

This document applies to the reporting period:

2018-2024

Last edited: October 2026



Methodology:

Compilation of Ecosystem Extent Maps

Ecosystem Accounts,

Central Statistics Office (CSO),

Ardee Road, Rathmines, Dublin 6 D06 FX52

ecosystems@csو.ie

Contents

1 Overview.....	1
1.1 What are Ecosystem Accounts?.....	1
1.2 Which ecosystems were mapped?	1
2 Data.....	6
2.1 CLCplus Backbone	6
2.2 Other EU data	6
2.3 National Level data	8
2.3.1 DLM Core – PRIME2	8
2.3.2 National Land Cover Map (NLCM).....	9
2.3.3 Land Parcel Identification System (LPIS)	9
2.3.4 Article 17 – EU Habitats Directive data	9
2.3.5 Natura 2000 habitat sites	9
2.3.6 Forest administrative data.....	9
2.3.7 EU Water Framework Directive transitional waters	9
2.3.8 Licensed aquaculture sites	9
2.3.9 INFOMAR	10
2.4 Boundaries	10
2.4.1 Ecosystem Accounting Area.....	10
2.4.2 Coastal and inland	10
2.4.3 Continuous and discontinuous urban ecosystem types	11
2.4.4 County Local authority boundaries.....	11
3 Ecosystem classification and mapping.....	16
3.1 Data preparation	16
3.2 Workflow	16
3.2.1 Data merging.....	18
3.2.2 Machine learning classification of peatlands	18
3.2.3 Residual land cover	19
3.2.4 Spatial aggregation	20
3.2.5 Complex ecosystem types	22
3.2.6 Small and improbable conversions	23
4 Classification accuracy	24
4.1 How was the sample created?.....	25
4.2 How was the sample labelled?	25
4.3 Sources of error	26
5 Non-intuitive conversions between ecosystem types.....	28

5.1 Forest & Woodland to Grassland.....	28
5.2 Settlements & Other Artificial Areas to Forest & Woodland	28
5.3 Settlements & Other Artificial Areas to Grassland.....	28
5.4 Settlements & Other Artificial Areas to Cropland	29
5.5 Cropland to Heathland & Shrub	29
5.6 Grassland to Heathland & Shrub.....	29
5.7 Forest & Woodland to Settlements & Other Artificial Areas	29
5.8 Forest & Woodland to Heathland & Shrub	29
5.9 Sparsely Vegetated Areas to Grassland	30
5.10 Conversions between Inland Wetlands and other ecosystems	30
6 Future work.....	30
6.1 Ecosystems not mapped due to lack of source data	30
6.2 Improvements in source data	30
7 Appendices.....	31

1 Overview

1.1 What are Ecosystem Accounts?

The [System of Environmental Economic Accounting - Ecosystem Accounting](#) (SEEA-EA) is a spatially-based, integrated statistical framework for organising biophysical information about ecosystems, measuring ecosystem services, tracking changes in ecosystem extent and condition, valuing ecosystem services and assets and linking this information to measures of economic and human activity. It is an integrated statistical framework adopted by the United Nations Statistical Commission.

The SEEA-EA outlines five sets of ecosystem accounts:

1. Ecosystem extent accounts
2. Ecosystem condition accounts
3. Ecosystem services (physical flow)
4. Ecosystem services (monetary flow)
5. Monetary ecosystem asset accounts

As part of a recent amendment to [Regulation \(EU\) No 691/2011](#) on environmental economic accounts, it is now mandatory to report ecosystem extent, condition and services (physical flow) accounts in line with SEEA-EA. The monetary flow of ecosystem services and the monetary value of ecosystem assets will not need to be accounted for under the new regulation. Mandatory reporting by member states will commence in 2026.

To produce ecosystem extent, condition and service accounts it is essential to map the total extent of all ecosystems within an ecosystem accounting area (EAA). For national level accounting, the EAA is the total extent of the territory of Ireland. For these accounts, it is the total area of Ireland in which terrestrial and transitional ecosystems occur. Note, the methodology presented in this document follows the methodological guidance on the compilation of ecosystem extent maps and accounts as outlined in Eurostat's 2026 edition [handbook](#) on ecosystem accounts.

1.2 Which ecosystems were mapped?

The ecosystems mapped as part of this release are given in Table 1. These are the terrestrial and transitional ecosystem types at levels one and two of the new EU ecosystem typology (Table 1 and Table 2). Ecosystems which were not mapped include three terrestrial level two ecosystem types (described in [section 6.1](#)) and all level two Marine Ecosystems. These were mapped using a minimum mapping width (MMW) of 50 metres and a minimum mapping unit (MMU) of 1 hectare, meaning that ecosystems occurring at a smaller spatial scale were generally not mapped. There were two exceptions to this:

- 1) The level two ecosystem type 'Natural & Semi-Natural Grassland' was mapped at an MMU of 25 hectares.

- 2) Areas where one or more ecosystem type occurred within a 1-hectare area. This typically occurs at the boundary of two ecosystems (e.g. Grassland and Forest & Woodland). When this happens, the mapped ecosystem is that which has the larger area within the 1-hectare area. Therefore, the smallest possible mapped area is 0.03 hectares (i.e. where source data suggests the occurrences of all 31 ecosystem types within the same 1-hectare areas). However, such occurrences are exceedingly rare, with the median model frequency across all ecosystems being 1 [IQR = 0.96-1.00].

Table 1. Description of level one of EU ecosystem typology (excluding Marine ecosystems)

Ecosystem type (Level 1)	Description
Settlements & Other Artificial Areas (1)	This class represents human habitats, i.e. ecosystems that are strongly modified by people and that are characterised by buildings and other man-made structures. It includes dispersed and dense residential, industrial, commercial, and transport areas, urban green areas, mineral and gravel extraction sites, dumping and construction sites. The class excludes peat extraction sites (classified under 'Inland wetlands'). The class has also been labelled 'urban ecosystems'.
Cropland (2)	Croplands are food production areas including both intensively managed cropland, extensively managed cropland, and multifunctional areas. They include areas with perennial and annual crops, and agro-ecosystems with significant coverage of natural vegetation (agricultural mosaics). Cropland may include agro-forestry areas such as cork and holm oak stands (see respective classes at level two). Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc., are considered part of this ecosystem type.
Grassland (3)	Grassland covers areas dominated by herbaceous vegetation (including in particular grasses and forbs but also mosses and lichens) of two kinds – modified grasslands (sown and used for grazing or hay and silage production) and (semi-) natural (low-intensity managed) grasslands. Grassland also includes some agroforestry area used for grazing, such as cork and holm oak stands or wooded pasture. Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc. are considered part of this ecosystem type.
Forest & Woodland (4)	Forests and woodlands include tree-dominated ecosystems with a canopy cover generally over 30% (in the temperate climate zone) or 10% (in boreal and Mediterranean climate zones) or vegetation where present trees can reach these thresholds <i>in situ</i> . For boreal and Mediterranean forest types a lower threshold is advisable due to extreme climatic conditions, which naturally limit the growth of trees and relative canopy cover.
Heathland & Shrub (5)	Heathland and shrub are areas with vegetation dominated by shrubs or dwarf shrubs, which may include dispersed trees with a canopy cover below 30%. They include natural ecosystems of predominantly harsh conditions as well as secondary ecosystems created by extensive human use. The class includes heathlands and sclerophyllous vegetation.
Sparsely Vegetated Ecosystems (6)	Sparsely or unvegetated ecosystems have a low density of vegetation, with typically at least 70% of barren soil. They include degraded sparsely or degraded non-vegetated areas as well as ecosystems under extreme natural conditions which may be traditionally grazed. They include bare rocks, glaciers, inland dunes and sand plains. In spite of low vegetation density, the ecosystems may contain high biodiversity of species adapted to an extreme environment.
Inland Wetlands (7)	Inland wetlands are areas that are year-round or seasonally strongly affected by water, in the form of temporary flooding or groundwater levels close to surface. This class includes natural, semi-natural or modified inland marshes as well as mires, bogs and fens, but excludes seasonally flooded grasslands and heathlands, for example. It also includes peat extraction sites.
Rivers & Canals (8)	Permanent freshwater inland surface waters of linear character. These include natural water courses, such as rivers, streams etc., as well as anthropogenic structures built for transportation, drainage or water supply purposes, i.e., canals, ditches etc.
Lakes & Reservoirs (9)	Permanent freshwater inland surface waters composed of primarily non-linear water bodies. These include natural water bodies (lakes) as well as anthropogenic water bodies developed mainly for water supply or energy generation purposes.

Marine Inlets & Transitional Waters (10)	Marine inlets and transitional waters are ecosystems on the land-water interface under the influence of tides and with salinity higher than 0.5 ‰. They include lagoons, estuaries and other transitional waters.
Coastal Beaches, Dunes & Wetlands (11)	The class coastal areas refers to land-based ecosystems close to the sea, with marine influences, such as salt spray and saline groundwater, and that may be flooded during high tide or extreme events. The class includes beaches, dunes (which may include wetland areas below the MMU in between rows of dunes) and coastal saltmarshes and salines.

Table 2. Description of level two of EU ecosystem typology (excluding Marine ecosystems)

Ecosystem type (Level 1)	Ecosystem type (Level 2)	Description
Settlements & Other Artificial Areas (1)	Continuous Settlement Area (1.1)	Also designated as continuous urban area or fabric. The Continuous Settlement Area type is assigned when settlement structures and transport networks are dominating the surface area. At least 80% of the land surface in the ecosystem asset is covered by impermeable features such as buildings, roads and artificially surfaced areas.
	Discontinuous Settlement Area (1.2)	Also designated as discontinuous urban area or fabric. The Discontinuous Settlement Area type is assigned when settlement structures and transport networks associated with vegetated areas and bare surfaces are present and occupy significant surfaces in a discontinuous spatial pattern. The impermeable features such as buildings, roads and artificially surfaced areas range from 30 to 80 % land coverage in the ecosystem asset.
	Infrastructure (1.3)	This includes land used for transport infrastructure such as roads, airports and ports, including associated areas (e.g. planted trees and bushes lines or spontaneous vegetation, such as grass verges), and artificial areas other than buildings that are used for commercial and industrial purposes including extraction sites, dump areas, and construction sites.
	Urban Greenspace (1.4)	Areas with vegetation within or partly embraced by urban fabric. This class is assigned for urban greenery, which usually has recreational or ornamental character and is usually accessible for the public. Includes small urban water bodies. Areas with soil sealing above 30% should be moved to class 1.1 or 1.2.
	Other Artificial Areas (1.5)	Areas that are artificial but do not fall under the other level 2 categories of settlements and artificial areas. This includes e.g. permanent green houses, cemeteries even if predominantly green. Countries should also record here types of artificial land of specific national importance, such as archaeological sites or others, if they do not belong to any of the level 2 categories 1.1 -1.4. Countries should inform what they cover in this category in a footnote in the questionnaire.
Cropland (2)	Annual Cropland (2.1)	Cropland planted for annually or regularly harvested crops other than those that carry trees or shrubs. They include fields of cereals, of sunflowers and other oil seed plants, of beets, legumes, fodder, potatoes, and other forbs. Croplands comprise intensively cultivated fields, fallow land, temporary grass for silage and grazing as well as traditionally and extensively cultivated crops with little or no chemical fertilisation or pesticide application. Faunal and floral quality and diversity depend on the intensity of agricultural use and on the presence of

		borders of (semi-)natural vegetation and woody structures between fields. Includes non-permanent greenhouse installations such as film tunnels. Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc., are considered part of this ecosystem type.
	Permanent Crops (2.3)	Crops not under a rotation system which provide repeated harvests and occupy the land for a long period before they are renewed. Mainly plantations of woody crops, e.g. vineyards, fruit and berry plantations, olive groves. Excludes pastures, grazing lands and forests. Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc., are considered part of this ecosystem type. Includes burnt areas of this type.
	Other Farmland (2.6)	Other types of farmland not included in the other categories of cropland such as nurseries, Christmas tree plantations and bioenergy grasses and short rotation coppice. Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc., are considered part of this ecosystem type.
Grassland (3)	Sown Pastures & Other Grass (Modified Grasslands) (3.1)	Stable grassland characterised by agricultural use or strong human disturbance. Floral composition dominated by Gramineae and shaped by human activity. Regularly re-sown and fertilised and used for grazing or mechanical harvesting of grass. Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc., are considered part of this ecosystem type.
	Natural and Semi-Natural Grasslands (3.2)	Grasslands under no or moderate human influence. Mostly low productivity grasslands composed of native species adapted to the local environment. Can be under agro-forestry use. Often situated in areas of rough, uneven ground, steep slopes or wetter areas; frequently including rocky areas or patches of other (semi-)natural vegetation. Small semi-natural elements which are associated with agricultural land use, such as hedges, ponds, grassy margins etc., are considered part of this ecosystem type. Includes burnt areas of this type.
Forest & Woodland (4)	Broadleaved Deciduous Forest (4.1)	Woodlands and forests dominated by summer-green non-coniferous trees that lose their leaves in winter. Includes woodland with mixed evergreen and deciduous broadleaved trees, provided that the deciduous cover exceeds that of evergreens. The proportion of conifers should not exceed 25%. Includes burnt areas of this type.
	Coniferous Forests (4.2)	Vegetation formation composed principally of trees, including shrub and bush understorey, where coniferous species predominate. The proportion of deciduous trees should not exceed 25%. Includes burnt areas of this type.
	Mixed Forests (4.4)	Vegetation formation composed principally of trees, including shrub and bush understorey, where neither broadleaved nor coniferous species strongly predominate (i.e. <75% deciduous and <75% coniferous trees). Includes burnt areas of this type.
	Transitional Forest & Woodland Shrub (4.5)	Transitional forests and woodland shrub. Includes vegetation that is always shrubland and areas of temporarily cleared forest (as part of forest management). Sporadic grazing use may occur. Includes burnt areas of this type.

	Plantations (4.6)	Monoculture plantations or plantations strongly dominated by one or few species of non-European coniferous and broadleaved trees with very sparse or lacking undergrowth, e.g. eucalyptus plantations. Forest stands of single or mixed species consisting of native and/or non-native trees species that have long been established in European ecosystems and have diverse undergrowth typical for forest ecosystems should be classified as part of types 4.1 to 4.4. If not possible to distinguish plantations, these areas should be attributed to the classes 4.1 – 4.4. Includes burnt areas of this type
Heathland & Shrub (5)	Scrub & Heathland (5.2)	Vegetation with low and closed cover, dominated by bushes, shrubs, dwarf shrubs (heather, briars, broom, gorse, laburnum etc.) and herbaceous plants, including semi-natural/successional stages and mature stages of development. Includes burnt areas of this type.
Sparsely Vegetated Ecosystems (6)	Bare Rocks (6.1)	Scree, cliffs, rock outcrops, including areas of active erosion, rocks and reef flats outside marine influence, inland salt planes. At least 90% of area of the ecosystem asset is covered by rocks. Rocks within a zone up to 100m from the high-water mark can be classified as coastal ecosystems.
	Semi-Desert, Desert & Other Sparsely Vegetated Areas (6.2)	Non-coastal habitats with less than 30% vegetation cover (other than in crevices of rocks, screes or cliffs) which are characterised by very low water availability. They include areas which are sparsely vegetated due to land degradation.
Inland Wetlands (7)	Inland Marshes & Other Wetlands on Mineral Soil (7.1)	Low-lying land usually flooded in winter, and more or less saturated by water all year round. Vegetation is composed mainly of rushes, sedges, and some reed and shrub. Other types of this class include reedbeds and springs.
	Mires, Bogs & Fens (7.2)	Wetlands, with the water table at or above ground level for at least half of the year, dominated by mosses, herbaceous or ericoid vegetation. Includes inland saltmarshes and water logged habitats where the groundwater is frozen. Excludes the water body and rock structure of springs and waterlogged habitats dominated by trees or large shrubs. Includes bog degradation stages dominated by heathland but excludes wet heathlands on mineral soils which support limited peat formation. Includes peat extraction sites. Includes burnt areas of this type.
Rivers & Canals (8)	Rivers & Streams (8.1)	Natural watercourses, such as rivers, streams etc. (even though often modified by man) serving as water drainage channels.
	Canals, Ditches & Drains (8.2)	Artificial watercourses serving as water drainage or transport channels.
Lakes & Reservoirs (9)	Lakes & Ponds (9.1)	Natural (but sometimes modified) water bodies with presence of standing water surface during the entire year (except in very dry years for some types).
	Artificial Reservoirs (9.2)	Artificial water bodies with presence of standing water surface during most of the year. Developed mainly for water supply or energy generation purposes.
Marine Inlets & Transitional Waters (10)	Macrophyte communities and biogenic reefs (of class 10) (10.1)	Intertidal areas shaped by the presence of plant and animal communities (>25% of the grid cell): a) Intertidal macrophyte communities which comprise different vegetation types occurring in the intertidal zone and near-shore marine areas, in particular brown, green and red algae, seagrass and/or other coastal macrophytes; b) Biogenic structures occurring in the intertidal zone and near-shore marine areas, formed by different types of shellfish or worms.

Coastal Beaches, Dunes & Wetlands (11)	Transitional waters (10.2)	Transitional waters which represent mosaics of other ecosystem types and have been included by convention as ecosystems of special interest. These are estuaries, deltas and lagoons. When these mosaic ecosystems are reported, it is important to avoid double counting and not to report their composite ecosystems of class 10 twice (once in 10.1 and second time under another sub-class of class 10).
	Intertidal areas (10.3)	Coastal areas under tidal influence between the low and high sea water level and where vegetation and sessile animals do not cover >25% of the grid cell. Isolated sandbanks can be special features of such areas. Intertidal areas of bays are included. Excluded are coastal beaches (see 11.1 and 11.2) and other areas above the high-tide mark.
	Anthropogenic structures and modified ecosystems (of class 10) (10.4)	Man-made structures in the intertidal zone and transitional waters with an intended installation on a longer-term to permanent basis (i.e. at least a couple of accounting periods) including aquaculture and energy infrastructure, salines and other areas where human activities have permanently or in a long term modified the physical aspects of ecosystems.
	Coastal dunes and fine sediment shores (11.1)	Coastal landforms formed by the deposition of fine sediment, such as sandy beaches, dunes (and associated dune slacks), muddy shores and the like. The class includes salt flats formed on fine sediment.
	Rocky, boulder and coarse sediment shores (11.2)	Beaches of gravel, pebble or cobble, and cliffs, rock outcrops, rock plateaus and boulders, reef flats situated above the high-water mark and normally up to 100 m from it. Areas of active erosion are included.
	Coastal halophytic wetlands (11.3)	Vegetated areas in the coastal zone regularly inundated and dominated by halophytic (salt-tolerant) plants.

2 Data

The different source data used to produce ecosystem extent maps for 2018, 2021 and 2024 can be found in Table 2. The data (summarised below) is a mix of EU-wide and national land cover maps, national administrative data and survey data.

2.1 CLCplus Backbone

The base landcover map used for these accounts was [CLCplus Backbone](#). This pan-EU land cover map is produced by the Copernicus Land Monitoring Service (CLMS) and classifies the entire country into 11 land cover types (detailed [here](#)), seven of which occur in Ireland. Although this data was itself used as source data for classification of most ecosystem types, functionally, it served as the ‘base layer’ onto which all other data sources were ‘layered’. See Table 3 to see how this data was used to classify different ecosystem types. Altogether, it was used in the classification of nine out of 11 ecosystem types (excluding Inland Wetlands and Rivers & Canals).

2.2 Other EU data

Four other CLMS products were used in the production of these ecosystem extent maps:

1. High-Resolution Layer – Vegetated Land Cover Characteristics (HRL-VLCC) – [Crop Types](#). This is one of the data layers produced as part of the HRL-VLCC [Croplands](#) product

category and was used as a source for the Cropland ecosystem type (Table 3). More specifically, it was used to identify areas of cropland not recorded in the Land Parcel Identification System (LPIS) database (see section on LPIS below).

2. [CORINE Land Cover \(CLC\)](#). Classes 243 (Land principally occupied by agriculture, with significant areas of natural vegetation) and 321 (Natural Grassland) were used to identify potential areas of Natural & Semi-Natural Grasslands.
3. HRL-VLCC – [Ploughing indicator](#). This is one of the data layers produced as part of the HRL-VLCC [Grasslands](#) product category. It was used to identify areas of the above CLC classes which had evidence of ploughing in the previous six years. Evidence of such precluded classification as Natural & Semi-Natural Grasslands.
4. HRL-VLCC – [Grassland Mowing Events](#). This is also one of the data layers produced as part of the HRL-VLCC Grasslands product category. It was used to identify areas of CLC classes 243 and 321 where mowing had occurred more than once within the mapping reference year. Evidence of such also precluded classification as Natural & Semi-Natural Grasslands.
5. Sentinel-2 Level-2A. This is atmospherically corrected, optical satellite imagery available from 10 to 20 m resolution and provided by Copernicus through the Copernicus Data Space Ecosystem ([CDSE](#)). It was used to create normalised difference vegetation index (NDVI) composites for filtering out non-green PRIME-2 vegetation geometries. It was also used to classify new areas of Mires, Bogs & Fens (see below section on peatland mapping).
6. European Marine Observation and Data Network (EMODnet). These are pan-EU habitat maps focusing on marine ecosystems. The maps are compiled from a diverse range of sources (i.e. national reporting agencies, academia, private sector) and are often in the form of survey or predicted data. EMODnet maps were used for mapping of Marine Inlets & Traditional Waters.

Table 3 Geospatial data sources used to create ecosystem extent maps for 2018, 2021 and 2024.

Data name	Source	Data type	MMU ¹	MMW ²	Reference years	Update frequency
CLCplus Backbone	Copernicus	raster	NA	NA	2018, 2021, 2023	two years
High resolution layer (HRL)-vegetated land cover characteristics (VLCC) – Crop Types	Copernicus	raster	0.25 ha	NA	2018, 2021, 2024	annual
High resolution layer (HRL)-vegetated land cover characteristics (VLCC) – Ploughing	Copernicus	raster	NA	NA	2018, 2021, 2024	annual
High resolution layer (HRL)-vegetated land cover characteristics (VLCC) – Mowing	Copernicus	raster	0.25 ha	NA	2018, 2021, 2024	annual
CORINE Land Cover (CLC)	Copernicus	raster	25 ha	100 m	2018, 2024	six years

¹ minimum mapping unit (MMU). Area based spatial features (e.g. a forest) smaller than the MMU are not represented in the mapping.

² minimum mapping width (MMW). Linear based features (e.g. a road or a river) with a width smaller than the MMW are not represented in the mapping.

Sentinel-2 Level-2A	Copernicus	raster	NA	NA	2018, 2021, 2024	Every five days, but annual time composites used
PRIME2 - DLM Core cadastral map	Tailte Éireann	vector	0.0001 ha	0.05 m (roads) - 0.1 m (water bodies)	2018 Q1, 2021 Q4, 2025 Q1	quarterly
National Land Cover Map (NLCM)	Tailte Éireann	vector	0.01 ha to 0.05 ha	50 m for linear features	2018	six years
CSO Built Up Urban Areas	CSO	vector	6 ha	NA	2022	reviewed with every Census cycle
Counties - National Statutory Boundaries - Ungeneralised	Tailte Éireann	vector	0.0001 ha	NA	2024	ad hoc
Local Authorities - National Statutory Boundaries - Ungeneralised	Tailte Éireann	vector	0.0001 ha	NA	2024	reviewed with every Census cycle
Water Framework Directive (WFD) - Transitional Waterbodies	EPA	vector	0.1 ha	28 m	2018, 2021	six years
Land Parcel Identification System (LPIS)	DAFM	vector	0.0001 ha	NA	2018, 2021	annual
Private forests	DAFM	vector	0.004 ha	NA	2018, 2021	annual
Forestry estate	Coillte	vector	0.0001 ha	NA	2018, 2021	annual
SSCO Natura 2000 habitat sites	NPWS	vector	0.001 ha	NA	2011-2025	irregular
Article 17 Grasslands	NPWS	vector	0.0001 ha	NA	2019	six years
EMODnet seagrass	EC DG MARE	vector	0.0001 ha	NA	2025	irregular
EMODnet macroalgae	EC DG MARE	vector	0.0001 ha	NA	2025	irregular
EMODnet biogenic substrate	EC DG MARE	vector	0.0001 ha	NA	2025	irregular
INFORMAR sediments	GSI and Marine Institute	vector	0.0001 ha	NA	2025	irregular
Licensed aquaculture sites	DAFM	vector	0.04 ha	NA	2021	Irregular

2.3 National Level data

2.3.1 DLM Core – PRIME2

The national cadastral map (also known as DLM Core PRIME 2) from Tailte Éireann was the main data source used for mapping terrestrial ecosystem types which are primarily characterised by artificial surfaces (Settlements & Other Artificial Areas) or water (Rivers & Canals and Lakes & Ponds). To a lesser degree, it was also used to classify ecosystems which are partly characterised by exposed rock (Sparsely Vegetated Ecosystems and Coastal Beaches, Dunes & Wetlands). PRIME 2 was not used directly – instead, the [Digital Landscape Models \(DLM\) Core Data](#) was used, which is derived from it. A breakdown of how PRIME 2 was used is provided in Table 3.

2.3.2 National Land Cover Map (NLCM)

The 2018 National Land Cover Map ([NLCM](#)) – produced by the Environmental Protection Agency (EPA) and Tailte Éireann – was a key data source used for the classification of several ecosystem types (Table 3). It was the primary data source for Inland Wetlands and Heathland & Shrub. To a lesser degree, it was also used to map Sparsely Vegetated Ecosystems, Marine Inlets & Transitional Waters, and Coastal Beaches, Dunes & Wetlands.

2.3.3 Land Parcel Identification System (LPIS)

The Land Parcel Identification System ([LPIS](#)) database, which contains crop type descriptions for over 1.3 million farm parcels, was used to classify both Grassland and Cropland ecosystem types (Table 3). LPIS is used by the Department of Agriculture, Food and the Marine (DAFM) to administer payments to farmers under area-based schemes such as the Basic Income Support for Sustainability (BISS), and the Areas of Natural Constraint Scheme (ANC).

2.3.4 Article 17 – EU Habitats Directive data

The National Parks & Wildlife Service (NPWS) maps habitats for reporting under Article 17 of the EU Habitats Directive. [Maps](#) for the natural and semi-natural grasslands (Calaminarian grassland, Orchid-rich calcareous grassland, Species-rich Nardus upland grassland, Molinia meadows, Hydrophilous tall herb, Lowland hay meadows) reported on under this Article were classified as the Natural & Semi-Natural Grassland ecosystem type. However, like with the areas of this ecosystem type derived from CLC, they were first qualified using the CLMS ploughing and mowing data as described above.

2.3.5 Natura 2000 habitat sites

These sites were accessed from the Site-Specific Conservation Objective (SCCO) data provided by the NPWS. They were used to map Coastal Beaches, Dunes & Wetlands, Bare Rocks, Natural & Semi-Natural Grasslands and Intertidal Areas

2.3.6 Forest administrative data

Private forest data from the Department of Agriculture, Food and the Marine (DAFM) and forest estate data Coillte were used as the main data sources for different Forest & Woodland ecosystem types.

2.3.7 EU Water Framework Directive transitional waters

The Transitional Waterbodies [data](#) reported by the Environmental Protection Agency (EPA) under the Water Framework Directive (WFD) were used to classify the ecosystem type Transitional Waters.

2.3.8 Licensed aquaculture sites

These are sites which are associated with an aquaculture license, as administered by DAFM. Such sites were used to map the ecosystem type Anthropogenic Structures & Modified Ecosystems (located in transitional waters), and excluded sites located in freshwater or in the sublittoral zone. Sites associated with a fishery order license were also removed, as these are larger, lower-intensity sites which typically do not require the establishment of permanent artificial structures.

2.3.9 INFOMAR

Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) is Ireland's national seabed mapping programme. INFOMAR non-biogenic seabed substrates were used to map the ecosystem type Intertidal Areas.

2.4 Boundaries

2.4.1 Ecosystem Accounting Area

To ensure ecosystem extent account comparability between reference years, it was necessary to define a permanent ecosystem accounting area (EAA) in which to map and account for the spatial extent of terrestrial and transitional ecosystems. The EAA boundary applied here was produced to delineate separately a terrestrial-transitional EAA from a marine EAA, which should be 'wall-to-wall' with one another. The production of these EAAs proceeded as follows: the [Designated Maritime Boundary Continental Shelf](#) from The Marine Institute was extended to include the Agreed boundary for Offshore Renewable Energy ([ORE](#)) development between Ireland and Northern Ireland. The latter boundary stops at the respective entrances to Lough Foyle and Carlingford Lough. Where each stop, a perpendicular line was drawn to the 2024 low water mark ([LWM](#)) from Tailte Éireann. The resulting linestring geometry was taken to define the outer extent of the marine EAA, whereas the LWM was taken as the inner extent of the marine EAA. The Water Framework Directive transitional waters ([TW](#)) from the Environmental Protection Agency (EPA), relevant landcover types (coastal sediments, mudflats and saltmarsh) from the 2018 National Landcover Map ([NLCM](#)) and coastal rocks from Tailte Éireann's PRIME 2 database were used to expand the area defined by the LWM but using the marine EAA produced above to clip out any areas that extended into Northern Ireland or the two aforementioned loughs. The LWM was further modified using the land border between Ireland and Northern Ireland, as delineated using the national county statutory [boundaries](#) from Tailte Éireann – this final modified LWM was used as the terrestrial-transitional EAA.

It is important to note that the EAA boundaries were defined for statistical purposes only – they in no way purport to define a boundary to any national territory and therefore should not under any circumstances be interpreted as such. The composite EAA shapefile can be provided upon request made to ecosystems@csso.ie.

2.4.2 Coastal and inland

It was necessary to define a coastal buffer zone to classify some ecosystem types, as suggested by [Eurostat](#). For example, exposed rock from PRIME 2 was classified as Bare Rock (part of Sparsely Vegetated Ecosystems) if it occurred inland, whereas it was classified as Rocky Shores (part of Coastal Beaches, Dunes and Wetlands) if it occurred at or near the coast. In practice, the coastal buffer zone was defined as the area within 1 km of the coastline. Therefore, inland was considered as any area more than 1 km inland from the coastline, whereas coastal was considered as the area inclusive of the coastal buffer zone and extending to the outer extent of the terrestrial-transitional EAA. The coastline in this case was considered to be the HWM merged with the outer extent of the EPA WFD transitional waterbodies. The reason for this is that the HWM in many areas extends significantly inland (e.g. following the Upper Shannon Estuary, Limerick Dock and the Middle Suir Estuary), which would result in the potential misclassification of inland ecosystems.

2.4.3 Continuous and discontinuous urban ecosystem types

The CSO Built Up Areas ([BUAs](#)) were used to differentiate Continuous and Discontinuous Settlement Areas. The CSO BUA boundaries were produced based on PRIME 2 building counts and are used to differentiate urban from rural areas to produce Census 2022 data for urban areas. This meant that data used to classify settlement areas (e.g. CLCplus Backbone class 1 ‘sealed’ and PRIME 2 building polygons) were classified as Continuous Settlement Areas if they occurred within BUAs or Discontinuous Settlement Areas if they were located outside of BUAs.

2.4.4 County Local authority boundaries

Spatial disaggregation of the compiled ecosystem extent map to the level of each local authority was done using the [local authority](#) and [county](#) boundaries generated from the 2024 National Statutory Boundaries from Tailte Éireann.

Table 4 Geospatial data sources and their ecosystem type correspondence. Also included is the order in which each classified ecosystem was mapped.

Source	Dataset name	Source attributes	Comment	Ecosystem (Level two)	Level two order	Ecosystem (Level one)	Level one order ³	Overall order ⁴
NPWS	Site Specific Conservation Objectives (SSCO)	Natura saltmarsh habitats		Coastal Halophytic Wetlands (11.2)	1	Coastal Beaches, Dunes & Wetlands (11)	1	1
Tailte Éireann	National Land Cover Map (NLCM)	Saltmarsh						
NPWS	Site Specific Conservation Objectives (SSCO)	Sand dune habitats		Coastal Dunes & Fine Sediment Shores (11.1)	2			2
Tailte Éireann	National Land Cover Map (NLCM)	Sand dunes and coastal sediments						
NPWS	Site Specific Conservation Objectives (SSCO)	Scree, rock and limestone habitats	Within 1,000 m from high water mark	Rocky, Boulder & Coarse Sediment Shores (11.2)	3			3
Tailte Éireann	National Land Cover Map (NLCM)	Exposed rock and sediments	Within 1,000 m from high water mark					
Tailte Éireann	PRIME 2 exposed layer	Cliff, rock, outcrop, scree and shingle	Within 1,000 m from high water mark					
None	-	-	No data could be identified	Artificial Shorelines (11.4)	4			
Tailte Éireann	PRIME 2 vegetation layer	Graveyards		Other Artificial Areas (1.5)	1	Settlements & Other Artificial Areas (1)	2	5
Tailte Éireann	PRIME 2 building layer	Greenhouses						
Tailte Éireann	PRIME 2 sites layer	Antiquity sites						
Tailte Éireann	PRIME 2 rail network	Railway network		Infrastructure (1.3)	2			6
Tailte Éireann	PRIME 2 vegetation layer	Roundabouts and verges						
Tailte Éireann	PRIME 2 ways layer	Relevant roads						
Tailte Éireann	PRIME 2 exposed layer	Extraction sites						
Tailte Éireann	PRIME 2 sites layer	Ports and airports						
Tailte Éireann	PRIME 2 vegetation layer	Public greenspace and sports fields	Selected if NDVI was 0.3 or higher	Urban Greenspace (1.4)	3			7
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 2 woody needle leaved trees	Within BUA and outside LPIS claimed area					
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 3 woody broadleaved deciduous trees	Within BUA and outside LPIS claimed area					
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 5 low-growing woody plants	Within BUA and outside LPIS claimed area					
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 6 permanent herbaceous	Within BUA and outside LPIS claimed area					

³ This is the order in which each level 2 ecosystem type (including residual land cover classes) was mapped for each level 1 ecosystem type

⁴ This is the order in which each composite level 1 ecosystem type was mapped (including residual land cover classes)

Tailte Éireann	PRIME 2 water layer	Small lakes and ponds associated with urban green	Can be considered 'urban blue' but not if larger than 1 hectare					8	
Tailte Éireann	PRIME 2 building layer	Buildings	Outside BUA	Discontinuous Settlement Areas (1.2)	4				9
Tailte Éireann	PRIME 2 artificial layer	Artificial surfaces	Outside BUA						
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 1 sealed	Outside BUA						
Tailte Éireann	PRIME 2 building layer	Buildings	Within BUA	Continuous Settlement Areas (1.1)	5				
Tailte Éireann	PRIME 2 artificial layer	Artificial surfaces	Within BUA						
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 1 sealed	Within BUA						
None	-	-	No data could be identified	Mixed Farmland (2.5)	1	Cropland (2)	3	10	
Department of Agriculture, Food and the Marine (DAFM)	Land Parcel Identification System (LPIS)	Agro-forestry		Agro-forestry (2.4)	2			11	
Department of Agriculture, Food and the Marine (DAFM)	Land Parcel Identification System (LPIS)	Permanent crops		Permanent Cropland (2.3)	3			12	
None	-	-	This ecosystem does not occur in Ireland	Rice Fields (2.2)	4			13	
Department of Agriculture, Food and the Marine (DAFM)	Land Parcel Identification System (LPIS)	Annual crops		Annual Cropland (2.1)	5			14	
Copernicus Land Monitoring Service (CLMS)	HRL-VLCC Crop type	Annual crops							
Department of Agriculture, Food and the Marine (DAFM)	Private forests	Forests with 75% or more canopy coverage of non-native conifer		Plantations (4.6)	1	Forest & Woodland (4)	4	15	
Coillte	Forest estate	Forests with 75% or more canopy coverage of non-native conifer							
Department of Agriculture, Food and the Marine (DAFM)	Private forests	Temporarily unstocked forest sites		Transitional Forest & Woodland Shrub (4.5)	2			16	
Coillte	Forest estate	Temporarily unstocked forest sites							
Department of Agriculture, Food and the Marine (DAFM)	Private forests	Forests where neither broadleaved deciduous nor conifer trees have a canopy cover of 75% or more		Mixed Forests (4.4)	3			17	
Coillte	Forest estate	Forests where neither broadleaved deciduous nor conifer trees have a canopy cover of 75% or more							

None	-	-	This ecosystem does not occur in Ireland	Broadleaved Evergreen Forest (4.3)	4			18
Department of Agriculture, Food and the Marine (DAFM)	Private forests	Forests with 75% or more canopy coverage of Scots pine (<i>Pinus sylvestris</i> (L.))		Coniferous Forest (4.2)	5			19
Coillte	Forest estate	Forests with 75% or more canopy coverage of Scots pine (<i>Pinus sylvestris</i> (L.))						
Department of Agriculture, Food and the Marine (DAFM)	Private forests	Forests with 75% or more canopy coverage of broadleaved deciduous species native to Europe		Broadleaved Deciduous Forest (4.1)	6			20
Coillte	Forest estate	Forests with 75% or more canopy coverage of broadleaved deciduous species native to Europe						
None	-	-	This ecosystem does not occur in Ireland	Sclerophyllous Vegetation (5.3)	1	Heathland & Shrub (5)	5	21
Tailte Éireann	National Land Cover Map (NLCM)	Heath and bracken		Scrub & Heathland (5.2)	2			22
None	-	-	This ecosystem does not occur in Ireland	Tundra (5.1)	3			23
Tailte Éireann	National Land Cover Map (NLCM)	Peatland	Updated based on random forest classification of Sentinel-2 satellite imagery for the account reference year	Mires, Bogs & Fens (7.2)	1	Inland Wetlands (7)	6	24
Tailte Éireann	National Land Cover Map (NLCM)	Swamp		Inland Marshes & Other Wetlands on Mineral Soil (7.1)	2			25
None	-	-	This ecosystem does not occur in Ireland	Ice Sheets, Glaciers & Perennial Snowfields (6.3)	1	Sparsely Vegetated Ecosystems (6)	7	26
NPWS	Site Specific Conservation Objectives (SSCO)	Scree, rock and limestone habitats	Inland from 1,000 m from high water mark	Bare Rocks (6.1)	2			27
Tailte Éireann	National Land Cover Map (NLCM)	Exposed rock and sediments	Inland from 1,000 m from high water mark					
Tailte Éireann	PRIME 2 exposed layer	Cliff, rock, outcrop, scree and shingle	Inland from 1,000 m from high water mark					
NPWS	Article 17 Grasslands	Calaminarian grassland, Orchid-rich calcareous grassland, Species-rich Nardus upland grassland, Molinia meadows, Hydrophilous tall herb, Lowland hay meadows	Included if no ploughing in preceding six years and no mowing more than once in reference year	Natural & Semi-Natural Grasslands (3.2)	1	Grassland (3)	8	28
Copernicus Land Monitoring Service (CLMS)	CORINE Land Cover	Classes 243 and 321	Included if no ploughing in preceding six years and no mowing more than once in reference year					
Department of Agriculture, Food and the Marine (DAFM)	Land Parcel Identification System (LPIS)	Agricultural grassland		Sown Pastures & Other Grass (3.1)	2			29
Department of Agriculture,	Licensed Aquaculture Sites	Sites excluding T09-078-1, T10-028B, T10-028A and any with the license type "Fisherv Order"		Anthropogenic Structures & Modified Ecosystems (10.4)	1	Marine Inlets & Transitional Waters (10)	9	30

Food and the Marine (DAFM)								
European Commission	European Marine Observation and Data Network (EMODnet)	Seagrass habitats	Excluding areas outside terrestrial-transitional ecosystem accounting area (EAA)	Macrophyte Communities & Biogenic Reefs (10.1)	2			31
European Commission	European Marine Observation and Data Network (EMODnet)	Macroalgae habitats	Excluding areas outside terrestrial-transitional ecosystem accounting area (EAA)					
European Commission	European Marine Observation and Data Network (EMODnet)	Biogenic substrates	Excluding areas outside terrestrial-transitional ecosystem accounting area (EAA)					
Environmental Protection Agency (EPA)	WFD transitional waters	All transitional waters		Transitional Waters (10.2)	3			32
NPWS	Site Specific Conservation Objectives (SSCO)	Tidal mudflats and sandflats	Excluding areas outside terrestrial-transitional ecosystem accounting area (EAA)	Intertidal Areas (10.3)	4			33
INFOMAR	IE GSI MI Seabed Sediment Classification Irish Waters	Non-biogenic seabed substrate	Excluding areas outside terrestrial-transitional ecosystem accounting area (EAA)					
Tailte Éireann	PRIME 2 water layer	Canals, ditches and drains		Canals, Ditches & Drains (8.2)	1	Rivers & Canals (8)	10	34
Tailte Éireann	PRIME 2 water layer	Rivers and streams		Rivers & Streams (8.1)	2			35
None	-	-	This ecosystem does not occur in Ireland	Geothermal Pools & Wetlands (Iceland) (9.3)	1	Lakes & Reservoirs (9)	11	36
Tailte Éireann	PRIME 2 water layer	Reservoirs		Artificial Reservoirs (9.2)	2			37
Tailte Éireann	PRIME 2 water layer	Lakes and ponds		Lakes & Ponds (9.1)	3			38
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 2 woody needle leaved trees		Plantations (4.6)	1	Forest & Woodland (4)	12	39
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 3 woody broadleaved deciduous trees		Broadleaved Deciduous Forest (4.1)	1			
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 5 low-growing woody plants		Scrub & Heathland (5.2)	1	Heathland & Shrub (5)		
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 6 permanent herbaceous		Sown Pastures & Other Grass (3.1)	1	Grassland (3)		
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 7 periodically herbaceous		Annual Cropland (2.1)	1	Cropland (2)		
Copernicus Land	CLCplus Backbone	Class 9 non and sparsely vegetated	Inland from 1,000 m from high water mark	Semi-Desert, Desert & Other Sparsely Vegetated Areas (6.2)	1	Sparsely Vegetated Ecosystems (6)		

Monitoring Service (CLMS)								
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 9 non and sparsely vegetated	Within 1,000 m from high water mark	Rocky, Boulder & Coarse Sediment Shores (11.2)	1	Coastal Beaches, Dunes & Wetlands (11)		
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 10 water	Inland from 1,000 m from high water mark	Lakes & Ponds (9.1)	1	Lakes & Reservoirs (9)		
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 10 water	Within 1,000 m from high water mark	Intertidal Areas (10.3)	1	Marine Inlets & Transitional Waters (10)		
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 253 coastal seawater buffer	Inland from 1,000 m from high water mark	Lakes & Ponds (9.1)	1	Lakes & Reservoirs (9)		
Copernicus Land Monitoring Service (CLMS)	CLCplus Backbone	Class 253 coastal seawater buffer	Within 1,000 m from high water mark	Intertidal Areas (10.3)	1	Marine Inlets & Transitional Waters (10)		
Central Statistics Office (CSO)	Ecosystem accounting area (EAA)	Terrestrial-transitional ecosystem accounting area (EAA)	Residual pixels not covered by any of above data during aggregation from 10 m to 100 m resolution	Intertidal Areas (10.3)	1	Marine Inlets & Transitional Waters (10)	13	40

3 Ecosystem classification and mapping

3.1 Data preparation

Several pre-processing steps were necessary to compile and merge the wide range of different source data used to produce the final ecosystem extent maps. Firstly, CLCplus Backbone – the base land cover map onto which all other data were layered – was clipped to the terrestrial-transitional EAA. Then, all other source data were formatted to ensure compatibility with CLCplus Backbone. This primarily related to all national data, and included two main steps:

1. The national data were generally all structured (or ‘projected’) to an Irish-specific coordinate reference system ([CRS](#)). Typically, this was the Irish Transverse Mercator (ITM)/ [EPSG:2157](#). By contrast, the EU data (including CLCplus Backbone) are projected to the European LAEA projection/ [EPSG:3035](#). The national data were re-projected to EPSG:3035, which is an equal-area projection making it better suited to statistical mapping for cross-continental comparison.
2. The national data were all [vector](#) based, meaning they detailed the exact dimensions of real world features such as fields, forests and rivers. These data appear as polygons when mapped and are created using multiple points connected by lines. The EU data sources are instead produced as [raster](#) images. A raster image is a grid of cells (all the same size) containing values, which in this case correspond to labels (e.g. different types of crops or land cover). It is worth noting that this type of data is inherently less accurate – as real-world features are rarely perfectly square – but it is a more straight-forward data structure and conducive for layering multiple geospatial datasets. Therefore, it was necessary to convert all national data from vector to raster format. The resolution (i.e. cell size) of the raster data (and the final compiled source map) was 10 × 10 m.

3.2 Workflow

Classification of each ecosystem type was done in an iterative manner whereby a separate map was produced for each level two ecosystem type. Each iteration can be simplified into three steps:

1. Map source data (e.g. annual crops from LPIS) – including re-projection and conversion from vector to raster format (if necessary)
2. Give level two ecosystem classification (e.g. Annual Cropland)
3. Give level one ecosystem classification (e.g. Cropland)

After classifying and mapping all level two ecosystem types for a given level one ecosystem type, all level two ecosystem type maps were then merged into a level one ecosystem type map. For example, such a map for the level one ecosystem type Cropland includes the spatial extent of its respective level two ecosystem types (for Ireland, this includes Annual Cropland, Permanent Cropland and Other Farmland). This is then repeated for the next ecosystem type (i.e. mapping of level two Grassland ecosystem types, then merging to a level one classification). After all ecosystem types were classified, each level one ecosystem type map was then merged into the final ecosystem extent map. This overall process is illustrated in Figure 1.

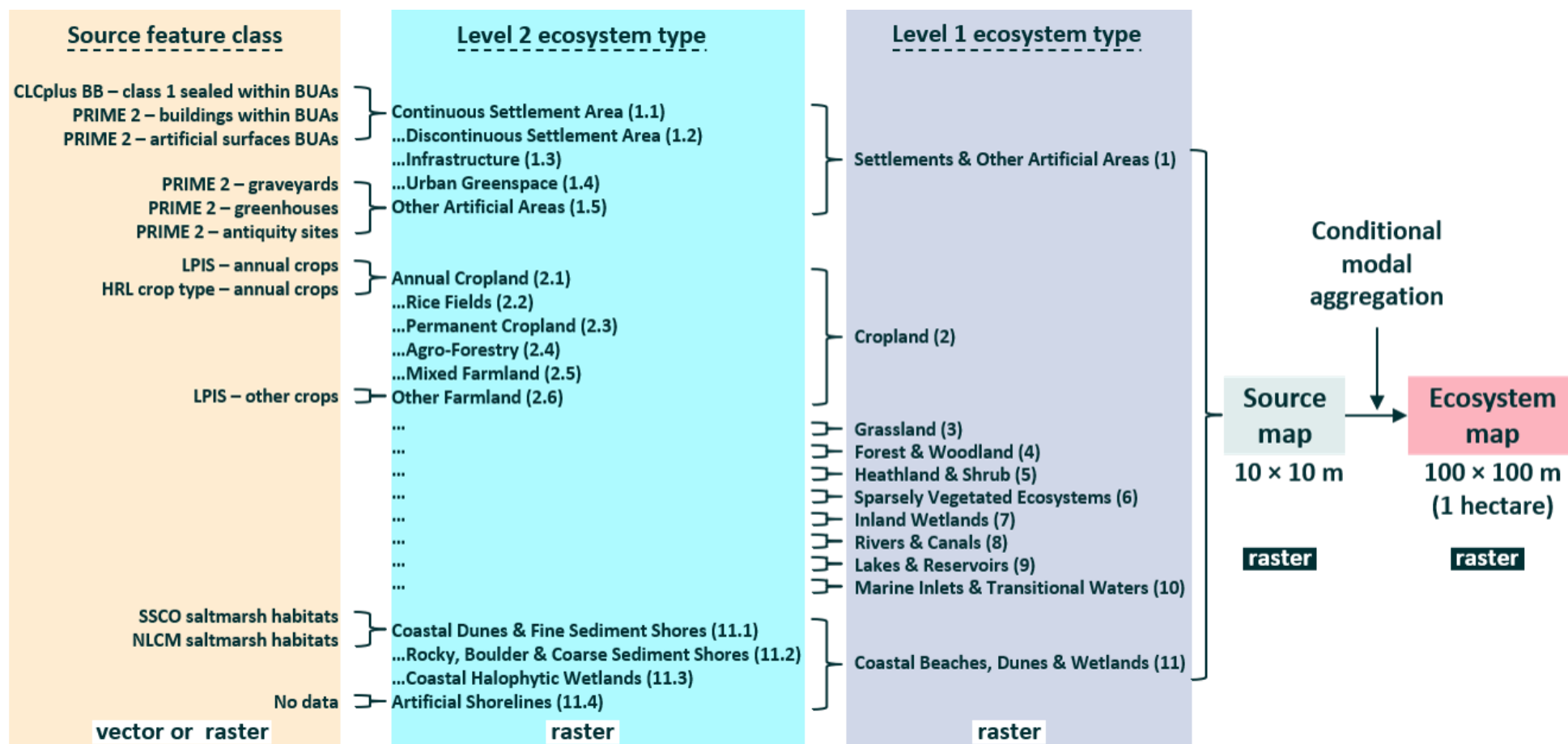


Figure 1 Overview of ecosystem classification and mapping workflow.

3.2.1 Data merging

Merging of level two (and subsequently level one) ecosystem type maps involves successive ‘layering’ of each map on top of the next. This can also be thought of as ‘gap-filling’, whereby the first map is added to a blank canvas after which the next is used to fill gaps in the previous. The final order of each ecosystem type map, as determined by the source data, is given in Table 4. The order of each map depends on three main attributes of the source data, including the year for which the data refers (i.e. data age), the degree of correspondence between the source data and the ecosystem type definition, and accuracy (i.e. expected level of error in the source data).

3.2.2 Machine learning classification of peatlands

The 2018 data source for Mires, Bogs & Fens was the ‘peatland’ feature class in the 2018 NLCM. This class includes fens, blanket bog, raised bog, cutover bog and bare peat land cover. Although the extents of these land cover types are not expected to change significantly in the medium term, expansions are the target of different national and EU policies, such as the EU Nature Restoration Regulation – this means that ecosystem extent accounts should be able to track such changes, even if they are limited or occur gradually over long periods of time. Potential changes could include conversions of agricultural land and land under forestry use back to functioning peatland (i.e. where these land cover types occur over peat soil). Whilst reductions in peatland can be observed based on new land cover datasets (e.g. CLCplus Backbone), additions to the peatland extent as mapped in the NLCM cannot be detected without repeated and targeted mapping.

3.2.2.1 Classification workflow

Although the NLCM peatland areas were mapped based on classification of ortho photography, it was assumed that Sentinel-2 satellite imagery should enable detection of any areas missed in the NLCM or new areas of peatland now exposed since the 2018 mapping (as might occur from felling of commercial forestry on drained peatland). Therefore, Sentinel-2 was used to update the extent of peatland as mapped in the 2018 NLCM – the pixel-based classification approach followed to achieve this can be summarised across the following steps:

1. Sentinel-2 Level-2A imagery was downloaded using the [OpenEO](#) API from the CDSE. For each reference year, a time composite was produced by taking the median value for each of five optical bands (B02, B03, B04, B08 and B12) across all available sub-annual imagery. This involved an initial cloud mask using the Scene Classification Layer (SCL), which is produced for every Sentinel-2 track by the Sen2Cor algorithm from the European Space Agency. Specifically, pixels classified in the SCL as shadow (class 3), clouds (class 8 and 9) and cirrus (class 10) were removed in the available Sentinel-2 imagery.
2. The final Sentinel-2 Level-2A time composite for Ireland was then clipped to the terrestrial-transitional EEA before transforming each pixel using a Gaussian blur smoothing function. This converted each pixel to the weighted sum of its neighbouring pixels in a 3 × 3 pixel moving window (i.e. a Gaussian weight matrix), thereby ‘smoothing out’ outlier pixel values (i.e. residual bright and dark pixels).
3. Derived indexes were added to the transformed Sentinel-2 feature stack. These included NDVI, normalised difference water index (NDWI) and a homogeneity texture layer using a 32-level grey level cooccurrence matrix (GLCM) generated from the smoothed Sentinel-2 B08.

4. Addition of Eurostat's digital elevation model (DEM) to the transformed Sentinel-2 feature stack.
5. A training sample of 4,000 randomly selected points per level one NLCM class (including the peatland class) was generated and used to train a multiclass random forest classification model. Note, prior to sample generation the NLCM was updated using the data sources below to minimise false training samples:
 - a. CLCplus Backbone (used to update for sealed surfaces, such as wind turbine infrastructure on peatland; also used to update for regenerating woodland scrub on drained peatland).
 - b. LPIS (used to control for changes into Cropland)
 - c. DAFM private forests and Coillte forest estate (used to control for any new forestry establishment on peatland)
6. Spatial cross validation of the random forest model. This was done using the R package blockCV to test model accuracy across $k = 5$ different spatial folds between training (75%) and testing (25%) splits of the total sample.
7. Hyperparameter tuning was done simultaneously, focusing on the number of variables considered in each split across each of 500 decision trees – this was tuned across two to nine variables. The final model for 2018, 2021 and 2024 is described in Table A1 in [appendices](#) of this document. Feature class importance for each model is also given in Figure A1 (appendices).
8. Application of validated random forest model to full Sentinel-2 Level-2A feature stack.
9. Post-processing of classified multi-class land cover map. These steps – the effects of which are given in Table A2 of this document's appendices – included:
 - a. Classification of binary 'peatland' versus 'non-peatland' map (i.e. aggregation of non-peatland classes into a single class).
 - b. Mask out predicted peatland pixels where they occur on non-peat soil, as mapped in the Irish Peat Soils Map (IPSM; [2024 Gilet et al., Geoderma, 44, 116933](#)).
 - c. Removal of predicted peatland pixels with <65% classification probability.
 - d. Add back areas of peatland from the NLCM.
 - e. Remove peatland areas smaller than 0.1 hectare.
 - f. Mask out areas which were mapped as heath and bracken in the NLCM.
 - g. Mask out areas which were mapped as wet grassland in the NLCM.
 - h. Mask out areas which were mapped as dry grassland in the NLCM.
 - i. Mask out areas which were mapped as improved grassland in the NLCM.

3.2.2.2 Validation of post-processed peatland map

The final peatland map for 2024 was subjected to a manual validation of classification accuracy. This validation was performed by CSO Ecosystem Accounts staff and involved sample labelling against the data layers which are listed in [section 4.2](#) of this document. The sample was an equal probability selection of 1,000 points from peatland (as mapped in the NLCM) and non-peatland (non-peatland on peat soil, as evidenced by the IPSM) locations. Each point was labelled twice by separate validators. The results of this validation are given in Table A3 in the appendices of this document.

3.2.3 Residual land cover

Roughly 9% of terrestrial-transitional EAA was not covered by national and pan-EU land cover products. These 'residual' areas were therefore based on the base land cover – CLCplus Backbone (Table 4). Just over 600 hectares (~0.01%) of the terrestrial-transitional EAA was not

covered by CLCplus Backbone. These were areas located between the outer extent of CLCplus Backbone and the LWM. Such areas were classified as Intertidal Areas (Table 4).

3.2.4 Spatial aggregation

The resolution of the final compiled maps was 10×10 m. To better account for the scale at which ecosystems occur, it was necessary to spatially aggregate to a resolution of 100×100 m (1 hectare). The rationale for this may be better understood with the below examples.

1. Linear features such as treelines are represented in the CLCplus Backbone land cover data at 10×10 m. However, it would be incorrect to classify these as the Forest & Woodland ecosystem type – instead, treelines should be considered as part of the broader ecosystem context (e.g. Cropland or Grassland). Aggregation to 1 hectare controls against such classifications, thereby reducing error.
2. Small bodies of water, which could be as small as 10 m^2 , would be incorrectly classified as the Lakes & Ponds ecosystem type. However, as with small linear features, such small landscape features which are observable as areal phenomena should also be considered as part of the broader ecosystem type. For example, a small pond in the corner of a field of pasture or on a large area of blanket bog should be considered part of Grassland or Inland Wetlands ecosystem types, respectively.



Figure 2 Spatial aggregation from 10×10 m compiled map to final 1-hectare ecosystem extent map.

3. Small regional and rural roads should generally also be classified as part of the wider ecosystem landscape. These roads are mapped from PRIME 2 at 10 m resolution. However, spatial aggregation to 1 hectare means that only large areas of road (e.g. motorways and intersections) with widths of 50 m or more (including associated vegetation) are represented in the final ecosystem map (classified as the Infrastructure ecosystem type). The effect of aggregating to one hectare is illustrated in Figure 2.

3.2.4.1 Conditional modal aggregation

Spatial aggregation to 100 m resolution followed a conditional modal rule, which meant that the final ecosystem classification was based on the below two criteria:

1. The ecosystem type at 1-hectare resolution corresponds to the most common ecosystem type within the same 1-hectare grid at 10 m resolution. Where two ecosystem types are equally frequent, the label assigned is that of the first encountered value – this can be regarded as random.
2. For the level two ecosystem type label to be assigned to the 1-hectare pixel, its corresponding level one ecosystem type must also be the most common ecosystem type within the 1-hectare area. The rationale of this step – which is illustrated in Figure 3 – is best explained with an example: a 1-hectare pixel may have 40% (i.e. 40 out of 100 10m pixels) which are Annual Cropland. The rest of the area is covered by Discontinuous Settlement Areas (36%) and Infrastructure (24%). Modal aggregation to 100 m resolution would result in the entire 1-hectare pixel being classified as the level two ecosystem type Annual Cropland, and Cropland when thematically aggregating to level one. However, this would be incorrect given that Settlements & Other Artificial Areas holds a 60% majority when combining the pixel share of Discontinuous Settlement Area and Infrastructure. Therefore, the correct approach is a conditional spatial aggregation, in which the final level two classification is dependent on its corresponding level two ecosystem type also being the majority ecosystem type when directly aggregating from a level one 10 × 10 m ecosystem extent map. In the above scenario, the level two classification should therefore be ET1.2 Discontinuous Settlement Area. It should be noted that this approach was not followed in the release [Ecosystem Extent Accounts 2021](#) and explains the considerably larger extent estimate for Settlements & Other Artificial Areas for the 2024 version of the release.

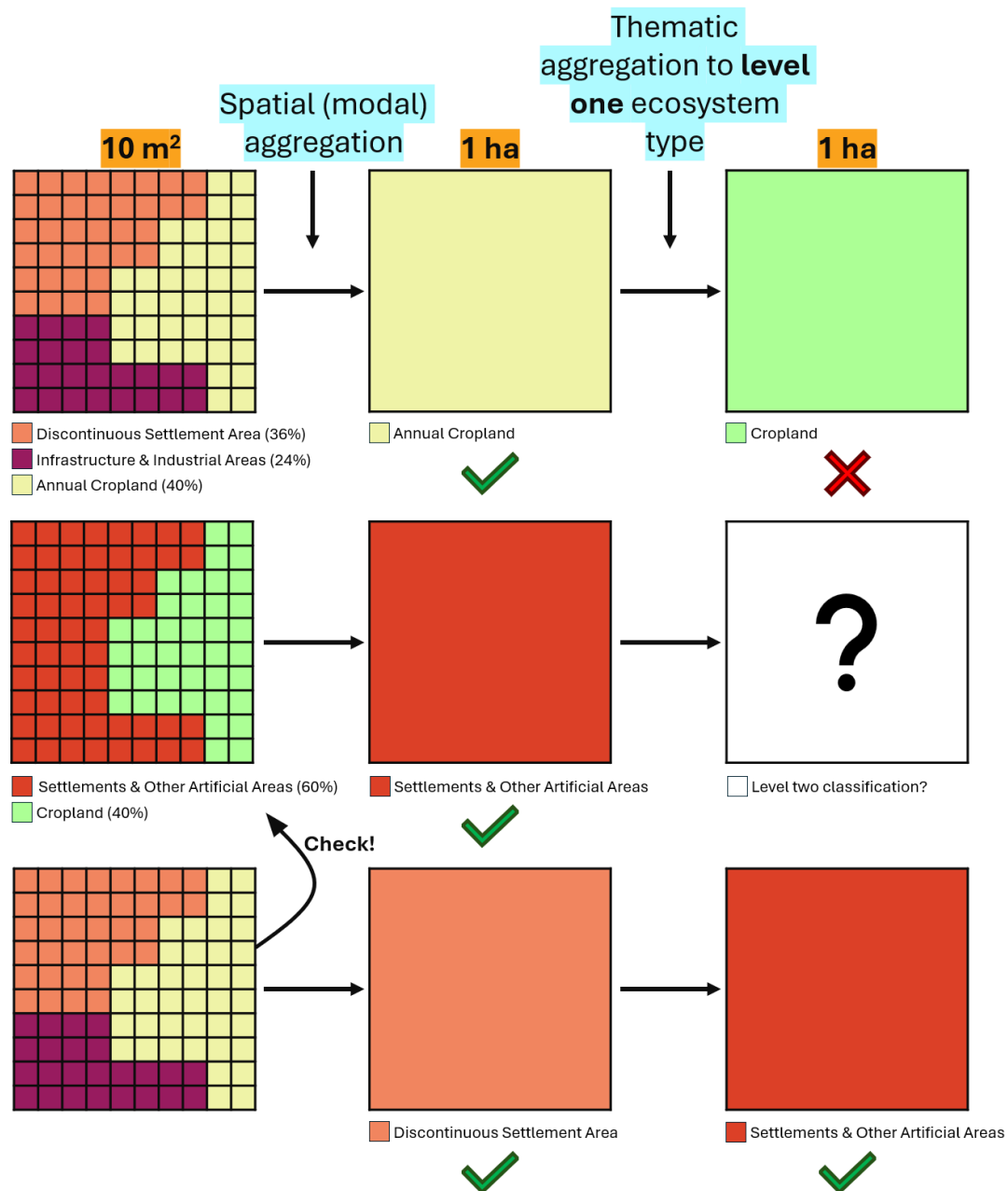


Figure 3 Illustration of the rationale for conditional spatial aggregation.

3.2.5 Complex ecosystem types

3.2.5.1 Urban Greenspace

This ecosystem type is defined as 'areas with vegetation within or partly embraced by urban fabric'. It is further described as 'green urban areas' with 'recreational or ornamental character' and may include 'small urban water bodies'. It also includes sports facilities (e.g. GAA pitches and golf courses) which occur within or outside of built-up urban environments. Classification of this ecosystem can be split into two parts:

- 1) Classification of urban green: This includes all relevant 'green' land cover classes from CLCplus Backbone (as indicated in Table 3) occurring within BUAs. However, such land cover was excluded if it was within a LPIS land parcel, as this would suggest agricultural

land use – meaning it should be mapped as Cropland or Sown Pastures & Other Grass. For example, some areas of land were described as permanent pasture in LPIS, indicating agricultural usage. This land was therefore classified as Sown Pastures & Other Grass instead of Urban Greenspace. In addition to the above, sports fields and field allotments as mapped in PRIME 2 were also classified as Urban Greenspace, regardless of occurrence within a BUA.

- 2) Classification of urban blue: Eurostat defines ‘urban blue’ as ‘lakes or substantial ponds in urban parks, or other water bodies in settlements areas’. It is recommended that it should be classified as Urban Greenspace if it is adjacent to urban green (as defined above) *and* is smaller than the MMU (i.e. 1 ha). If nonadjacent to urban green and smaller than the MMU, then it is not mapped, whereas if nonadjacent and larger than the MMU, then it is mapped and classified as the level two ecosystem type ‘Lakes & Ponds’. This was the approach taken here, with lakes and ponds being those labelled as such in PRIME 2.

3.2.6 Small and improbable conversions

As outlined in the ecosystem accounts [handbook](#), negligible and implausible ecosystem conversions between accounting periods should not be recorded in the final ecosystem extent accounts. Eurostat guidance recommends the following:

1. To disregard implausible conversions between ecosystem types. For example, it is considered implausible for Marine Inlets & Transitional Waters to convert into Inland Wetlands. For all conversions considered implausible by Eurostat, please consult Table 2.3 in the ecosystem accounts [handbook](#).
2. To disregard ecosystem asset changes which are smaller than minimum change thresholds. Thresholds were defined per level two ecosystem type and are listed in Table 5. Note, a threshold of one hectare is the same as no threshold.
3. To disregard conversions between ecosystems which are smaller than 100 hectares.

Implementation of these thresholds requires that the ecosystem extent maps be adjusted with respect to the opening extent map. Therefore, pixels in the 2021 map were adjusted relative to the 2018 map (which is therefore treated as the base extent map), whereas the 2024 map was adjusted relative to the adjusted 2021 map. Adjustment means resetting pixels which violate the above conversion thresholds.

Table 5 Ecosystem asset conversion thresholds below which conversions were not recorded.

Ecosystem type (level two)	Ecosystem asset conversion threshold (hectares)
Continuous Settlement Area (1.1)	1
Discontinuous Settlement Area (1.2)	1
Infrastructure & Industrial Areas (1.3)	1
Urban Greenspace (1.4)	1
Other Artificial Areas (1.5)	1
Annual Cropland (2.1)	1
Rice Fields (2.2)	1
Permanent Cropland (2.3)	1
Agro-forestry (2.4)	1

Mixed Farmland (2.5)	1
Other Farmland (2.6)	1
Sown Pastures & Other Grass (3.1)	1
Natural & Semi-Natural Grasslands (3.2)	1
Broadleaved Deciduous Forest (4.1)	1
Coniferous Forest (4.2)	1
Broadleaved Evergreen Forest (4.3)	1
Mixed Forests (4.4)	1
Transitional Forest & Woodland Shrub (4.5)	1
Plantations (4.6)	1
Tundra (5.1)	5
Scrub & Heathland (5.2)	1
Sclerophyllous Vegetation (5.3)	5
Bare Rock (6.1)	5
Semi-Desert, Desert & Other Sparsely Vegetated Areas (6.2)	5
Ice Sheets, Glaciers & Perennial Snowfields (6.3)	5
Inland Marshes & Other Wetlands on Mineral Soil (7.1)	1
Mires, Bogs & Fens (7.2)	1
Rivers & Streams (8.1)	5
Canals, Ditches & Drains (8.2)	1
Lakes & Ponds (9.1)	5
Artificial Reservoirs (9.2)	5
Geothermal Pools & Wetlands (Iceland) (9.3)	5
Macrophyte communities and biogenic reefs (10.1)	5
Transitional waters (10.2)	5
Intertidal Areas (10.3)	5
Anthropogenic Structures & Modified Ecosystems (10.4)	1
Coastal Dunes & Fine Sediment Shores (11.1)	5
Rocky, Boulder & Coarse Sediment Shores (11.2)	5
Coastal Halophytic Wetlands (11.3)	5
Artificial Shorelines (11.4)	5

4 Classification accuracy

As outlined in section 2.63 of the ecosystem accounts [handbook](#), ecosystem extent mapping accuracy ‘should be examined and recorded in the metadata’. The suggested approach is that which is recommended in Venter et al. (2024) – “*Uncertainty audit’ for ecosystem accounting: Satellite-based ecosystem extent is biased without design-based area estimation and accuracy assessment*”. This study outlined an approach for producing unbiased ecosystem extent account estimates using a confusion matrix from a validated random sample. Although unbiased extent estimates are not provided in the extent accounts, the same approach was still used to generate a stratified random sample for a confusion matrix analysis to measure classification accuracy. Note, classification accuracy was assessed for the 2024 ecosystem extent map and at level one of the EU ecosystem typology only (excluding Marine ecosystems).

4.1 How was the sample created?

A random probability sample was drawn from the classified ecosystem extent map, based on a total sample size which is determined based on a desired level of precision. This was done as follows:

1. Variance in total ecosystem area was first modelled using the binomial variance formula:

$$S_i = \sqrt{U_i(1 - U_i)}$$

Here, S and U are the standard deviation and user's accuracy for ecosystem i . User's accuracy is the proportion of correctly classified areas (1 hectare grid cells) of ecosystem i . Here, a moderate U of 0.8 for all ecosystems was selected.

2. Cochran's formula was then used to determine the ideal sample size (n):

$$n = \frac{(\sum W_i \cdot S_i)^2}{S_o^2}$$

Here, W is the area weight for ecosystem i . This is determined directly from the pixel counts in the compiled ecosystem extent map. S_o is the standard error for overall accuracy. An overall standard error of 0.01 (i.e. 1%) was assigned. A smaller standard error would require a larger sample size and *vice versa*. With the above, an ideal sample size of 1,600 was predicted, which were distributed proportionally based the ecosystem weights. A minimum sample size of 50 was also assumed to ensure rare ecosystem types (i.e. Rivers and Canals) were not underrepresented in the validation.

4.2 How was the sample labelled?

The sample was split between five separate validators (CSO Ecosystem Accounts staff members), each of whom were asked to indicate whether they agreed with the sample's classification in the compiled ecosystem extent map. The validation environment is shown in Figure 4. Validators were provided with several map layers to assist in validation. These included:

- High-resolution satellite imagery from Esri™ for the 2024 reference year.
- The 10 × 10 m resolution ecosystem extent map (also referred to as 'source land cover')
- NDVI difference layer – this depicts (at 10 × 10 m resolution) the difference in NDVI between winter and summer periods, which can assist in distinguishing between Heathland & Bracken (high NDVI difference due to 'greening up' during summer months) and Mires, Bogs & Fens (limited greening up in summer months).
- The 2018 NLCM
- OpenStreetMap
- The most recent publicly available Google Satellite imagery
- LPIS for 2024 – mainly used to verify temporary grassland classifications
- Sentinel-2 true colour time composite imagery for the 2024 reference year

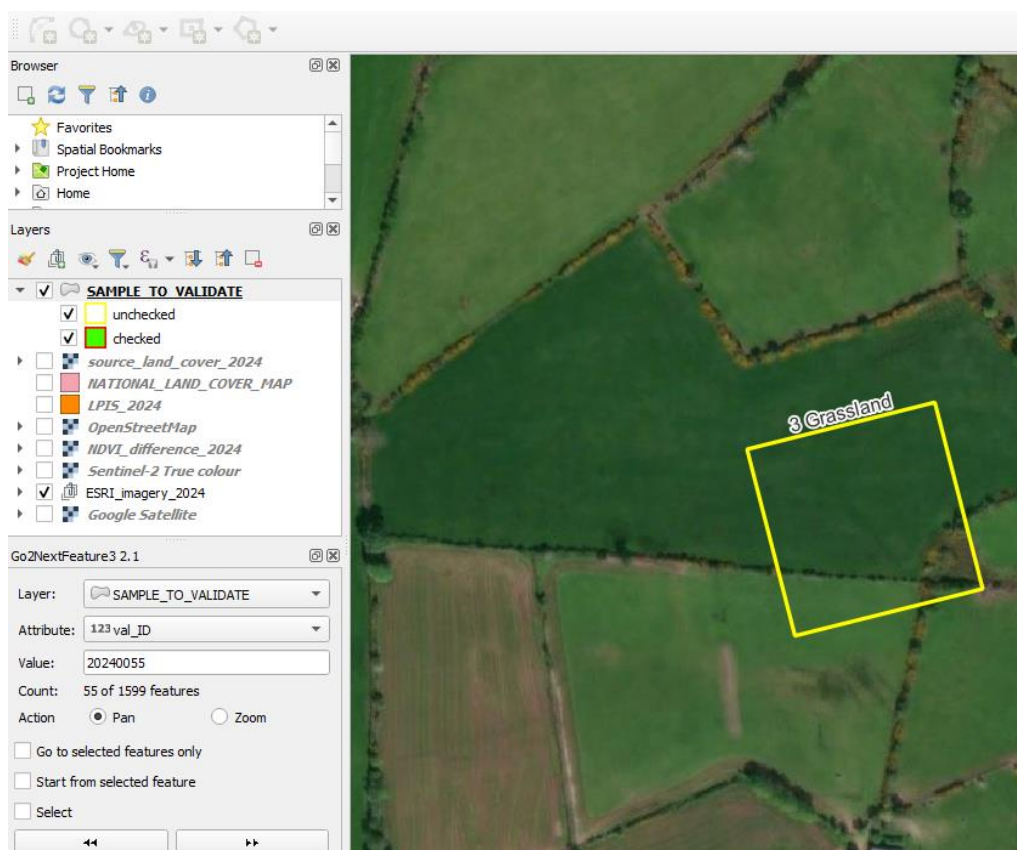


Figure 4 Validation environment in QGIS used to manually validate a stratified random sample from the 2024 ecosystem extent map.

4.3 Sources of error

The final accuracy statistics are provided in the [Background Notes](#) of the Ecosystem Extent Accounts 2024 release, wherein accuracy statistics are given for ecosystem types one to 11. Overall accuracy – expressed as Cohen’s kappa – was 0.96. Note, this statistic adjusts for the agreement between validation points and the classification map that would occur by chance. Accuracy may therefore be considered high but not perfect. Error in this case primarily comes from the source data used to classify and map each ecosystem. Sources of error from the principal data sources are given below.

4.3.1 National Land Cover Map (NLCM)

The NLCM was a key data source used for ecosystem classification. However, it comes with overall kappa estimates of 0.862 and 0.774 for its level one and two land cover classes, respectively (see NLCM report [here](#)). Therefore, this error would have transferred to the final ecosystem extent maps where NLCM feature classes were used. This error may also increase over time, as the NLCM is currently a once-off product produced for the 2018 reference period. Note however, the classification hierarchy in Table 4 is optimised to avoid prioritising older data sources. As noted, the NLCM peatland class was also updated based on random forest classification of Sentinel-2 satellite data to enable identification of new or unmapped peatland areas.

4.3.2 CLCplus Backbone

Overall accuracies ('plausibility validation approach') reported at EEA38 level for 2018, 2021 and 2023 CLCplus Backbone versions were 0.852, 0.853 and 0.886, respectively. Although these are high, CLCplus Backbone raster products are relatively new and have not yet been subject to a rigorous external and independent validation process against other statistics. Moreover, the 2023 version of this dataset was used as the base land cover for the 2024 ecosystem extent map (there is no 2026 version). Therefore, where ecosystems are classified using CLCplus Backbone in 2024, they may be out of date. An example of this is the Lysaghtstown solar farm in Co. Cork, which was constructed in 2024. The location of this installation is classified in the 2024 ecosystem extent map as Cropland based on CLCplus Backbone, whereas it should have been mapped as a Settlements & Other Artificial Areas ecosystem asset.

4.3.2.1 Issue with CLCplus Backbone woody classes

CLCplus Backbone classes 2 (woody needle leaved trees) and 3 (woody broadleaved deciduous trees) are overrepresented in 2018 compared to 2021 and 2023. In 2018, they made up 13.8% of CLCplus Backbone land cover, compared to 12.7% and 12.6% for 2021 and 2023, respectively. Residual areas of these classes (i.e. areas not covered by national level data) were classified as Forest & Woodland, resulting in a likely overestimation of Forest & Woodland for 2018. Technical feedback on this issue was provided to the CSO by the CLMS following a request made from Eurostat and the European Environmental Agency (EEA). The feedback outlined that these discrepancies are a consequence of uncertainty in class assignment of small linear formations of these classes. This would include treelines, for which canopy size was more often overestimated in the 2018 iteration. However, it was explained that this was due to a methodological update between 2018 and subsequent iterations. These updates should carry through to future iterations, meaning improved comparability for these classes.

4.3.3 PRIME 2

Although spatially very accurate, PRIME 2 features may not always be updated in or close to real time. This means that spatial objects which may inherently be less permanent (e.g. extraction sites) could be spatially delineated in the data several years after they change in real life. For example, one functional PRIME 2 class initially considered as relevant for classification of the level two ecosystem type Infrastructure was 'area under construction'. However, of the 2,398 polygons of this class in the 2021 version of PRIME 2, 1,214 were recorded as being last updated in 2012. However, overall, it is not expected that this type of error is common, as most PRIME 2 classes used for these accounts should not be so transient in nature. Another source of error from PRIME 2 includes areas classed as gardens. When removal of these from PRIME 2 is not timely – particularly in rural settings – some areas of Croplands or Grasslands can be misclassified as Settlements & Other Artificial Areas. In this scenario, a landowner may give over an area of garden for agricultural use. However, this land use change may not be reflected in PRIME 2 until many years later. Generally, these types of conversions are also not expected to be common.

4.3.4 LPIS

Errors in this data include the following:

- Temporary grassland: as a rule, newly sown fields of grass in LPIS are considered as temporary grassland until the sixth year after resowing, at which point they become permanent grassland. However, some field parcels are expected to not follow this rule, such that a field of crops or resown grass could become permanent grassland earlier than

expected. This can be due to changes in parcel ownership or for other undetermined reasons and may affect around 10,000 hectares in any one year.

- LPIS may not capture areas of Cropland or Grassland where growers are not claiming area-based payments. This error should also be minimal however, as the other data sources used for these ecosystem types (e.g. CLCplus Backbone or the HRL-VLCC Crop type data) are derived from earth observation and are consequently less biased.

4.3.5 CLC

The CLC classes used as evidence of occurrence of Semi-Natural and Natural Grasslands are not regarded by national experts to be particularly accurate. They are also mapped at a 25 ha MMU, meaning areas of Semi-Natural and Natural Grasslands smaller than 25 ha will not be captured. It also means that, for example, some ecosystems such as Forest & Woodland may be mapped as Semi-Natural & Natural Grasslands. This can happen where an area of woodland larger than the 1 ha MMU used for producing the ecosystem extent maps is situated in the middle of a larger area of Natural & Semi-Natural Grasslands.

5 Non-intuitive conversions between ecosystem types

These are conversions which are generally considered to be rare by Eurostat, and are outlined in the new Eurostat Ecosystem accounts [handbook](#).

5.1 Forest & Woodland to Grassland

When forests are felled, they are often reclassified as temporary unstocked forests (TUF) and are classified as the ecosystem Transitional Forest & Woodland Shrub. However, sometimes such areas are excised (e.g. sold) and removed from the forest inventory. The land can then be subject to a land use change. This may include a change to agricultural use, in which case the land may be managed as grassland pasture. Additionally, when areas of woodland outside of administrative databases are felled, it is possible that they may also convert to grassland over time.

5.2 Settlements & Other Artificial Areas to Forest & Woodland

These conversions generally correspond to pixel based noise resulting from changes between CLCplus Backbone class 1 (sealed) and woody class pixels corresponding to broadleaved and needle-leaved trees. These are common where there are forest edges or treelines which ‘bleed’ into adjacent land cover, such as grassland or settlement areas. In such cases, CLCplus woody classes can systematically under- or -overestimate Forest & Woodland due to how these classes are affected by phenological variation between reference periods – these conversions may therefore ultimately be attributed to different climate patterns between reference years for CLCplus Backbone. However, it cannot be ruled out that such conversions reflect tree growth resulting in gradual canopy expansion over time. The vast majority of these conversions are individual 1-hectare changes, typically where rural dwellings are situated close to woodland.

5.3 Settlements & Other Artificial Areas to Grassland

These conversions correspond to changes from Infrastructure and Urban Greenspace to Grassland. Most correspond to 1-hectare changes which generally reflect either transient changes in land use or what could be regarded as pixel-based noise. For example, where a road is being built through an agricultural grassland landscape it will have a non-vegetative ‘footprint’

either side of it during its construction stage (i.e. within the opening account year). This means it will briefly become Settlements & Other Artificial Areas (i.e. Infrastructure) and then become Grassland (i.e. Sown Pastures & Other Grass) again in the closing account year. These conversions often reflect construction activity outside of built-up urban areas. However, they can also occur due to shifts in the sub-1-hectare proportions of different ecosystems. For example, in the opening account year a 1-hectare pixel can be occupied by 40% Settlements & Other Artificial Areas (e.g. a rural dwelling), 30% Grassland (e.g. pasture) and 30% Forest & Woodland. In the closing account year, the Forest & Woodland component may reduce to 10% due to removal of woodland scrub to establish more grassland pasture, resulting in an increase from 30% to 50% of Grassland. In the opening account year, spatial aggregation will result in a classification of Settlements & Other Artificial Areas. However, in the closing account year, Grassland will be the majority, resulting in a classification change from Settlements & Other Artificial Areas to Grassland. Finally, there are also a small number of outdated amenity grassland geometries which are subject to *ad hoc* removal across PRIME 2 iterations. When these happen, they tend to be recorded as conversions from Urban Greenspace to Sown Pastures & Other Grass.

5.4 Settlements & Other Artificial Areas to Cropland

These conversions are generally explained by the same reasons as outlined for conversions into Grassland.

5.5 Cropland to Heathland & Shrub

This can occur where agricultural land which is claimed for arable use (e.g. fallow or wild bird cover) leaves agricultural use (i.e. exits LPIS) and is classified as Heathland & Shrub based on CLCplus Backbone class 5 (low-growing woody plants).

5.6 Grassland to Heathland & Shrub

These occur where areas of rough pasture transition into areas of low-growing scrubby vegetation, which are mainly classified from the CLCplus Backbone class 5 (low-growing woody plants). They are partly also explained by pixel based noise arising from shifts in ecosystem proportions at the 1-hectare level, as described above.

5.7 Forest & Woodland to Settlements & Other Artificial Areas

This can occur when areas of woodland are incorporated as part of new industrial, commercial areas or residential areas. For example, Center Parcs in Co. Longford is located on a former Plantation (forestry) site and was constructed within the change period for these accounts. It can also include instances where new settlement areas are built and interspersed with pre-existing small patches of woodland (i.e. where, for example, patches of mature trees are not removed during development).

5.8 Forest & Woodland to Heathland & Shrub

These conversions can occur where small areas of woodland or forestry are felled, giving way to regeneration of shrubby vegetation. They may be partly also driven by pixel based noise in areas where heathland and rough pasture cooccur within the landscape.

5.9 Sparsely Vegetated Areas to Grassland

This corresponds to areas which are at the threshold between sparsely vegetated and grassland. These areas are partly influenced by pixel-based noise in CLCplus Backbone.

5.10 Conversions between Inland Wetlands and other ecosystems

Other ecosystems in this case include Cropland, Grassland, Forest & Woodland and Heathland & Shrub. Conversions which are common here include those which occur between low-growing herbaceous land cover and bare/ cutover peatland (i.e. former industrial peat extraction sites). These are highly transitional peatland areas, many of which can be expected to be under varying degrees of management. This can include naturally regenerating scrub and woodland, newly planted forest which for – undetermined reasons – are not recorded in available administrative data sources, and areas of anthropogenic conversions between agricultural land (fallow, temporary grassland) and degraded peatland. Note, it also includes some conversions into Heathland & Shrub, which corresponds to areas of natural scrub regeneration on areas of degraded peatland. It can also correspond to pixel-based noise where peatland and heathland are interspersed. Given that these areas correspond to land which is in a highly transitional state – and are therefore by definition difficult to assign to one ecosystem type over another – it is recommended that these ecosystem changes be treated with caution.

6 Future work

Future work – which may result in revisions to accounts for 2018 to 2024 (see CSO's [revision policy](#)) – will focus on obtaining new and improved data sources, where available, for each ecosystem type. This will mainly include ecosystems which are classified at level two of the EU ecosystem typology, in particular those which have not yet been mapped due to a current lack of source data.

6.1 Ecosystems not mapped due to lack of source data

These include Mixed Farmland, Agro-Forestry and Artificial Shorelines. Mixed Farmland is challenging to map due to a lack of guidance on the appropriate scale at which such ecosystem assets should be classified. Agro-Forestry is an ecosystem type which may increase as a result of new policy incentives (e.g. Forestry Programme 2023-2027). Geospatial for Artificial Shorelines most likely exists within the PRIME 2 database, but it is unclear how it is classified. Future work on this ecosystem will require consultation with Tailte Éireann.

6.2 Improvements in source data

Improvements in source data mainly relate to ecosystems (e.g. Macrophyte Communities & Biogenic Reefs) which are currently classified from field survey data. They also include ecosystems for which classification methodologies may improve over time. This can include, for example, the machine learning approach used as part of this release to update the extent of peatlands. Finally, it can include ecosystems for which source data are administrative and subject to structural changes over time. This may include LPIS, but it could also include official mapping data, such as Tailte Éireann's PRIME 2 database.

7 Appendices

Table A1 Accuracy of random forest classification models for classification of peatland in Sentinel-2 Level-2A imagery.

	2018	2021	2024
Number of variables per split in RF tree	2	2	2
Mean out of bag error	0.2686	0.2843	0.3038
User's accuracy	0.7286	0.7031	0.7052
Producer's accuracy	0.7317	0.7063	0.6890
F1	0.7301	0.7047	0.6970

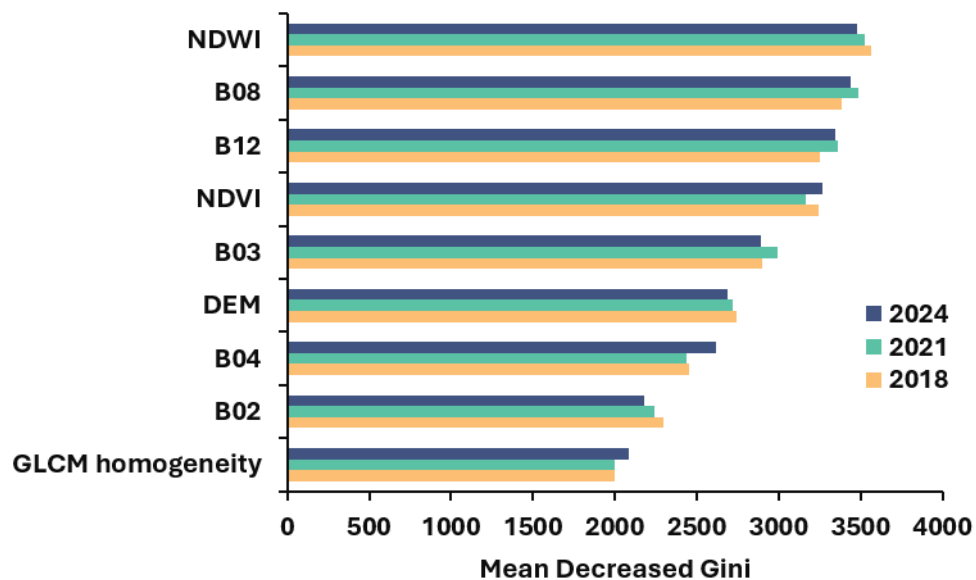


Figure A1 Feature importance of random forest peatland classification models from Sentinel-2 Level-2A imagery for 2018, 2021 and 2024.

Table A2 Effects of each post-processing step applied to areas of peatland mapped based on random forest classification of Sentinel-2 Level-2A imagery.

Post-processing step	2018	2021	2024
Raw predicted peatland area	501,999	532,730	518,477
Area masked to peat soil extent	429,510	450,735	433,379
Filter low probability pixels (<65%)	260,691	250,457	231,011
NLCM peatland areas added back	503,686	503,617	500,147
Filter small areas (<0.1 hectare)	503,686	503,617	500,147
NLCM heath and bracken added back	478,994	480,404	477,345
NLCM wet grassland added back	465,733	466,962	465,014
NLCM dry grassland added back	465,327	466,602	464,677
NLCM improved grassland added back	464,587	465,861	463,986

Table A3 Results of manual validation of peatland areas, as mapped in the National Land Cover Map (NLCM) and updated using random forest classification of Sentinel-2 Level-2A imagery for 2024.

Statistic	Value	Meaning
User's accuracy	0.887	11.3% of identified peatland pixels are not peatland
Producer's accuracy	0.938	6.2% of peatland pixels were missed
F1	0.921	Harmonic mean of precision and recall (balanced statistic)



**An
Phríomh-Oifig
Staidrimh**

Central
Statistics
Office