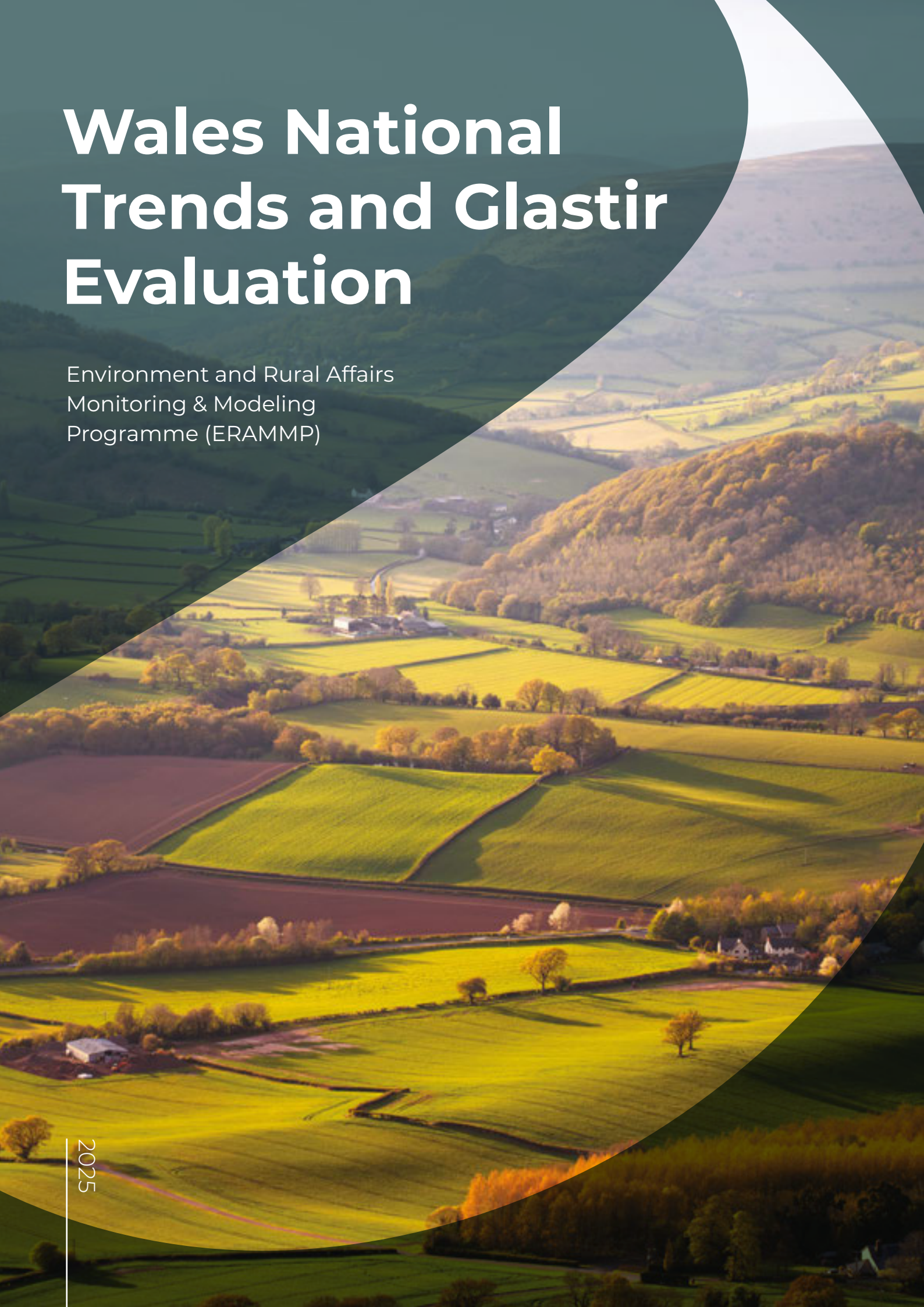
Wales National Trends and Glastir Evaluation

Environment and Rural Affairs Monitoring & Modeling Programme (ERAMMP)



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ERAMMP Report-105: Wales National Trends and Glastir Evaluation

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Abbreviations used in this report

AES	Agri-Environment Scheme
AWI	Ancient Woodland Indicators
BGS	British Geological Survey
BTO	British Trust for Ornithology
CS	Countryside Survey
ERAMMP	Environment and Rural Affairs Monitoring & Modelling Programme
EU	European Union
FPS	Farm Practices Survey
GA	Glastir Advanced
GB	Great Britain
GE	Glastir Entry
GHG	Greenhouse Gas
GMEP	Glastir Monitoring and Evaluation Programme
HEA	Historic Environment Asset
HNV	High Nature Value Farmland
LCM	Land Cover Map
LiDAR	Light Detection and Ranging
LULUCF	Land Use, Land Use Change and Forestry
NFI	National Forest Inventory
NFS	National Field Survey
NRW	Natural Resources Wales
Olsen P	Olsen Phosphorus
PROW	Public Rights of Way
RDP	Rural Development Plan
RPW	Rural Payments Wales
SFS	Sustainable Farming Scheme
SLM	Sustainable Land Management
UK	United Kingdom
UKCEH	UK Centre for Ecology & Hydrology
VQI	Visual Quality Index
WATS	Welsh Archaeological Trusts
WEFO	Welsh European Funding Office
WFC	Whole Farm Code
WFG	Well-being of Future Generations (Wales) Act 2015
WG	Welsh Government
WGRC-RDP	Welsh Government Rural Communities – Rural Development Programme

Contents

Executive Summary

Introduction to ERAMMP

The Environment and Rural Affairs Monitoring and Modelling Programme (ERAMMP) is funded by the Welsh Government (WG) to provide a range of scientific evidence and analysis to support the development of policies and evaluate programme implementations in the agriculture and land use sector.

ERAMMP is a partnership of 23 organisations led by the UK Centre for Ecology & Hydrology (UKCEH) which have a combined expertise in a wide range of environmental, economic and social areas across multiple sectors including agriculture, forestry, recreation, and health and well-being. The partnership was developed to deliver the Glastir Monitoring and Evaluation Programme (GMEP) funded by WG from 2012-16 which provided the essential building blocks for ERAMMP which has continued the GMEP community approach.

This latest report provides evidence on the current status and change for a range of habitats and natural (and some selected cultural) resources. These National Trends support the evidence needs of the next State of Natural Resources Report (SoNaRR) in 2026, update two Well-being of Future Generations (Wales) Act 2015 (WFG) national indicators (No. 13 Concentration of carbon and organic matter in soil; and No. 43 Area of Healthy Ecosystems in Wales), and provide a baseline for Sustainable Land Management (SLM) and the Sustainable Farming Scheme (SFS) monitoring and evaluation. A new method for reporting on the status of biodiversity in Wales (WFG National indicator No. 44 Status of biological diversity in Wales), has also been developed but is not reported here as further testing with the stakeholder community is required.

The environmental outcomes from the Glastir land management options are also provided to support reporting by the Welsh European Funding Office (WEFO) to the European Union (EU) for its investment in the Wales Rural Development Plan (RDP). The unique approach in Wales of integrating national and Agri-Environment Scheme (AES) monitoring by GMEP and ERAMMP increases monitoring efficiency, enables integration at a systems level and enhances our understanding of the overall contribution of AES schemes to the national picture.

ERAMMP methodology:

In brief, the methods used for capturing National Trends and Glastir management option outcomes have included a repeat of an integrated National Field Survey (NFS) first delivered by GMEP 2013-16, use of satellite and aerial imagery (UKCEH Land Cover Map, British Geological Survey aerial photography), a repeat of the ADAS Farmer Practice Survey (FPS), and greenhouse gas modelling. Where data is available, the status and trends of National Trends are reported for both the long term (up to 47 years) and the short term (last 10 years). The impact of Glastir management options is reported for the time Glastir was active (2012 onwards). The overall approach taken recognises that our landscapes and Natural Resources can be slow to respond to management interventions requiring long-term monitoring and operate as inter-connected whole systems which require integrated monitoring methodologies.

COVID-19 resulted in a two-year delay in delivering this report due to limits on access to land required to complete the NFS.

Key Headline Findings Include:

National Trends

1. In 2021, satellite imagery from the UKCEH Land Cover Maps family (LCM) was used to estimate that Woodland covered 358,400ha (16.9%) of Wales. This represented a 7% increase since 2010 and a new planting rate of 2,200ha per year of which Glastir provided funding for an increase of 1% or 3,780ha (5ha of which was for agroforestry). Woodland cover is classed where woody species dominate a 10m satellite pixel. There was also a 4% increase in new and restored Hedgerow and a 9% increase in both width and height of Hedgerows to a new total length of 52,700km in 2021. An expansion of Urban cover of 28,200ha over the same time period was greater than that for Woodland. Urban represented 6% of Wales in 2021. Note that Urban cover now represents 50% more area than Arable which was 4% in 2021. This increase was primarily due to the conversion of Improved Grassland. Overall, there was a 5% loss of the most productive agricultural land (Arable and Improved Grassland) over the same time period. No change in the area of Semi-Natural Habitat was detected (WFG National Indicator No. 43) between 2010 and 2021 which represents 42.6% of Wales. The impact of the Woodland and Urban cover changes will have been important for landscape visual quality at the local scale as well as impacting on many other services and benefits. Overall, 6.8% of Wales changed land use between 2010 and 2021.

2. With respect to habitat condition, a suite of headline indicators was selected by the GMEP Advisory Group to simplify reporting. These indicators have been analysed over three time periods to track trends of time over the long, medium and short term for a set of WG prioritised themes.

7%

increase in Woodland between 2010 and 2021

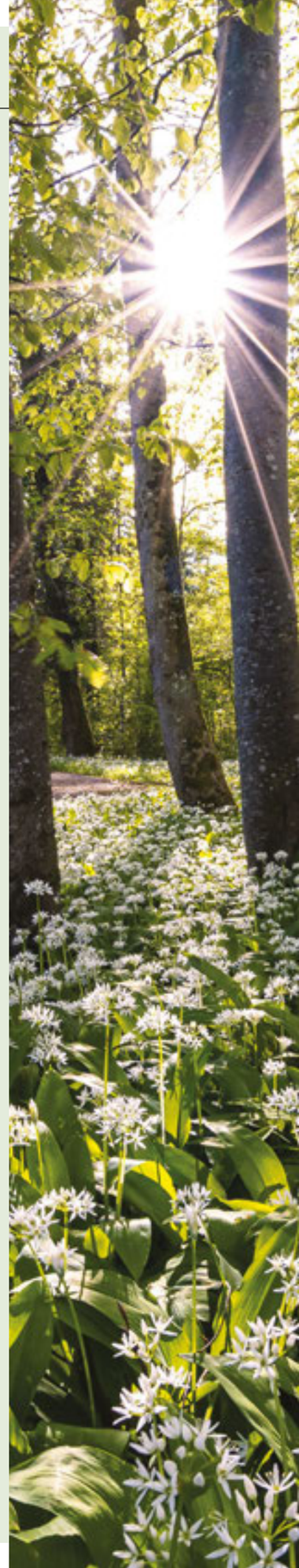

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Figure 1. The percentage of indicators across 6 Glastir objectives (Woodland, Biodiversity, Headwaters and Ponds, Soil, Climate Change, Landscape and Access and 2 other WG priorities (Priority species and Blanket Bog) which had improved (green), were stable (grey) or had declined (red) over the: A) long term (pre-2007*), B) medium term (2007-16) and C) short term (2013-16 to 2021-23). Dark green represents new indicators or indicators not re-surveyed. Indicators were selected by the GMEP Advisory Group.

3. Whilst the majority of indicators suggest no change or stability, the number of indicators in decline (red) has steadily increased from the previous two assessments (i.e. pre-2007* and 2007-2016) to the current assessment (2013-16 to 2021-23) (Figure 1). Further action may be required to increase the resilience and sustainability of our Natural Resources to the ongoing pressures of land use and management, climate change, chemical pollution and bio-risks.

4. A similar pattern was observed for National Trends for the five Natural Resources and four Asset Classes, with most indicators suggesting no change or stability but with more indicators of decline (blue) than for improvement (green) (Figure 2). An enhanced set of new and improved ERAMMP indicators are used here to replace some of the indicators selected by the GMEP Advisory Group which have not been repeated.

*Legacy monitoring programmes are of variable duration; the longest spans from 1978-2007 and shortest spans from 1998-2007.

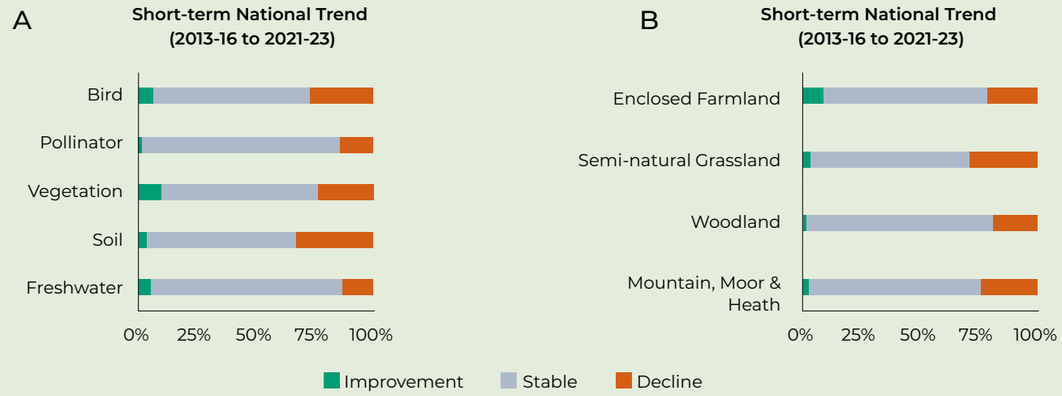

Figure 2. The percentage of total counts of indicators which had improved (green), were stable (grey) or had declined (red) at the national scale for: A) five Natural Resources, and B) four Asset Classes over the short term (2013-16 to 2021-23). ERAMMP indicators are used.

5. As Asset Classes contain a mix of Broad Habitats and Landscape linear and point Features, which are all reported separately in the State of Natural Resource Report (SoNaRR). ERAMMP experts were asked to weight indicators by their importance for assessing the current status of 19 Broad Habitats and Landscape Features. This expert assessment concluded: 12 (63%) Broad Habitats and Landscape Features were in a state of concern or had declined; 6 were stable (32%) and 1 had improved (Hedgerows). This compares to a previous assessment for 13 Broad Habitats and Landscape Features using pre-2007* data, when just 4 (31%) were of concern or had declined (Figure 3). This represents a doubling of Broad Habitats and Landscape Features which are now of concern or had declined in the last 10 years.

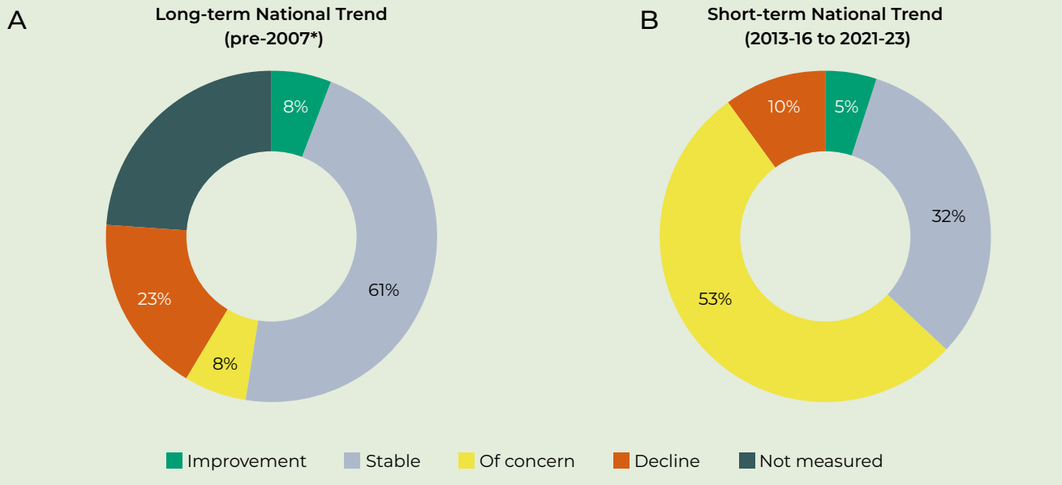

Figure 3. The percentage of Broad Habitats which had improved (green), were stable (grey), were of concern (yellow), had declined (red) or were not measured (dark green) at the national scale for the A) long-term (pre-2007*) and B) short-term (2013-16 to 2021-23).

* Legacy monitoring programmes are of variable duration; the longest spans from 1978-2007 and shortest spans from 1998-2007.

6. Some headline statistics which have contributed to these summary results include:

Some specific headlines which indicate stability or improvement include:

- Increased Hedgerow height (+9%) and width (+9%) and a **4% overall increase** in new and restored Hedgerows.
- **An increase** in positive plant indicator richness for Improved Grassland.
- **A decrease** in the number of negative plant indicators in Semi-Improved Grassland.
- **Stability** in the Vegetation condition of Woodland and Dwarf Shrub Heath.
- Bird indicators relating to Woodland and Upland Farmland are stable and there was an **increase in Granivorous Bird species of 24%.**
- **No change** in the national topsoil carbon concentration (WFG Indicator No. 13).
- **No change** in area of Semi-Natural Habitat (WFG Indicator No. 43) which covers **42.6% of Wales .**
- No change in the condition of Historic Environment Assets (HEAs) with **54% in excellent or sound condition.**
- **80% of Headwaters remain in good ecological condition**, however, the remainder are continuing to decline.
- Number of significantly or severely modified Streamsides has reduced from **43% to 30%.**
- **A halt in the decline of plant species richness in Broadleaved Woodland** (Figure 4).
- **An increase in positive plant indicator richness** and a reduction in plants which favour high fertility for Improved Grassland.

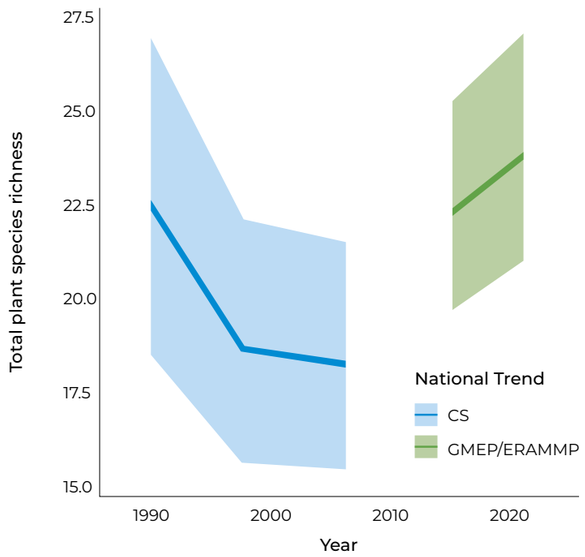

Figure 4. A halt in the decline of total plant species richness in Broadleaved Woodlands captured by Countryside Survey (1990-2007) and now by the most recent assessment by GMEP/ERAMMP (2013-16 to 2021-23).

50%

of Hedgerows are now in favourable condition.

80%

of Headwaters remain in good ecological condition.

An increase in positive plant indicator richness and a reduction in plants which favour high fertility for Improved Grassland.

54%

of Historic Environment Assets remain in excellent or sound condition.

24%

increase in Granivorous Bird species.

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Some specific headlines of concern or decline include:

- **8% decrease in plant species richness** across all habitats and **22% increase** in non-native plant richness.
- **13-35% decrease** in several Bird indicators, particularly for Arable and Grassland species.
- **23-75% decrease** in Pollinator indicators, depending on the Broad Habitat.
- **6-32% increase** in Soil compaction.
- **4% of Soils** in Wales eroded or disturbed.
- **8% loss** in topsoil carbon concentration in Arable and Horticulture habitats.
- **A 15% increase** in phosphorus levels in Improved Grassland Soils and **three-fold increase** in the number of Improved Grassland sites exceeding the leaching threshold for water quality (Figure 5).
- **A two-fold increase** in the number of sites exceeding the leaching threshold for phosphorus in Arable soils and a 7.7% loss of topsoil carbon.
- 72% of Improved Grassland sites retain Soil acidity levels **below production thresholds.**
- **66%** of Headwater streams have invasive invertebrates.
- **46%** of Ponds now in poor or very poor condition, an increase from **37%** (Figure 6).
- **Two-fold increase** in the percentage of Ponds with invasive species from **9% to 19%.**
- **A four-fold increase** in the percentage of dry Headwaters and a seven-fold increase in dry Ponds. These now represent **13% and 11%** of the populations respectively.
- **50%** of Public Rights of Way remain blocked and/or not signed.

Photo © Callum Macgregor

65%

of Streamsides still have habitat modification due to poaching.

15%

increase in phosphorus levels in Improved Grassland Soils.

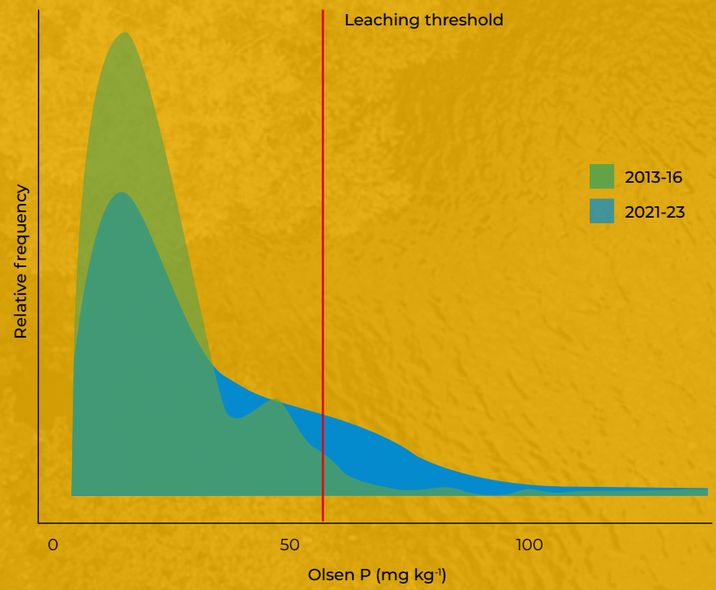

Figure 5. A three-fold increase in Improved Grassland sites now exceeding the threshold for phosphorus leaching from 2013-16 to 2021-23. This is an increase from 5% to 17% of all sites.

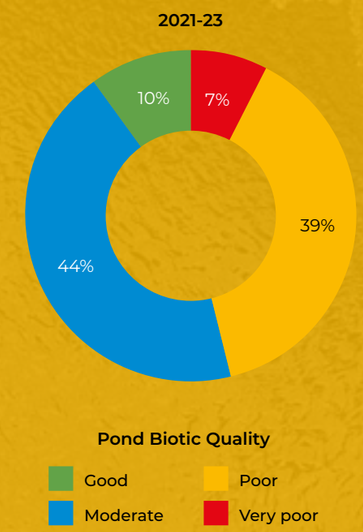

Figure 6. An increase in the percentage of Ponds in poor or very poor condition across Wales from 37% in 2013-16 to 46% in 2021-23.

23-75%

Decrease in pollinator indicators.

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Glastir Impact

7. Outcomes from the Glastir scheme have been assessed following the same sampling design, methodologies, indicators and analytical approaches used for reporting National Trends.

8. The Glastir scheme provided additional support for environmental services to improve the land and environment as part of the Welsh Government Rural Communities – Rural Development Programme (WGRC-RDP). It comprised a family of related schemes to deliver outcomes at a farm, forest and landscape level including: (i) Glastir Entry, (ii) Glastir Advanced, (iii) Glastir Commons, (iv) Glastir Organic, (v) Glastir Small Grants, (i) Glastir Woodland Creation and (vii) Glastir Woodland Restoration.

The objectives of Glastir were:

- Combating climate change
- Improving water quality and manage water resources
- Improving soil quality and management
- Maintaining and enhancing biodiversity
- Managing landscapes and historic environments
- Improving public access to the countryside

Additional outcomes (following the Welsh Audit Office request to broaden the scheme outcomes):

- Improving number of farms undertaking action concerning climate change
- Improving diversification and efficiency of farms
- Improving profitability and wider sustainability

9. Overall, 40% of agricultural land (38% of Wales) participated in the Glastir scheme with 25% of agricultural land in Wales having specific management options applied to particular land parcels to improve the status of the Natural Resources. It is the impact of these targeted Glastir land management options which are evaluated here relative to land without options. Land in Glastir but without specific management options and not included in our analysis was subject to the Whole Farm Code (WFC). The WFC covered a series of rules which all Glastir participants had to adhere to across their entire land holdings in the scheme.

10. It was anticipated that a significant number of participants from previous AES would come into the Glastir scheme, and this was observed with 54% of the Tir Gofal and/or Tir Cynnal schemes land area entering the Glastir scheme. Despite more than 700 options being offered in the Glastir scheme, a small number of just five options represented 62% of land area in scheme. These were four options relating to maintaining and/or limiting stock numbers in pasture and open country, and a fifth for Glastir Organic interventions.

11. In all analyses, change in response to Glastir management options is defined as a change relative to the trend observed in land with no management options (Figure 7). A result of this is that an improvement may reflect a reduced decline in a resource and not necessarily an overall net improvement. Likewise, a decline may be a reduction in a positive trend and not an overall decline. The summary results presented here are aggregated results from a large number of analyses of Glastir management option 'bundles' which captured the impact of the options prioritised for analysis by WG and for which there was sufficient uptake by land managers to enable analysis.

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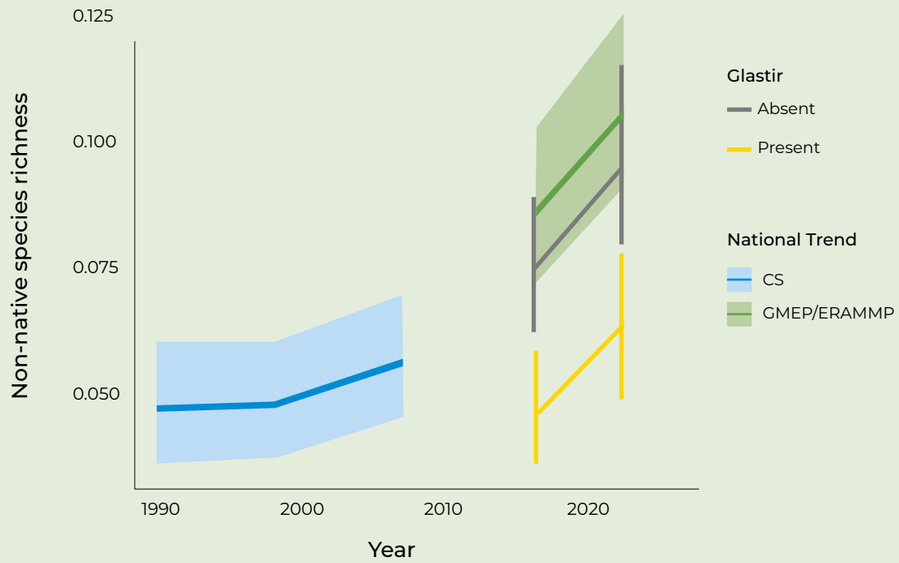

Figure 7. An example of a figure combining National Trend and Glastir Impact data. This example indicates the start of an undesirable increase in non-native plant species richness captured by Countryside Survey (CS) (blue) from 1990 to 2007 which GMEP/ERAMMP (green) shows increased in the recent survey (2013-16 to 2021-23). Land which came into the Glastir scheme (orange) had lower levels of non-native plant species compared to land outside of the scheme (grey) however the rate of increase is identical in both to the National Trend meaning there has been no benefit of the Glastir management options. The blue and green shaded areas and vertical lines indicate the statistical uncertainty around the mean values.

12. The analysis of the data from the NFS indicates the impact of Glastir management options could not be detected for most indicators (grey), had modest improvement (blue) for a few indicators, with some trade-offs (orange) also observed (Figure 8).

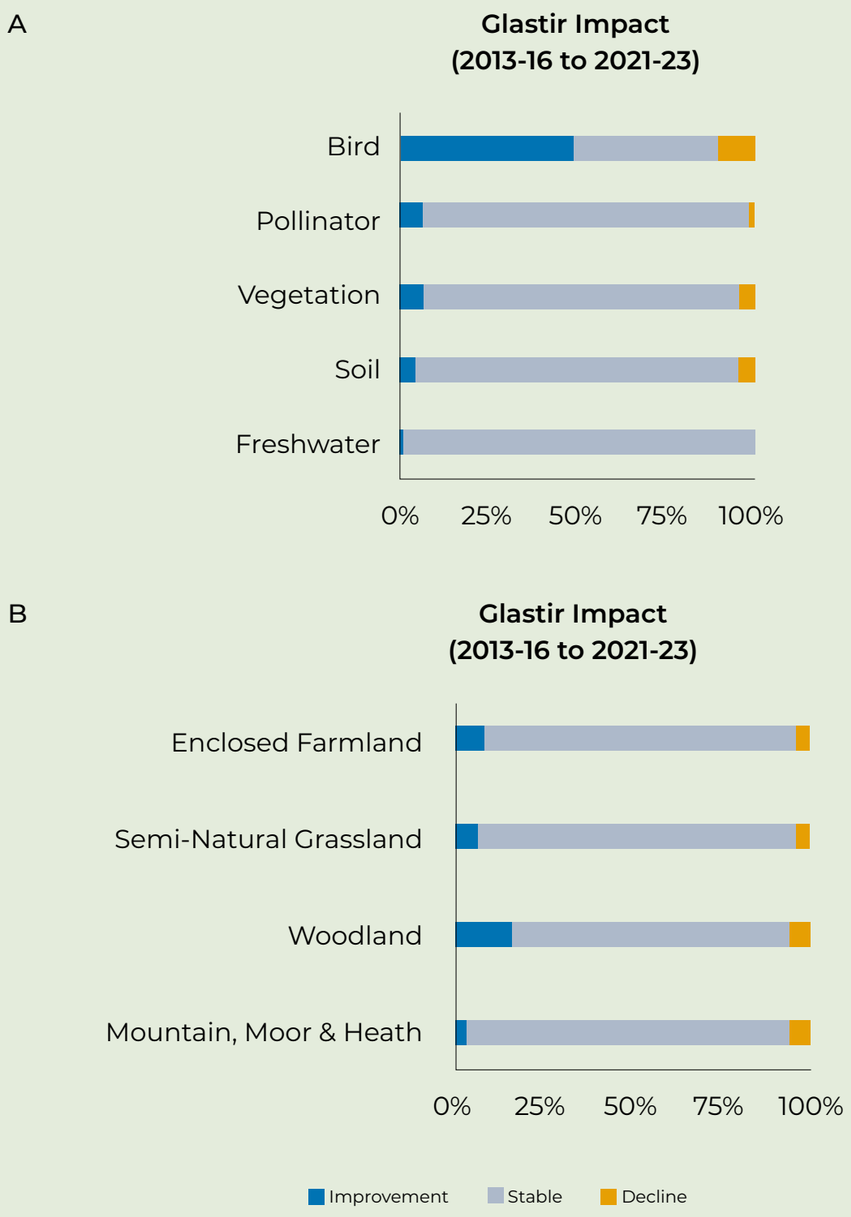

Figure 8. The percentage of total counts of indicators which had improved (blue), were stable (grey) or had declined (orange) at the national scale for land within the Glastir scheme for: A) five Natural Resources, and B) four Asset Classes over the short term (2013-16 to 2021-23). Indicators are the enhanced ERAMMP suite of indicators.

13. These results are however variable depending on the Natural Resource. Birds were the most responsive relative to Pollinators, Vegetation, Soil, and Freshwater (Figure 8A). This more positive outcome for Birds is not repeated in the National Trend data potentially reflecting the mobility of Birds to exploit local patches of new or improved habitat without necessarily resulting in a net increase in abundance nationally. This illustrates the benefit of embedding AES evaluation as part of a national monitoring programme particularly for mobile species.

14. Results were also variable depending on the Asset Class. More improvement is reported for Enclosed Farmland and Woodland (Figure 8B). This is likely to be due to a requirement for Glastir management options which create habitat (e.g. field margins) or fundamentally change a key driver (e.g. stock exclusion from Woodland). This is in contrast to many options for Semi-Natural Grassland and Mountain, Moor and Heath Asset Classes, where maintaining current extensive practices from past AES schemes (e.g. low stock numbers), rather than encouraging transformative change, were most common. Indeed, the ADAS Farmer Practice Survey (FPS) confirmed only 31% of farm managers self-reported a change in management due to Glastir payments in the latter stages of the scheme and only 34% on entry to the scheme. This suggests maintenance was the priority for payments particularly for the more widespread grassland and upland habitats. This compares to 61% reporting change in a previous survey for Tir Gofal and Tir Cynnal possibly due to payments being made to continue options under both schemes for some farms although simple modelling found no evidence of this link. This relatively low rate of management change by farm managers has resulted in very little change in environmental condition over the 10-year time period on land where Glastir management options were present. One caveat however is that small scale changes e.g. on field margins and streamsides are likely to have been under-reported using the FPS approach which captures management changes of large areas.

15. Experts weighted the evidence for Glastir management options to provide a single impact assessment score for each of the nine Glastir objectives. Due to the limited impact and / or uptake of management options all were considered as having low impact for land in scheme for the six environmental and cultural objectives. Impact assessment was higher for the outcomes for the objectives relating to profitability, sustainability, diversification and efficiency. Overall, Glastir had a low impact on National trends with the exception of farm profitability and sustainability which was given a medium score (Table 1).

16. The Asset Classes and Broad Habitats reported here combine spatially across Wales to create a rich variety of landscapes. In 2017, GMEP amalgamated a range of landscape and farm management indicators to explore if land which had entered the Glastir scheme (but not yet subject to Glastir management options) had more characteristics which were thought to confer resilience, compared to land outside of the scheme (Figure 9). This analysis indicates Glastir payments were prioritised on maintaining and improving land of better environmental quality.

Table 1. Expert assessment of the overall impact of Glastir management options for land in scheme mapped to the nine Glastir objectives and their contribution to National Trends. Glastir management options are likely to impact National Trends when the impact is large and there is sufficient land with uptake of the options.

Glastir objective	Impact for land in the Glastir scheme	Influence on National Trends
Combating climate change	Low	Low
Water quality and manage water resources	Low	Low
Soil quality and management	Low	Low
Biodiversity	Low	Low
Landscapes, historic environments and public access	Low	Low
Woodland creation and management	Medium	Low
Actions by farmers for climate change	Low	Low
Improving profitability and sustainability	High	Medium
Improving diversification and efficiency	Medium	Low

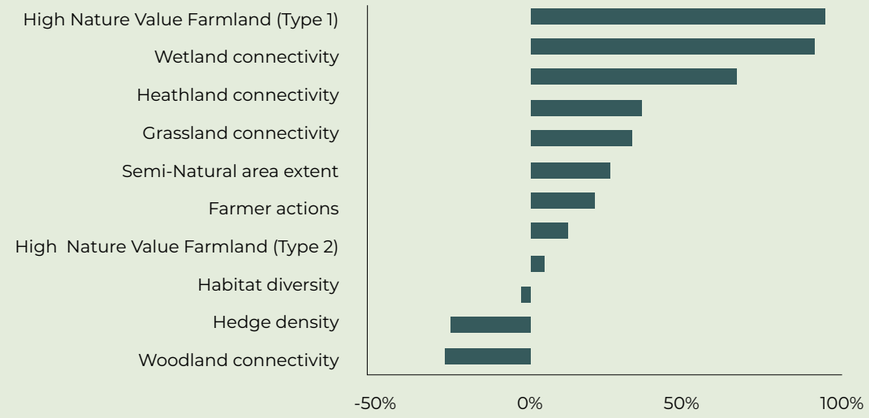

Figure 9. The GMEP 2017 comparison of land in Glastir compared to the national mean for metrics of resilience. Bars to the right of the central '0' line indicate a more positive value for that characteristic for land in Glastir.

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17. This picture of greater resilience of land in scheme has been assessed for change using the most recent NFS and FPS data. The data indicate some gains in resilience characteristics by land with Glastir management options including: a 3.5% increase in grassland connectivity (but no change in Woodland, Heathland and Wetland connectivity); a 4% increase in new and restored Hedgerow; and 25-40% of land managers making some improvements to increase diversification and efficiency. There was however no change in Semi-Natural Habitat area or Habitat Diversity. It is concluded that the higher initial status of resilience of land in scheme has been maintained, with a small indication of improvement over and above that observed outside of the scheme.

Climate change mitigation was one of the six Glastir environmental objectives. From 2010 to 2021 there was an increase in emissions from agriculture reported in the Agriculture Greenhouse Gas Inventory for Wales of 0.33Mt to 5.7Mt CO2eq/yr in 2021 and a reduction in the sink within the Land Use, Land Use Change and Forestry (LULUCF) sector of 0.02 to -0.7Mt CO2eq/yr. There therefore remained a significant gap between the two inventories of 5Mt CO2eq/yr in 2021 which needs to be closed if the land-based sector is to achieve Net Zero as a whole. The main contribution of Glastir to a reduction in greenhouse gas (GHG) emissions was likely to be related to changes in stock numbers, fertiliser use, new Woodland planting and peatland restoration. ERAMMP has captured evidence to report on each of these potential areas. Overall, the results suggest a limited contribution by the Glastir management options to GHG emission reductions between 2010 to 2021. This is in line with original GMEP 2017 modelling, which estimated a less than 2% decrease in nitrous oxide and methane emissions (the two dominant contributors to the Agricultural GHG Inventory) were likely.

The contribution of Glastir to GHG emissions reductions:

a. No change in stock numbers in response to Glastir payments. There was also no consistent trend in sheep and lamb, and cattle and calves between 2010 and 2023 for all of Wales, with +5% increase in sheep and lamb and -2% in cattle and calves in the WG 'Survey of Agriculture and Horticulture: June 2023' suggesting this is an industry wide situation.

b. No change in fertiliser use due to Glastir payments. An industry-wide decline in fertiliser use of 25% since 2010 is reported for England and Wales most likely before due to costs, but Glastir has not further influenced this trend.

c. Whilst there has been a significant creation of new Woodland (23,600ha, +7%), Glastir was responsible for just 3,780ha. Hedgerow creation and restoration in Wales has increased by 4% (2,200km) with Glastir responsible for 1,370km of new Hedgerows. These new woody features will be contributing little to increase the carbon sink until they are more mature. The potential for a small increase in carbon is however established for the longer term.

d. Wales has an area of 82,000ha of peatland (4% of Wales). A review of all reported peatland restoration activities from across Wales by ERAMMP suggests a total of 9,000ha of peatland restoration had occurred, with the majority most likely delivered since 2010 and with 5000ha targeted on peat itself rather than surrounding land. (Figure 10). Glastir contributed funding for 992ha (11%) of this restoration. Using a spatially explicit data approach only possible for Wales, GHG emissions from peatland restoration as a whole were calculated to have been reduced from 506,000 t CO2-e yr-1 to 491,000 t CO2-e yr-1 by 2023, a decrease of 15,000 t CO2-e yr-1 (a decrease of 3% from 1990 values). Glastir contributed 1,100 t CO2-e yr-1 (0.2%) of this decrease. The decrease in GHG emissions (3%) is less than for the area restored (11%) as restoration has been targeted on peatlands with lower rates of GHG emissions.

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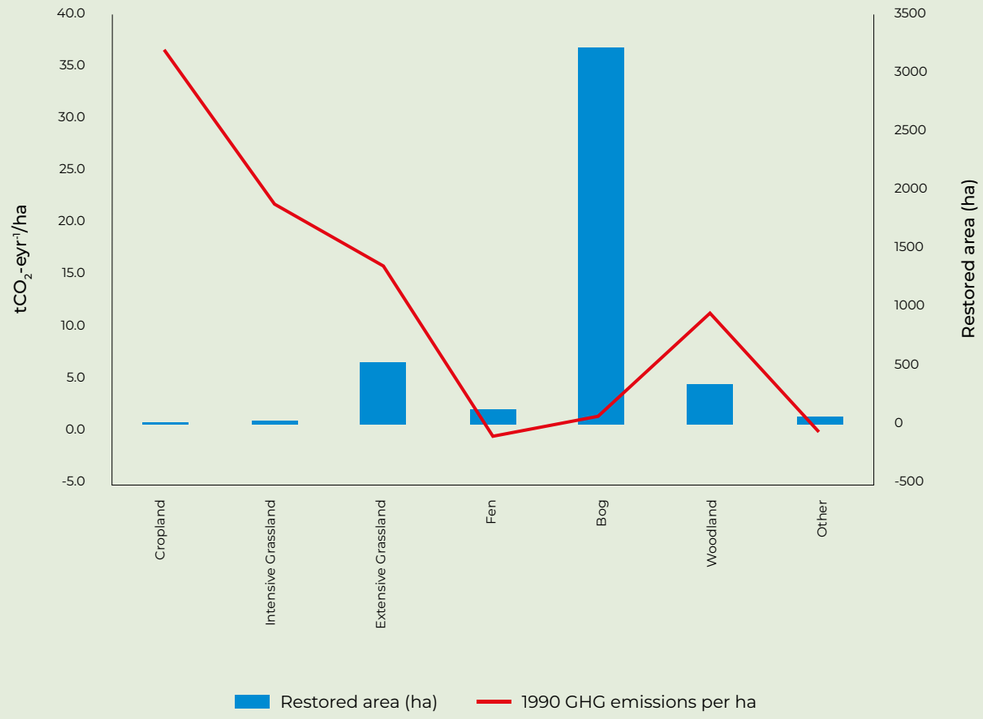

Figure 10. Emission rates by area from different types of peatland and peatland restoration areas in 2023. Note little restoration area has occurred on high emitting peatland types such as Cropland, Intensive and Extensive Grassland. Most restoration has been on Bog which has low rates of GHG emissions resulting in lower net emission reductions than the restoration area would suggest.

18. Looking forward, the results from the ADAS FPS provide an indication as to how prepared the agriculture sector is for (i) future climate change, (ii) the need for greater diversification and efficiency and (iii) improved profitability and sustainability. These three Glastir objectives were requested by the Welsh Audit Office.

Glastir objectives requested by the Welsh Audit Office and evidence derived from ADAS FPS:

a. **Improve number of farms undertaking action concerning climate change:** 49% of all respondents had taken no action to adapt to climate change threats. Between 9% and 40% of farms had taken actions to mitigate specific climate change threats in the past three years, with the average number of actions being 1.1 out of a possible 6. The dairy sector was most active in this space. Glastir payments contributed an additional 0.3 actions.

b. I**mprove diversification and efficiency of farms:** There was a small increase in the number of actions per farm to improve the farm business, e.g. 9% more took action on 'diversification' in scheme for farms in the Glastir Entry (GE) and Glastir Advanced (GA) schemes.

c. **Improving profitability and wider sustainability:** Between 25-40% in GE or GA schemes agreed they had made improvements which had increased business resilience, environmental motivation, acquisition of sustainable skills, and personal health and welfare as a result of scheme participation. Between 55-84% of farm managers agreed their objectives to improve various aspects of farm economics including income stability, business viability and improved profitability, had been met.

Headline Report

Overall, these results suggest that some progress has been made and early adopters are changing management practices. However, there is significant room for improvement if the agricultural sector is to prepare for the projected challenges of more climate extremes and increasing uncertainty and volatility in many global markets.

19. **In conclusion, the Glastir evaluation assessment indicates there is only modest evidence of environmental improvement on land subject to Glastir management options as originally specified in the Glastir objectives in 2012. A different approach to pay for more transformational actions (i.e. not paying for the status quo) with more targeting to increase cost-benefit outcomes will be needed if environmental and cultural improvements are to be an objective of payment schemes going forward.**

20. **Finally, the combined results from the National Trends and Glastir Evaluation assessments suggest there are many challenges ahead if the combined Nature and Climate crises are to be met together with the four objectives of SLM including producing food and other goods in a more sustainable manner. Currently at best, management actions including those delivered by Glastir are holding Broad Habitats and Natural Resources stable but in many cases these are at historically low levels. Moreover, there are warnings of this stability being lost with early indications suggesting a return to a decline for many.**

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The Environment and Rural Affairs Monitoring and Modelling Programme (ERAMMP) provides business-critical scientific evidence and analysis to the Welsh Government (WG) to support the development of policies and evaluate programme implementation in the agriculture and land use sector. The work involves three inter-related components of Monitoring, Expert Review and Integrated Modelling, and builds on the Glastir Monitoring and Evaluation Programme (GMEP) funded by the WG between 2012-16 which provided the essential building blocks on which ERAMMP has been developed and delivered (2017-24).

The purpose of this latest ERAMMP Report is to provide evidence of National Trends for a range of habitats and natural (and some cultural) resources to support the next State of Natural Resource Report (SoNaRR), deliver updates of several Well-being of Future Generations (Wales) Act 2015 (WFG) national indicators and provide a baseline for Sustainable Land Management (SLM) and the Sustainable Farming Scheme (SFS). The policy landscape active during the period relevant to this report includes support and regulation mainly associated with European Union (EU) Common Agricultural Policy. With respect to rural grants and payments, there was

The purpose of ERAMMP is to provide business critical scientific evidence to the Welsh Government in the agriculture and land use sector.

a mix of schemes which include the Basic Payment Scheme to support good environmental practice underpinned by Cross Compliance requirements. The single Agri-Environment Scheme (AES) available was Glastir, which provided additional support as part of the Welsh Government Rural Communities – Rural Development Programme (WGRC-RDP) for environmental services to improve the land and environment. It comprised a family of related schemes to deliver outcomes at a farm, forest and landscape level including: (i) Glastir Entry, (ii) Glastir Advanced, (iii) Glastir Commons, (iv) Glastir Organic, (v) Glastir Small Grants, (vi) Glastir Woodland Creation and (vii) Glastir Woodland Restoration.

The objectives of Glastir were:

- Combating climate change
- Improving water quality and manage water resources
- Improving soil quality and management
- Maintaining and enhancng biodiversity
- Managing landscapes and historic environments
- Improving public access to the countryside

Additional outcomes (following the Welsh Audit Office request to broaden the scheme outcomes) were:

- Improving number of farms undertaking action concerning climate change
- Improving diversification and efficiency of farms
- Improving profitability and wider sustainability

The second purpose of this latest ERAMMP Report is to report on the outcomes from the Glastir management options. Reporting on policy outcomes was a requirement of EU funding which supported the Glastir scheme and was also intended to guide future scheme development in Wales post-EU exit. Glastir management options will have direct impacts mostly at the local scale, where the management options occur with effects spilling over into the wider landscape to varying degrees for different indicators. If the uptake of these options either individually or together are of sufficient scale, they may also contribute to a shift in the National Trend. Whilst this latter is not explicitly tested directly here, the co-location of measurements and adoption of identical methodologies mean an inference can be made as to the contribution of Glastir management options towards National Trends. This integrated approach of combining national and AES monitoring is unique to Wales within the UK and Europe and increases efficiency, improves integration and enhances our understanding of the overall contribution of AES schemes to the national picture. ERAMMP is only one source of evidence the Welsh European Funding Office (WEFO) will use to provide the complete report required by the EU for its investment in the WGRC-RDP.

Methods

The evidence reported here comes from a range of robust scientific approaches including:

- A repeat of a nationally representative, integrated National Field Survey (NFS) for habitat condition reporting;
- Outputs from remote sensing technologies i.e. the UKCEH Land Cover Map (LCM) for reporting on change in habitat extent;
- Aerial images from the British Geological Survey (BGS) for quantifying extent of soil erosion and disturbance;
- Modelling approach for peatland restoration greenhouse gas (GHG) emission reporting, and
- ADAS Farm Practices Survey (FPS) to capture changes in farmer management practices.

The approaches used builds on long term, integrated methods in line with the requirements of the Well-being of Future Generation (Wales) Act 2015 (WFG).

The main effort has been delivering a repeat sampling of the NFS, which captures co-located information in a carefully selected set of 1km sample squares from across Wales to provide a robust and representative picture of trends in habitat condition across the wider countryside. The approach taken recognises that our landscapes and Natural Resources can be slow to respond to management interventions and operate as inter-connected whole systems.

The NFS survey was delayed by two years due to COVID-19, resulting in this report being published in 2025 rather than the intended 2023. The NFS provides evidence of where there was detectable:

- Improvement in extent and condition;
- A halt of a historic decline;
- Ongoing stability;
- Early signs of a new decline which are of concern;
- Or where decline is continuing, and further action is needed.

The NFS provides evidence for reporting against a suite of headline indicators selected with the GMEP Advisory Group and a wider set of indicators developed by ERAMMP to provide a more in-depth picture to capture change in habitat condition; Landscape Features such as Hedgerows, Field Boundaries and Veteran Trees; Vegetation condition and diversity, Birds and Pollinator diversity; (top)Soil health; Headwater, Streamside and Pond quality; threats and condition of Historic Environment Assets (HEA); and the condition of Public Rights of Way (PROW). The data collected can also support the testing and development of future indicators and targets as policy questions change over time. Duplication of monitoring by other organisations, such as Natural Resources Wales (NRW), was avoided to ensure added value. The period reported is for the change detected from 2013-16 to 2021-23 and is linked to longer-term trends which use comparable methods where this is available. It should be noted, the NFS would not be possible without the support of the farming unions and > 2,000 land managers who provided access to their land to deliver the NFS during both GMEP and ERAMMP, and their support is gratefully acknowledged.

In addition to data captured from the NFS, the change in habitat extent was reported using historic and current satellite data to estimate change from 2010 to 2021 using an approach developed by UKCEH for their LCM which has been reporting since 1990 and now produces maps annually. Remote sensing using aerial imagery also has been used by the BGS to help develop new metrics for detecting soil erosion and disturbance which were ground-truthed in the NFS.

To further understand the potential drivers of change captured in the NFS of land in and out of the Glastir Entry (GE) and Glastir Advanced (GA) schemes, ADAS has repeated a FPS to capture how farm managers have implemented Glastir actions. **ERAMMP also provides an update to the evidence base as to the rate of adaptation and diversification by the agriculture sector to meet the challenges of climate change and market volatility. Over 600 farms were selected, stratified across four farm types repeating methodology developed previously. In phone interviews, farm managers were asked to self-assess their response to GE or GA payments over the latter part of the scheme. These responses were compared to those out of scheme and to responses from the 2nd FPS which reported in 2016 capturing primarily GE level participants and their response to entry to the scheme.**

To assess the change in GHG emissions from the Agriculture and Land Use sector, and the likely contribution of Glastir management options to these reductions, evidence has been collated from the UKCEH LCM, FPS, WG Survey of Agriculture and Horticulture: June 2023; The British Survey of Fertiliser Practice 2023; and the Agriculture and the Land Use, Land Use Change and Forestry (LULUCF) GHG emission inventories. In addition, ERAMMP has enhanced this GHG evidence base to quantify the effect of peatland restoration on GHG emissions in Wales. As in-depth information on peatland restoration is not available for all four nations of the United Kingdom (UK), this detailed modelling approach is not included in the UK or Devolved Administration GHG inventories which requires common data availability for all four nations. The approach models the likely outcomes for GHG emissions of restoration on different types of peatland and at different stages of degradation.

Finally, it should be noted that ERAMMP collects information across the wider countryside and complements the monitoring of rare species and Priority Habitats on land or in Freshwaters by other organisations including many voluntary schemes often supported by the Local Environment Records Centres. Conclusions or inference from the results therefore consider the general landscape and environment of Wales and should not be interpreted as informing about rarities unless where this is explicitly stated, e.g. reporting of the priority bird index. Nevertheless, the wider countryside outside of designated areas provides habitat for many species and provides the majority of our Soil and Freshwater resources. It also provides the connectivity through which species can move across the landscape in response to climate change and other pressures and provides a source of dispersal potential for priority habitats to improve.

In this Headline Report, findings are structured in four parts:

- Critical changes in the land use and the farming system in Wales since 2010 and those as a result of Glastir payments since 2012 which are most relevant to this report;
- National Trends for a wide range of habitats and natural (and some cultural) resources over the long (40+ years) and short term (10 years) plus impacts on landscape quality and resilience;
- Evaluation of Glastir excluding the Whole Farm Code (WFC) (hereafter described as the impact of Glastir management options) on farm management practices, a range of habitats and resources, landscape quality and resilience mirroring the approach taken for National Trends.
- Expert assessment as to the success of Glastir management options in helping to meet the objectives of Glastir and their overall role influencing National Trends.

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Land Use and the Farming System in Wales

Combining recent and historic satellite data indicates 6.8% of land changed land use over the 11-year period between 2010 and 2021 (Figure 11). The rate and changes observed are similar to those observed for Great Britain (GB). Specific land use changes were:

- Woodland cover represented 16.9% of Wales in 2021 which is an increase of 23,600ha (7%) since 2010, representing a new planting rate of 2,200ha per year which matches current WG ambitions. This increase is due to a 10% increase in Broadleaved Woodland and a 7% decline in Coniferous Woodland. The area and increase are greater than that reported by the National Forest Inventory (NFI) for well recognised methodological differences, including the historical absence of small woodlands (<0.5ha) from the NFI which will be included in future NFI accounts. Planting due to Glastir payments contributed 3,780ha (1%) with 5ha for agroforestry.
- There was a 2,200km increase in new and restored Hedgerow, which also increased in height and legnth (both by 9%) to a total length of new and restored Hedgerows of 52,700km in 2021-23. Glastir supported the planting of 1,370km of new Hedgerow.
- The funding source of the remaining new Woodland and new and restored Hedgerow is not known but is likely to have been delivered by a mix of land managers, Non-Government Organisations and the forestry industry to deliver the known wide range of benefits which can derive from Woodland, Hedgerows, Orchards, individual trees and other woody features.

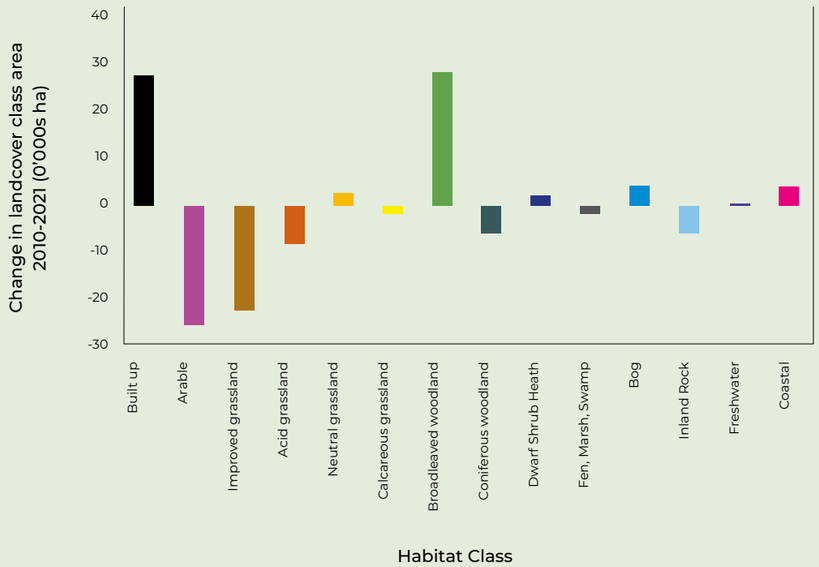

Figure 11. Change in land cover across Wales (thousands of hectares) from 2010 to 2021 estimated from the UKCEH LCM.

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- There was an expansion in cover of Built-up/ Urban land from 2010 to 2021 which now represents 6% of Wales land area. This was an increase of 28% (28,200ha). The majority was conversion of Improved Grassland. The NFS does not capture any further information on the condition of this Urban land as the survey only includes peri-urban areas (i.e. where soil sealing, (for example, by concrete and tarmac) is < 25% of a survey square).
- Overall, there was a 5% decrease (48,900ha) in intensively management farmland i.e. Arable and Improved Grassland over the same 11-year time period, indicating a loss of the most productive agricultural land in Wales. Arable represents just 4% of Wales in 2021 i.e. less than that of Urban.
- Whilst there was an apparent small 1.2% increase in the area of Semi-Natural Habitat (i.e. defined as all land that isn't Arable, Improved Grassland, Coniferous, or Built-up/Urban) was within detection limits of the satellite approach and is not considered sufficiently robust for updating the WFG National Indicator for Healthy Ecosystems (No. 43), which reports using the extent of Semi-Natural Habitat. The area of Semi-Natural Habitat in 2021 was 904,600 ha or 42.6% of Wales. This is larger than that reported previously by NRW of 31% for 2017-18 due to a difference in methodology. Irrespective of the total amount, the key issue is that there has been no change over the last 11 years.
- Glastir management options contributed an area of 3,890ha (0.2% of Wales) of new habitat through habitat reversion or conversion. This is well within the detection limit of satellite data and is derived purely from Rural Payments Wales (RPW) data on payments. This area is different from payments to improve the condition of existing habitats, which was the priority for most Glastir payments.
- Wales has 82,000ha of peatland, 4% of Wales' land area. There has been 9,000ha of peatland restoration (primarily rewetting and removal of trees and scrub) with most likely since 2010. Glastir management options have been responsible for 992ha (1.2%) of this restoration since 2012 with funding from other sources which is likely to include, for example, EU Life funding and WG funding sources outside of the Glastir scheme. Other Glastir-funded options, such as low or reduced grazing and nutrient inputs on or surrounding peatlands, may also have contributed to a change in peatland condition reported here.


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External data sources indicate the following changes in some key drivers which will have contributed to National Trends:

- The WG Survey of Agriculture and Horticulture: June 2023 indicates there has been a 5% increase in sheep and lamb numbers since 2010 and a decrease of 2% in cattle and calves' numbers. Numbers were highest in 2017 for sheep and lamb and 2010 for cattle and calves. Pig numbers declined by 8% and poultry increased by 36%. Both the ADAS FPS and these national statistics indicate the GE and GA scheme did not make significant change to overall livestock numbers on land holdings in those schemes after a small initial decline on entry. It should be noted, these changes will not reflect consolidation and intensification of some sectors e.g. the dairy and poultry sectors in particular regions across Wales which may lead to specific local impacts (e.g. emissions to air and rivers) nor the efficiency levels of different sectors relating to either overall yield or resource-use efficiency including emissions.
- There are ongoing declines in fertiliser use since data collection started in 1993, with a 25% reduction since 2010. The ADAS FPS indicates there was no additional impact of GE and GA schemes on fertilisation use other than a small reduction on scheme entry. Reductions in use were reported to be primarily driven by input costs across the agricultural sector.
- There are many other drivers of change (and indeed also at times no change) in the agriculture and land use sector that are too numerous to mention here, including input costs, global markets, the regulatory and enforcement landscape, legal and tax rules, culture, and workforce and skills.

5% increase in sheep and lamb numbers between 2010 and 2023.

National Trends

Recent trends for the 10-year period from 2013-16 to 2021-23 are reported for a wide variety of headline indicators agreed with WG and the GMEP Advisory Group together with additional indicators to provide greater context for six of the nine Glastir objectives. The indicators aim to strike a balance between the fine grain of data at collection resolution (e.g. on individual species) available from the NFS and the aggregate measures better suited for high-level policy relevant metrics. For example, species data are combined to report on the overall abundance, species number, species diversity and ecological function of Vegetation, Pollinators and Birds. Overall habitat and asset condition evaluations have then been summarised using expert judgement to provide a more policy-focussed assessment as to whether the asset or resource is: in decline, of concern, stable or improved. It should be noted that a stable trend status may indicate holding the status quo despite ongoing pressures such as climate change, ongoing air pollution and a challenging economic climate for land managers and thus a positive outcome i.e. where this has prevented further degradation or maintained high-quality habitat and asset conditions, stability could be considered a success. However, where stability represents a lack of improvement in condition from a historically low level, particularly where Glastir was intended to drive improvements in that condition as indicated in several of the Glastir objectives, that stability may not represent success. A lack of detectable change may also occur where increases or declines have been small or patchy, as opposed to true stability, which should be borne in mind when interpreting the results.


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Headline Results

In 2017, the baseline GMEP NFS reported against a set of headline indicators to explore the current and long-term status of a range of Glastir objectives and two other WG priorities. The results indicate that, whilst the majority of indicators (Figure 12) suggest no change or stability (blue), the number of indicators in decline (red) has steadily increased from the previous two assessments (i.e. pre-2007* and 2007-2016) to the current assessment (2013-16 to 2021-23) (Figure 12). ERAMMP has used the same set of indicators to explore the most recent trends and identified similar findings which is reported below. Note that indicators used for this particular analysis were selected with the GMEP Advisory Group. All further figures uses a more comprehensive set of new and improved ERAMMP indicators where some of the indicators selected by the GMEP Advisory Group which have not been repeated or where some indicators have been improved.

Figure 12. The percentage of indicators across 6 Glastir objectives (Woodland, Biodiversity, Headwaters and Ponds, Soil, Climate Change, Landscape and Access and 2 other WG priorities (Priority species and Blanket Bog) which had improved (green), were stable (grey) or had declined (red) over the: A) long term (pre-2007*), B) medium term (2007-16) and C) short term (2013-16 to 2021-23). Dark green represents new indicators or indicators not re-surveyed. Indicators were selected by the GMEP Advisory Group.

* Legacy monitoring programmes are of variable duration; the longest spans from 1978-2007 and shortest spans from 1998-2007.

When a more comprehensive ERAMMP list of indicators are used to capture new areas of interest required for SoNaRR reporting for the last 10 years (2013-16 to 2021-23), a similar picture is observed. A pattern of more indicators reflecting decline (red) relative to improvement (green) is clearly shown, although the majority of indicators remain as stable (blue) (Figure 13).

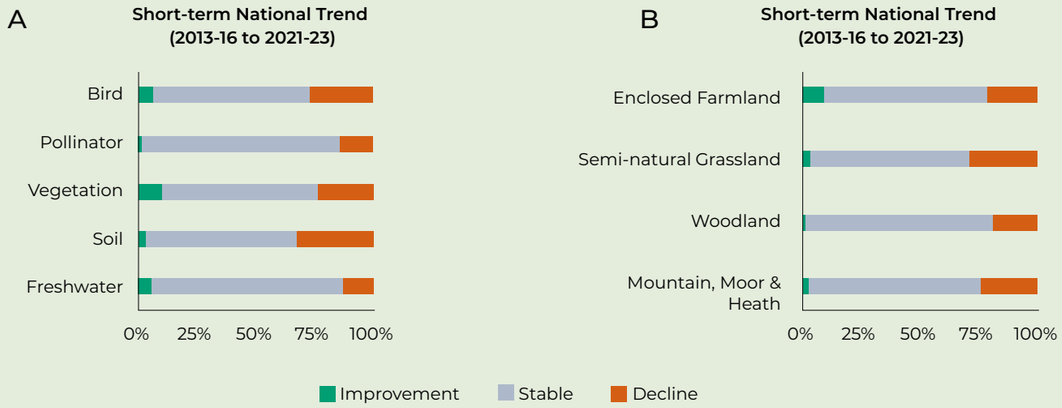

Figure 13. The percentage of total counts of indicators which had improved (green), were stable (grey) or had declined (red) at the national scale over the short term from 2013-16 to 2021-23 for: A) five Natural Resources, and B) four Asset Classes. Trends of indicators in Freshwater bodies located predominantly in each Asset Class are included in Figure B.

The high number of indicators of decline is most clearly seen for Soil, Vegetation and Birds and for the more intensively managed Asset Classes of Enclosed Farmland and Semi-Natural Grassland. There is no obvious explanation of why Soil, Vegetation and Birds have more indicators of decline. Indeed, the mobility and population renewal rate by Birds and Pollinators are often thought to be more responsive than Soil and Vegetation. For example, see the more positive response by Birds to Glastir management options reported in Figure 18. The expanded set of indicators combined with the scale of data which inform the National Trends perhaps removes potential biases linked to assessments of local improvement (as in Glastir), which mobile species can most easily respond to without any net change in populations. The greater number of negative indicators for Enclosed Farmland and Semi-Natural Grassland is perhaps easier to explain to their generally higher rates of management intensity, which is more likely to drive degradation when economic and climate pressures cause an increase in management intensity.

As Asset Classes are a bundle of a set of Broad Habitats each of which have their own cultural legacy, pressures and benefits they provide to us, the ERAMMP team has reviewed the evidence and provided the following assessment of current status of individual Broad Habitats and selected Landscape Features and compared this to previously reported trends in the long term (pre-2007*). This level of reporting was again carried out in response to NRW requests for evidence at the Broad Habitat level for SoNaRR (Table 2).

* Legacy monitoring programmes are of variable duration; the longest spans from 1978-2007 and shortest spans from 1998-2007.

Table 2. Expert assessment of the overall long-term and short-term trend in the condition of all major Broad Habitats in Wales and selected Priority Habitats and Landscape features. This assessment was carried out by weighting individual indicators as to their importance in illustrating current status of condition rather than early warnings of change such as changes in fertility and moisture levels.

Asset Class and Broad Habitat (including 2 Priority Habitats and 3 Landscape point and linear features)	Long-term trend (pre-2007*)	Short-term trend (2013-16 to 2021-23)
Woodland		
Broadleaved, Mixed and Yew Woodland	Stable	Stable
Coniferous Woodland	Stable	Stable
Mountain, Moor and Heath		
Dwarf Shrub Heath	Stable	Stable
Bog	Stable	Of concern
Blanket Bog	Improved	Of concern
Bracken	Stable	Stable
Fen, Marsh, Swamp	Declined	Declined
Marshy Grassland	N/A	Of concern
Inland Rock	N/A	Of concern
Semi-Natural Grassland		
Unimproved Neutral Grassland	Stable	Of concern
Calcareous Grassland	N/A	Of concern
Acid Grassland	Stable	Of concern
Enclosed Farmland		
Arable and Horticulture	Declined	Declined
Improved Grassland	Of concern	Of concern
Semi-Improved Grassland	Stable	Of concern
Hedgerows	Declined	Improved
Individual Trees	N/A	Stable
Boundaries	N/A	Stable
Streamsides	N/A	Of concern

* Legacy monitoring programmes are of variable duration; the longest spans from 1978-2007 and shortest spans from 1998-2007.

According to this summary by experts, 12 (63%) habitats and features were in a state of concern or had declined; 6 were stable (32%) and 1 (5%) had improved (Hedgerows) using expert judgement to weight the individual indicators. Comparing this to the long-term status for 13 Broad Habitats and Landscape linear and point features where data is available, this represents a picture of concern as previously just 4 (31%) were of concern or had declined. As seen for the Asset Classes, there are more issues of concern for the more intensively managed Semi-Natural Grassland and Enclosed Farmland habitats and features relative to Woodland and Mountain, Moor and Heath.

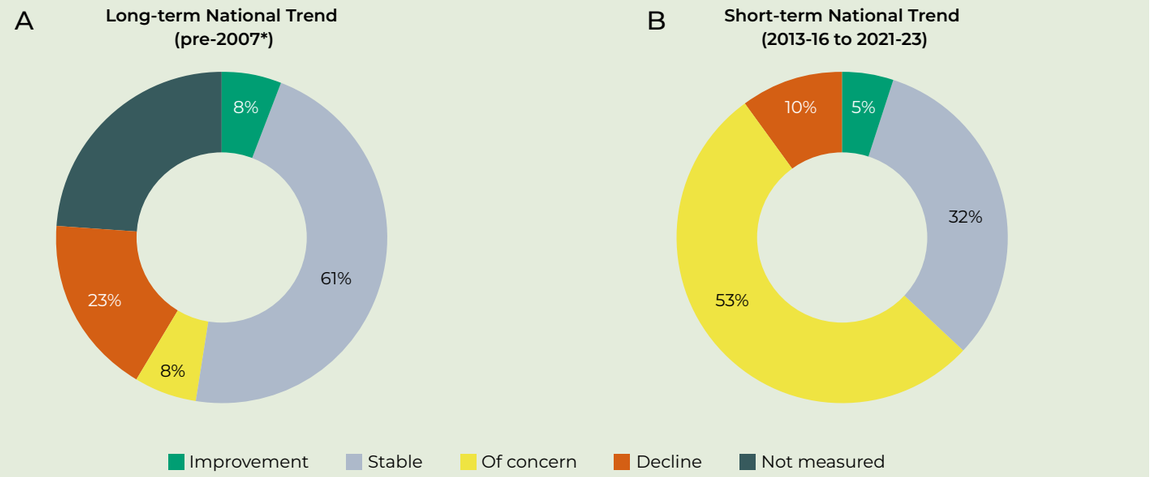

Figure 14. The percentage of Broad Habitats which had improved (green), were stable (grey), were of concern (yellow), had declined (red) or were not measured (dark green) at the national scale for the A) long-term (pre-2007*) and B) short-term (2013-16 to 2021-23).

This evidence when taken together suggests that whilst nature-positive actions funded by Glastir or other sources have been sufficient to maintain condition of the majority of habitats over the last 10 years, there are now signs which suggest this is starting to change. Further action may be required to increase the resilience and sustainability of our Natural Resources to the ongoing pressures of land management, climate change, chemical pollution and bio-risks.

* Legacy monitoring programmes are of variable duration; the longest spans from 1978-2007 and shortest spans from 1998-2007.

Some headline statistics from the NFS for the period 2013-16 to 2021-23 which indicate stability or positive trends include:

- Ancient Woodland Indicators (AWI) remain stable and there has been a halt in the decline of nectar plant species and total plant species richness in Broadleaved Woodland.
- Increased Hedgerow height (+9%) and width (+9%) and a 4% overall increase in new and restored Hedgerows. An increase in woody species richness (+6%) and stability of AWI in Hedgerows. 50% of Hedgerows are now in favourable condition, an increase of 2.3%.
- The age of individual trees in the landscape is progressing but overall numbers have not increased. The number of epiphytes has increased.
- Most indicators for Acid Grassland indicate stability.
- An increase in positive plant indicator richness and a reduction in plants which favour high fertility for Improved Grassland.
- The number of negative plant indicators has decreased in Semi-Improved Grassland and the long-term decrease in Soil acidity has stopped.
- Bird indicators relating to Woodland and Upland Farmland are stable and there was an increase in Granivorous Bird species of 24%.
- There is no change in the overall topsoil carbon concentration (WFG National Indicator No. 13) although there are losses and gains in some individual Broad Habitats.
- 80% of Headwaters remain in good ecological condition, however the remainder are continuing to decline.
- 54% of HEAs remain in excellent or sound condition. The number of threats to these assets has declined by 32%.
- An increase in grassland connectivity and stability of Woodland, Heathland and Wetland connectivity.
- The Landscape Visual Quality Index (VQI) reported in GMEP has not been updated. However, an increase in Woodland cover of 23,600ha will have positive local effects on the VQI whilst the increase in Urban cover of 28,200ha will have had a negative local effect. However, these changes are unlikely to converge and overall impacts on the VQI at a national scale are unlikely.
- There was no change in the area of Semi-Natural Habitat (WFG National Indicator No. 43).
- A mix of minor changes in characteristics associated with resilience, which result in an assessment of no overall net change at a national scale.

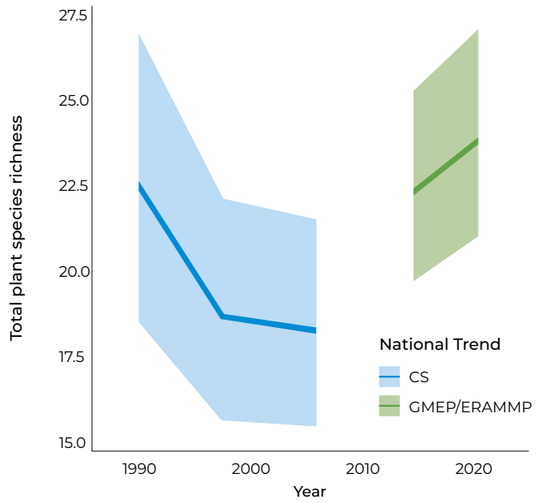

Figure 15. A halt in the decline of total plant species richness in Broadleaved Woodlands captured by Countryside Survey (1990-2007) and now by the most recent assessment by GMEP/ERAMMP (2013-16 to 2021-23).

50%

of Hedgerows are now in favourable condition.

80%

of Headwaters remain in good ecological condition.

An increase in positive plant indicator richness and a reduction in plants which favour high fertility for Improved Grassland.

54%

of Historic Environment Assets remain in excellent or sound condition.

24%

increase in Granivorous Bird species.

Photo © Annie Spratt, Unsplash

Headlines statistics which are of concern or in decline from the from the NFS for the period 2013-16 to 2021-23 and where further action is needed include:

- An overall reduction in plant species richness across Wales from across all Broad Habitats of 8% and a 22% increase in non-native plant richness.
- A 13% decline in Arable Bird species, 18% decline in grassland Bird species and 35% decline in vertebrate-eating Bird species.
- A decline in overall Pollinator abundance in Unimproved Neutral Grassland from 49 to 21 per site (-58%) and in Calcareous Grassland from 106 to 55 per site (-48%). A 23-75% decrease in butterfly abundance and butterfly species richness in Broadleaved Woodland, Fen, Marsh, Swamp, and Calcareous Grassland.
- Reduced light levels for plants in Broadleaved Woodland which is an issue often linked to under-managed Woodlands.
- A decline of 10% of the bog-building plant Sphagnum in Bogs.
- Fen, Marsh, Swamp has lost plant diversity, has an increased Grass:Forb ratio (a negative indicator), increased Soil compaction by 27%, and has lost 45% of butterfly abundance and 58% of butterfly species richness.
- Soil density has increased by 6-32% in 7 of 10 Broad Habitats. Increased Soil density is an indicator of compaction but can also be driven by changes in soil organic matter, weather and climate.
- Soil acidification has re-started in three important upland habitats: Dwarf Shrub Heath, Bog and Acid Grassland. The reasons for this need further analysis but it could include ongoing nitrogen deposition and/or climate change. In addition, the majority of Improved Grassland sites (72%) have Soil acidity levels which remain below the production threshold which is most likely linked to the continued use of synthetic fertiliser without the accompanying use of lime.
- A 15% increase in phosphorus levels in Improved Grassland Soils and three-fold increase in the number of Improved Grassland sites exceeding the leaching threshold for water quality (FIgure 16).
- A two-fold increase in the number of sites exceeding the leaching threshold for phosphorus in Arable soils and a 7.7% loss of topsoil carbon. Soil carbon is WFG National Indicator No. 13. 4% of surveyed Soil was disturbed or eroded.
- 65% of Streamsides still have habitat modification due to poaching, which can increase the risk of streambank erosion and pathogen transfer from livestock into water courses.
- Pond condition has declined with 46% now in poor or very poor condition. This is an increase from 37% in 2013-16 (Figure 17). The percentage of Ponds with invasive species has more than doubled.
- A four-fold increase in the percentage of dry Headwaters and a seven-fold increase in dry Ponds. These now represent 13% and 11% of the populations respectively. Whilst dry Headwaters and Ponds can be naturally occurring, an increase in the percentage of dry sites is cause for concern if sustained over time going forward.
- 50% of PROW condition in the NFS sample were blocked and/or not signed, representing no change from 2013-16.

Photo © Callum Macgregor

65%

of Streamsides still have habitat modification due to poaching.

15%

increase in phosphorus levels in Improved Grassland Soils.

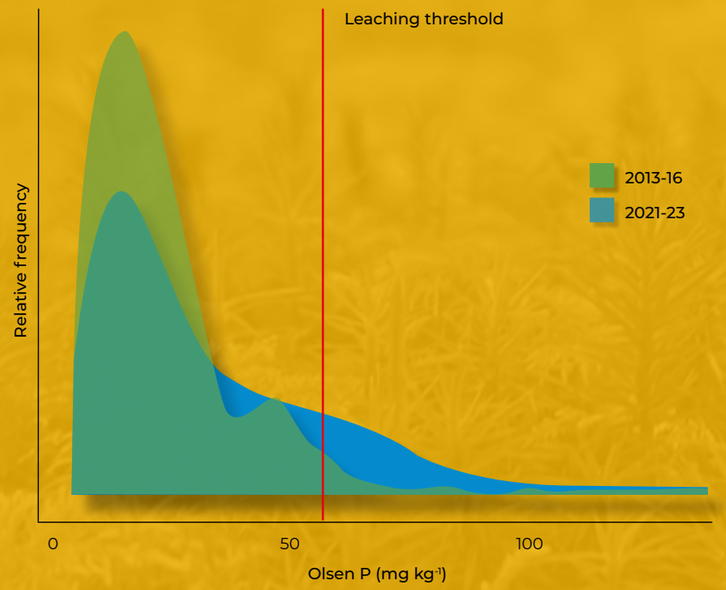

Figure 16. A three-fold increase in Improved Grassland sites now exceeding the threshold for phosphorus leaching from 2013-16 to 2021-23. This is an increase from 5% to 17% of all sites.

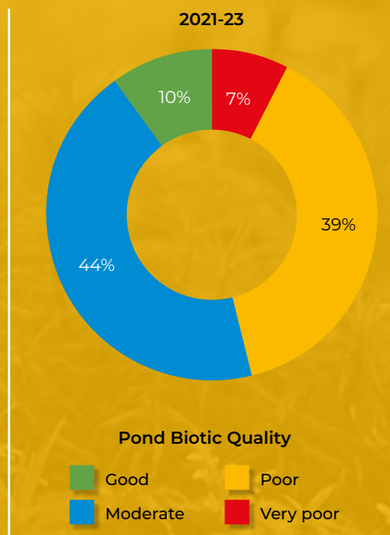

Figure 17. An increase in the percentage of Ponds in poor or very poor condition across Wales from 37% in 2013-16 to 46% in 2021-23.

23-75%

Decrease in pollinator indicators.

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The Impact of Glastir Management Options

Glastir is the land management scheme introduced by WG in 2012 as part of Axis 2 of the EU Rural Development Programme (RDP) 2007-13 to support farmers to manage their land to benefit the Natural Resources of Wales. As described earlier, there were nine clear objectives for Glastir.

Total land area in Glastir was 783,800ha (38% of Wales; 40% of agricultural land) of which 495,148ha (23.8% of Wales; 25.4% of agricultural land) had specific actions applied to particular land parcels to maintain and improve the status of the Natural Resources of Wales. The difference between these two areas represents land covered by the Whole Farm Code (WFC), which required farm managers to adhere to a series of rules across their entire land holdings.

Glastir management options were embedded within the following family of related schemes: (i) Glastir Entry, (ii) Glastir Advanced, (iii) Glastir Organic, (iv) Glastir Commons, (v) Glastir Small Grants (various), (vi) Glastir Woodland Creation and (vii) Glastir Woodland Restoration. Here, we focus on the impact of the management options only, i.e. we explicitly exclude land outside of management options that was only subject to the requirements of the WFC. Future analysis could extend analysis to include the WFC if requested.

Overall, over 700 options were offered in the Glastir scheme but a small number of just five options represented the major uptake of options, whether reported by number of agreements or Glastir management option area (62% by area). Four of these five options related to stock management control in pasture or open country, and the fifth was for Glastir Organic interventions. Approximately half of land in the Tir Cynnal and Tir Gofal scheme transitioned to the Glastir scheme, with 423,00ha or 54% of Glastir's whole farmland area intersecting land under Tir Gofal and/or Tir Cynnal. The Glastir evaluation results presented here are aggregated results from a large number of analyses of Glastir management option bundles which captured the impact of the options prioritised for analysis by WG and for which there was sufficient uptake by land managers to enable analysis. If there is low uptake, analysis was not possible due to insufficient power to detect change. These results are available in the ERAMMP Technical Annex 105 and associated supplements (Emmett, et al., 2025) by option bundle and by theme.

To capture evidence of where management was being maintained from previous AES schemes or where management changes have been implemented in the GE and GA schemes, the ADAS FPS reported on changes self-reported by the farm managers in and out of schemes. This information is essential to understanding the underlying drivers of change or no change reported by the NFS. The FPS is also our main evidence source for the following three Glastir objectives:

- Improving numbers of farms undertaking action concerning climate change
- Improving diversification and efficiency of farms
- Improving profitability and wider sustainability

In all analyses, change in response to Glastir management options is defined as a change relative to the trend observed in land with no management options. A result of this is that an improvement may reflect a reduced decline in a resource and not necessarily an overall net improvement. Likewise, a decline may be a reduction in a positive trend and not an overall decline. If this approach had not been taken, results could have under-represented the benefits of Glastir management options. Finally, it should be noted that a lack of detectable change (i.e. indicated in bullets and figures as no change or Low/No detectable effect) may occur where increases or declines have been small or patchy, which should be borne in mind when interpreting the results.

The influence of Glastir management options on the National Trends will depend on the magnitude of the effect size of an option, the effective implementation and targeting of the total area the option was applied to across Wales as a proportion of the total asset. An option which is highly effective, well implemented and targeted but applied to only a small proportion of an asset area is unlikely to influence the National Trend.

700+

options were offered in the Glastir scheme.

Changes in Farm Management

A minority (31-34%) of farm managers changed the management of their farm in response to GE and GA payments in the latter stages of the scheme indicating maintenance of many management practices supported from past AES. For example, overall there was no difference in stock numbers in and out of schemes (Figure 19). This compares to 61% who reported changes in management practices for Tir Gofal and Tir Cynnal possibly due to payments being made to continue options under both schemes for some farms although simple modelling found no evidence of this link. One caveat to this finding however is that small scale changes e.g. on field margins and streamsides are likely be under-reported using the FPS approach which captures management changes across the whole farm.

With respect to fertiliser use, there was no difference again between in and out of scheme in the later stages of the scheme and only small changes on entry (Figure 18). The majority of all respondents reported large decreases in fertiliser use likely due to increased costs, but a small number reported large increases. These few large increases reported by some farm managers could help to explain the two-to-three-fold increase in number of Soil samples with excess nutrient levels reported.

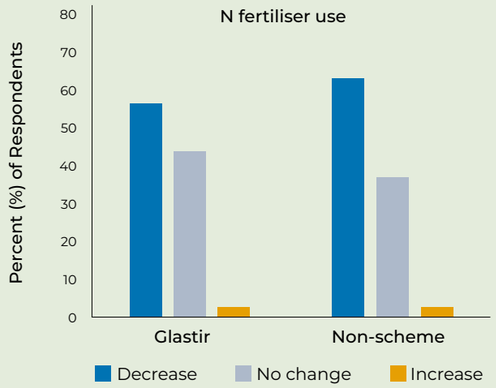


Figure 18. Percentage of survey respondents who reported a large increase or decrease in N fertiliser use in the past three years. Excludes Organic and Commons management options.

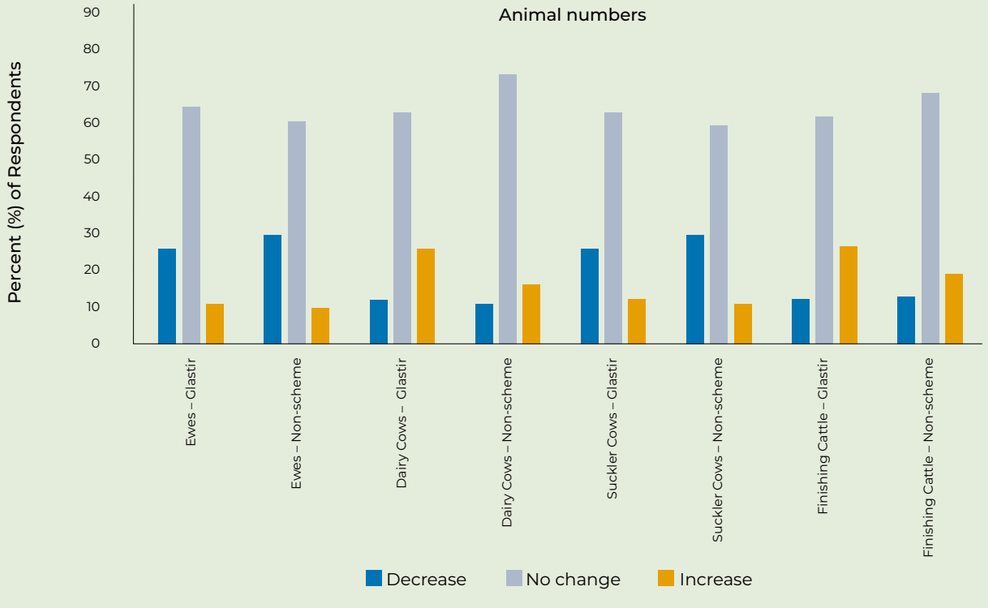


Figure 19. Percentage of survey respondents who reported a large increase or decrease in animal numbers in the past three years. Excludes Organic and Commons management options.

Some evidence of more soil and manure management actions (10-15%) was identified by farm managers in schemes. 49% of all respondents had taken no action to adapt to climate change threats, with between 9-40% of farms having taken actions to mitigate specific climate change threats in the past three years with the average number of actions being 1 out of a possible 6. The dairy sector was most active in this space. Glastir on average contributed an additional 0.3 actions of the total 6 possible actions.

There was a small increase in the number of actions per farm to improve the farm business, e.g. 9% more took action on 'diversification' in scheme. Between 25-40% in GE or GA agreed they had made improvements which had increased business resilience, environmental motivation, acquisition of sustainable skills, and personal health and welfare as a result of scheme participation. 55-84% of Glastir scheme respondents stated their objectives had been partly or fully realised. 85% of respondents had hoped that the scheme would provide extra income to help support the farm business to remain viable or profitable and 75% hoped that the scheme would provide income stability. Overall, the FPS suggests some change in management practices in GE and GA but more evidence of maintaining current practices and relatively modest action to increase resilience, sustainability and diversity. There is good evidence however, to show GE and GA supported income stability.

Headline statistics for farms in and out of the Glastir Entry and Advanced schemes:

- **31-34% of farm managers changed the management of their farm in GE and GA schemes.**
- No difference in livestock changes in or out of scheme in the latter part of the scheme with only small changes on entry.
- No difference in changes in fertiliser use comparing in or out of scheme in the latter part of the scheme with only small changes on entry.
- 93% of respondents in scheme stated they would not have proceeded with Woodland restoration or creation without Glastir support.
- There was no direct effect of scheme on total actions to improve nutrient management; a small increase (< 10%) for manure management actions; and 10-15% increase in some soil management actions.
- **49% of all respondents had taken no action to adapt to climate change threats.**
- 9-40% of farms had taken actions to mitigate specific climate change threats in the past three years, with the average number of actions being 1 out of a possible 6. Dairy was most active in this space. Glastir contributed an additional 0.3 actions.
- There was a small increase in the number of actions per farm to improve the farm business, e.g. 9% more took action on diversification in scheme.
- Between 25-40% in GE or GA agreed they had made improvements which had increased business resilience, environmental motivation, acquisition of sustainable skills, and personal health and welfare as a result of scheme participation.
- **55-84% of Glastir scheme respondents stated their objectives to improve various aspects of farm economics had been partly or fully met. These included objectives to improve business viability, income stability and improved profitability.**

Changes in Environmental Outcomes

The impact of Glastir management options were explored in relation to the six environmental Glastir objectives and additional Welsh Government priorities using the indicators selected by the GMEP Advisory Group (Figure 20).

All tests were carried out comparing land with and without Glastir management options. It should be noted therefore, where a positive effect is detected, this may be a reduced rate of decline rather than an overall improvement. The results indicate some positive (blue) outcomes and a few unintended negative (orange) effects, however the majority of tests identified no detectable effects (grey).

All tests were carried out comparing land with and without Glastir management options.

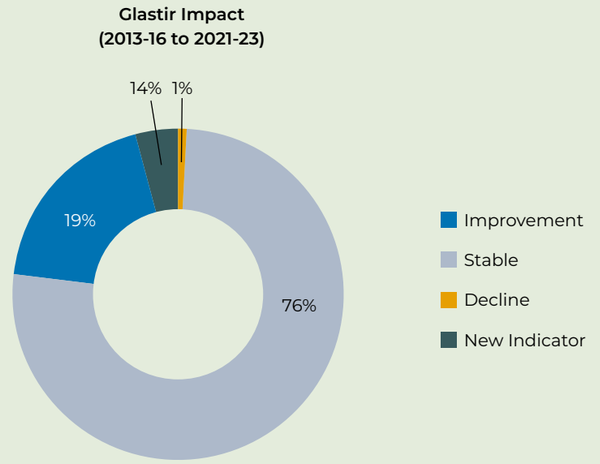
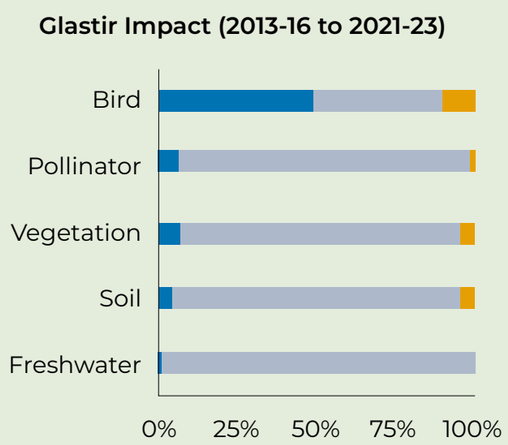


Figure 20. The percentage of total counts of indicators which had improved (blue), were stable (grey), or had declined (orange) between 2013-16 and 2021-23 across six Glastir environmental and cultural objectives and two additional priorities at the request of WG (i.e. Blanket Bog and Priority Species). The tests compared land in Glastir management options to those outside. Indicators used were those selected by the GMEP Advisory Group. Not measured (dark green) are indicators where no repeat measurements were available.

This result is perhaps not surprising when considering the results from the FPS which indicated only 31-34% of farm managers had changed management practices in the GE and GA schemes. However, some improvements could have been expected even from maintenance of past AES management options due to known lags in many ecological outcomes which may have contributed to the improvements reported. Analysis to explore this was included for some indicators but relatively few examples were identified. Further work is needed to explore this.

The enhanced list of ERAMMP indicators was used to aggregate findings for the five Natural Resources and four Asset Classes to explore the sensitivity of different ecosystem components and land use types. It is clear from the Natural Resource results that Bird indicators are the most responsive to the impact of Glastir management options (Figure 21A).

A



B

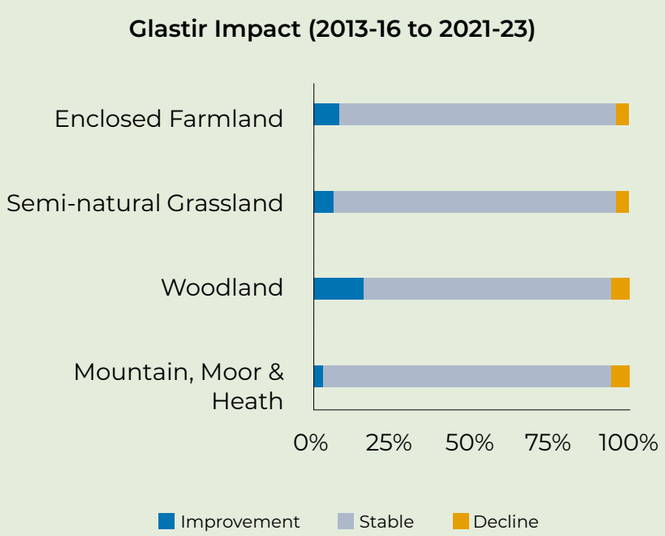


Figure 21. The percentage of total counts of ERAMMP indicators which had improved (blue), were stable (grey) or had declined (orange) at the national scale in the short term from 2013-16 and 2021-23 for: A) five Natural Resources, and B) four Asset Classes in response to Glastir management options. Analyses were all carried out relative to land without Glastir management options.

With respect to Natural Resources, Bird indicators were the most responsive to Glastir management options.

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Photo © Edmund Fellowes

Photo © Wllm Davy, Unsplash

This result probably reflects that the options targeting Birds are often based on well-established ecological relationships with individual management types. In addition, Birds use landscapes at large scales, due to their high mobility, so can respond quickly to management within years, as well as showing local population changes. As a positive trend for Birds was not reported in National Trends, this perhaps suggests Birds are moving to locally improved land in scheme rather than increasing abundance and diversity overall at a national scale.

A worrying finding was the relative fast loss of benefits from previous AES schemes for some habitats suggested degradation can be fast but recovery slow.

No impact of Glastir management options was reported for Freshwater habitats and features, but data was limited due to the method for selecting management bundles which did not prioritise Freshwater outcomes at WG's request. The survey of the final squares in 2025 should provide greater detection levels.

With respect to Asset Class, Enclosed Farmland and Woodland showed the clearest responses to Glastir management options.

Pollinators are also mobile but over shorter distances, and little response is detected here with the exception of responses to Arable and Organic management options where a few positive outcomes were reported. Previous analysis of the GMEP data identified landscape contextual dependencies for Pollinators, e.g. the rate of Pollinator increases is greatest where flower cover was low (<5%) which need to be explored using the new ERAMMP survey data (Alison, et al., 2022) as it may provide more power to detect change.

For Vegetation as for Pollinators, landscape contextual dependencies were identified by GMEP (Alison, et al., 2022), and this needs to be explored further for ERAMMP. As an initial start to this work, changes in total plant species richness in Semi-Natural Grassland was found to be linked to the amount of High Nature Value (HNV) Farmland within the 1km^2 survey square, likely due to the availability of potential seed sources.

Similar landscape contextual issues are unlikely for Soil reflecting their fixed position in the landscape. There was a very limited response either positive or negative to Glastir management options on Soil.

With respect to Asset Class, Enclosed Farmland and Woodland showed the clearest responses to Glastir management options (Figure 21B). In Enclosed Farmland, and for the Arable and Horticulture Broad Habitat particularly, land cover can be highly dynamic and management change tends to change habitat quality for Biodiversity considerably. Woodland Management was dominated by stock exclusion and Rhododendron control, which are well-established approaches with habitat response times that are well-aligned with the timeframe of GMEP and ERAMMP.

As for National Trends, Asset Classes bring together a set of Broad Habitats each of which have their own cultural legacy, pressures and benefits they provide. The ERAMMP team have therefore reviewed the evidence and provided the following assessment of the impact of Glastir management options for individual Broad Habitats and Landscape Features. The results suggest again low or no detected impacts for the majority of habitats (12), with some improvement for nine habitats and features, and one habitat where evidence was very mixed indicating significant trade-offs. The least responsive habitats and features were within the Mountain, Moor and Heath Asset Class (Table 3).

Table 3. Expert summary assessment of the effect of Glastir management options on the full range of Natural Resources recorded for all major Broad Habitats in Wales and selected Priority Habitats and Landscape features. This assessment weighted outcomes for specific indicators which were considered of greatest importance of the current status of each Broad Habitat rather than indicators of early warnings. Language used ('Low/No' and 'Some') illustrate the modest and variable response of the individual indicators. Note that there are many priority species and habitats which are not included in this assessment due to the nature of the ERAMMP survey.

Asset Class and Broad Habitat (including 2 Priority Habitats and 3 Landscape point and linear features)	Glastir Impact
Woodland	
Broadleaved, Mixed and Yew Woodland	Some improvement
Coniferous Woodland	Low/No detectable effect
Woodland Birds	Some improvement
Mountain, Moor and Heath	
Dwarf Shrub Heath	Low/No detectable effect
Bog	Low/No detectable effect
Blanket Bog	Some improvement
Bracken	Minimal improvement with some trade-offs
Fen, Marsh, Swamp	Low/No detectable effect
Marshy Grassland	Low/No detectable effect
Inland Rock	Low/No detectable effect
Upland Farmland Bird	Low/No detectable effect
Semi-Natural Grassland	
Unimproved Neutral Grassland	Some improvement
Calcareous Grassland	Low/No detectable effect
Acid Grassland	Low/No detectable effect
Grassland Birds	Some improvement
Enclosed Farmland	
Arable and Horticulture	Some improvement
Improved Grassland	Some improvement
Semi-Improved Grassland	Low/No detectable effect
Hedgerows	Some improvement
Individual Trees	N/A
Boundaries	Low/No detectable effect
Streamsides	Low/No detectable effect
Arable Birds	Some improvement

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Positive outcomes in response to Glastir management options

- Glastir management options had a positive effect on Birds in Arable, Woodland, Grassland and Hedgerows relative to land without Glastir management options slowing declines seen in National Trends (Figure 22).
- In contrast, there were very few positive outcomes for Vegetation. Of numerous statistical tests carried out, there were only a few notable exceptions:
    - Halt in the decline of plant species richness for Wales as a whole.
    - Increased AWI in Broadleaved Woodland with the Woodland Management bundle.
    - Increased cover of Dwarf Shrub Heath in Blanket Bog, positive plant indicators and a reduced decline of *Sphagnum* cover with the Commons management bundle.
    - Increased plant species richness in Bracken with Grazing Low/No Inputs bundle.
    - Increase positive plant indicators in Unimproved Neutral Grassland.
    - Glastir was responsible for 1,370km of new Hedgerow creation.
- There were very few positive effects for Pollinators. Exceptions were:
    - Increased butterfly richness with Arable Management.
    - Organic management increased butterfly abundance in Arable land and butterfly richness in Improved Grassland.
- For Soil, there were few positive outcomes. The only notable exceptions were:
    - Increased topsoil carbon concentration with Woodland Management, for Bracken under Commons management and for Semi-Improved Grassland under Habitat Management bundles.
    - Reduced acidity with Grazing Low/No Inputs management bundle in Fen, Marsh, Swamp.

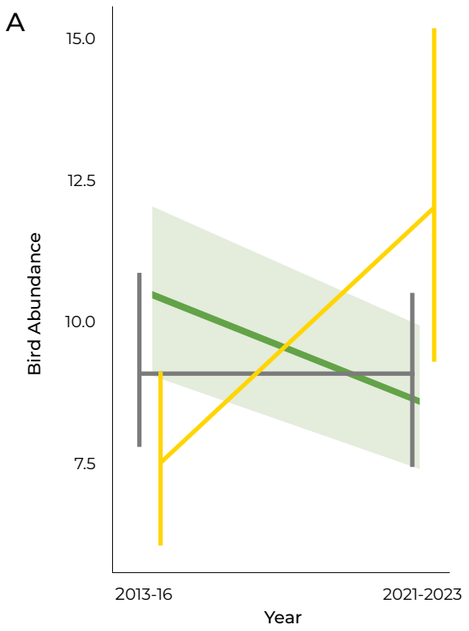

Figure 22. The positive effect of high occurrence of Glastir management options within the survey square on Grassland Guild Bird species (i.e. orange relative to grey dash lines). This positive trend is not seen in the National Trend (green). The green shaded area and vertical lines indicate the statistical uncertainty around the mean values.

Photo © Callum Macgregor

Increased positive plant indicators in Unimproved Neutral Grassland.

Increased topsoil carbon concentration with Woodland management.

1,370km

Glastir was responsible for 1,370km of new Hedgerow creation.

Organic management increased butterfly abundance in Arable land and butterfly richness in Improved Grassland.

Photo © Annie Spratt, Unsplash

Outcomes not as intended and trade-offs in response to Glastir management options

- No detectable effects for most Vegetation indicators.
- Some negative effects of Glastir management options on Pollinator indicators were detected for Broadleaved Woodland and Dwarf Shrub Heath.
- Unexpectedly there was no effect on soil nutrient status with Grazing Low/No Inputs.
- Soil carbon gains in Broadleaved Woodland and Improved Grassland in past schemes have quickly been lost due to low transfer into Glastir management options. This suggests degradation may be faster than recovery.
- There was no effect on Headwaters or Ponds and only one positive benefit for Streamsides, however numbers are low due to lack of prioritisation of sample squares with water features in this re-survey. Completion of the complete survey will increase detection levels.
- There has been no increase in habitat diversity or connectivity of major habitats for land with Glastir management options in general, nor for land considered as being of HNV Farmland Type 1 (farmland with high cover of semi-natural Vegetation) and Type 2 (farmland with a mosaic of habitats and land uses).
- Although not directly tested, the creation of an additional 3,780ha of new Woodland and 1,370km of new Hedgerow due to Glastir management options will have resulted in some local change in the Landscape VQI developed by GMEP but little change in the overall national statistic.

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Rapid loss of soil improvement from previous AES schemes if low transfer into Glastir.

No detectable effects for most vegetation indicators.

No reduction in soil nutrient status with low fertiliser input and grazing options.

Some negative effects of Glastir management options on Pollinator indicators were detected for Broadleaved Woodland and Dwarf Shrub Heath.

The results indicate some positive impacts, some unintended negative impacts, however the majority of tests identified no detectable effects of Glastir management options.

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Change in Landscape Resilience of Land In Scheme and Out of Scheme

In 2017, GMEP amalgamated a range of landscape and farm management indicators captured from the NFS, satellite information and the FPS to explore if land which had entered the Glastir scheme (but not yet subject to Glastir management options) had more characteristics which were thought to confer resilience, compared to land outside of the scheme. This was found to be the case for most indicators (Figure 23).

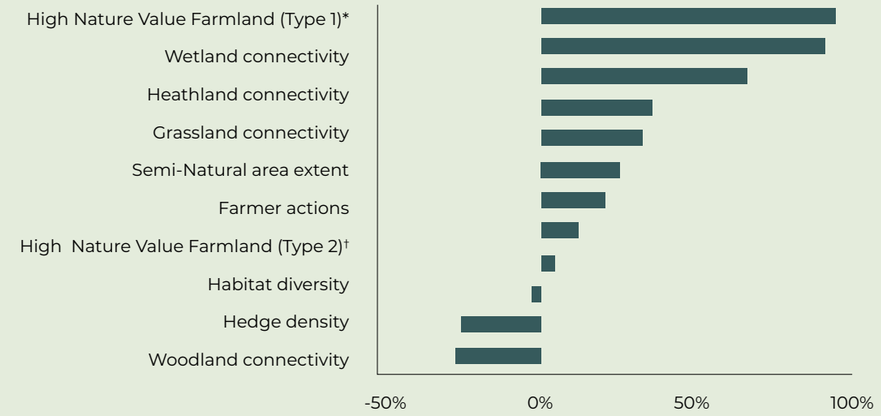

Figure 23. The GMEP 2017 comparison of land in Glastir compared to the national mean for metrics of resilience. Bars to the right of the central '0' line indicate a more positive value for that characteristic for land in Glastir.

The most recent data from the NFS and FPS suggest a mixed picture of change with some gains in resilience characteristics by land in scheme including: no change in Semi-Natural Habitat area or habitat diversity (which has declined at the national scale); a 3.5% increase in grassland connectivity but no change in Woodland, Heathland and Wetland connectivity at a national scale; an increase in Hedgerow length; and a number of land managers (25-40%) in scheme making some improvements to increase diversification and efficiency in response to Glastir payments. It is concluded that the higher initial status of resilience of land in scheme has been maintained with some areas of improvement.

* Farmland with a high proportion of semi-natural vegetation.
† Farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc.

Changes in Greenhouse Gas Emissions

From 2010 to 2021 there was an increase in GHG emissions from agriculture reported in the Agriculture GHG Inventory for Wales of 0.33 to 5.7Mt CO2-e yr^{-1} in 2021 and a reduction in the sink within the LULUCF sector of 0.02 to -0.7Mt CO2-e yr^{-1}. There therefore remained a significant gap between the two inventories of 5Mt CO2-e yr^{-1} in 2021 to be closed if the agriculture and land use sector is to achieve the WG target of Net Zero as a whole for the Agriculture and Land Use sector. The main contribution of Glastir to a reduction in GHG emissions was likely to be related to any change in stock numbers, fertiliser use, new Woodland and Hedgerow planting, and peatland restoration. Evidence relating to each of these is described below.

The contribution of Glastir management options to GHG emissions

- The ADAS FPS indicated no change in stock number in response to Glastir payments towards the end of the scheme after an initial small reduction on entry. Overall National Trends in stock number reported in the Survey of Agriculture and Horticulture: June 2023 also indicates there is no consistent trend in sheep and lamb numbers and cattle and calf numbers between 2010 and 2023 (+5% in the sheep and lamb and -2% in cattle and calf numbers) for Wales as a whole. It should be noted, these changes will not reflect consolidation and intensification of some sectors, including the dairy and poultry sectors, in particular regions across Wales which may lead to specific local impacts (e.g. emissions to air and rivers) nor the efficiency levels of different sectors relating to either overall yield or resource use efficiency including emissions.
- There are ongoing declines in fertiliser use since data collection started in 1993, with a 25% decrease since 2010 across England and Wales. The ADAS FPS indicates there was no further decrease in the GE and GA schemes after an initial small reduction on Entry. Reductions in use were reported to be primarily driven by input costs across the sector.
- Whilst there has been significant new Woodland (23,600ha, +7%) since 2010, Glastir management options were responsible for 3,780ha (+1%) of new Woodland. Glastir was however responsible for the majority of new and restored Hedgerow (2,200km).
- With respect to peatland restoration, Wales has an area of 82,000ha of peatland (4% of Wales). A review of all reported peatland restoration activities from across Wales by ERAMMP suggested a total of 9,000ha of peatland restoration had occurred, most likely the majority since 2010 and with 5000ha targeted on peat itself rather than surrounding land. (Figure 24). Glastir contributed funding for 992ha (11%) of this restoration. Using a spatially explicit data approach only possible for Wales, GHG emissions were calculated to have been reduced from 506,000 t CO2-e yr^{-1} to 491,000 t CO2-e yr^{-1} by 2023, a decrease of 15,000 t CO2-e yr^{-1}. A reduction of 3% from 1990 values of which Glastir contributed 1,100 t CO2-e yr^{-1} (0.2%).

Overall, this evidence suggests a very limited impact of Glastir management options on GHG emission reductions. This is consistent with GMEP initial modelling of potential Glastir outcomes (Emmett & the GMEP team, 2017) which suggested likely reductions of < 2% in methane and nitrous oxide emissions which are important components of the agricultural GHG emissions.

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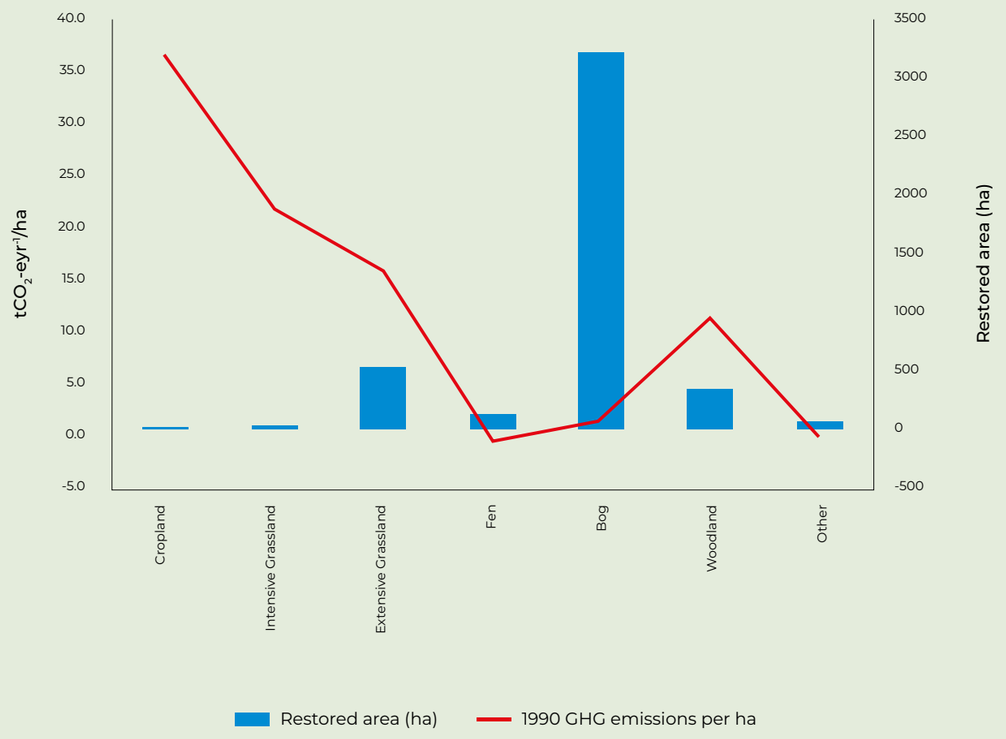

Figure 24. Emission rates by area from different types of peatland and peatland restoration areas in 2023. Note little restoration area has occurred on high emitting peatland types such as Cropland, Intensive and Extensive Grassland. Most restoration has been on Bog which has low rates of GHG emissions resulting in lower net emission reductions than the restoration area would suggest.

Mapping of Evidence to Glastir Objectives

The range of results reported in this Headline Report is complex due to the many varied requests for ways to report the data from WG and NRW. A mapping and assessment exercise has therefore been completed to better understand the overall impact of Glastir management options mapped against the original objectives of the scheme particularly for WEFO reporting needs back to the EU. The results suggest that Glastir management options have at best helped to maintain current Natural Resources but have not delivered intended improvements stated in the original objectives (Table 4).

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Table 4. A summary of headline findings for the impact of Glastir management options (excluding WFC) mapped to Glastir objectives from a range of ERAMMP and other data sources. Glastir management options are likely to only impact the national picture when the impact is large and there is sufficient land with uptake of the options. National Trends also provided evidence for the scores in this final column.

Glastir objective	Supporting evidence	Counter evidence	Impact on land with management option(s)	Influence on National Trends
Combating climate change	3,780ha of Woodland creation (Source RPW) 992ha of peatland restoration (Source: WG database)	No change in livestock numbers or fertiliser use by farm managers in Glastir Entry or Advanced after an initial small increase on entry to the scheme (Source: FPS)	Low	Low
Notes: The small area in Woodland creation and peatland restoration will not offset continued fertiliser and livestock emissions from grazed land with Glastir management payment options. These same statistics mean there has been a very limited contribution at a national level. This is supported by little evidence of a decrease in national sheep and cattle numbers (WG Survey of Agriculture and Horticulture: June 2023) and an increased gap between the Agriculture and LULUCF GHG inventories from 2010 to 2023.				
Improving water quality and managing water resources	None	No change in Headwater or Pond quality but limited data (Source: NFS)	Low	Low
Notes: The broader impact on the quality and management of rivers, lakes, groundwater and coastal waters was beyond the commissioned remit of the ERAMMP programme. Data is captured by NRW.				
Improving soil quality and management	Increased Soil carbon concentration in Broadleaved Woodland (Source: NFS) 10-15% increase in actions to improve Soil and manure management (Source: FPS)	Most other indicators demonstrate no difference to land outside of management options. This includes many examples of no change and/or a decline in Soil quality (Source: NFS) Loss of carbon concentration in Improved Grassland (Source: NFS)	Low	Low
Notes: No change in response to Glastir management options is calculated relative to the trend observed on land with no management payments. Therefore, no change may still indicate a decline and an improvement may only indicate a reduced decline or indeed an enhanced improvement.				

Glastir objective	Supporting evidence	Counter evidence	Impact on land with management option(s)	Influence on National Trends
Maintaining and enhancing biodiversity	Positive effects for Birds in Arable, Woodland, Improved Grassland and Hedgerow habitats halting declines seen in National Trends (Source: NFS) 3,890ha of habitat creation (Source: RPW) Halt in the decline of total plant species richness for Wales as a whole (Source: NFS)	No change in Semi-Natural Habitat area or Habitat diversity (Source: UKCEH LCM) Few improvements for plant biodiversity and Pollinator abundance and diversity across all habitats (Source: NFS) No effect on biodiversity in Headwaters and Ponds (but limited data) Source (NFS) Little effect on Streamsides (Source: NFS)	Low	Low
Managing landscapes and historic environments and improving public access to the countryside	An increase in grassland connectivity (Source: UK-CEH LCM) Reduced threats to Historic Environment Assets (Source: NFS) Small local changes in the Landscape Visual Quality Index due to local increases in Woodland and Urban cover (Source: UKCEH LCM)	A decrease in habitat diversity (Source: UKCEH LCM) No change in condition of Historic Environment Assets (Source: NFS)	Low	Low
Notes: At the national scale, an increase in Urban land cover of 28,200ha could offset benefits of the national increase of 23,600ha in Woodland cover with respect to Landscape Visual Quality Index) (Source: UKCEH LCM). However, impacts of both are unlikely to converge so local changes will be expected but with no net effect at national scale likely.				
Woodland creation and management	3,780ha of Woodland creation (Source: RPW) Increase in Ancient Woodland Indicators Increase in Woodland Birds Increased Woodland connectivity Increased Soil carbon concentration Reduction in Soil compaction (Source: all NFS)	Only one single effect on Vegetation condition (Source: NFS) No effects on Pollinator indicators (Source: NFS)	Medium	Low
Notes: Scores are downgraded from medium to low for national impact due to low uptake of Glastir management options across Wales for Woodland options by area.				
Improving numbers of farms undertaking action concerning climate change	An average of 1.1 actions to adapt to climate change threats were undertaken on average by all farm managers out of 6 possible actions irrespective of scheme participation. An additional 0.3 actions were taken by farm managers in scheme (Source: FPS)		Low	Low
Notes: 49% of respondents in the FPS had taken no action to respond to climate change. Between 9-40% had taken some action in the last three years with the average number being 1. Most active sector was dairy. These numbers are for all respondents.				
Improving profitability and wider sustainability	55-84% of Glastir scheme respondents stated their objectives to improve various aspects of farm economics had been partly or fully met. (Source: FPS) 71-79% agreed Glastir had partly or fully met their objectives to improve business viability, income stability and improved profitability (Source: FPS)		High	Medium
Notes: Scores are downgraded from high to medium for national impact due to numbers in Glastir Entry and Advanced schemes as a proportion of national population.				
Improving diversification and efficiency of farms	25-40% of land managers in Glastir Entry and Advanced scheme had made some improvements which would contribute to this objective (Source: FPS)	Majority of land managers had made no change in response to Glastir payments (Source: FPS)	Medium	Low
Note: Scores are downgraded from medium to low for national impact due to numbers in Glastir Entry and Advanced schemes as a proportion of national population.				

This assessment should be considered alongside the many pressures on the agriculture and land use sector from increasing input costs, a complex global market, ongoing climate change and increasing competition for land for multiple needs. More positive outcomes were identified for improving profitability and sustainability of farms (high) and improving diversity and efficiency (medium) for farms in scheme.

The influence of Glastir management options on National Trends reported were also assessed. Glastir management options are only likely to impact National Trends when there is significant change combined with widespread uptake. With the exception of improving farm profitability and wider sustainability, all assessments were scored as low.

Limitations and Further Work

Whilst the long-term and integrated approach taken by ERAMMP was the most robust and extensive monitoring programme undertaken across the four nations of the UK for the period reported, there are some constraints and limitations to the evidence reported here.

The most notable of these is the approach for National Trends which focuses on the wider countryside rather than specific hotspots of Biodiversity and Natural Resources in designated land, which will be the focus for 30 by 30 biodiversity reporting going forward. Reporting on designated land is currently the responsibility of NRW and was explicitly excluded from commissioned requirements of ERAMMP (although designated land is well represented in the survey). ERAMMP data can help provide a national context for any enhanced monitoring of designated land going forward. In addition, provision of high-quality habitat between designated land within the wider countryside is known to be important for species to move across the landscape in response to the pressures of climate change and other pressures. The approach taken by ERAMMP therefore provides valuable context for future 30 by 30 biodiversity monitoring (as well as its value of covering many other Natural Resources beyond Biodiversity). A new method for capturing more data for both priority and common species from the Local Environment Records Centres for biodiversity has been developed (Smart, et al., 2022) but is not reported here as it requires further testing with the wider stakeholder community. This is intended to contribute to a methodology for reporting on status and change of the WFG National Indicator No. 44: Status of Biological diversity in Wales.

The method of analysis has also focussed on capturing over-arching National Trends rather than reporting on changes in the extremes of the population, which may be important for local and regional issues such as river quality. This approach is starting to be developed by the ERAMMP team as illustrated by the reporting of increased numbers of sites with soil nutrient levels which risk leaching to rivers at a local level whilst average national numbers remain unchanged. The Freshwater team have also included some statistics which demonstrate the importance of outliers and extremes.

ERAMMP data can help provide a national context for any enhanced monitoring of designated land going forward.

Finally, the impact of Glastir management options for a single field or farm may not be reflected in these national statistics. Results are known to be dependent on the landscape context within which that field or farm sits. Average results in national AES can therefore often be far lower than that reported from demonstration or exemplar fields and farms. Again, a start has been made to explore these landscape dependencies with evidence reported for some indicators in this report with respect to the presence of HNV Farmland in the surrounding area, which may encourage dispersal and movement into a field or farm and across the landscape. This was also the topic of in-depth analysis of GMEP data by ERAMMP (Alison, et al., 2022). Further analysis is required however to better understand the spatial context of scheme outcomes which could increase our power of detection of change and its variability and then subsequently inform future targeting of actions.

The initial condition of a site can also greatly impact on the magnitude of improvement detected as identified by previous analysis of GMEP data (Alison, et al., 2022). GMEP results clearly identified management options had in general been targeted on the better environmental quality land, which could affect the impact the magnitude of benefits realised. However, the situation is complex as, for example, high initial cover of Hedgerows and Woodland limits the benefits of new Hedgerows for Pollinators but improves outcomes for plant species richness (Alison, et al., 2022). Hedgerow creation can be associated with declines in Birds associated with open country (e.g. Skylark and Lapwing) but only where Hedgerow density is above 120m/ha. Again, this issue deserves more in-depth analysis using the more recent ERAMMP data.

A final reason for poor upscaling from single fields or farms to national scale can be poor implementation of options by land managers (MacDonald, et al., 2019). This issue cannot be reported by ERAMMP but is rather the responsibility of compliance activities but should be noted as an important potential limitation of scheme success.

Overall, this is only an initial exploratory analysis of the very rich ERAMMP NFS evidence base and other data sources. Other analyses going forward need to include exploration of drivers of change beyond the Glastir scheme, such as climate change; species-specific responses (e.g. specific priority Birds); as well as exploiting the database to create national benchmarks to help inform the many individual landscape improvement projects underway. Again, a start has been made on this with UK-level Soil health benchmarks now available based on the 40 years' record of Soil health collected by the UKCEH Countryside Survey programme on which the ERAMMP NFS design is based. This work could be extended for a wider set of resources to improve management goal setting and continual improvement.

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Conclusions

Overall, the national picture is one of stability combined with many areas of concern according to levels of detection available to us. Stability relates to Low/No detectable effect and it should be remembered that other more targeted approaches covering hotspots of Biodiversity or priority species (or indeed local areas of resource degradation) may give a different picture. Taking these caveats into account, current levels of regulation, Glastir payments and other nature-positive actions whether delivered by public or private organisations appear to be sufficient to hold many resources within the wider countryside stable within our detection limits. However, whilst this stability could be considered a success, it is clear that many indicators are at a low level following historical declines. It is also clear that the improvements which are clearly laid out in the Glastir objectives have not occurred. This conclusion should be seen within the context of increasing challenges linked to continuing air pollution particularly of ammonia from livestock, increasing extreme events linked to climate change and input costs for land managers. Even stability or 'holding the line' in the future will be challenging with a limited public purse, increasing uncertainty and volatility in many global markets from which it will be difficult to protect the Welsh agriculture and land use sector, and consumers.

With respect to the impacts of the Glastir management options, the evidence presented here suggests that impacts have at best been modest relative to land without Glastir management options and critically not of the scale hoped for to achieve the nine objectives set by the WG. This is perhaps not surprising when considering the relatively modest payments to most landowners and the self-reported statistic that only 31-34% of farm managers reported changing farm management practices in response to GE and GA scheme payments. This is likely to be due to the significant area of land (54%) which transferred into the Glastir scheme from the Tir Gofal and Tir Cynnal schemes where specific management practices are likely to have been maintained.

A different approach to pay for more transformational actions (i.e. not paying for the status quo) with more targeting to increase cost-benefit outcomes may be needed if environmental and cultural outcomes are to be an objective of payment schemes going forward. Actions need to be of sufficient magnitude at a local level to restore or to protect prioritised Natural Resources and taken up at a sufficient scale nationally to have impact at a national scale. However, it may be only part of the solution going forward as it is interesting to note that Glastir management options only paid for 1% of new Woodland and 11% of Peatland restoration across Wales since 2010. Clearly, other activities have supported the other 6% of new Woodland and 89% of Peatland restoration. However again, these bottom-up initiatives were not of sufficient impact or scale to protect and improve our Natural Resources or improve National Trends for the last 10 years from 2013-16 to 2021-23. WG perhaps needs to consider how to support, promote and integrate these private and public initiatives. Overall, there are many challenges ahead if the combined Nature and Climate crises are to be met together with the four objectives of SLM, including the first objective of producing food and other goods in a more sustainable manner.

Finally, it should be recognised, that this report was only possible due to the long-term commitment by WG to ensure a robust evidence and monitoring approach towards evaluating policy outcomes and support a robust scientific evidence base for future policy development. Wales has been unique in this commitment among the four nations of the UK and Europe over the last 10 years, providing one of the strongest evidence sources for both National Trends and the impacts of an AES on Natural Resources. The permissions to access land granted by many landowners and tenants with management control and the support of farming unions were also essential for the completion of the NFS. Their support is much appreciated.

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