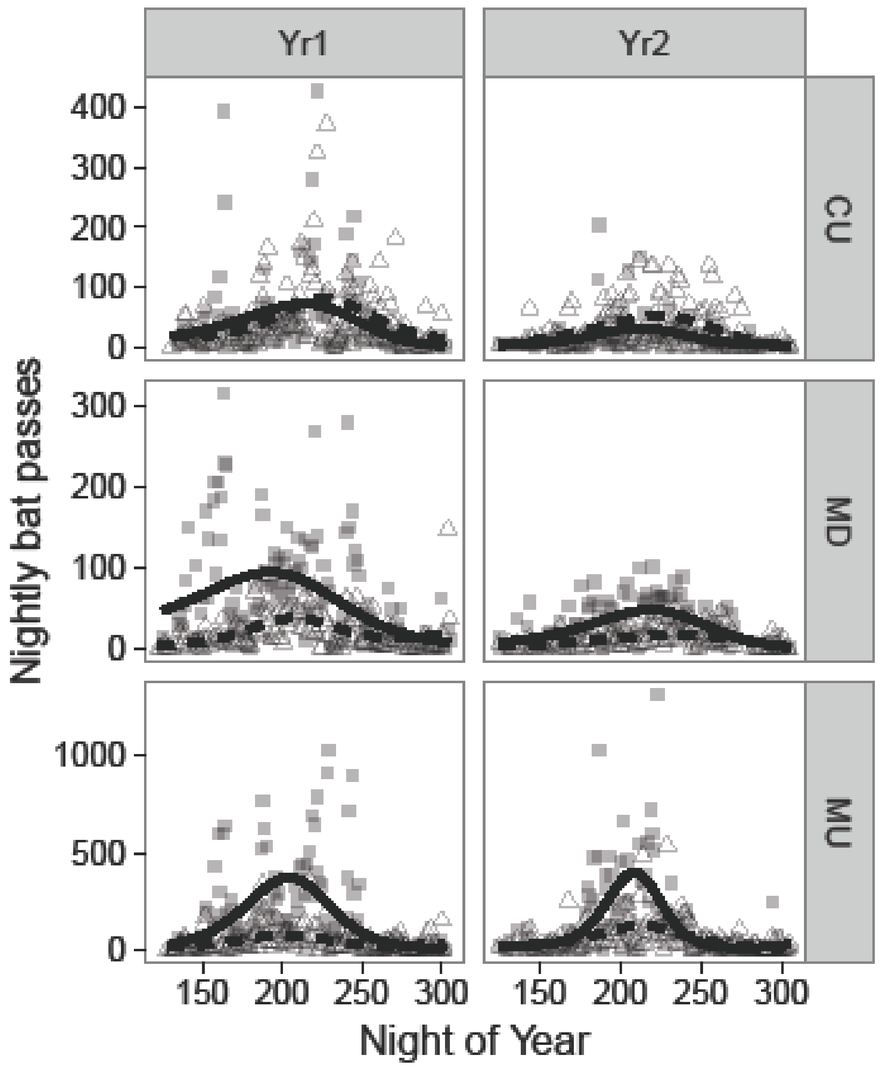
Monitoring bat activity reveals species preferences

Pipistrellus pygmaeus



Location, and detectable recording area (red) of three SMX-US ultrasonic microphones (MD= Mharcaidh Downstream; MU=Mharcaidh Upstream; CU=Allt nan Cùileach).

Acoustic recorder



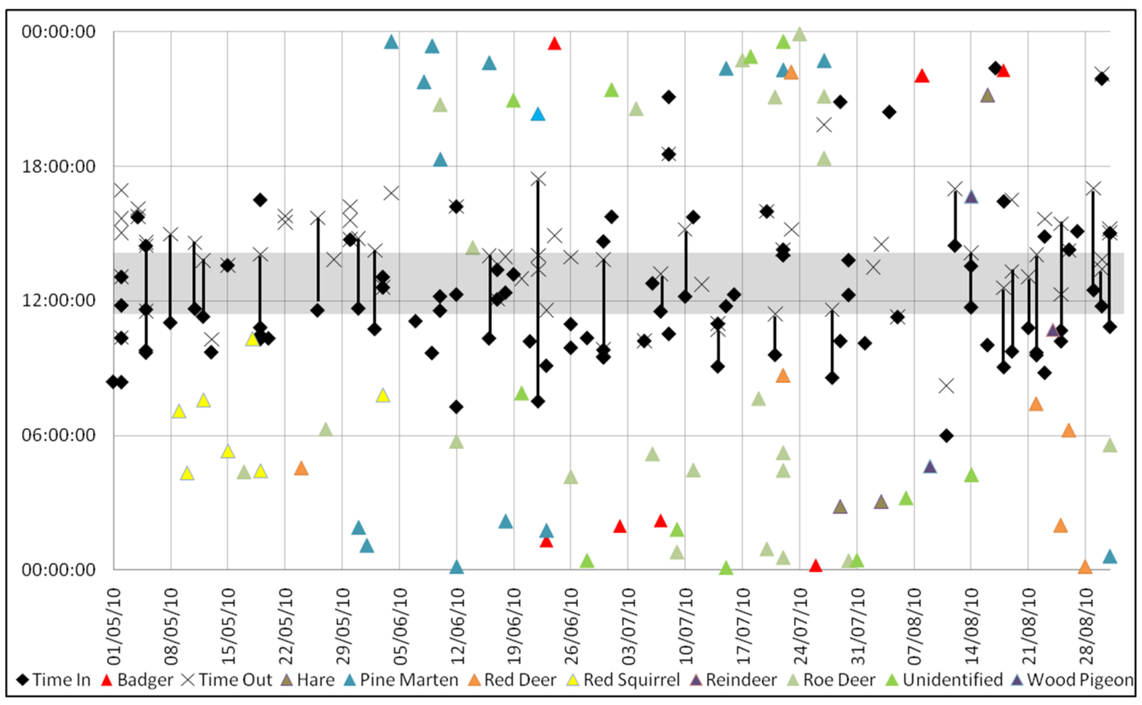
Pipistrellus pipistrellus (solid line) and *P. pygmaeus* (dashed line)

Use of new technology (e.g. continuous acoustic bat/bird recording) provides in-depth data

Andrews, C., Dick, J., Smith, R. (in prep) On the importance of site selection when remotely surveying bats.

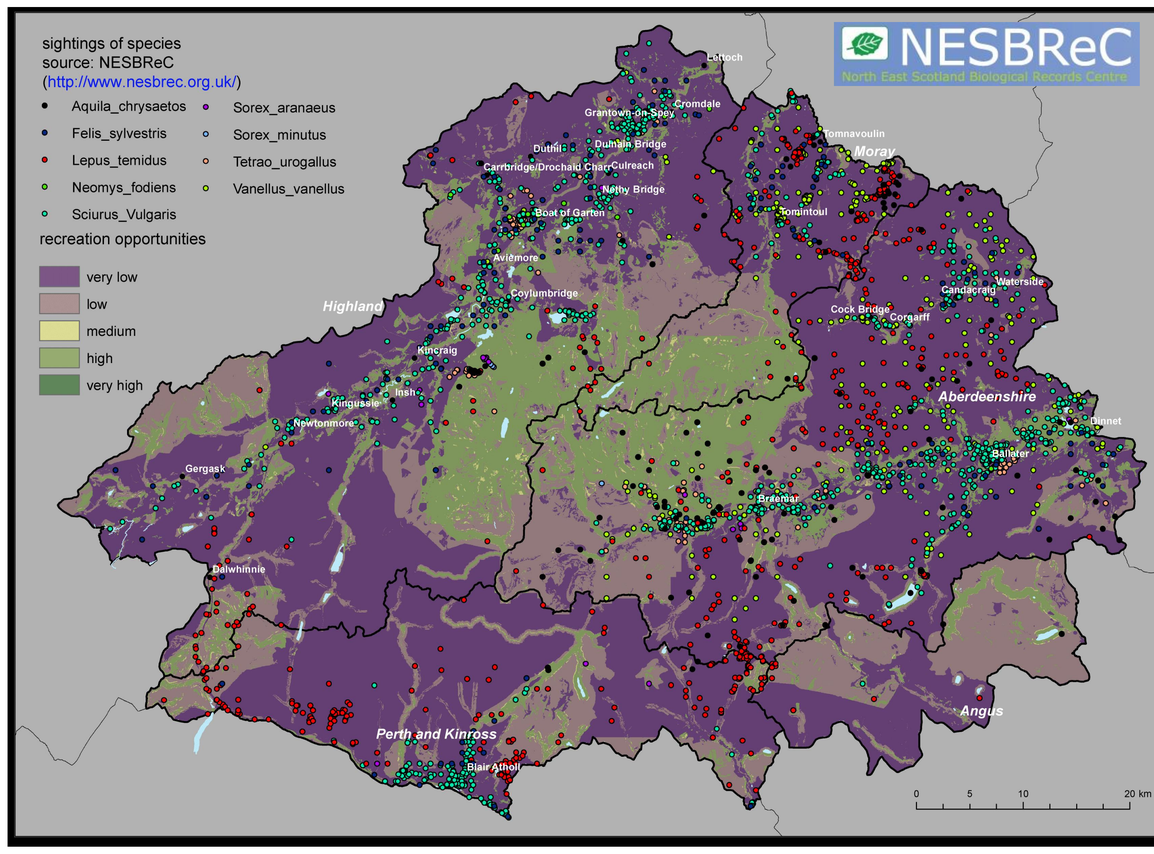
Detailed geo-phenological knowledge of how a species makes use of an area aids management planning.

Camera trap monitoring and citizen science data combined with recreational preference modelling highlights trade-offs between biodiversity and humans



Temporal occurrence of species and humans entering and leave catchment

Understanding temporal human/wildlife interactions can aid management e.g. policy of wild camping in park



Recreational opportunity and occurrence of rare species in Cairngorms National Park

Combining publically available citizen science biodiversity data on rare species with recreational potential can highlight potential areas of conflict and aid management decisions

Zulian G. & Dick, J. (in prep) The application and evaluation of ESTIMAP- Recreation to local resource use planning in Cairngorms National Park.

Dick, J. Andrews, C., Smith, R. (in prep) Temporal conflict between humans and wildlife: Cairngorms National Park

WHY: is collaboration important?

BECAUSE: to travel fast we go alone to travel far we go together

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