



Previous and proposed indicators of environmental outcomes relating to the reporting of national trends and the outcomes of Glastir and future Sustainable Land management (SFS) by ERAMMP

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Glastir Outcome	Unique id		Indicator	Logic chain	Data source (1)	Data source (2)	Field survey	EO; LIDAR; Aerial photography	Citizen	Model or modelling approach	Social survey	Comments	organisation responsible	Past reporting path	Future reporting path	SoNARR requirement? Y/N to be filled in by NRW
	2nd outcome	3rd outcome														
Woodland	Landscape	Resilience	W10	All broadleaved woodland Area ('000s ha)	Asset-extent	GMEP	NFI						FR	GMEP	ERAMMP	
Woodland	Landscape	Resilience	W11	All coniferous woodland ('000s ha)	Asset-extent	GMEP	NFI						FR	GMEP	ERAMMP	
Woodland	Landscape	Resilience	W03	Small Woodland Area ('000 has)	Asset-extent	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Resilience	Resilience	W06	Habitat Connectivity (using straight line distance)	Asset-extent	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Biodiversity	Resilience	W07	Patch size	Asset-extent	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Biodiversity	Resilience	W01	Large Broadleaved Woodland Ancient Woodland indicator plant species	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Woodland			W02	Large Broadleaved Woodland ground vegetation light score	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Biodiversity	Resilience	W04	Small Broadleaved Woodland Ancient Woodland indicator plant species	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Woodland			W05	Small Broadleaved Woodland ground vegetation light score	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Biodiversity		W08	Woodland birds (Breeding Bird Survey Woodland Bird Indicator)	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Biodiversity		W09	Woodland Pollinator abundance	Asset-function	GMEP							UKCEH	GMEP	ERAMMP	
Woodland	Biodiversity		W12	Presence of non-native understory plant species, specifically highlighting Rhododendron where present	Asset-condition	GMEP							UKCEH	SoNARR	ERAMMP	
Woodland	Biodiversity		W13	Cover of a set of non-native invasive species – particularly Impatiens glandulifera, Heracleum mantegazzianum, and Fallopia japonica	Asset-condition	GMEP							UKCEH	SoNARR	ERAMMP	
Woodland	Biodiversity		W14	Cover of dormouse habitat indicator species: Rubus fruticosus, honeysuckle, hazel and oak	Asset-condition	GMEP							UKCEH	SoNARR	ERAMMP	
Woodland			W15	Deadwood			NFI?					proposed addition following first stakeholder meeting				
Woodland			W16	Veteran trees in woodland		GMEP?	NFI?					proposed addition following first stakeholder meeting				
woodland	Biodiversity		W17	less broad bird indicator		GMEP?						proposed addition following first stakeholder meeting	BTO			
woodland	Biodiversity		W18	lower plants to record woodlands at risk								proposed addition following first stakeholder meeting				
woodland			W20	Area of natural regeneration			LW? / NFI?					proposed addition following second stakeholder meeting				
woodland			W21	Tree disease			NFI/Woodland trust etc?					proposed addition following second stakeholder meeting. Suggest signposting to various data sources as agreed not to be included in NFS by NRW and WG				
woodland			W22	Tree damage from pests			NFI?					proposed addition following second stakeholder meeting				
woodland			W22	Canopy density (from high score of ground vegetation or EO?)		GMEP	LW?					proposed addition following second stakeholder meeting				
Freshwater	Biodiversity	Resilience	FW01	Headwater streams - Macroinvertebrates index for eutrophication & general degradation: Sensitivity of taxa1, 2 (O/E ASPT – mean observed v expected taxon sensitivity)	Service	GMEP								GMEP	ERAMMP	
Freshwater	Biodiversity	Resilience	FW02	Headwater streams - Macroinvertebrates index for eutrophication & general degradation: Number of sensitive taxa 1, 2 (O/E NTAXA – mean observed v expected number of scoring taxa)	Service	GMEP								GMEP	ERAMMP	
Freshwater			FW03	Headwater streams - Invertebrate diversity metric for stream health (%)	Service	GMEP								GMEP	ERAMMP	
Freshwater	Resilience		FW04	Headwater streams - Near-natural or predominantly unmodified (%)	Asset-condition	GMEP								GMEP	ERAMMP	
Freshwater	Biodiversity	Resilience	FW05	Ponds - good ecological condition (%)	Asset-condition	GMEP								GMEP	ERAMMP	
Freshwater			FW06	Land-water interface - Area of in scheme land mitigated for runoff/flood (%)	Management	GMEP						Model no longer used. Proposed to drop this at first stakeholder meeting		GMEP	ERAMMP	
Freshwater			FW07	Land-water interface - Area of out of scheme land mitigated for runoff/flood (%)	Management	GMEP						Model no longer used. Proposed to drop this at first stakeholder meeting		GMEP	ERAMMP	
Freshwater			FW08	Stream modification - Poaching	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW09	Stream modification - Culverts	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW10	Stream modification – Bank modifications	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW11	Stream modification – Channel modifications	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW12	Stream modification - Bridges	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW13	Stream modification - Fords	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW14	Stream modification - Weirs	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW15	Stream modification - Outfalls	Management	GMEP								GMEP	ERAMMP	
Freshwater			FW16	Stream modification - Embankments	Management	GMEP								GMEP	ERAMMP	
Freshwater	Biodiversity		FW17	Invasive and Non-native species	Asset-condition	GMEP									ERAMMP	
Freshwater			FW18	Biorisks / pathogens	Asset-condition							proposed addition following first stakeholder meeting				
												Could be added in future years if Biobank established of water samples				
Biodiversity	Resilience		B03	Habitat and woodland mean patch size (m <sup>2</sup> )	Asset-extent	GMEP	UKCEH LCM						UKCEH	GMEP	ERAMMP	
Biodiversity	Resilience		B53	Broad habitat areas	Asset-extent	GMEP	UKCEH LCM / LW					Work needed to link historic field and UKCEH LCM data to Phase 1 and Living Wales. Areas were not reported in GMEP due to this issue.	UKCEH/LW		ERAMMP	
Biodiversity	Resilience		B02	Habitat diversity (no. of habitats)	Asset-condition	GMEP	UKCEH LCM						UKCEH	GMEP	ERAMMP	
Biodiversity	Resilience		B04	Habitat condition – arable (number of annual forbs per 4m <sup>2</sup> )	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Biodiversity	Resilience		B07	Habitat condition – Wales (numbers of positive CSM indicator species summed across all published lists and counted in 4m <sup>2</sup> plots in all habitats)	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Biodiversity	Resilience		B05	Habitat condition – improved land (number of positive CSM indicators per 4m <sup>2</sup> )	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	
Biodiversity	Resilience		B06	Habitat condition – woodland (number of ancient woodland indicators per 4m <sup>2</sup> )	Asset-condition	GMEP							UKCEH	GMEP	ERAMMP	





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Indicator Category	Indicator Code	Indicator Description	Measurement Method	Reporting Body	Notes	Responsible Organisation	Other Organisations	ERAMMP
Landscape and Access	L06	Recreational use			NRW?		?	Proposed at 2nd stakeholder workshop
Landscape & Access	L07	Cameras to record usage	Service					Has been trialled successfully at ECN sites. Proposed at 2nd stakeholder workshop
Landscape & Access	L08	Area of semi-natural land without tracks and roads	Asset-condition		LW			New roads and tracks for new woodland planting, wind turbines and other initiatives in semi-natural land may be increasing fragmentation
Soil	S01	Carbon (g/kg, from organic matter)	Service	GMEP				UKCEH GMEP ERAMMP
Soil	S02	pH	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Soil	S03	N (g/100g dry soil)	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Soil	S04	Phosphorus (Olsen P mg/ kg)	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Soil	S05	Soil biota (Total invert catch)	Public Good	GMEP				UKCEH GMEP ERAMMP
soil	S13	Soil microbial taxa diversity	Asset-condition	GMEP				Data was reported in GMEP but no funding for analysis in ERAMMP Bangor University GMEP
soil	S12	Pathogens (e.g. plant pathogens) and biorisks (e.g.	Asset-condition					biobank allows this in future if required Bangor University Scientific paper
Soil	S06	Peatland condition (Estimated total emissions ktCO <sub>2</sub> e yr <sup>-1</sup> )	Service	GMEP				UKCEH GMEP ERAMMP
Soil	S07	Peatland condition: Blanket bog <i>Sphagnum</i> % cover	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Soil	S08	Bulk Density (g/cm <sup>3</sup> )	Asset-condition	GMEP				UKCEH SoNARR ERAMMP
Soil	S09	Erosion and other soil damage features extent	Asset-condition	ERAMMP				now included in survey and will be reported UKCEH ERAMMP
Soil	S10	organic matter explicitly (i.e. not converted to soil organic carbon)	Asset-condition	GMEP				proposed addition following first stakeholder meeting UKCEH ERAMMP
Soil	S11	Farmer self assessment for OM, pH, N and P	Asset-condition		WG?			Additional option going forward
Soil	S12	Soil moisture	Service	UKCEH?	LW?			Absolute or proxy could be used UKCEH / LW?
soil	S13	Digital twin approach for key indicators and functions	Asset-function	UKCEH?				Rapid development in this area which integrated field, EO and modelling data UKCEH?
soil	S14	Area of winter cover crops / bare soil	Management		LW?			EO can track this now LW?
soil	S15	Tillage	Management		LW?			EO can track this now LW?
soil	S15	Report all values as number of samples above or below an agreed threshold / or use benchmarking population approach	Asset-condition	ERAMMP				nation soil benchmarks are now available for GB in UKCEH soil benchmarking tool for 4 indicators UKCEH ERAMMP
Resilience	R01	Area - Percentage (%) of semi-natural land	Asset-extent		UKCEH LCM			Work needed to link historic data from past data stream from NRW to Living Wales? UKCEH reported here using UKCEH LCM NRW/LW/UKCEH GMEP ERAMMP
Biodiversity	B02	Diversity - Habitat diversity (from GMEP survey squares)	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Biodiversity	R03	Diversity - Habitat diversity (From CEH Landcover map 2007)	Asset-condition		UKCEH LCM			Note all EO needs some ground-truthing data from field survey UKCEH GMEP ERAMMP
Resilience	R04	Connectivity - Wetlands	Asset-extent	GMEP				UKCEH GMEP ERAMMP
Resilience	R05	Connectivity - Grassland	Asset-extent	GMEP				UKCEH GMEP ERAMMP
Resilience	R06	Connectivity - Heathland	Asset-extent	GMEP				UKCEH GMEP ERAMMP
Resilience	R07	Connectivity - Woodland	Asset-extent	GMEP				UKCEH GMEP ERAMMP
Resilience	R08	Connectivity - Hedge density	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Resilience	R09	HNV Farmland – Type 1	Public Good	GMEP				UKCEH GMEP ERAMMP
Resilience	R10	HNV Farmland – Type 2	Public Good	GMEP				UKCEH GMEP ERAMMP
Biodiversity	R11	Condition – CSM species across all habitats	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Freshwater	R12	Condition – Headwater streams and ponds	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Resilience	R13	Farm diversity and efficiency – number of farms undertaking any actions	Management	GMEP				Not repeated as commissioned elsewhere ADAS GMEP ERAMMP
Resilience	R14	Unexpected variation in primary production	Asset-condition		LW?			LW ERAMMP?
Resilience	R15	Area of disease / fire etc	Asset-condition		LW?			LW ERAMMP?
Climate Change Mitigation	CC01	Contribution by land use and land use change (ktCO <sub>2</sub> e yr <sup>-1</sup> ) (excludes peatlands)	Service	LULUCF GHG inventory				AEA GHG inventory ERAMMP
Climate Change Mitigation	CC02	Agriculture Emissions (CO <sub>2</sub> eq (kt N <sub>2</sub> O + CH <sub>4</sub> ))	Service	Agric GHG inventory				NAEI GHG inventory ERAMMP
Climate Change Mitigation	CC03	Agriculture emissions including embodied emissions (typical average farm data only tCO <sub>2</sub> e/ha) - beef	Service	GMEP				No new survey commissioned GMEP ERAMMP
Climate Change Mitigation	CC04	Agriculture emissions including embodied emissions (typical average farm data only tCO <sub>2</sub> e/ha) - dairy	Service	GMEP				No new survey commissioned GMEP ERAMMP
Climate Change Mitigation	CC05	Agriculture emissions including embodied emissions (typical average farm data only tCO <sub>2</sub> e/ha) - mixed	Service	GMEP				No new survey commissioned GMEP ERAMMP
Climate Change Mitigation	CC06	Agriculture emissions including embodied emissions (typical average farm data only tCO <sub>2</sub> e/ha) - sheep	Service	GMEP				No new survey commissioned GMEP ERAMMP
Climate Change Mitigation	CC07	Peatland condition (ktCO <sub>2</sub> e yr <sup>-1</sup> ): Estimated total emissions	Service	GMEP				UKCEH GMEP ERAMMP
Biodiversity	CC08	Peatland condition: Blanket bog <i>Sphagnum</i> % cover	Asset-condition	GMEP				UKCEH GMEP ERAMMP
Climate Change Mitigation	CC09	Peatland - area restored	Asset-condition					Aerial photography method developed UKCEH ERAMMP

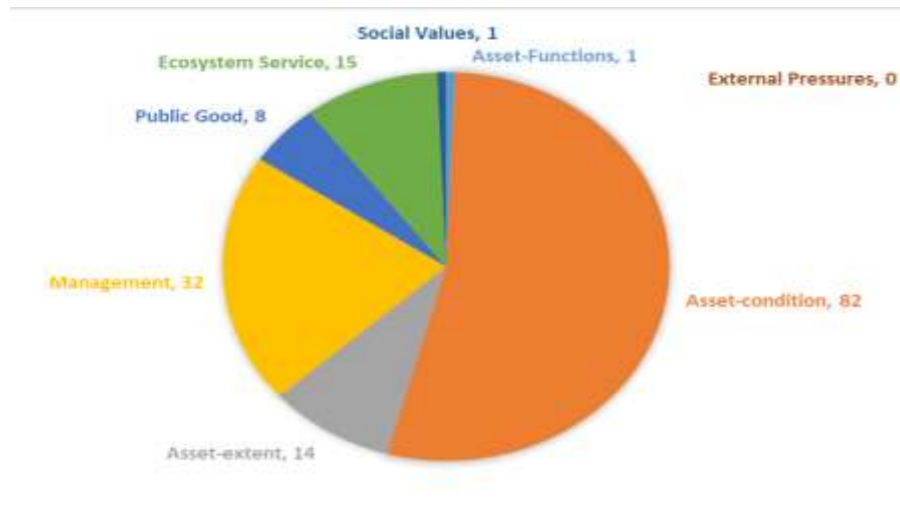


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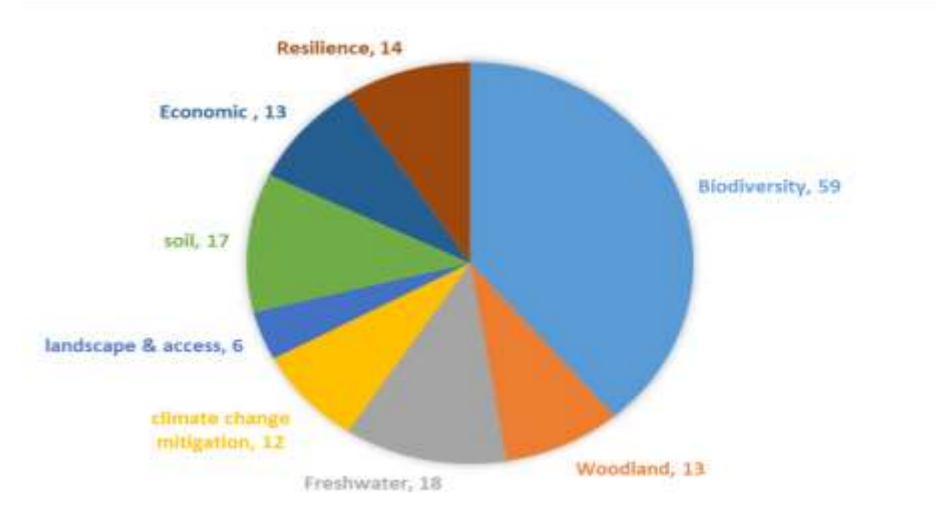
Indicator	Category	Code	Description	Asset	Management	Public Good	Ecosystem Service	Social Values	External Pressures	Other	Source	Responsible Party		
Climate Change Mitigation	Climate Change Mitigation	CC10	Peatland - identified as improved agriculture or forestry	Asset-condition							Overlay of peatland and improved agriculture and forestry	UKCEH / LW	ERAMMP	
Climate change mitigation	Climate change mitigation	CC11	Rural renewable energy	Management							Signpost to data sources			
Climate change mitigation	Climate change mitigation	CC12	Woodland - area of new woodland (split by native / non-native and patch size and age?) and total carbon sequestration	Asset-extent							To agree	LW	ERAMMP	
Economic	Climate Change Mitigation	E07	% of farms in scheme investing in on-farm renewable energy production	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E08	Percentage (%) of farms taking action for adaptation to climate change - Flooding	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E09	Percentage (%) of farms taking action for adaptation to climate change - Drought	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E10	Percentage (%) of farms taking action for adaptation to climate change - Soil erosion	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E11	Percentage (%) of farms taking action for adaptation to climate change - Biodiversity	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E12	Percentage (%) of farms taking action for adaptation to climate change - Pests & disease	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E13	Percentage (%) of farms taking action for adaptation to climate change - Heat stress	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E01	Percentage (%) of farms taking action for business improvement - Fuel & energy efficiency	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E02	Percentage (%) of farms taking action for business improvement - Nutrient efficiency	Management	GMEP							ADAS	GMEP	ERAMMP
Economic	Climate Change Mitigation	E03	Percentage (%) of farms taking action for business improvement - Water use efficiency	Management	GMEP							ADAS	GMEP	ERAMMP
Economic		E04	Percentage (%) of farms taking action for business improvement - Animal health	Management	GMEP							ADAS	GMEP	ERAMMP
Economic		E05	Percentage (%) of farms taking action for business improvement - Diversification	Management	GMEP							ADAS	GMEP	ERAMMP
Economic		E06	Farm viability increase as a consequence of receiving the Glastir Efficiency Grant	Management	GMEP							ADAS	GMEP	ERAMMP



Breakdown by Logic Chain

	Asset-Functions	Asset-condition	Asset-extent	Management	Public Good	Ecosystem Service	Social Values	External Pressures	TOTAL
Biodiversity	1	47	3	4	5	0	0	0	60
Woodland	0	8	5	0	0	0	0	0	13
Freshwater	0	4	0	11	0	3	0	0	18
climate change mitigation	0	3	1	1	0	7	0	0	12
landscape & access	0	3	0	0	0	2	1	0	6
soil	0	11	0	2	1	3	0	0	17
Economic	0	0	0	13	0	0	0	0	13
Resilience	0	6	5	1	2	0	0	0	14
<b>TOTAL</b>	<b>1</b>	<b>82</b>	<b>14</b>	<b>32</b>	<b>8</b>	<b>15</b>	<b>1</b>	<b>0</b>	<b>153</b>

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Breakdown by Outcome