Waters of LIFE

Framework of Measures and Best Practice Guidelines for the Protection and Restoration of High Status River Waterbodies

Annex 2: Forestry

Tables of Measures for Mitigating Impacts from Significant Issues arising from Forestry Activities in Catchment Areas where the Objective is Restoration

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An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
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1 Introduction

The Waters of LIFE is a European Union funded Life Integrated Project which aims to help reverse the loss of Ireland's most pristine rivers. The ongoing loss of high-status waters is a worrying trend for water quality in Ireland. The protection and restoration of these waters is one of the key underpinning principles of the EU Water Framework Directive.

The project aims to develop, test and validate effective catchment management measures to reverse this declining trend. Six project catchments have been selected, five demonstration catchments and one control catchment. These are:

- Avonmore, Co. Wicklow - https://www.watersoflife.ie/catchments/avonmore/
- Awbeg (Kilbrin), Co. Cork - https://www.watersoflife.ie/catchments/awbeg_kilbrin/
- Graney, Co. Clare - https://www.watersoflife.ie/catchments/graney/
- Islands, Co. Roscommon / Co. Galway - https://www.watersoflife.ie/catchments/islands/
- Sheen, Co. Kerry (Control Catchment) - https://www.watersoflife.ie/catchments/sheen/
- Shournagh, Co. Cork - https://www.watersoflife.ie/catchments/shournagh/

The measures in this document were identified in the context of mitigating the issues related to forestry pressures acting on high status objective river waterbodies in general and the demonstration catchments in particular. However, these measures are equally applicable to river waterbodies which have been assigned a good status objective under the river basin management plan.

The Waters of Life "Framework of Best Practice Measures and Guidelines for the Protection and Restoration of High Status River Water Bodies" Report[1] provides the scientific basis and approach for selecting and implementing the most appropriate measures to protect and/or improve High Status Objective (HSO) river waterbodies in their Irish environmental settings.

2 Context

Afforestation is a *significant pressure* in 45 catchment areas of HSO waterbodies, even though coniferous forestry covers a relatively limited area – approximately 6% – of these catchments.

The main pressures arising from forestry are:

- Afforestation (new planting).
- Access/road construction.
- Tree felling, extraction and reforestation.
- Public access, resulting in environmental risks and impacts, e.g. fly tipping.
- Aerial fertilisation.

Each of these pressures is described in Section 7 of LAWPRO/EPA (2022b)[2].

The impacts arising from these pressures contribute the following *significant issues*: sediment, phosphate, total phosphorus, ammonium, pH, pesticide and hydrology.

Factors that influence both the impacts and the required measures are as follows:

[1] https://www.watersoflife.ie/app/uploads/2023/08/Measures-Framework.pdf

[2] For further details see LAWPRO/EPA (2022b) at this link: https://lawaters.ie/app/uploads/2022/09/Print_CSM-Volumes-23_April-2022.pdf

- The soil drainage characteristics, in particular whether planting is on mineral or peat soils and subsoils. Planting on peatlands has resulted in legacy issues such as sediment, ammonium and DOC losses, as well as degradation of the peatland ecosystem.
- The phases of the forestry cycle, with particular pressures and potential impacts associated with each stage:
    i) preparation,
    ii) planting,
    iii) growing,
    iv) thinning and
    v) felling.
- The changes in the hydrology of catchments due to afforestation. Mature forestry affects the volume of effective rainfall in a catchment. As trees mature, the proportion of water returned to the atmosphere by interception and transpiration increases. This results in lower rates of runoff, particularly during summer periods when the relative air humidity is lower. Groundwater hydrographs below closed canopy forest reveal consistently lower water tables than equivalent areas lacking tree cover. This reduction in effective rainfall impacts shallower hydrological pathways disproportionately and has knock-on effects on water quality with the proportion of less mineralised water, derived from poorly drained soils proving less during baseflow. By contrast, once the storage capacity of the canopy has been exceeded, stem flow (water flowing down a tree trunk from the canopy) can result in rapid runoff responses, facilitated by the presence of ridge/furrow microtopography, which is installed in naturally waterlogged areas at the start of the planting cycle. Overall, mature plantation forestry in areas that are naturally poorly drained can result in more variable stream runoff and water quality. It is likely that these processes also apply in the case of broadleaf species, including natives, particularly during the summer periods when canopies may be closed (and when stresses to aquatic ecosystems may be greatest).
- While planting of trees is a potential pressure, it can also be a significant measure in mitigating impacts on water quality from other pressures, particularly agricultural activities.

3 Explanatory Comments

- A key principle in deciding on and establishing measures is **"right measure in the right place"**. Determining the 'right measure in the right place' is based on a number of factors, such as the following:
    i) The **issue of concern** (pollutants, hydrology, morphology). The main pollutants of concern arising from forestry are: sediment, PO_4, Total phosphorus (TP), NH_4, pH and pesticides. Each has differing potential both in their impact and abilities to be transported in water and, in particular, to be attenuated on the land and in the landscape.
    ii) The **pressure(s**) causing the issues of concern, for instance, the differing phases of the forest cycle. with particular pressures associated with each:
        a. preparation,
        b. planting,
        c. growing,
        d. thinning and
        e. felling. In the case of pollutants, the relative **loading** from each specific pressure and the **likelihood** of the loading reaching the receptor are important factors that require consideration and assessment.
    iii) The physical setting such as the topography (particularly slope), soil and subsoil types (mineral or peat) and associated drainage characteristics.

iv) Whether the objective is to **'restore' (improve) or 'protect' (maintain**), as more stringent and resource intensive measures are likely to be needed to achieve the restore/improve objective.

Therefore, each of these factors needs to be taken into account in deciding on measures prior to their establishment, as a means of ensuring that they are efficient and effective in achieving their objectives. The catchment science and management process that encompasses these factors is shown in Figure 1.

- Table 1 provides a menu of measures for seven issues of concern arising from forestry – sediment, PO_4, TP, NH_4, pH, pesticides and hydrology (flows).

- The table provide an estimate of the effectiveness of measures, that have been designed, located and established appropriately, to be used as a guide in assessing and deciding on possible measures. Four categories are given – High (H), Medium (M), Low (L), Insignificant (-).

- The measures have been categorised based on whether they are:
  i) Mandatory.
  ii) Incentivised/voluntary.

- Forestry has significant co-benefits for Green House Gas (GHG) emission reduction, carbon sequestration and terrestrial ecosystems. However, the primary objective of the measures outlined in this document is achieving Water Framework Directive (WFD) and Habitat Directive (HD) goals, and therefore the effectiveness scoring is based on the potential to mitigate the impact of the issues of concern on aquatic ecosystems.

- In compiling the tables, the assumptions are:
  i) The receptors are surface water ecosystems.
  ii) Desk-based and field-based assessments have been undertaken in advance of decisions on measures. Therefore, the following factors are known, thereby providing the basis for decision-making on measures: a) the issues of concern arising from forestry that are impacting on the ecosystems; b) the physical setting; c) the life cycle of the plantation; and d) the 'story' of the catchment.
  iii) The effectiveness ratings are based on measures needed in the catchments of waterbodies in *Areas for Restoration* where, for instance, significant mitigation of the impacts may be needed.
  iv) The High (H) rating has been reserved for measures that on their own will make a significant difference to improving the water quality.
  v) To achieve receptor restoration and the desired aquatic ecosystem objective, a suite of measures at an appropriate scale will generally need to be established.

- When considering the content of the table, the recommended approach is to:
  i) Ensure that characterisation of a waterbody catchment has been undertaken and the following is known: a) the required objective (e.g. status) has <u>not</u> been achieved and the catchment is therefore an *Area for Restoration*; b) the issues of concern; c) the physical settings; and d) the pressures causing the impacts.
  ii) Start with the issue of concern (e.g. sediment).
  iii) Keep in mind the main physical and pressure settings.
  iv) Analyse each possible measure in terms of potential to mitigate the impact of the issue of concern arising from the specific pressure (e.g. the potential to reduce the load of sediment entering a watercourse during clear felling), and in the process make a significant contribution to restoring the waterbody to the required objective and condition.

v) Keep in mind that a combination of measures is likely to be needed.
vi) Use the measures effectiveness ratings when prioritising establishment of measures.

Sources of information on prevention of water pollution from forestry

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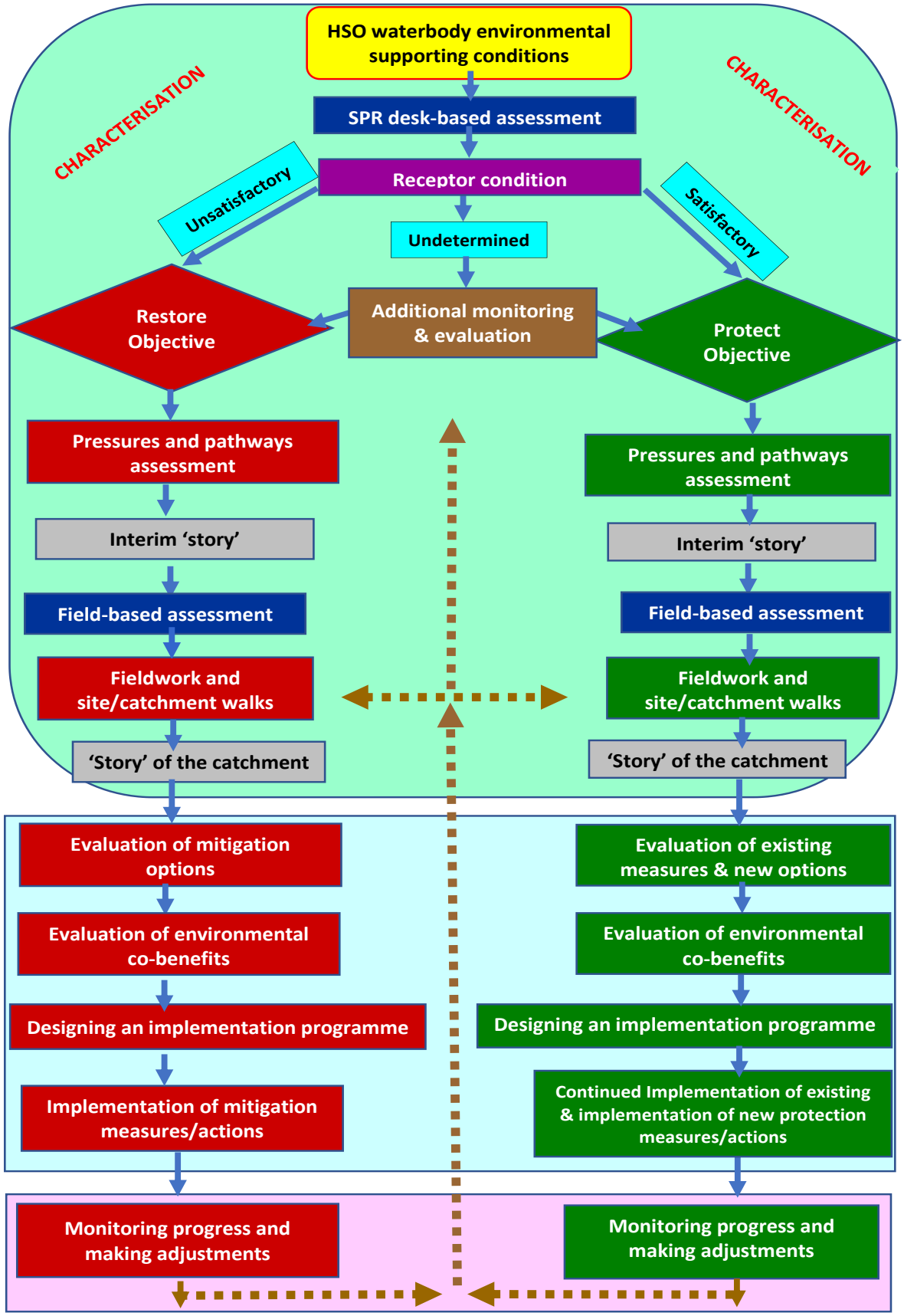

Figure 1: Process flowchart for evaluation of measures in HSO waterbody catchments.

Table 1: List of measures for Forestry, categorised based on location in the landscape, with guidance on estimated effectiveness potential for pollutants and hydrology, where the objective is restoration to the required waterbody status or condition.

No.	Cat.	Measure	Measures Effectiveness (High (H), Medium (M), Low (L), Insignificant (-)													
			Sediment		PO4		TP		NH_4		pH		Pesticide		Hydrology	
			Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt
F01	Source reduction & Control	Harvest plans that take account of receptor sensitivity (e.g. high status)	H	H	-	H	-	H	-	M	-	-	-	-	-	-
F02		Appropriate tree felling/harvesting (e.g. cabling at appropriate sites)	H	H	-	-	-	M	-	-	-	-	-	-	-	-
F03		Appropriate reforestation operations, e.g. no windrowing	H	H	-	M	-	M	-	-	-	-	-	-	-	-
F04		Timing of planting/felling (i.e. in dry season)	H	H	-	-	-	-	-	-	-	-	-	-	-	-
F05		Greening up – delaying felling on some coups until others naturalised/greened up	M	M	L	L	L	L								
F06		Fertiliser and pesticide management	-	-	H	H	-	H	-	-	-	-	H	H	-	-
F07		Compliance with aerial fertilisation requirements	-	-	-	H	-	H	-	-	--	-	-	-	-	-
F08		Existing scheme: *NeighbourWood*	H	H	-	H	-	H	-	-	-	-	H	H	-	-
F09		Existing scheme: *Reforestation for native forests*	H	H	-	H	-	H	-	-	-	H	H	H	L	L
F10		Proposed scheme: *Reforestation for continuous cover forestry*	H	H	-	M	-	M	-	-	-	M	H	H	L	L
F11		Deforestation on peatland	-	H	-	H	-	H	-	H	-	H	-	H	-	H
F12		Peatland restoration	-	H	-	H	-	H	-	H	-	H	-	H	-	H
F13	Mobilisation control	Management of roadways (e.g. location, construction & maintenance)	H	H	-	-	-	-	-	-	-	-	-	-	L	L
F14		Proposed scheme: *Controlled removal of trees on banks of watercourses*	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F15		Rectifying rutting caused on clearfell sites	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F16		invasive species control	M	M	-	-	-	-	-	-	-	-	-	-	-	-

No.	Cat.	Measure	Measures Effectiveness (High (H), Medium (M), Low (L), Insignificant (-))													
			Sediment		PO4		TP		NH_4		pH		Pesticide		Hydrology	
			Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt	Mn	Pt
F17	Pathway Interception	Compliance with water setback distances	H	H	-	-	-	-	-	-	-	-	L	L	-	-
F18		Maintenance of buffer zones	M	M	L	L	L	L	-	-	-	-	-	-	-	-
F19		Ditch management (e.g. In-ditch sediment traps, alternating stretches for ditch clearance)	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F20		Installation of in-field sediment traps/curtains	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F21		Drain blocking (bottom of slopes (riparian areas)	M	M	-	-	-	-	-	-	-	-	-	-	-	-
F22		Establishment of spatially targeted variable width/extended buffers[3]	H	H	M	M	L	L	-	L	-	-	L	L	M	M
F23		Proposed scheme: *Establishment of ponds on major flow delivery pathways*.	M	M	-	-	-	-	-	-	-	-	-	-	-	-
F24		Proposed scheme – *Reforestation for biodiversity and water protection*	H	H	H	H	H	H	H	H	H	H	H	H	H	H
F25	Receptor works	Appropriate installation and maintenance of culverts	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F26		Installation of silt fences	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F27		Bank stabilisation	L	L	-	-	-	-	-	-	-	-	-	-	-	-
F28		Proposed scheme: *Use of portable, lightweight, modular bridging systems to avoid watercourse access*	L	L	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Mineral soil= Mn

Peat = Pt

Measure a condition in the licence or required in the application.

[3] Buffer zone may include some native tree planting.

4 Environmental Measures in Forestry Programme 2023-2027

The Forestry Programme 2023 – 2027 (FP) contains a number of proposed environmental measures which can be funded by the Department of Agriculture, Food and the Marine. The environmentally focused measures include forestry schemes for both agricultural land and existing forests. The following sets out *new* proposed measures that will form part of the national forestry programme, which can be trialled and developed through the Waters of LIFE IP.

4.1 Afforestation (new planting on agricultural land).

The Afforestation Scheme contains measures directly applicable as a mitigation to pressures arising from other land uses, and for the first time the Forestry Programme contains new measures designed to specifically act as such. In addition, other new measures are proposed that are directly applicable to the Project but have never been trialled. It is proposed that the Water of Life Project be used as one of the first areas to apply these measures, and learnings from these applications, using the expertise available through the Project, will be applied to the Schemes nationally. Existing schemes such as the Creation of Forests on Public Lands will also be eligible for planting in the project area, but the following outlines new measures that can be trialled and developed through the project.

4.1.1 Forests for Water

The Forests for Water Scheme is designed specifically to incentivise farmers to plant forest plots of native trees in areas or in a design that will provide direct benefits to water quality. Farmers are incentivised through direct payments of a capital grant to cover the costs associated with establishment such as the plants themselves, fencing, replacement of failed plants etc.; a premium payment over 20 years to compensate for income foregone and an upfront payment of €1,000 as an added incentive, (see Table 2 for available funding). This is a new measure in the forestry programme for 2023 and targets the following:

- Areas identified as having a high Pollution Impact Potential (PIP) for Phosphorus loss through overland flow, as identified using the EPA PIP maps. Planting will be targeted to break the pathway and protect the delivery point.
- Areas identified as being suitable for planting to deliver positive water quality outcomes by the Waters of LIFE IP, Blue Dot Programme the Local Authorities Waters Programme (LAWPRO), through their Local Catchment Assessment (LCA) work.
- Areas where native forest will serve a function in drinking water source protection.
- Areas identified by the Office of Public Works for Nature Based Solutions to flood management.
- Areas identified by Inland Fisheries Ireland to benefit fish habitat, stream ecology and climate adaptation.
- Areas contiguous to the Annex I habitat Alluvial Woodland 91E0, which is currently in Bad condition in the latest Article 17 report *The Status of EU Protected Habitats and Species in Ireland 2019.*

4.1.2 Agroforestry

Agroforestry has been identified as an example of a farming practice that has positive effects on several environmental and climate impacts compared to agricultural land without trees, including significantly improving soil infiltration[4]. Although developed specifically or solely for the benefit of water quality, it was one of the primary motivations for developing the scheme. The previous Forestry Programme 2014 – 2020 (extended to 2022) introduced agroforestry as a scheme for the first time,

[4] This is measure A39 in the Report on Agricultural Activities Measures

limited to a silvoarable system however the new forestry programme has included new systems, namely silvopastoral and forest gardening.

4.1.3 Emergent Forests

This measure provides grant aid to farmers to retain areas of emerging scrub woodland instead of bringing them back into agricultural use. Previously, this was included as a measure in the Native Woodland Conservation Scheme but is now included as a standalone measure.

4.1.4 NeighbourWood Scheme

A "NeighbourWood" Scheme has existed for several years as a measure to enhance existing forests for visitors, providing support for amenities, invasive species removal and new planting. This afforestation scheme allows for the creation of private forests that will be open to the public from the outset, providing opportunities for education and citizen science, as well as recreation and health benefits.

4.2 Existing Forests

Forestry is characterised as a significant pressure in High Status Objective Waterbodies, as one of the primary land uses in these catchments. The following describes the new measures proposed which can be developed and refined through the project. Existing grant schemes such as the Continuous Cover Forestry Scheme will continue to be available in the project area and can also be refined throughout the lifetime of the project.

4.2.1 Ecologically Enhanced Forest Roads

The Scheme provides the opportunity for funding road projects with an enhanced emphasis on biodiversity, forest protection and water management. This will be achieved through enhanced design and construction measures and forest protection facilities. Eligible measures under this action include:

- Creation of forest road edge habitat comprising open habitat, scrub and then broadleaf trees.
- Creation of connectivity withing the forest by providing open space habitat adjoining road.
- Incorporation of water hotspots adjoining road into associated open space component.

4.2.2 Temporary Forest Access Measure

The objective of this new proposed scheme is to facilitate the use of temporary bridging (in sites where permanent or ongoing access is not required, (e.g. one-off harvesting events) subject to appropriate assessment process and located only where appropriate. This will avoid the requirement for instream works and the use of culverts, which can develop into barriers, in this way the measure is also relevant to the barriers programme. Support will also be provided for temporary road reinforcements to allow access. The installation and specifications can be trialled and refined through the project. Measures include support for:

- Portable, lightweight bridging systems that are readily available and provide a modular, scalable and safer alternative to locally constructed temporary crossings.
- Modular systems that can be carried by forwarder equipment to sites and can be installed and removed with minimal site preparation or disturbance.
- Temporary bridging systems that can be used on forest roads to facilitate haulage without the requirement for in-stream works, such as the insertion of culverts.

4.2.3 Forest Machinery Grant

The measure will also support the purchase of cable timber extraction systems for use on steep and soft site types. Technological advances in these areas require regular upgrading of equipment to ensure optimal efficiency and adherence to safety requirements. This Scheme will not apply to harvesting and forwarding machines.

4.2.4 Environmental enhancement scheme

This new measure, which includes actions for water habitats/species, provides grant support to encourage forest owners to undertake works within existing forests and during current rotations, to achieve structural changes and to improve the environmental 'footprint' of those forests regarding impacts on (inter alia) water quality. The scheme can also be used to promote:

- Habitats / Species – within existing forests.
- Creation or extension of an existing setback adjoining designated areas, specific habitats or to benefit specific species.
- Creation of forest edge adjacent to specific habitats.
- Enhancement of habitat for specific species by planting native trees and shrubs
- Creation or improvement of connectivity either by planting native trees/shrubs or open areas as connectivity corridors.

4.2.5 Water protection

A payment for ecosystem services (PES) is proposed on the forestry programme 2023, which contains a proposal for a 7 year premium payment where services are delivered to protect water. This scheme is still in the proposal stage and there is potential to develop it through the project.

4.2.6 Forest Management Plans (iPLAN Scheme)

The iPLAN scheme will promote more active forest management resulting in forests that have greater capacity to deliver eco-system services, climate resilience, roundwood value and forest health vitality than those that are not subject to forest management planning practices. Healthier and more resilient, vigorous forests are less susceptible to attack by harmful forest pests and diseases and are less inclined to suffer from storm damage. Regarding climate adaption, forests that are sustainably managed are more likely to continue to support habitats and habitats rich in biodiversity.

4.2.7 Climate Resilient Reforestation

4.2.7.1 Element 1: reforestation for continuous cover forestry

Reforestation for Continuous Cover Forestry) encourages the creation of forest specifically designed and laid out to be managed for quality timber production under established CCF principles / practices, thereby delivering all of the ecosystem services associated with CCF, e.g. soil and water protection, retention of forest ecosystem, landscape, etc. Species mixtures must be compatible with CCF management, and can comprise nonnative, naturalised and native species, conifers or broadleaves.

4.2.7.2 Element 2: reforestation for native forests

This measure encourages the replacement of existing conifer stands at reforestation stage, with the most appropriate native forest type or types appropriate for that site, using Ireland's Native Woodland Scheme Framework and the five scenarios therein[5]. The site is managed to encourage the development of native forest type(s), on a CCF basis, for the purpose of delivering native forest ecosystem / biodiversity and associated benefits regarding wider biodiversity within the landscape, habitat connectivity, the protection of water, etc. Wood production is permitted under this element, where compatible with the primary objective.

This element is intended to address certain situations where the gradual conversion of non-native forest to native forest by transformation may not be realistic due to site and stand conditions.

[5] A sixth scenario for alluvial woodland has been developed and will be added.

4.2.7.3 Element 3: reforestation for biodiversity and water protection

This measure involves the creation of an undisturbed area of biodiversity comprising widely-spaced native species, with drain-blocking, within the area alongside a water setback required at reforestation stage. The aim is to create a permanent semi-natural buffer that will provide further protection to water and enhance biodiversity through the second rotation and beyond. The resulting area will then be managed where suitable and subject to appropriate environmental assessments, to retain its protective function, for instance future machine access would be restricted and invasive species such as rhododendron controlled. The creation of mosaics of open habitats and native scrub/forest will benefit and increase the protection of watercourses and other biodiversity features or habitats such as adjoining designated areas in terms of future forest operations. In addition, it would promote riparian restoration, increased protection of wetlands, veteran trees, hedgerows while also increasing habitat connectivity and commuting corridors. The elements of the scheme include:

- Planting.
- Planting supplemented by natural regeneration, or natural regeneration alone.
- Creation of an attenuation area.
- Redirecting drains.
- Changing species.

The scheme will be trialled in the project on a pilot basis and will be applicable nationally.

Table 2: Funding

Measure	Grant/ha	Premium/ha	Premium duration (years)	Upfront Payment/ha	Timeline for delivery*
Forests for Water	€6,744	€1,142	20	€1,000	March 2023
Agroforestry	€8,555	€975	10	No	March 2023
Emergent Forests	€2,500	€350	20	No	March 2023
NeighbourWood Scheme	TBC	TBC	TBC	TBC	Q4 2023
Ecologically Enhanced Forest Roads	TBC	No	No	No	Q1 2024
Temporary Forest Access Measure	100%	No	No	No	Q4 2023
Forest Machinery Grant	TBC	No	No	No	Q1 2024
Environmental enhancement scheme	TBC	TBC	TBC	TBC	Q4 2023
Water protection (Payment for ecosystem services)	TBC	TBC	7	No	Q3 2024
Forest Management Plans (iPLAN Scheme)	TBC	TBC	TBC	TBC	TBC
Climate Resilient Reforestation	TBC	TBC	TBC	TBC	Q2 2024

*Subject to approval, rates and schemes are as proposed currently.