Funding Ireland's Biodiversity

A Financial Needs Assessment for Biodiversity in Ireland

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An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
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Executive Summary

This report provides a Financial Needs Assessment (FNA) of the amount that will need to be spent on biodiversity to meet the objectives of the new National Biodiversity Action Plan (NBAP) 2023-2030 which was published in January 2024. The FNA was undertaken by researchers based at University College Dublin funded by the Department of Housing, Local Government and Heritage (DHLGH) (the home Department for the National Parks and Wildlife Service) with support also from the Irish Research Council (IRC). The report was first drafted in 2022 and subsequently updated in 2023 and 2024 to take account of the new EU Nature Restoration Law.

The FNA follows on from Ireland's National Biodiversity Expenditure Review (NBER) which was completed in 2018 and complemented by a Policy and Institutional Review (2020). It was the first such exercise conducted for a developed country to employ the methodology of the Biodiversity Finance Initiative (BIOFIN) of the United Nations Development Programme (UNDP). The NBER estimated total biodiversity expenditure for the period 2010-2015 at €1.5 billion. In Ireland, as is likely with all developed countries, biodiversity expenditure occurs, not through a single body, but through the sectoral activities of many government departments and agencies, as well as by environmental NGOs and some private initiatives. There is a degree of mainstreaming of responsibility for biodiversity between government bodies which can make this expenditure challenging to track. Given that Government Departments have their own particular remits, the NBER applied coefficients of between 5% and 100% to different types of expenditure to apportion its relevance to biodiversity. It also tagged this expenditure to the objectives and targets of the former NBAP and the Aichi Targets of the UN Convention on Biological Diversity.

The BIOFIN methodology also supports the compilation of a Financial Needs Assessment (FNA) to estimate what *needs to be spent* to protect and restore biodiversity. In contrast to the NBER, the FNA only deals with expenditure which is primarily directed at conserving and restoring biodiversity and not with secondary expenditure where other Departmental objectives are the principal intention for the spending. Projecting the amount of dedicated spending which is needed to conserve biodiversity and meet targets in the future is a difficult task. A starting point is the Prioritised Action Framework (PAF), a multiannual planning framework of measures and funding needed implement and support the Natura network which was undertaken separately in 2021. Conventionally, most dedicated biodiversity expenditure by the National Parks and Wildlife Service (NPWS) has been directed at these Protected Areas which cover 13% of Ireland's land area. The current PAF, however, has expanded proposed expenditure to support "green infrastructure" (protected habitats) in the wider countryside where this helps to sustain the Natura 2000 Network. ***Figure 1*** shows the proportionate expenditure proposed for different habitats under the PAF.

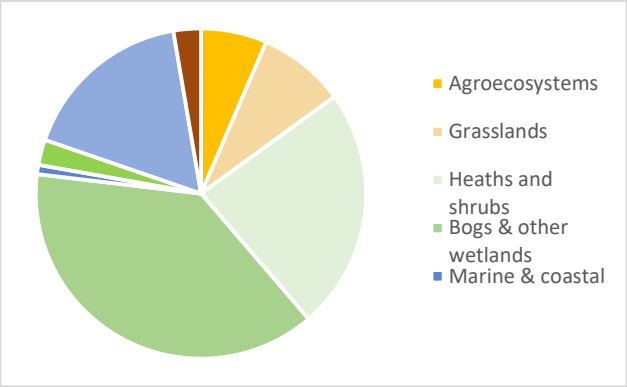

***Figure 1*. PAF relative expenditure of €102m** (excludes horizontal expenditure of €60.5 million)

The EU Biodiversity Strategy has been the backbone of biodiversity protection in the EU and presents an ambitious plan to reverse the degradation of ecosystems by 2030. However, the latest report on the State of Nature in the EU from the European Environment Agency finds that only 15% of habitats are in good conservation status. This small proportion is confirmed by Ireland's third Article 17 report to the European Commission (DCHG 2019) on the status of Protected Habitats and Species. This finds a continued and worrying decline in 46% of the habitats that should be protected, and identifies 39% of habitats as being in "bad" status (see ***Figure 2***). Furthermore, the latest reports on the implementation of the Water Framework Directive in Ireland find that recent modest improvements in rivers and lakes, which are so important to much of our biodiversity, have stalled and that there has been a further decline in high status rivers.[1] The priority is to arrest these declines by removing the pressures that continue to contribute to the loss and deterioration of species, habitats and environmental quality. However, given the degradation which has been experienced, and

[1] EPA Water Quality in 2023: An Indicators Report

our dependence on 'ecosystem services' of value to human beings, an increasing emphasis is being placed, not just on protection, but on restoration of the natural environment. Initiatives are being taken by the UN, through its Decade of Ecosystem Restoration, and by the EU, through the Green Deal and Biodiversity Strategy 2030.

In June 2024, the EU passed the Nature Restoration Law. The NRL will mandate Member States to restore at least 20% of the EU's land and sea areas by 2030 and ultimately all degraded areas by 2050. The regulation focuses on agro-ecosystems, peatlands, forests, freshwater , marine and urban ecosystems. In addition, the NRL has ambitious objectives to reverse the decline in pollinators and to restore many rivers to free-flowing status.

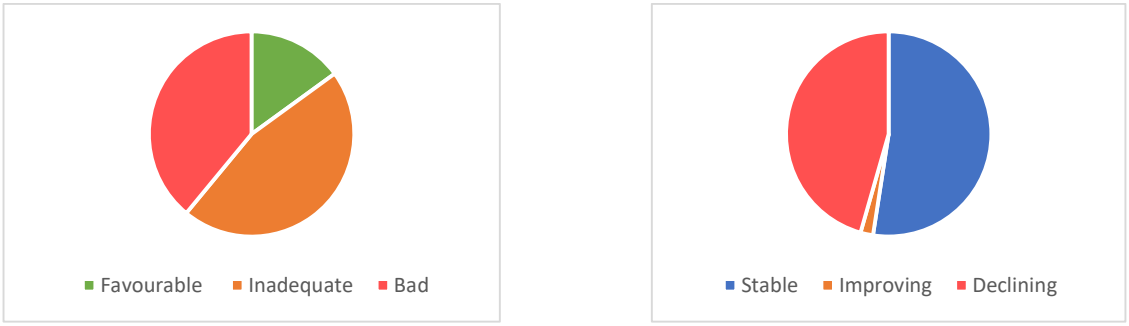

Figure 2. **Results for habitat status 2019**

The FNA represents an initial step to estimate the total amount of additional biodiversity expenditure needed to meet the needs of the new NBAP (2023-2027) and the first of the new targets set by the NRL. It recommends solutions to bridge this resource gap. An accompanying Resource Mobilisation Strategy presents the mechanisms whereby resources can be located and mobilised to this end. Although many objectives of the new NBAP cannot be measured with quantitative targets, the plan contains more performance indicators than previous plans. For now, the FNA has restricted itself to examining the NBAP's targets in relation to a number of key habitat groups and ecosystems such as high nature-value farmland, peatlands, forests, freshwater, the coast and marine. For most of these sectors, the FNA has extrapolated the area of land cover types needing restoration. Improved data on habitat extent and condition is also becoming available following the publication of spatial land use land cover (LULC) databases in 2023 and will be available to support biodiversity spending projections in the future.

The resourcing situation of the NPWS itself has improved in the last few years and there has been a reversal of the steady decline in funding that occurred over the period examined by the NBER. At this time, insufficient staffing and resources had been a factor in the infringement proceedings launched by the European Commission in 2020 in response to Ireland's failure to make sufficient progress on the implementation of measures required to achieve the objectives of the Habitats Directive. A review of the NPWS, undertaken in 2021 (Stout and O'Cinneide 2021), recommended a 'whole of government' approach in recognition of the role of natural capital in underpinning sustainable growth and to allow the NPWS to properly implement conservation measures to deliver the outcomes required by EU Nature Directives. The review further recommended a re-examination of the organisation's structure and governance, a conservation measures team, team-based structures comprised of expertise from various conservation sectors, improved interaction with regional staff, and additional staff to deal with conservation measures, restoration, national parks and the marine, amongst other proposals. In 2024, the NPWS published its Strategic Action Plan 2022-2023 which set the basis for the NPWS to become an Executive Agency and proposed establishment of five new directorates with clearly defined responsibilities and reporting arrangements.

These structural changes have enhanced the capacity of the NPWS to perform its responsibilities with respect to the conservation and monitoring of Protected Areas and species. It also supports the NPWS in taking a more strategic approach towards cross-section coordination within the agency and cross-sectoral coordination with other Government Departments and Agencies. Additionally, it provides an opportunity for the NPWS to support applications to the likes of EU LIFE, Interreg or LEADER for restoration and to explore opportunities for supplementary private sector funding. This will be especially important to meet the expectations of the NRL, noting that, to date, spending has been dominated by current expenditure rather than capital expenditure on restoration.

More strategic cooperation with the Department of Agriculture, Food and the Marine (DAFM) and agencies such as the Local Authority Water Programme (LAWPRO) and the Environmental Protection Agency (EPA) would allow the NPWS to input to the cost-effectiveness of policy and the removal of adverse incentives that run counter to biodiversity protection. The classic case in this regard is agriculture which occurs over 75% of Ireland's terrestrial area and has a profound influence on biodiversity. To mitigate these impacts, around €230m has been spent each year on Agri-Environment Schemes (AES) largely to dissuade farmers from intensifying their production or to compensate others for whom the marginality of their land limits their capacity to do so. This is by far the largest

component of expenditure identified by the NBER. However, evaluations repeatedly show that activity-based schemes, which have hitherto dominated AES, have not demonstrated effectiveness in protecting biodiversity. While agriculture's impacts on biodiversity are less overt than those of the past, there has been a gradual attrition of environmental quality without much in the way of corresponding improvement and a continued loss of what we used to call farmland species, such as the curlew, lapwing and corncrake. If national biodiversity objectives are to be met, then DAFM must strengthen collaboration to draw on the experience of NPWS. For example, the existing NPWS Farm Plan Scheme has been effective in demonstrating the benefits of targeted and locally-led schemes.

Forestry is another area for which the NPWS would ideally have a more active role in restoring the condition of native woodlands and expanding the small area of remnant native woodland. Similar arguments apply to the marine environment which faces natural resource demand pressures from fishing and for hydrocarbons or wind energy. The NPWS receives no direct funding from the European Maritime and Fisheries Fund (EMFF) and has limited capacity to support marine conservation measures.

Additional resources would raise the capacity of the NPWS to input more strategically to the protection of biodiversity in all sectors. Memoranda of Understandings with other Government Departments could complement these by allowing the NPWS to broaden its focus on the Natura Network to a more proactive role in the wider countryside which is essential to the survival of mobile species that are not confined to Protected Areas. It would demonstrate the Government's recognition of the importance of ecosystem services to all sectors of the economy, including food production, fisheries water quality, and our quality of life. This includes the commitment to environmental restoration articulated by the NRL. The strategy should include 'nature-based solutions' to adapt to climate change by restoring peatlands, forests and coastal ecosystems to reduce carbon emissions and to mitigate the risk of flooding and sea level rise. It would also allow the NPWS to investigate other funding sources that are available from the EU or the private sector, including the growing area of carbon finance and the emerging area of biodiversity credits, supported by additional incentives available from the European Investment Bank under the European Green Deal Investment Plan. These would bring in new resources and reduce the vulnerability of the NPWS to changing political priorities or any future austerity, allowing it to be more independent and proactive in pursuing cost-effective biodiversity conservation and restoration.

Expenditure

Figure 3 presents the current level of biodiversity spending relevant to the FNA alongside the additions proposed by the PAF and our initial assessment of sectoral financial needs as of 2022. In **agriculture,** AES continue to dominate biodiversity expenditure. Ireland's CAP Strategic Plan (GOI 2020) aims to contribute to the objectives of the European Green Deal by ensuring environmental sustainability alongside the economic viability of the agricultural sector. At least 25% of the Pillar I budget is now directed to "Eco Schemes "with a minimum requirement that 4% of land is dedicated to non-productive areas." Support for "green Infrastructure" in the PAF includes enhanced environmental, climate and social 'conditionality' of payments The FNA examines the potential value of developing schemes resembling the NPWS Farm Plan Scheme. Although such a scenario would imply the appointment of more officers, it is argued that more could be achieved with almost the same resources of **€240 million** per year. Subsequent to the initial draft of the FNA, the Agri-Climate Rural Environment Scheme (ACRES) was launched in October 2022 with higher funding than the previous AES and with support for results-led approaches and cross-farm actions in targeted Cooperation areas.

Much attention is currently being directed towards **peatlands** given the contribution they make to mitigating climate change due to their capacity to store huge volumes of carbon. With the cessation of Bord na Móna's harvesting of peat, and with numerous peatland LIFE-IP projects in progress, there has been a recognition that peatlands provide a nature-based solution for the mitigation of greenhouse gas emissions. €30 million per year is already being spent in this area, but additional investment in restoration is needed to a minimum total of **€55 million** per year, but with the potential to be supported by blended private-public finance.

For forests, there is a restoration opportunity given Ireland's small area of remnant **native woodlands**. Numerous ecosystem services are realised from native woodlands, including for amenity and for climate change mitigation and adaptation. These public good benefits are acknowledged by Coillte in its recent Strategic Plan (Coillte 2022) which confirms that 20% of the company's estate is managed primarily for biodiversity. *Coillte Nature* was specifically established in 2019 to restore and create areas of native woodland. Similar initiatives in the forestry sector have begun to attract blended finance motivated by Corporate Social Responsibility (CSR) reporting and voluntary carbon offsetting. The combination of current and minimum proposed expenditure in this sector is estimated at around **€14 million** per year.

Freshwater rivers and lakes provide numerous ecosystem services and are the focus of the health and biodiversity objectives of the Water Framework Directive. Pollution, primarily of nutrients from agriculture and non-point sources, is the principal pressure, but water quality has been slow to respond to policy initiatives to date. Restoration of wetlands, and eutrophic lakes and lagoons is needed. In total, expenditure of at least **€24 million** per year is required.

The **coastal environment** is facing numerous threats from eutrophication, disturbance and in-shore fishing practice. Enhanced conservation measures are already delivering some positive returns, but a minimum spend of **€6.5 million** per year is proposed to begin to restore many damaged habitats. In the offshore **marine habitat,** much of the existing EMFF spend of **€8.9 million** per year is directed to valuable research, but only a small proportion of this is on direct conservation measures. Until recently, marine

ecosystems were of generally good status aside from those commercial fish species which have been over-exploited. However, climate change is a serious threat to the marine environment, as elsewhere.

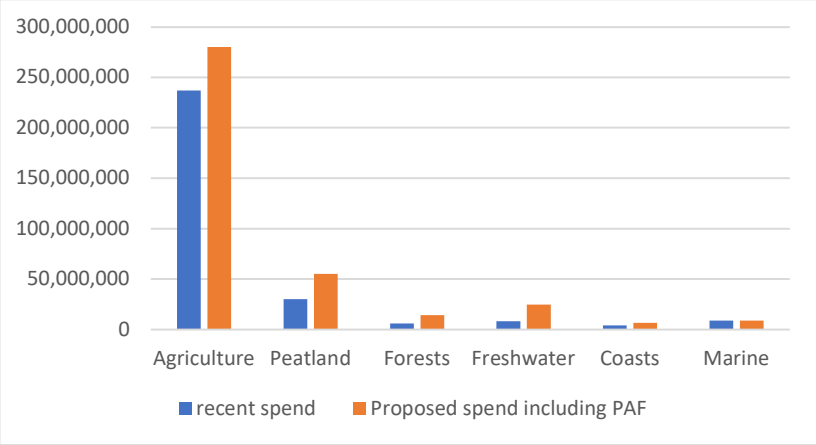

Figure 3. **Total amount of recent and proposed expenditure including that set out in the PAF.**

Opportunities from the new Nature Restoration Law

Ireland's environmental expenditure to date has been focused on environmental monitoring and protection. Much can be achieved in this way, particularly when supported by effective enforcement of existing nature legislation, including national policies and Europe's Habitats and Birds Directives. Protection also provides the basis for environmental enhancement of the many habitats which have been gradually degraded over time by human activities. The new European Nature Restoration Law (NRL), passed in 2024, takes matters a significant leap forward given its ambitious targets. Restoration implies a more proactive approach, particularly in circumstances where habitats and wildlife populations have been protected in principle, but without adequate funding to secure ecosystems' resilience to many continued pressures such as the intensified use and exploitation of natural resources, pollution, habitat fragmentation and alien species. ***Figure 4*** gives an indication of the increase in resources needed.

Applied to **agriculture**, the regulation aims to increase the area of high-diversity landscape features and the prominence of extensive production systems with the aim of contributing to the recovery of agro-ecosystems as measured by the Grassland Butterfly Index and the Common Farmland Bird Index. In practice, this means transferring farm financial supports towards sustainability objectives which encourage the setting aside of some land for high nature value farming (HNVf) or non (food) productive use, and identifying ecological targets while helping farmers to decide how best to achieve them through result-based payment systems. The FNA discusses how much can be achieved without significant increases to spending on the sector generally and without significant loss of food productivity. Potentially, this could be the beginning of a landscape approach to biodiversity conservation, the protection of water bodies and provision of ecosystem services. This could encompass restoration or new habitat creation including riparian buffer strips, diverse species grasslands and ponds. The challenges of working towards the higher targets of the NRL over time are likely to remain, but fundamentally there is a synergy between the protection of ecosystems, farm productivity, food quality and nutrition. This is particularly so in a country where sustaining livelihoods on marginally productive land also serves nationally agreed social and rural development objectives. **€160 million** was spent on ACRES in 2023 with €1.5 billion committed over the six years of the CAP Strategic Plan.

Much progress has been achieved in recent years with regard to **peatlands**, In the short-term it would appear that only a modest increase in expenditure by €8.5 million to **€63 million** per year could be sufficient to meet the targets of the NRL. In the near term, these targets can be achieved by restoring lands which have been used for industrial peat extraction, combined with some restoration of forest lands where trees have been inappropriately planted on nutrient-poor peatlands. The share of restoration of farmed peatlands may need to increase over time, but much of this land is degraded blanket bog commonage or marginal land which could continue to be farmed extensively. A contribution from private peat workings may be needed in due course, but is expensive due mainly to the decision to compensate turbary rights. In all these peatland systems, there are ecosystem service rewards for greenhouse gas emissions, storm mitigation, water supply and water quality which reduce public expenditure in other areas. There are also opportunities for private and blended finance linked to carbon, water and biodiversity, including potentially from the proposed EU Carbon Removals regulation linked to climate change mitigation. Ireland is at the forefront of initiatives to benefit from this finance through its progress towards a common Peatland Standard.

There is an urgency for the restoration of our **native woodlands** which have been significantly degraded by deer browsing and alien species to the point where many are now failing to regenerate. Wildfires and disease are adding new challenges to the existing and continued threats. Fortunately, policy has become more supportive of the protection of native woodlands and native species planting.

The expenditure liability presented by the NRL depends on how the baseline is interpreted. The absolute area of remaining native woodland is small, but while the protection of ancient woodlands is critical, some other woodlands are so degraded that restoration could arguably be better directed at new planting and planting for connectivity. Additional expenditure of up to €11 million per year is needed to a total of **€25 million per year**, although restoration of losses from ash die-back could itself require a further annual spend of **€10 million**.

Of the **freshwater environment**, much needs to be done to restore river and lake water quality as well as wetlands and meadows which have been previously drained or severely degraded. Freshwater networks provide for the ecological functioning of all other environments, providing also essential ecosystem services in terms of water supply, drinking water and amenity. Wetlands, including aforementioned bogs and fens, further underpin these services as well as providing for flood mitigation. The gradual restoration of freshwater ecosystems in line with the targets of the NRL is likely to account for an additional spend to a total of around **€46 millio**n per year. An expansion of barrier removal to contribute to the free-flowing status, particularly of salmonid rivers, is likely to require an additional **€4 million**. Improvements in water quality will require much more commitment in terms of enforcement and integrated land use policy in line with the Green Deal, requiring expenditure by other state bodies well in excess of that directed to habitats alone.

In the **coastal environment,** more needs to be achieved to protect species vulnerable to disturbance or predation. The near-term restoration needs are not too onerous, although expenditure of around **€11 million** is needed to restore areas of saltmarsh, dunes, lagoons and machair grasslands. In the longer term, expenditure will be needed to create new space for wildlife in the face of climate change, including increased storm intensity and the risk to migratory birds from coastal squeeze due to rising sea levels. Strategic decisions will need to be taken with regard to the environment, flooding and agricultural land. In the **marine environment** much can be achieved by ensuring more rigorous protection of marine ecosystems. Fisheries policies rather than expenditure can begin to provide for the recovery of fish populations, but these policies will need to be bolstered through restoration of damaged ecosystems, primarily through the establishment, funding and enforcement of Marine Protected Areas at an additional cost of around €15 million towards a total of **€24 million** per year.

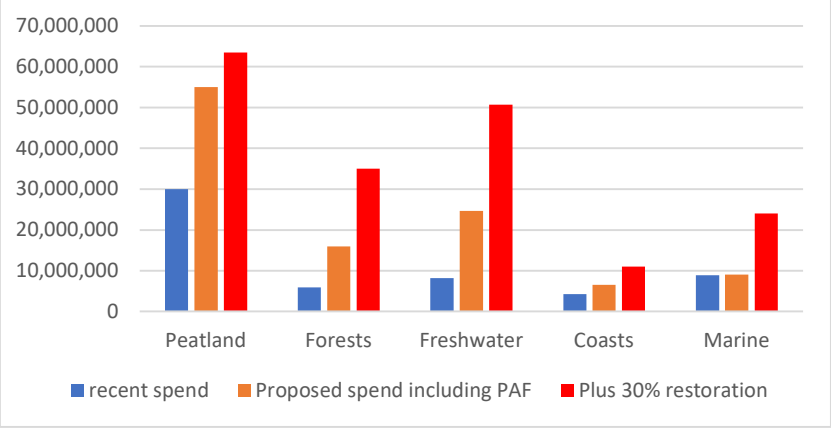

Figure 4. **Proposed expenditure, including PAF & restoration spend needed to meet NRL 2030 targets**

The table below indicates the approximate additional expenditure that will be needed to support the initial target of the NRL.

Table 1. Initial estimates of the expenditure needed per year to support the initial 30% target of the NRL

	Farmland	Peatland	Native woodland	Freshwater	Coasts	Marine
Additional spend	€40m	€8.5m	€11m	€26m	€6.5m	€15m
Total 30% restoration	€280m*	€63.5m	€25m (+€10m**)	€50m***	€11m	€24m****

*Includes existing social transfer element, ** Potential cost to restore effect of ash die-back, *** Includes accelerated river barrier removal, *** includes fisheries protection of MPAs

1. Introduction

The Financial Needs Assessment (FNA) of Biodiversity in Ireland is the third in a complementary set of outputs informed by guidance issued by the Biodiversity Finance Initiative (BIOFIN) of the United Nations Development Programme (UNDP, 2018). Subsequent to the production of the National Biodiversity Expenditure Review (Morrison & Bullock, 2018) and Policy and Institutional Review (Mc Guinness & Bullock, 2020), the FNA aims to characterise the level of priority spending on biodiversity necessary to achieve key targets set out by Ireland's 4th National Biodiversity Action Plan (NBAP) and provide tangible recommendations for changes in how biodiversity finance can be optimised. This latter goal can be achieved through four main mechanisms:

1. **Generating additional revenue for biodiversity**
2. **Delivering better for biodiversity, using existing revenue**
3. **Realigning expenditure from existing sources**
4. **Avoiding unnecessary future expenditure on biodiversity**

Detailed and realistic finances are increasingly recognised as an essential component of conservation planning. The continued lack of information on the costs of conservation is seen as a clear obstacle to the mobilisation of sustainable long-term financing and making the best use of the scarce resources available for conservation. To address this issue, BIOFIN, under the auspices of the Convention on Biological Diversity (CBD), is encouraging states to undertake national scale costing studies for conservation, also known as Financial Needs Assessments, to fully understand how much they should be spending on conservation (UNDP, 2018). As a signatory party to the CBD, the Irish Government has committed to undertaking a FNA (DCHG; IFNC 2019-seed*s for nature*).

Most national and local strategies and plans for conservation lack primary data on the cost of conserving biodiversity and an accompanying financial plan (Armsworth *et al.* 2011). For example, in a US sample spanning 5 years, only 13% of plans reviewed were found to have taken account of the economic costs of conserving habitats (Newburn *et al.* 2005; Polasky *et al.* 2008). Iacona *et al.* (2018) report that the "*explicit quantification of the financial costs of implementation is rare".* Effectively, many national agencies for conservation have historically overlooked the relevance of establishing appropriate financing for conservation and are instead operating, as Frazee *et al.* (2003) have observed, a '*see no evil, hear no evil, speak no evil'* policy.

Our lack of understanding of the costs of protecting biodiversity and the budgets required to implement National Biodiversity Strategies and Action Plans (NBSAPs) is argued by BIOFIN (UNDP, 2018) to have resulted in inadequate finance for conservation, with correspondingly poor results. A lack of realistic estimates of the costs of protected area establishment and effective management can hinder conservation planning and result in under-funded *"paper parks"* that fail to meet conservation goals (Frazee *et al.* 2003). Thus, a clear financial plan, including a detailed and realistic resource needs assessment and budgets for NBSAPs, could provide the justification for upscaling resources and garnering support from ministries of finance and other budgetary decision makers. Cost information can also enable effective conservation as arguably the "*greatest biodiversity gains are achieved when conservation actions can be undertaken cheaply in locations important for biodiversity"* (Armsworth *et al.* 2011; Iacona *et al.* 2018; Naidoo *et al.* 2006).

As a preparatory phase of the Irish FNA for biodiversity, a literature review was conducted (*Appendix A: Costing Conservation*) to explore the approaches which could be used to calculate the costs of halting biodiversity decline in Ireland. This literature review also collated both recently published FNAs globally and peer-reviewed research on the cost of conservation interventions at various scales. The information and insight gained through the literature review was subsequently used to inform the development of a draft FNA methodology for Ireland.

A revised methodology was developed and adopted owing to the logistical challenges experienced as part of the Covid-19 pandemic which severely limited the opportunity for consultation and workshops. The findings of this process (as conducted from March 2020 to February 2021) are presented in the current report, including the specific adjustments made to this methodology in light of the initial need to examine the cost of enhancing the condition of key habitats in response to the proposed EU Restoration Regulation (Nature Restoration Law). A synthesis of these results is then presented in three forms;

1) As a quantitative overview of priority spending (but not in direct comparison to the NBER results for 2010-2015),
2) Consideration of the cost of enhancing or restoring priority habitat groupings, such as peatlands and agricultural habitats, and
3) Consideration of key funding sectors, such as government departments, non-profit organisations and semi-States

Subsequently, a set of actionable recommendations are made, based upon these findings which are tailored to key sectors relating to Irish biodiversity. Finally, a condensed list of viable financial solutions is presented, offering mechanisms for an Irish context and informed by the above results to either generate additional revenue, deliver better with existing funding, realign expenditure, or reduce future spending. These options will be developed further in subsequent stages of the BIOFIN process such as the Resource Mobilisation Strategy (RMS) and the Strategic Financial Plan, through consultation with relevant State bodies.

2. Proposed FNA methodology, September 2019

Based on an extensive review of existing studies and literature on biodiversity costings (see *Appendix B: Costing Conservation*), a results-based or activity-based costing approach was selected, where possible, as the best way to calculate the cost of halting biodiversity decline in Ireland. The former National Biodiversity Action Plan (NBAP) 2017-2021 represented the starting point, but it also seemed likely that this would not be of sufficient resolution or timescale to identify the targets or actions necessary to fully halt biodiversity decline. The Prioritised Action Framework (PAF) of proposed actions for Natura sites provides an alternative set of broadly costed actions, but only for protected sites. The figures have been updated in response to the draft of the new NBAP (2023-2030), the EU Biodiversity Strategy and the targets for ecosystem restoration set out in the proposed EU Restoration Regulation. The following section outlines in more detail the proposed stages of this methodological approach.

Step 1. Preparation

Initial preparatory actions include:

1. Identifying potential data sources
2. Establish a consultation plan
3. Consulting on, and reviewing, the methodology
4. Gathering relevant plans, policy statements and documents, including costing data and biodiversity objectives/targets.

Step 2. Review the scope and clarity of actions necessary to reverse biodiversity decline

A key initial component of developing the methodology for the Irish FNA was to clarify the actions and results required to halt biodiversity loss in Ireland. Internationally, the starting point for this has often been to review the scope and clarity of biodiversity objectives constituting NBSAPs. The former Irish NBAP (2017-2021) had 7 key objectives, 18 sub-targets and 119 targeted actions. However, each Irish NBAP is relatively short-term (5 years). A full assessment of the cost of halting biodiversity loss is likely to require a much longer timescale and broader vision: e.g. 2030 or 2050. Therefore, it was advised that the objectives and actions first need to be reviewed to assess whether they are sufficient to reverse long-term biodiversity decline across Ireland, or whether they need to be extended over longer time horizons. Defining quantitative outcomes from these targets was immediately identified as an important first step in the consultative process with NBAP stakeholders and other partners.

Once the key results, objectives and sub-objectives have been agreed they could then be assessed as to whether they can be converted into '*costable actions'* by using a logical framework (e.g. Figure 2.1) to translate information from targets, strategies and sub-strategies into actions. Costable actions can be defined as *"specific actions or activities that seek to achieve a clear or quantified result, the estimated cost of which can be calculated based on their description, research, or expert opinion*" (UNDP, 2018). Once the results are clearly defined, actions can be developed and examined to ensure that they are the most appropriate to achieve those results. In general, NBSAPs and other strategic documents tend to include many actions that are either difficult to cost or stated in general rather than specific terms.

NBSAP		Links	Costing Structure Elements
Element	**Description**		
National Biodiversity Targets	High-level targets for the country to achieve the NBSAP and other national strategies. Often refect Aichi Biodiversity Targets.	The elements of the NBSAP may or may not translate efectively to the costing structure, but they should always be linked in a consistent order.	Targets (Results)
Strategies (and Sub-strategies)	NBSAP categories that lead to targets (ideally).		Outcomes
Actions	A description of how strategies and sub-strategies are implemented.		Outputs
Costable Actions	Disaggregation of actions into specifc actions that can be costed with minimum ambiguity.		Outputs
Inputs/Resources/Unit costs are commonly used in the country budgeting process. They include both recurring and capital costs. This can be valuable input for countries wishing to develop a budget based on the costing process.			

Figure 2.1. A logical framework to structure NBSAP results for costing. From the BIOFIN Handbook (UNDP, 2018)

Therefore, a key stage in the initial FNA methodology was to clarify and quantify NBAP targets and sub targets where possible with the NPWS to enable meaningful costing. Where an action or target was found to be too broad, it was divided into individual elements and specific activities which contribute to achieving the stated results and which could be costed. For example, a generic strategy such as *"protect endangered species"* would require linkages to a specific result statement such as *"decrease predation of nests by 30 percent",* and a related set of outputs and activities (such as increasing the number of rangers, strengthening the prosecution of illegal wildlife trade cases, etc.) (UNDP, 2018). However, not all NBSAP actions are likely to be costable. For example, costing a political or coordination decision would not be possible. The following table presents the steps required to generate a set of costable actions associated with the Draft NBAP.

Table 2.1: Key proposed steps in scoping and clarifying costing frameworks

Step	Description
1	Detailed review of comprehensiveness and 'costability' in the NBAP and other key national biodiversity related plans to assess whether the results and targets contained therein fully encompass the actions necessary to halt biodiversity decline over the long term.
2.	Consult on and agree the results and targets necessary to halt biodiversity decline nationally with the NPWS and other stakeholders. This will be predominantly guided by those contained within the NBAP.
3	Using a logical framework, convert results or targets into costable actions. Include all biodiversity objectives as well as outcomes, outputs and inputs. This may require the development of alternative options to cost different actions to achieve the same results.
4	Refine and review the actions with consultees/stakeholders to identify those actions most likely to deliver results, aiming for maximum parsimony.
5	Finalise results, giving a logical framework of outcomes, outputs and targeted actions.

Subsequent to this work, momentum began to build in relation to the Nature Restoration Law (NRL). The FNA was asked to examine the possible costs of implementing these in the short and longer term to meet the target sets out the NRL. Agreement on the wording of the NRL and restoration targets was only achieved at the end of 2023 and still has to be agreed and finalised by the European Parliament. These targets will have a considerable influence on the biodiversity financial needs. Preliminary estimates have been included in this report, but are subject to the detail which will ultimately be included in Member States' Restoration Plans.

Step 3. Develop initial costing tables

Once the logical framework and actions have been agreed upon, initial costing tables must then be developed, using desktop study, expert input and government budgetary information via the NPWS and other relevant government departments. At this stage, each action would need to be clearly understood and quantified to a degree necessary for cost units or expert estimates to be attributed. As stated in the BIOFIN Handbook, "*to cost an action, it is necessary to understand various details about that action, including the timeline, scale, location, responsible organization*" (UNDP, 2018). There are a number of possible sources of costing data for use in developing these costing tables, requiring further refinement through expert opinion and workshops. A non-exhaustive list of these sources is presented Appendix C of this report.

Key documents to achieve this were:

- The Prioritised Action Framework (PAF) for Natura 2000 spending, produced by the NPWS (2020).
- National Biodiversity Expenditure Review (NBER 2018), produced as part of the earlier stage of the BIOFIN process, noting that a direct comparison between figures in the FNA and in the NBER is not advised by BIOFIN.
- Sets of standard Government budgeting units or account codes, which could be used as standard unit costs (e.g. administrative or communication costs, equipment, human resources, etc.).
- The accounts of Government Departments and programme spending, in particular:
    - DHLGH - NPWS; All programmes
    - DAFM - Agriculture division - Agri-environment schemes, pollution management, ASSAP, EIP-AGRI
    - DAFM - Forest Service - Neighbourwood Scheme, Native Woodland Scheme, etc.
    - Relevant LEADER grants
    - Relevant Local Agenda 21 grants
- Annual reports of relevant commercial or NGO bodies
- Academic studies and reports published by conservation projects, such as EU LIFE end of project reports etc.

Alongside the collection of cost data from published reports and existing studies, data was also obtained through expert input and surveys. Alternatively, in cases where no other data sources are available, BIOFIN recommends that proxy sources should be explored such as the market costs of agricultural land or through extrapolation to national levels from successful small-scale pilots.

Cost data then needs to be complied into costing tables (spreadsheets with drop down menus), including common unit costs of items such as vehicles, salaries etc. Collated cost data needs to be broken down into different cost categories (see *Appendix A: Costing Conservation*) alongside contextual information. Multiple cost estimates or sources should be averaged. Actions can then be costed by defining unit costs and quantities over the target time period (UNDP, 2018).

Table 2.2: Steps required in compiling costs of targets and sub-targets of the Draft NBAP

Step	Description
1	Develop a logic chain for each of the results and sub-targets, detailing activities required for each result
2	Quantify each action as far as possible
3	Breakdown each activity into possible cost categories
4	Collate cost data from documentary sources
5	Collate cost data from expert input, interviews or questionnaires / surveys
6	Compile cost data into a cost catalogue

Step 4. Refine costs with expert input and review

Once initial costing tables and costing for actions have been developed these should then be refined through workshops, individual expert consultation and stakeholder engagement. This process is likely to be iterative to arrive at agreed costing figures. BIOFIN highlight that *"these discussions with experts can also assess the most cost-effective alternative actions and approaches to achieve biodiversity results*" (UNDP, 2018). Figure 2.2, below, shows the likely steps required to arrive at final estimates of costs of conservation for each target, progressing through three stages of estimation and iteration. These theorised steps are simplified into the 5-step process outlined in Table 2.3.

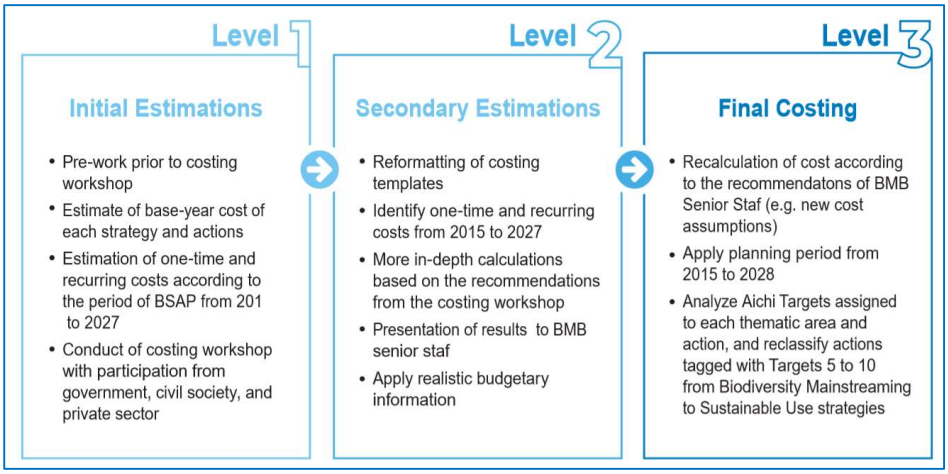

Figure.2.2: A theorised three-stage cost estimation protocol to arrive at final costs for conservation (UNDP, 2018)

Table 2.3: Steps towards achieving refined cost estimates for NBAP targets in Ireland

Step	Description
1	Present cost catalogues to stakeholders for further refinement
2	Incorporate stakeholder comments into cost catalogues
3	Re-circulate cost catalogue to stakeholders for final comments
4	Finalised costs and work up activity costs for each target or result
5	Include alternative costs, scenarios and different timescales where possible

Step 5. Analyse the results of the costing exercise

The final step in the proposed FNA protocol for Ireland would be to cross-tabulate these estimated costs across all actions with reference to (though not through direct comparison with) the outputs expected by the Irish NBER. These analyses will include the following:

- Most prominent costs coded by NBAP target, BIOFIN target, sector of spending, CBD Aichi target, Sustainable Development Goal, and SEEA code (System of Environmental Economic Accounting)

- Distribution between recurring/current versus capital spending
- Most relevant cost drivers (e.g. agri-environment payments, land purchase, staff time)
- Opportunities for economies of scale
- Main risk to continued funding or growth
- Comparison of costs to national priorities (i.e. NBAP targets and previously identified NBER spending)

The BIOFIN process also recommends that analysis should include a 'reality check' of the expected costs, through internal consultation with the steering committee (UNDP, 2018).

Step 6. Estimate the unmet biodiversity finance needs and gaps

The aim of this final step is to compare the detailed costing estimates with projected future expenditure to determine the range of biodiversity finance needs for various strategies and actions. BIOFIN highlights that comparing the NBER results to those of the FNA to generate an overall finance gap needs to be carefully considered, as the BER and FNA are often not directly comparable. This is because the NBER estimates all biodiversity expenditures in a country, including secondary expenditures by other Government Departments for whom biodiversity is not a primary objective. In comparison, costing studies generally focus *only on primary* cost estimates. Therefore, some actions may not be included in the Draft NBAP (e.g. ongoing spending on national parks) whilst the NBER does include some of these costs. Fundamentally, "*while the BER seeks to capture existing expenditures, the FNA seeks to capture the additional costs required to change the status quo*" (UNDP, 2018). A number of strategies are advocated by BIOFIN to reconcile the BER and FNA results:

i. Make one-to-one comparison of specific activities via tagging systems or
ii. Reduce the NBER results to only those captured in the FNA study (which depends on the quality and level of detail in the original BER data).

3. FNA methodology adopted, March 2020

Following the review of existing FNA methodologies adopted internationally (see Appendix A) and given the restrictions of applying this in an Irish context, several notable revisions were applied to the actual FNA methodology adopted in this study. The following section outlines the emergent limitations associated with applying the idealised methodology outlined in Section 2 and the necessary modifications to this protocol, from data collection, analysis, interpretation and eventual deployment.

3.1. Emergent limitations in the FNA protocol

As a protocol designed for application in the developing world, and informed by the unique set of restrictions presented in such circumstances, applying the BIOFIN FNA process to a developed world country inevitably requires some level of modification. However, the year 2020 also presented some completely unforeseen restrictions in developing an FNA, notably the restrictions imposed in response to the Covid-19 pandemic.

3.1.1. The NBAP targets

Although comprehensive in its outlook and ambitious in the coverage of its targets, Ireland's former NBAP (2017-2021) and the targets it contained did not readily lend themselves to costing. Importantly, very few of these targets adhered to SMART principles (Specific, Measurable, Achievable, Realistic and Time-bound). As such, it was extremely difficult to estimate the costs of achieving a target, when many of these (including those identified as priority targets) lack a quantified key performance indicator (KPI) or deadline for delivery. In many cases, NBAP targets include action verbs such as "restore", "promote" or "achieve" which, although providing a useful call-to-action, do not provide a means of verifying whether that task has been achieved. The FNA was subsequently revised to include the targets of the new 4th NBAP (2023-2030), which includes more in the way of indicators, although the same argument applies to many topics. Therefore, developing costing frameworks for - and deriving an estimated cost of – meeting targets would require considerably more capacity (time and staff) than was initially anticipated. In their current form, each target would require lengthy consultation with conservation actors and funders to enable bottom-up activity-based costings to be generated.

Ireland is not alone in struggling to appropriately quantify progress in its NBAP targets. A review by the CBD expert panel on Resource Mobilisation found that NBSAP structures around the globe were "*structurally sound, but operationally ineffective*" (CBD, 2020). Although a limited number of developed nations have attempted a BIOFIN approach, many have struggled with the subjectivity in their NBSAP targets. For example, Finland has also trialled this process and has reported that the vast majority of metrics for progress were based on expert opinion and workshops, and not on any KPI. The second interim review of Ireland's NBAP by the National Biodiversity Forum stated that the next NBAP should include specific, measurable, actionable, realistic and time-bound (SMART) targets and KPIs to measure impacts on biodiversity. It added that targets should focus on measurable results-based outcomes and actions with an evidence base demonstrating effectiveness. Ireland's draft NBAP contains 163 targets and associated actions. **Table 3.1** BIOFIN Costing Approaches pros and cons

Costing Approach	Common Uses	Opportunities	Challenges
Incremental Budgeting Approach	Annual increments allocated to most budgets	Gradual change	Limited vision. Lack of connection with results
Historical Projections	Empirical data used for budgeting	Accurate, based on real experience	Not comprehensive, based on limited budgets
Cost Modelling	Extrapolation from small cases, for new activities	Alterative scenarios, understanding cost effectiveness	Lack of empirical data; specific context
Activity-Based Costing	Project budgeting, programme budgets	Detailed bottom-up budgeting	Not necessarily focused on outcomes
Results-Based Costing	Planning by objectives, log frame, programme-based budgeting	Best practice, detailed, focused on outcomes	Advanced approach, but not used in most countries

3.1.2. Costing difficulties

Throughout the initial stages of costing estimation and interaction with key stakeholders, it became apparent that a majority of organisations fundamental to biodiversity in Ireland had great difficulty in estimating their required costs beyond a business-as-usual mindset. In some circumstances, organisations struggled to quantify their current income and expenditure, and could therefore not accurately calculate future costings. This is largely a consequence of limited budgets and, for NGOs, a largely hand-to-mouth existence. No comprehensive conservation needs assessment has been undertaken for most habitats and species. That is, there has been no strategic assessment of what specific conservation measures should be undertaken in the short, medium or longer term, and

how these should be prioritised relative to one another. Immediate needs are largely understood, and pragmatic measures proposed given the overall resources available, but this has confined much spending to monitoring and maintenance rather than restoration.

Without functional tagging of expenditure across departments, the risk of double-counting also became highly apparent and prominent in early stages of data collection, as multiple departments often claimed the same expenditure, possibly in an effort to inflate apparent spending on biodiversity. Discussing future financial requirements for biodiversity could not be done in most circumstances, as no organisation had a tangible quantitative target for biodiversity, even those whose primary remit is biodiversity conservation or those who have committed to a specific NBAP target. This reflects the non-SMART nature of most targets. It became clear that developing individualised bottom-up costing frameworks based on the operations of each organisation, and tailored to each relevant NBAP target, was not feasible in the time-scale and with the resources committed to this FNA. Thus, in many cases, an incremental costing methodology was adopted whereby existing expenditure on priority actions was taken as a baseline, with a requirement that this spending should increase. The PAF for expenditure on the Natura Network and associated green infrastructure has been an important source of data, with the assumption that these costs can reasonably be extrapolated to a national scale (i.e. the broader goals of the NBAP). Only in a limited number of circumstances, could cost modelling or results-based costing be applied.

A further emergent limitation relating to costs, concerned the outdated figures from the NBER, published in 2018 but with figures applying to 2015. It was found that much has changed in the intervening years, with significant LIFE-IP projects having commenced and a new budgetary focus on peatland restoration, as two examples. As such, an initial phase of updating the spending in areas of priority expenditure was first required, to allow improved estimation of future expenditure requirements.

3.1.3. Developed vs. developing world application

The comprehensive review of completed FNA projects across the globe (predominantly in a developing world setting) revealed that application of the BIOFIN model in a developed world nation is markedly different. It was found that the developed world is not a 'blank canvas' in terms of biodiversity expenditure, but has complex layers of governance and vested interests that may extend decades into the past. This results in complex overlaps of financial support, department responsibilities, and suites of stakeholders involved in the conservation of ecosystems. Further, the more representative and equitable governance structures of the global north also require higher levels of engagement and consensus around spending decisions. By comparison, in the developing world, limited spending and actions are currently in place making quantification of this and strategizing future spending much easier, versus the multi-layered web of spending and actions already in place in a developed world context. These findings are reflective of the recent review by the CBD expert panel on Resource Mobilisation, which found that much more simplified costing frameworks could be composed in developing world contexts and that NBSAPs could learn from the errors of more developed nations and benefit from the guidance of BIOFIN in composing targets.

3.1.4. Pragmatic and actionable results

In consultation with the NPWS, it was agreed that the FNA should produce pragmatic, concise and easily-actionable outputs that would directly feed into a policy formulation if and when required. As well as requiring good baseline figures for current and immediate increases in available finance, this resulted in an increased focus on qualitative thematic analysis of current spending on biodiversity and modes of filling the biodiversity finance gap. This included analysis of the ways in which current spending is conducted, potential improvements in efficiency, a realignment of existing expenditure towards generating additional expenditure, and avoiding expenditure with an adverse impact on biodiversity (e.g. by limiting harmful subsidies). Through this process, a set of simplified recommendations could be made per major ecosystem type and key sector. Despite the focus on the easily actionable outputs, the FNA report does, though, include some sets of projections of the expenditure that would be needed to move away from incremental improvements to larger scale restoration of key habitats.

3.1.5. Project resource limitations

Some other nations adopting the BIOFIN approach (as reviewed in Appendix B) have pulled together dedicated teams overs several years to develop their FNA and ancillary deliverables. These nations have integrated the process into existing structures within government departments, providing access to experts, additional resources when required, and legitimacy when contacting other government departments. Although impartiality is achieved by outsourcing the process in Ireland to an academic body, this also diminishes access to knowledge gatekeepers. The benefit of having a "champion" of FNA within a department was evident in interactions with the NPWS. Similar key contacts should ideally be designated through cross-departmental buy-in (particularly Dept. Agriculture, Forestry and the Marine, and the Dept. Finance).

3.1.6. Covid-19

BIOFIN advises the use of expert workshops, focus groups, interviews and stakeholder events to address the absence of existing indicators of progress or spending on NBAP targets. However, owing to the Covid-19 pandemic restrictions on conducting face-to-face meetings or in convening groups, it was unfortunately not possible to follow the recommended protocol. This mainly affected the ability to develop costing frameworks in line with the iterative costing process recommended by BIOFIN. Although meetings could be

conducted over tele-conferencing facilities, the availability of respondents to meet online diminished continually throughout the pandemic. Despite this, interviews with nearly 100 key informants were obtained over a 9-month period.

3.2. FNA protocol adopted

3.2.1. Scoping and Clarification of targets / actions

Guidance provided by BIOFIN refers to the need to make a comprehensive estimate of the financial expenditure needed to meet biodiversity targets. Given the limited resources available, the current FNA has focused on the principal habitats in need of conservation and restoration, informed by interviews with NPWS Science and Biodiversity Units and others. It has also reviewed the adequacy of supporting infrastructure and the role of Semi-state bodies, local authorities and NGOs. Where possible, cost modelling, or results-based costing, was applied. However, in many cases, consultees did not have information on the cost of specific activities and so an incremental costing methodology had to be adopted whereby existing expenditure on priority actions was taken as a baseline, with the consultee being asked how this spending should increase.

3.2.2. Qualitative – interviews

A total of 57 interviews were held with different stakeholders. These included 21 people within NPWS, including policy managers, sector specialists and rangers, 5 with NGOs, 7 with Biodiversity Officers and Heritage Officers, 2 with the Heritage Council, 1 with the National Biodiversity Data Centre, 1 with the Natural Capital Ireland, 1 with the Department of Housing, Local Government and Heritage (formerly DHPLG), 4 with the Department of Agriculture, Food and the Marine (DAFM), 3 with Coillte, 1 with the Marine Institute, 1 with Bord Iascaigh Mhara, 1 with the Climate Action Regional Office, and 1 with the National Treasury Management Agency. In addition, discussions were held during meetings and conferences, although because many of these were on-line due to Covid-19 this understandably limited the amount of interaction compared with what would have been hoped for previously. Meetings were attended on biodiversity financing, including for example green bonds and the role of the European Investment Bank, and the Chartered Institute of Ecology and Environmental Management. A presentation was made at the Ecosystem Services Partnership meeting in Estonia in June 2021.

The interviews provided a broad platform from which to better understand the financial situation for biodiversity, where resources are needed or lacking, where there is potential for improvement in the prioritisation or management of resources, and interactions with other bodies or agencies. The interviews covered sources of expenditure or activity including NPWS, DAFM, Local Authorities, NGOs, European co-funding such as LIFE or LEADER and addressed biodiversity priorities attaching to agriculture, forestry, the marine peatlands, water and to protected species. To provide for a triangulation of responses, people were met who belong to the same or related organisations and who work in similar areas.

The interviews covered the following areas:

- NPWS Ranger work and responsibilities
- Plants/grasslands (NPWS),
- Bogs (NPWS, CANN, Bord na Mona)
- Marine (Birdwatch Ireland, Irish Whale and Dolphin Group, Marine Institute, Bord Iascaigh Mhara, NPWS)
- Heritage Council / Heritage Officers
- County Councils / Biodiversity Officers
- Water (Freshwater Pearl Mussel Project, Irish Water, LAWPRO, DHLPG)
- Agriculture (DAFM, EIP_Agri, ASSAP, NPWS)
- Finance and relationships (NBDC, Irish Wildlife Trust, Vincent Wildlife Trust, BCI, Natural Capital Ireland)
- Forestry (Forest Service, NPWS, Coillte),
- Animals & Birds (NPWS, NPWS Wildlife Crime, Vincent Wildlife Trust)
- Conferences included Scottish Wildlife Trust, European Business & Nature Summit, ESP Tartu, CIEEM.

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4. Results

4.1. Quantitative analysis

The FNA examined the various expenditure up to 2021 by Department, Agency or NGO along with their respective programmes, projects and items. As with the NBER, this expenditure can be defined as government or private, or as capital or current expenditure, and can be allocated (or tagged) to a primary NBAP Target, a secondary NBAP Target, the CBD Aichi targets, the UN Sustainable Development Goals, the EU Biodiversity Strategy targets, the IUCN targets and SEEA classes. The FNA is not directly comparable with the NBER as it is focused on expenditure that is *intentionally* expected to benefit biodiversity, whereas the NBER included also secondary expenditure which indirectly benefits biodiversity either by design or default. It does, however, apply the same coefficients (5%, 25%, 50%, 75%, 100%) to denote our assessment of the relevance of different Departments' expenditure to biodiversity. The choice of coefficients makes a considerable difference to the projected expenditure. This is especially the case for the sectors of agriculture and water. The FNA should therefore be regarded as a separate process and not interpreted as a simple extension of the expenditure that was estimated by the NBER.

Recent levels of biodiversity expenditure are illustrated by Figure 4.1a which demonstrates clearly the high proportion accounted for by agri-environmental schemes (AES), including here measures for grasslands and heath, including for AES measures dedicated to the protection of certain species (e.g. hen harrier and red grouse). Biodiversity related expenditure for peatlands has increased somewhat subsequently to the figures included here, but that for the coastal and marine environment, woodlands and forest and freshwater has remained much the same and relatively small. To put this into context, Figure 4.1b shows the relative proportions of Ireland that are accounted for by different land cover or habitat types. This demonstrates the relative abundance of bogs and other peatlands and wetlands relative to higher productivity 'agricultural' land where most expenditure occurs. The proportion accounted for by forests is mainly exotic coniferous plantation.

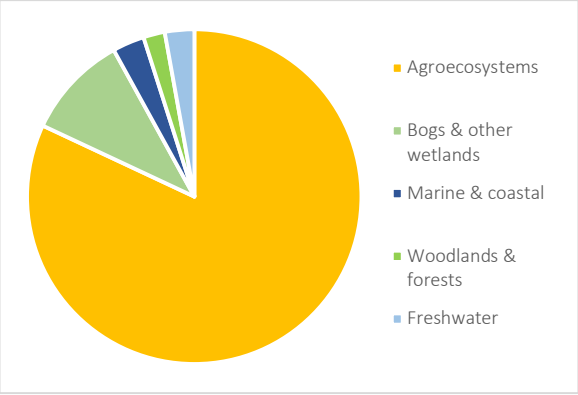

Figure 4.1a Biodiversity related expenditure by land use 2021

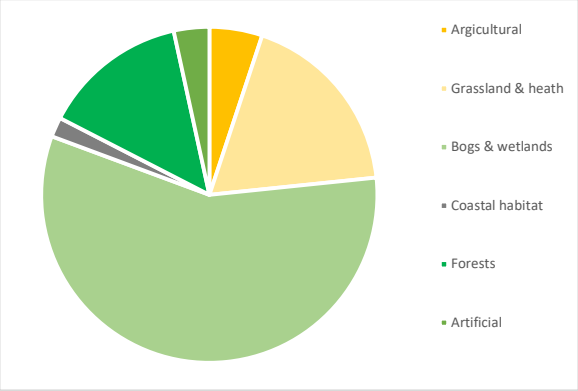

Figure 4.1b Terrestrial land cover

Expenditure proposed for the PAF is shown by Figure 4.2. The PAF identifies the amount of expenditure proposed for the conservation of Natura habitats and species. These sites cover 13% of Ireland's land area, or 16,947km^2, while six marine SACs cover 9,867km^2. The PAF identifies **€60.40 million** for Horizontal measures and is comprised mostly of *recurring* expenditure along with a modest amount of *once-off* expenditure on site designation, administration, monitoring, research and communication and awareness. For

Natura Site actions, it lists annualised figures of **€59.6 million** of recurring expenditure and **€7.6 million** of once-off expenditure over the six years of the Multiannual Financial Framework (MFF) for 2021-27. The PAF also includes proposals for **€16.8 million** and **€15.4 million** of recurring and once-off expenditure respectively on green infrastructure (habitat external to Natura sites) where there is clear evidence that this supports Natura habitats or species. In addition, **€2.6 million** of expenditure is identified for species specific measures, although €15.5 million of the total intended for AES is directed as species such as hen harrier (*Circus cyaneus*) and red grouse (*Lagopus lagopus hibernicus*) The relative size of expenditure for different habitats is illustrated in Figure 4.2, while the smaller pie chart to the right illustrates the relative total and share of expenditure for green infrastructure.

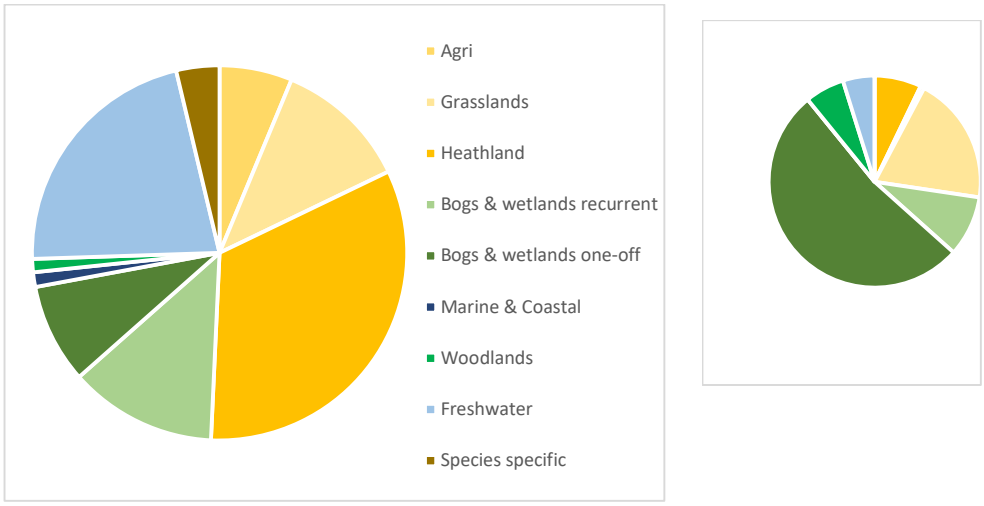

Figure 4.2 Proposed expenditure for PAF Natura (left) and green infrastructure (right) showing relative size

Spending on AES is directed at habitat defined largely as "heath" based on the EU's Mapping and Ecosystem Services (MAES) definition. In Ireland, this includes much upland habitat and is combined with a sizeable number of measures to protect hen harrier in these areas. This habitat is often a mosaic of grassland and peatland. Specific AES measures for grassland are identified separately in Figure 4.2 and this too is a sizeable share of AES spending (and is discussed below) as well as spending proposed for peatland.

As it addresses only Natura sites and related green infrastructure, the PAF provides only a starting point for the FNA objective of estimating the expenditure necessary to meet the targets of the current and future NBAPs. It does though contain proposals for significant increases in expenditure in areas such as restoration of both NPWS raised bogs and formerly worked Bord na Móna bogs.

Whereas Figure 4.2 shows the cumulative expenditure needed, **Figure 4.3** shows the individual estimates of recent biodiversity related spending, the PAF estimates and broad estimates of the amount that could need to be spent on restoration to meet the needs of the first 2030 targets of the NRL as currently proposed. Because the scale of AES spending in the PAF is so large relative to that of non-AES expenditure, the figures are illustrated using a logarithmic scale. Estimates of minimum and maximum possible extrapolated spending are discussed in some sections depending on whether area data from Article 17 reporting or Standard Data Forms are used as the reference. The estimates also depend on the ecological condition of habitats for which there is often insufficient evidence at local level. As the lowest level of conservation status is used to define condition at a national level, this area would include some habitats which are actually in relatively good condition and less of a priority for restoration.

The estimates for NRL restoration have been converted into annual figures in the tables below. They are, though, very uncertain, being based on extrapolation from known restoration costs in a few example locations, for instance peatland restoration, an expansion of native-species forest, or a gradual programme of catchment management and the re-naturalisation of rivers, lakes and lagoons. However, for AES, there is no maximum. Rather, it is described below how potentially a Results-Based Agri-Environment Payment Scheme (RBAPS) could be delivered more efficiently than the former AES programmes such as GLAS with no additional costs after allowing for the inclusion of personnel and administration costs. For the coastal and marine environment, expenditure is available from other Government Departments to support sustainability objectives (and biodiversity), but a more substantial increase in expenditure (beyond the maximum shown in Figure 4.3) would be needed to fully meet the objectives of the Water Framework Directive and Marine Strategy Framework Directive, and to prevent the long-term degradation of habitats.

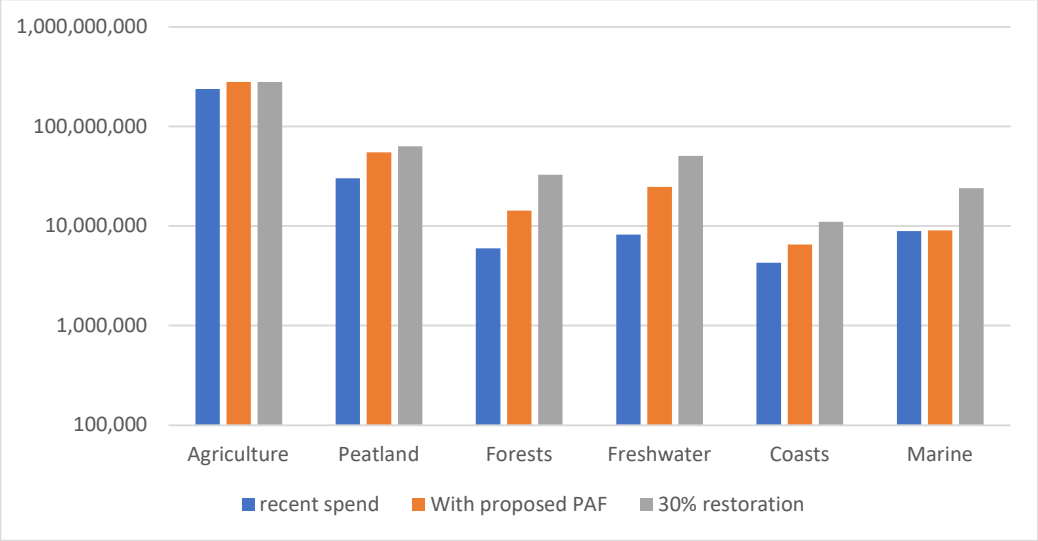

Figure 4.3 PAF, recent spending and future financing needs (€ millions logarithmic scale)

FNA estimates for PAF Natura spending, recent spending, minimum and maximum extrapolated spending for each habitat is presented at the end of each detailed habitat section and summarised below.

1) Agri-environment

Around €35.4 million of annual spending on farmed habitats is identified in the PAF for AES payments for Natura sites along with €7.3 million for associated green infrastructure. Of this, the summary table below lists €6.3 million of expenditure as being labelled for agroecosystems, €28.2 million for heaths, and €8.3 million for grasslands. These figures include around €12.8 million towards species specific measures, although many of these relate to birds such as hen harrier and red grouse and are included in the section on Peatlands. By comparison with these figures, total national-level spending on AES measures as of 2021 amounted to nearly **€240 million**. As well as the public good benefits associated with biodiversity and the environment, it is important to recognise that AES are also welfare payments, or social transfers, that supplement core farm incomes. For these reasons, it is important to note that AES were subjected to a **75%** coefficient in the NBER. It is impossible to identify within the confines of the current study to what farmland area further conservation measures could be expanded, although the NRL will provide more direction in this respect. AES agreements are also notably absent from many of the more intensively farmed areas of the country due to the high opportunity cost and farmers' reluctance to be bound by conservation rules or to take land out of production. The new CAP Strategic Plan for Ireland does, though, require that holdings include 4% of non-productive areas, with some exceptions for Natura areas and others. If more targeted support for pockets of remaining or newly created habitat in these more intensively farmed areas were to be included in AES, then maximum annual expenditure would exceed current levels of spending. However, an argument is made in this report that the same area of farmland as included in the former AES could be managed for conservation more effectively, and at lower cost, through greater adoption of results-based agri-environment payment schemes (RBPS) akin to the NPWS Farm Plan Scheme, at least before consideration of personnel and administration costs. Indeed, such measures, along with others to mitigate climate change and protect water quality, have been included in the Cooperation Areas of the new ACRES national scheme.

Proposed PAF Natura spend	Recent spend	Minimum spend
€43 million	€237 million	€280 million
AES for agro-ecosystems, grasslands, heaths, hen harrier and other bird species measures	Mostly former GLAS activity-based measures plus some recent Agri-EIP, etc.	Replace prescription measures with locally-led and RBAPS schemes at same cost + €3.7m for AES advisors

2. Peatlands

Just under **€37 million** of annual spending is directed towards peatlands in the PAF, with the highest proportion included under once-off green infrastructure measures which involve peatland rehabilitation or restoration. Recent expenditure on peatland conservation and restoration has been around €30 million per year, including €15 million in annual payments from the Department of Environment, Climate and Communications (DECC) under the Enhanced Decommissioning Rehabilitation and Restoration Scheme (EDRRS) for Bord na Móna bogs. The amount of restoration needed to fulfil the needs of the NRL will depend on what is interpreted as "agricultural

land on peat soils" and "rewetting" and on the role that restored cutaway and turbary can make as well as allowances for restoration from forestry. Given that there has been much recent expenditure on peatland rehabilitation and restoration, the additional expenditure is likely to be at least **€8.5 million** per year prior to 2030, but possibly as much as €18 million per year.

Recent spend	Proposed spend under PAF	Additional spend to meet NRL targets by 2030
€30 million pa	€37.0 million pa (peatland) €55 million pa "Other" state spend	€8.5 million pa.
NPWS (inc CTCCS), EDRRS, LIFE Wild Atlantic and Peatlands & People.	"Other" relates to additional State expenditure and may be exaggerated by once-off measures. In addition, €28m is to be spent on Heath, including dry health habitat and upland bird measures.	Lowest annual cost of measures to meet 2030 target of the NRL

3. Native woodland

Just under €6 million is spent each year on native woodlands. After some hiatus in recent years, Forest Service spending on the Native Woodlands Scheme, both the Establishment and Conservation elements, has increased slightly. Total Forest Service spending is around €3.5 million per year before consideration of the clauses included in commercial timber grants for proportions of native trees, woodland margins and stream sides. Recent Coillte spending on monitoring and its Coillte Nature initiative amounts to at least €1.3 million per year and NPWS spending has been €1.1 million per year. Spending proposed under the PAF for native woodlands amounts to €2.4 million per year. More needs to be spent to add to the woodland resource and to prevent a deterioration in the current state of woodlands. At present, the uptake for schemes supporting native woodland by private landowners has been modest, even when planted for commercial purposes. There are potential opportunities to encourage more planning in return for carbon credits which are not being realised at present. For the time being, spending is less than what is needed. An increase in expenditure would secure improvements for the best examples of native woodland, but for the purposes of the NRL there is the question of whether to restore a national native woodland habitat on site or to undertake new planting of native species, given the cost of protecting woodlands from invasive understory species and deer browsing and the potential benefits of protecting watercourses and achieving habitat connectivity. Further spending will depend on whether NRL is considered to apply also to the restoration of habitats and landscapes in which ash is dominant (such as many rural hedgerows) following the devastation for this species by ash die-back disease for which the only defence is long-term breeding of resistant trees.

Recent and proposed PAF spend	Additional NRL spend per year to 2030	NRL additional spend to address ash dieback in natural landscape
€14 million pa	€11 million pa	€10 million pa
Net additional NPWS spend of €8.4m pa (€24.1m in PAF) plus existing spend of €5.9m by Forest Service, Coillte and NPWS,	Including allowance for rhododendron eradication, lower (€6m) and higher (€11m) estimates of addressing the problem in remaining native woodland.	Minimum spend of €10m for dealing with ash dieback in hedgerows and native woodland.

4. Freshwater

Significant amounts are spent each year on measures to monitor and improve water quality. Excepting investment in major infrastructure such as wastewater treatment plants, over €8.2 million is spent each year on LIFE projects, relevant EIP-AGRI schemes, and by the Local Authority Water Programme (LAWPRO) and the IFI Salmon Conservation Fund, after coefficients are applied to account for the spend that is primarily directed at biodiversity rather than human health or social factors. Despite this expenditure, the latest reports from the EPA show that water quality has resumed its decline with a loss, in particular, of high status rivers. While there has been some positive biodiversity stories, native fauna and flora is seriously threatened by invasive aquatic species and exogenous effects such as climate change. Additional expenditure of €16.5 million is identified by the PAF for Natura sites and green infrastructure. For water quality in the wider countryside, the LAWPRO model of farmer and public engagement is promising. Guidelines for forestry planting and harvesting have been set out. Catchment management is now pursued by the DECC and EPA. However, the elephant in the room continues to be nutrification from agriculture. Much hope is placed on future CAP reform and the possibility of incentives for direct measures to protect water quality rather than to just moderate land use intensity. NRL spending is likely to focus on waterbodies and non-peatland wetlands whose status has deteriorated. However, only land use policies can address the inflow of water to these habitats.

Current and proposed PAF spend	NRL additional spend including sub-catchments	Additional restoration spend to restore rivers to free-flowing status
€24 million pa	> €22 million pa	+ €710,000 - €4 million pa

LAWPRO, ASSAP, AES, EIPs LIFE and forest management for FPM and lake catchments	Applying LIFE projects such as for Carragh and Lough Carra to 7 catchments per year (51 by 2030)	Removal of 5 major barriers per year *or* these and smaller barriers on 15% of rivers.

5. Coastal areas

The PAF includes spending estimates for Natura coastal and marine sites together at €894,000. Additional related spending of €2.4 million is identified for AES measures related to lagoons, dunes and machair. Extrapolating these figures to the area of degraded coastal habitat for which there are estimates of the conservation spend needed per hectare, would suggest a minimum spend to meet the targets of the NRL of just €1.4 million per year. However, this figure excludes other key habitats which are reported in the Article 17 Status report as being in adequate or bad condition such as estuaries, inlets and bays, accounting for which could raise annual restoration costs significantly. Some habitats, such as dunes and saltmarsh, are under increasing pressure from sea levels rise, extreme weather events, IAS and recreation and would need continuous investment into the future a consequence.

Recent and proposed PAF spend	Extrapolation to national area	Additional spend to meet NRL targets by 2030
€4.3 million pa	€6.5 million pa	€4.5 million pa
With AES of around €3.43m including for coastal species.	Adds €2.2 million, mostly for conservation of habitats where costs are known	Restoration of 30% lagoons, dunes and saltmarsh.

6. Marine

Marine conservation has been almost exclusively addressed through the Marine Institute, principally through surveys of wild fisheries and the seabed. The PAF acknowledges the importance of surveys, including the ObSERVE programme, particularly given potential pressures with regard to commercial fishing and hydrocarbon exploration and exploitation. Most biodiversity relevant activity to date has involved monitoring pressures, particularly from commercial fishing, while marine biodiversity has been left to itself to adapt. This situation may change with the implementation of Marine Protected Areas (MPAs) which will require more proactive fisheries protection to be effective.

Recent and proposed PAF spend	EMFF allocation & Natura 2000	Additional spend on MPA protection and to meet NRL targets for 2030
€31,500 pa	€8.9 million pa	€15 million
Mainly protection of seabird colonies	Average Marine Institute annual spend on monitoring and research	Completion of MPA designation. Increased island predator control. Mostly fisheries protection costs to permit natural recovery. Figures subject to much uncertainty

4.2. Agriculture - Conserving farmland biodiversity in Ireland

4.2.1. Irish farmland biodiversity

In comparison to the industrial farming practices in regions of mainland Europe, Ireland's high number of small and often marginally productive farms contain habitats which support a large proportion of our extant biodiversity, including hedgerow networks, woodland fragments, semi-natural grasslands and uplands unsuitable for high-intensity agriculture. The value of these areas for biodiversity is well recognised across Europe (Batáry *et al.* 2015), although the farmed area of the Natura 2000 network in Ireland is considerably higher at 59% than the EU aggregate of 38% (Bleasdale & O'Donoghue, 2015). Additionally, the extent of Ireland's High Nature Value Farmland (HNVf) was recently found to be substantially higher outside of protected areas than previously thought and is believed to exceed 1.8 million hectares (Matin *et al.* 2020).

Outcome 2A of the NBAP 2022-27 aims to protect and strengthen the network of protected areas. **Outcome 2B** addresses conservation actions for biodiversity and ecosystem services in the wider countryside. Action 2B1 contains a specific objective to provide sufficient incentives for farming for nature while 2B2 requires support for this from DAFM and NPWS including for enhanced connectivity. Action 2B2 requires DAFM and relevant stakeholders to develop and implement Results Based Agri-Environment Payment Schemes (RBAPS) as part of the CAP Strategic Plan. Target 2B4 calls for DAFM and Teagasc to provide support for organic farming while 2B6 calls for measures to reduce pesticide use. Action 2B7 calls for support for enhanced biodiversity and ecosystem services delivery from agro-ecosystems, including HNVf. **Outcome 2C** is highly relevant to agriculture too in that it calls for nature-based solutions (NbS) to improve the quality of waterbodies.

Over the period 2014-2020, €662 million was allocated to AES under the European Agricultural Fund Rural Development (EAFRD). Most of the Objective 1 and 4 targets do not require significant new spending as they are mostly linked to existing AES. Indeed, the NBER indicated the dominance of agricultural supports at both State- and EU-level in supporting farmland biodiversity, accounting for 75% of total spending on biodiversity between 2010-2015 (Morrison & Bullock, 2018). This spending is constituted by a diversity of schemes, ranging across incremental, activity-based and results-based payments. Table 4.1 below, outlines the most prominent of these schemes in terms of investment and potential effect on biodiversity, showing details on the nature of funding and future prospects. Each of these is treated in greater detail thereafter, with synthesis of findings and recommendations posited.

Table 4.1. An overview of the highest value Agri-Environment Schemes, with notes on their value and future funding status [3]

Programme	2021 costs	Future status
CAP - GLAS	€ 187,424,630 (peak spend across MFF)	Successor to AEOS and REPS. Due to phase out by 2022, with likely continuation in modified form in next MFF. Biodiversity benefits are unclear.
– REAP	€ 10,760,000	Results-Based Agri-Environment Pilot transition scheme
CAP - M12 Natura 2000 payments	€ 10,464,000 7,444,700	Figure shown is annual mean across MFF (2014-2020) with likely continuation in modified form in next MFF.
EIP-AGRI	€ 8,300,000	Only programmes with direct benefit to farmland biodiversity are included in figure. Success of the programme, including tangible results, advocates for continued support as part of next RDP.
Burren Programme	€ 1,474,000	Prominent part of RDP with quantifiable success. Likely to continue through RDP.
NPWS agri-ecology programmes	€ 826,292	Display a range of effectiveness, with numerous results-based schemes. Continued decline in government funding, though capacity is lacking to utilise future increases.

[3] Reference: DAFM Annual Report 2021

Total	**million**	

4.2.2. The Rural Development Programme (RDP)

Spending on farmland biodiversity is mainly embedded in Ireland's Rural Development Programme through direct AES payments (M12 (Agri-Climate Rural Environment Scheme (ACRES), Natura 2000 payments and EIP-AGRI programmes). Most AES initiatives to date have been activity-based schemes, incentivising modified pro-biodiversity management such as altered mowing regimes, time-delimited hedgerow maintenance and the installation of bird boxes amongst many other measures. Although important in facilitating these actions, measurement of the impact of this funding has been lacking (Ó hUallacháin *et al.* 2015), a point starkly highlighted by numerous recent assessments of the CAP across the EU (AE, 2017, 2019; ECA, 2020). The most recent of these, which included Ireland as a case study, found that Member States favoured low impact options, rarely adopted results-based or 'dark green' schemes, and that direct payments had little effect on farmland biodiversity overall. In particular, Greening Payments were found to be largely ineffective at mobilising pro-biodiversity action, requiring almost no change to existing practices to receive payments (AE, 2017). Ireland's former mid-term assessment of the RDP 2007-2013 also found little impact on rural biodiversity and called for more impactful measures (Indecon, 2010). While the recent RDP (2014-2020) did identify impact on farms, this was mainly quantified through farmer self-assessed uptake of measures with little external ecological monitoring (Indecon, 2019). These findings were mirrored by a recent assessment of the former Green Low Carbon Agri-Environment Scheme (GLAS) by the Irish Government Economic and Evaluation Services (IGEES) which found low additionality in measures taken. For example, the highest proportion (33%) of payments were made to a single category, low-input permanent pasture, only one option of which contained the desired number of flora species (McDermott, 2019). Furthermore, participation was highest (52%) amongst lower impact sheep farmers, while eligibility for the 'traditional hay meadow' measure (61,500ha in 2017) required the presence of only three species of grass (McDermott, 2019). Thus, although the agricultural sector presents the greatest opportunity to conserve biodiversity in the wider countryside and has the greatest level of resources at its disposal through the RDP, these broad-brush approaches require significant revision.

4.2.3. Semi-natural grasslands

Ireland's farmed area is predominantly under grass (4.1 million hectares). Very little of this area is represented by unimproved or diverse species grassland. There are only an estimated 23,000 ha of semi-natural grassland across Ireland, with varying levels of protection status, use intensity and importance for biodiversity (O'Neill *et al.* 2013). This habitat represents the bulk of what can be described as HNVf. Diverse species grassland is singled out in the NRL which calls for an improvement in grassland butterfly index (as an indicator of ecological quality). Only 2,878 ha of this habitat in Ireland is formally designated across six Natura 2000 Annex I habitats[4] , the majority of which is actively farmed at varying intensities (NPWS, 2019a). Although a small proportion of Irish pasture is designated as environmentally sensitive permanent grassland (3.9%; one of the lowest in the EU27), Irish farmers declared 100% of this designated area within the former Greening Measures, versus other categories which were set at lower claim rates (AE, 2019). The same report also found that Ireland claimed CAP M12 payments (those relating to compensation for useable agricultural area lying within Natura 2000 sites and WFD priority areas) at a rate of over 120% of eligible land. The next highest proportions from the EU27 were Cyprus and Estonia at just under 60% claim each (AE, 2019). Thus, Irish farmers demonstrate good awareness of the financial value of semi-natural grasslands, although it is unclear from the report if this excess claim arises from misreporting or under-estimation of the total area of semi-natural grassland. This suggests that semi-natural grasslands in Ireland require further surveying and formal designation.

The cost of priority financing for grassland habitat types has been estimated in the PAF at **€8.09 million** per annum for the Natura 2000 network and a further **€156,436** for wider green infrastructure measures. Of this sum, much is directed at the recurring agri-environmental management of machair and fixed dunes (included under Coastal), bird species (curlew and whinchat) and the former Burren Programme (€4,000). By comparison, other Natura agroecosystems which are dominated by hen harrier measures for heathland habitat and bird measures attract €16.76 million, plus €2.37 million for green infrastructure.

The expenditure associated with extending the costs of conservation and restoration measures in the PAF to the entire qualifying area of annex 1 grasslands, excluding coastal grazed grasslands (which are dealt with in Section 4.4), is presented in Table 4.2. However, an important limitation is the difficulty in accurately estimating the total area of annexed grasslands in the wider countryside (i.e. outside Natura 2000). As shown in the Table, estimates of coverage based on Article 17 reporting is significantly less than that presented by Standard Data Form (SDF) submissions to the EU. Although the former estimates are based on limited data availability on verified areas, the SDF figures are thought to be less reliable as these are based on a combination of estimated and derived figures of the area of Natura qualifying habitat or species. The exercise does, however, demonstrate the scale of investment required in the wider countryside, as the true national extent of valuable grassland habitat is thought to be significantly higher than either of these figures and also excludes degraded habitat which could potentially be restored. These grasslands present a potential opportunity for future environmental restoration, noting both their biodiversity value and potential for more organic systems. Numerous species associated

[4] References 6130, 6210, 6230, 6410, 6430 and 6510

with this habitat, including meadow flora and birds such as curlew, lapwing and corncrake are either of bad status or have incurred significant declines.

Table 4.2. Semi-natural grassland habitat within Natura2000 network and the wider countryside and the priority costs that would be associated with its conservation if extended to the total area

Grassland habitat type	Article 17 (ha)	Standard Data Form (ha)
6130 – Calaminarian grassland	6.17	9.00
6210 – Orchid-rich calcareous grassland	1,415.58	3,367.00
6230 – Nardus grassland	611.14	598.00
6410 – Molinia meadow	585.73	3,047.00
6430 – Hydrophilous tall herb	100.42	207.00
6510 – Lowland hay meadow	159.86	940.00
Total area of annexed semi-natural grasslands (ha)	2,878.89	8,168.00
Annualised cost at national level*	**€ 1,040,654**	**€ 3,054,311**

* Figure derived from annualised /ha cost of AES (extensive grazing, no fertiliser) and once-off non-productive measures (scrub removal) provided by the PAF.

The proposed PAF measures for other grassland habitats exclude recurring and one-off spending that could be needed to provide further protection for species; for example, measures to protect ground-nesting birds. This is indicative of broader overlaps across numerous cost estimate categories provided by the PAF (and indeed across the multitude of agri-ecology schemes in operation at present), for which a targeted holistic farm approach engaging individual landholders would offer a superior solution. This could involve a 3-fold difference in coverage, indicating a need to accurately identify areas of priority habitat and to combine these into tailored programmes of interlinked actions for which individualised costs have been estimated. The period over which investment is to occur is of critical importance as PAF estimates are made for the next MFF, 2028:2034.

4.2.4. EIP-AGRI programmes

An example of a more holistic approach to farmland conservation in the wider countryside is presented by the agricultural European Innovation Partnerships, or EIP-AGRI, which are 56% funded by the EAFRD and 44% by exchequer contributions. Over 57 EIP-AGRI projects are currently in operation. This is a sizeable increase on the 25 projects which were in effect at the time of the compilation of the FNA whose cumulative expenditure was €34.2 million as of the end of 2021. The majority of these projects were centred on sustainable nature-positive farming practices, accounting for €52.8 million of the allocated expenditure over the 6 years of the RDP. These included two Themed Projects for Hen Harriers and Freshwater Pearl Mussels (accounting for €25 million and €10 million respectively). Other EIPs have broad coverage across a range of areas, such as regenerative agriculture, commonage, uplands, HNVf, tourism, peatlands and breeding birds.

As with most AES interventions, the inclusion of a high proportion of farmers in any one catchment is vital as the actions of a single uncooperative landholder may undermine the efforts of others. In this regard, the local administration of EIP programmes is a prominent benefit, imbuing a sense of pride and ownership through bottom-up engagement and results-based feedback. Indeed, the Bride EIP is already benefitting from the involvement, without payment, of numerous additional neighbouring land-users, perhaps in the hope of it becoming a larger stand-alone project with direct support of the RDP, such as the Burren Programme. It also indicates a low risk of exposure to non-compliance. Some programmes, such as the Pearl Mussel Programme EIP, are on course to follow suit, having originated as a smaller LIFE programme. However, while locally run, concern was raised by respondents to this study that EIPs may be less well monitored than their LIFE or Farm Plan predecessors. For example, monitoring for the Pearl Mussel Programme is to be limited to on-farm practices and larger-scale changes in-stream water quality measures or population demographics of pearl mussels themselves.

Although the administrative costs of EIP programmes are higher than mainstream AES, their ability to engage a broad swathe of farming communities (particularly those from high-impact sectors such as dairy; e.g. BRIDE EIP) and their higher likelihood of delivering results, makes EIPs a good option for locally-run AES. For this study, estimates of future spending could not be provided, but its current success suggests that the funding allocation will be retained. EIP-AGRI thus provides a viable incubation pathway for the development and scalability of results-based AES.

4.2.5. NPWS agri-ecology initiatives

The NPWS currently operates a diverse suite of agri-ecology programmes, or varying age, cost, coverage, and effectiveness. Table 4.3 gives an overview of these programmes and their expenditure for 2018 and 2019. Overall, funding for these programmes has fallen significantly across the current MFF (2014-2020), mainly owing to a reduction in funding for the NPWS Farm Plan Scheme (see section, below) and the gradual relocation of support for the Burren Programme to DAFM. This loss of expenditure has been somewhat replaced with an increase in other schemes, although this study reveals that the capacity to use increased allocations for some programmes is limited.

Table 4.3. Recent NPWS agri-ecology programmes and expenditure

Programme	Expenditure 2018	Expenditure 2019
Burren Programme	€13,118	€13,144
Farming for Nature	-	€15,000
Corncrake Grant Scheme (CGS)	€118,411	€108,664
Curlew Conservation Programme (CCP)	€177,762	€273,061
Natterjack Toad	€37,000	€33,000
Sub-total	**€346,291**	**€442,869**
NPWS Farm Plan Scheme	€480,000	€454,592
Total	**€826,292**	**€897,462**

Although representing a small proportion of expenditure at present, the Burren Programme formerly occupied a larger part of NPWS agri-ecology spending. Following its success, the majority of support for the programme has transitioned to direct RDP funding through DAFM since 2016, totalling up to €1.8 million annually, with NPWS making a small contribution towards administrative costs. The Burren Programme had achieved quantified success in both activity-based and results-based initiatives, which are tailored to individual farmers, and was recently heralded as a successful AES with results-based elements at EU level (AE, 2019). Owing to their directed and well-monitored nature, these measures, at an average of €2,576 per farmer for 2019, also represent excellent value for money that is both locally relevant and scalable.

As one of the longest-running agri-ecology schemes of the NPWS, having been established in 1993, the Corncrake Grant Scheme has represented a large proportion of spending. This is now, however, regarded as being more ad-hoc and reactive than other programmes and lacks the results-based elements of more modern initiatives. Its funding has been steadily decreasing since 2014 owing to a combination of more nuanced payments schemes on offer from other organisations and a contraction of the corncrake's breeding population and range. In comparison, the Curlew Conservation Programme is seen as a more effective model for breeding bird conservation on farmland. Since its inception in 2017, its popularity with farmers and the associated payments have grown steadily. It was claimed, though, by the respondents to this study that, while DAFM had paid farmers up to €8 million annually as part of GLAS for curlew measures, there was little monitoring of the impact of these measures. For example, an assessment of GLAS had found that only circa. 5% of farms were inspected for compliance (McDermott, 2019). Given that these GLAS payments were not results-based, the NPWS Curlew Conservation Programme arguably achieved a similar level of quantifiable conservation impact for 3% of the cost. The linkages of this programme with the newly awarded LIFE Atlantic Crex project will expand this agri-ecology stream considerably as a targeted results-based initiative.

4.2.6 NPWS Farm Plan Scheme

In contrast to the slow progression of the agricultural sector towards adoption of well-monitored RBAPS and the apparent low effectiveness of the sizeable expenditure (GLAS alone represented at least €437 million of direct exchequer spending by 2022, plus a further €556 million of EAFRD funds), other bodies with a direct remit for biodiversity have been conducting (and iteratively improving) such schemes for decades. One such scheme, designed, administered and implemented by the NPWS, is the Farm Plan Scheme.

The NPWS Farm Plan Scheme works with individual land users to compose novel farm-specific conservation strategies, by incentivising modified farming practices using individualised scoring systems for both activity-based and results-based metrics, and continued engagement with local NPWS staff. These plans should not overlap with existing CAP or EIP measures and payments, although assistance may be provided if the environmental benefits of involvement go beyond those of GLAS or EIPs. Many of these Farm Plans have provided a testbed for broader regional or national RBAPS, with some now integrated beyond the 5-year life of individual Farm Plans, into the national RDP as GLAS measures or as EIPs.

Beginning in 2006, the Scheme reached peak expenditure in 2010 with an annual budget in excess of €5 million across 600 farm plans nationwide, covering a range of farm-based biodiversity such as semi-natural grasslands, ground-nesting birds and hedgerows. Since the economic downturn of 2008, the Farm Plan strategy has been streamlined considerably, reducing funding and numbers of plans

but with a more focussed set of agreed actions and bespoke results-based elements to each. Over the period 2016-2019, direct spending by the NPWS on Farm Plans did not exceed €500,000 annually. Previous Farm Plans have either been subsumed into the RDP or were discontinued after their 5-year term expired. Although increased funding has now been made available for the Scheme's expansion, administrative and technical capacity is currently limiting further expansion of Farm Plans beyond the present cohort of plans (38 plans covering a collective area of 2,099 ha of high-nature value farmland at the time of writing). Given the high level of engagement in the composition of NPWS Farm Plans by procured farm planners and NPWS staff, in comparison to existing AES programmes such as GLAS, increasing the scale of the strategy would require the likely establishment of regional administrative nodes and the hiring of dedicated Farm Plan regional officers, potentially as members of a Conservation Measures Unit.

Despite these costs, the benefits of Farm Plans over existing broad coverage national AES seem apparent based on recent audits of GLAS (Indecon, 2010, 2019), not least in their combination of a broad swathe of traditional AES payment mechanisms into a single holistic farm-specific assessment and payment structure with results-based elements across a 5 year plan (NPWS, 2020). It is thus believed by the consultees to this study that this strategy may represent a more effective approach to conservation of farmland biodiversity than broad-brush schemes operating at a national scale and that the scheme reflects the recommendations presented by the CAP4Nature Technical Group in their assessment of CAP Green Architecture and Implementation (2020) and the recent Farming for Nature guidance document produced jointly by Teagasc and the NPWS (O'Rourke & Finn, 2020).

As a demonstrative exercise, the cost of an expansion of the NPWS Farm Plan Scheme to national coverage can be extrapolated using existing /ha costs and recent quantifications of the area of HNVf across Ireland. Based on likelihood analysis for the presence of HNVf by Matin *et al.* (2016), and overlaying this with NPWS priority areas for farmland wildlife as part of AES (Matin *et al.* 2020), a conservative estimate of total high-priority HNVf was derived, of 1,864,964 ha. Of this, a total of 775,715 ha coincides with NPWS priority areas. Using this area (representing the overlap of high-HNVf likelihood and NPWS priority area) as a priority action, it is estimated that the management of this area under a Farm Plan model would cost in the region of €177 million, although this estimate does exclude the time of NPWS staff or contractors. Table 4.4 below, presents these calculations. As an indicative comparison, the peak annual expenditure of GLAS was €208 million, again excluding the time of DAFM staff and farm consultants. It is also important to note that GLAS did include measures aimed at other elements of farm biodiversity, such as hen harrier and curlew that would be included in other NPWS agri-ecology measures outside of Farm Plans. However, it is claimed that while curlew payments through GLAS (estimated at c. €8m across the MFF) vastly exceeded that of the separate smaller-scale NPWS Curlew Conservation Programme (€273,061 in 2019), GLAS measures did not include adequate monitoring or farm-specific considerations and additional benefits were low (33% for farmland birds) (McDermott, 2019). Therefore, the impact is largely unknown, a point highlighted by the recent audit of CAP AES measures (ECA, 2020).

Table 4.4: The extrapolation of the NPWS Farm Plan Scheme costs to a national level, and comparison to peak costs of GLAS (DAFM)

Scheme or type	cost	*Source*
NPWS Farm Plan cost 2018	€ 455,000	*NPWS Agri-ecology Unit*
Total area covered 2018	2,099 ha	"
Mean cost per ha	€ 228.68	"
High-HNVf overlap with NPWS priority areas	775,715 ha	*Matin et al. (2020)*
Annualised national cost if extrapolated at national level to >Natura sites	**€ 177,390,757**	
GLAS peak annual budget for comparison	€ 208,780,000	*DAFM, CSO*

This assessment demonstrates the cost implications of introducing an alternative means of achieving objectives for HNVf. However, it is not intended to represent an estimate of exact costs, nor is it intended to advocate for the replacement of existing models of AES . GLAS also provided for actions which were not necessarily associated with HNVf, including watercourses and hedgerows. Rather, this presentation aims to demonstrate the relative cost-effectiveness of NPWS agri-ecology schemes, having the added value of bespoke design, expert ecological knowledge, advanced results-based payments and linkages to long-term monitoring structures. Another factor is the high quality of local administrative support. In both the NPWS and DAFM figures presented above, staff time is not accounted for, and it is highly likely that /ha administration costs of NPWS Farm Plans exceed those of GLAS and ACRES, which may offset the difference presented in Table 4.4. However, the biodiversity benefits accruing from a transition to a model based on NPWS Farm Plans, while retaining sustainable agricultural productivity, would be highly desirable. At present, an estimated 20% of NPWS agri-ecology staff time is occupied by Farm Plans. Thus, administering a theorised national Farm Plan Scheme would necessitate a 74-fold increase in existing Farm Plan administrative effort (0.2 x [775,719 ha / 2,099 ha]), equating to an additional circa €3.7 million. However, improved collaboration between DAFM and NPWS could capitalise on the extensive network of agricultural advisors already operating nationally. Furthermore, given current DAFM AES are co-funded by the EAFRD, as opposed to NPWS schemes which are not, a co-designed and co-administered interdepartmental scheme could present substantial cost efficiencies. This would be

supplemented by the highly successful EIP-AGRI scheme, which would continue to incubate models better able to engage with high-income farmers who do not currently opt for AES (GLAS, Farm Plans, etc.).

4.2.7 Limitations of agri-ecology measures

As with a large proportion of NPWS operational expansions, a limitation of available staff to administer any increases in funding is again apparent. Thus, any increase in resource provision would require suitable provision of FTEs. The findings of the current study highlight the value of decentralised administration of Farm Plans as a means of connecting with rural communities and providing access to farm planners, although keeping administration local would significantly increase the costs of an expanded Farm Plan scheme in its current guise, in comparison to the broad-brush GLAS alternative. The Irish government has committed to an expanded Farm Plan scheme in budget 2021 (GoI, 2020), with a targeted increase of 250 plans. It was unclear, at the time of writing, whether this would also include an increase in administrative capacity.

The impetus to jointly manage EAFRD funding available for ACRES or other AES measures is again apparent given the expertise held by the responsible body for biodiversity in Ireland (NPWS) and organisations focussed on the sustainable growth of Irish agriculture (DAFM, Teagasc). A lack of suitable representation in the governance of biodiversity-related agriculture funds thus significantly hinders the effectiveness of current AES and the ability of NPWS to contribute to their improvement.

An additional limitation is the lack of incentives for farmers to join voluntary schemes, either broad-and-shallow AES measures or NPWS Farm Plans. For example, it has been highlighted by respondents to this study that incentivisation risks the emergence of a cohort of intermediate-level farmers (estimated at over 70,000 in number) who choose not to adopt AES even while still earning less than the more intensive businesses. This cohort, trapped by the polarisation of specialisation (e.g. Burren, Farm Plans, etc.) versus intensification (e.g. expansive dairy), risk being left behind in future RDP design.

Finally, the age of some existing NPWS agri-ecology measures, which may be founded on historical species distributions or top-down AES models, inhibits their effectiveness. For example, the Corncrake Grant Scheme (CGS), founded in 1993, has been described as "reactive and ad hoc" in nature, relying partly (along with census data) on self-reporting by farmers of calling male birds to provide compensation for subsequent modified practices such as delayed mowing. However, in some regions, corncrake have been absent for several years, although the CGS may still extend to these areas. Such prescriptive and top-down schemes may be popular as supplementary incomes, but levels of regional redundancy will continue to limit their effectiveness in protecting species.

4.2.8 The CAP Strategic Plan

The last Multi-Annual Financial Framework ended in 2020, necessitating a redesigned Common Agricultural Policy and associated national Strategic Plans. With the instigation of ambitious targets under the EU Green Deal, which encourage the coupling of climate and biodiversity at national policy level and mandates the mainstreaming of these within EU Directives, higher priority has emerged for results-based agricultural measures (EU, 2020). Additionally, MEPs have collectively called for legally binding targets for biodiversity, as with climate targets (EP, 2019). These changes have resulted in several domestic groups advocating for greater biodiversity considerations in the new CAP Strategic Plan. For example, the Cap4Nature group (Cap4Nature, 2019) made 6 key recommendations for biodiversity and farming, while the Farming for Nature Technical Group have presented a new CAP Green Architecture (FfN, 2020). The eventual publication of this CAP Strategic Plan revealed three important elements of high consequence for farmland biodiversity in Ireland:

- An overall reduction of 3% in total MFF value is proposed on indicative 2018 prices, with an associated reduction of 9.1% in EAFRD funding. Although in current prices this does not represent a significant reduction, it does signal an intention of the EU to substantially restructure the status quo.
- Despite this effective reduction, which mainly targets Pillar 1 payments (i.e. direct payments to farmers with little biodiversity benefit) Ireland would benefit from an increase of approximately €300 million in per-hectare payments, termed a Rural Development "Sweetener". Average payments /ha (€262/ha) would remain slightly below the EU-27 average (€264/ha).
- The co-financing rate for AES measures has not changed from the initial Commission proposals of 2018, and remains at 80% EU, while other measures have lowered their co-financing rates. This is likely to incentivise government investment in biodiversity-friendly AES as a means of minimising MS exchequer contributions. The overall intention of this is to attract greater national contributions, without disincentivising environmental measures.

The DAFM have, throughout the course of this study, expressed a growing commitment to results-based payments as a means of reaping tangible environmental benefits and optimising the more constrained CAP payments in the next MFF. The CAP Strategic Plan incentives will also render such a trend cost effective in terms of co-financing. Immediately following the announcement of proposed CAP revisions, concerns were expressed by the Irish Farmers Association that payments will not keep pace with inflation and that that existing payments structures should be retained, demonstrating the difficulty in modifying the payment systems which currently

underpin environmentally harmful practices across the Irish farming sector. Thus, incentivising biodiversity-positive management practices through results-based payments could offer a cost-effective means of effecting this change without diminishing EU support.

4.2.9 Farmland Recommendations

Agriculture has a tremendous influence on the state of biodiversity in the wider countryside. Agri-environmental spending is also responsible for 75% of total biodiversity expenditure. However, although GLAS had an improved design relative to former AES, its effectiveness was poor and it could be viewed as being as much a social as an environmental support. There was little monitoring of its success. In common to other Member States, the lowest commitment options still tend to be selected by farmers. The role of the NPWS FPS has diminished even though its model of targeted holistic farm management is sound. The Burren Programme has been moved under the responsibility of DAFM, but it was an exemplar of results-based scheme, while EIPs show similar promise with respect to targeting.

Given the importance of farmland to Irish biodiversity and the widely varying efficacies of AES to date, a better model is required which goes beyond poorly monitored broad-brush measures which supplement incomes but do not fulfil their environmental objectives. Cross-sectoral consultation for this study has found that AES are largely built on business-as-usual models which attempt to optimise the spending impact for biodiversity. However, the Commission has identified the need for a "Green Architecture" that can contribute to climate change mitigation, sustainable development, biodiversity and ecosystem services that is responsive to local needs and contains enhanced conditionality. Results-based measures have been adopted in the ACRES which also includes eight geographically targeted areas. Positive changes have been included in the CAP Strategic Plan of which the total budget for Ireland is €9.8 billion. Ineffective baseline greening measures have been replaced with a series of Good Agricultural and Environmental Conditions (GAEC) setting aside 3-4% by incentivising the retention of non-productive features and landscape features which were formerly not supported by CAP payments and vulnerable to removal. However, environmental NGOs have argued that the plan remains weak on HNVf, including grassland. An expert group, drawn together by Ireland's CAP4Nature Network (2020), had argued for more local targeting and greater attention for non-priority habitat. It had proposed an extension in the list of "landscape features" and that baseline conditionality of semi-natural habitat be increased from 5% to 10% to account for additionality in that most Ireland farms already exceed 5% on the basis of hedgerows alone.

On the basis of the consultation undertaken for this report, and the need to realise cost-effectiveness, the following recommendations are proposed drawing on the combination of NPWS scientific expertise and the resources and scalability provided by DAFM.

a) Payments by benefit

To date, AES payments have been based on income foregone. However, the profitability of more intensive agriculture, especially dairy and tillage, has meant that the cost of extending schemes to this sector is excessive and uptake has been poor away from farms which tend to maintain some degree of extensive practice, contributing to additionality. If agricultural policy is serious about confronting sustainability and biodiversity protection then an extended degree of reasonable cross-compliance is necessary. Additional payments and AES should be subject to results-based payments. Payments and schemes should be linked to distinct social benefits which include sustainability, biodiversity and ecosystem services including protection of water and mitigation of climate change.

b) Results-based landscape / catchment schemes

More locally targeted measures are needed. To date, outside of certain schemes, this approach has not been favoured due to the voluntary nature of agri-environmental payments. However, landscape-level funding operating at a catchment scale, can provide the more aggregate conditions to support results-based schemes, reflecting the positives of both EIP-AGRI programmes and NPWS Farm Plans. Indeed, the PAF incudes projections for green infrastructure spending outside of Natura areas of €1.77 million per year. Results-based AES and are specifically identified in the draft NBAP 2022-2027. A more ambitious level of landscape-level expenditure could involve collectivised application, monitoring and disbursement, using EAFRD funding and State co-funding, with DAFM coordination and NPWS advice, guidance and impact evaluation. This would increase the administrative capacity of NPWS towards biodiversity objectives and the scientific capacity of DAFM towards cross-compliance, and would provide further scope to coalesce related Water Framework Directive and nitrates derogation measures (e.g. ASSAP, LAWPRO, etc.). Baseline data and monitoring is needed to ensure appropriate effectiveness, but could become possible with the higher resolution land cover data likely to be provided by the OSi in 2021 which could also be incorporated into the Land Parcel Identification System used by DAFM.

c) A national Farm Plan network

Despite the success of NPWS Farm Plans, expansion is now restrained by capacity. If this limitation was alleviated, it could allow the Scheme to establish bespoke on-farm actions at a nationwide scale, focussing on HNVf as a priority. At present, much HNVf is not eligible for agricultural or enhanced payment, including lowland species-rich grassland. An expansion of the Farm plan

Scheme could transition to co-funding through ACRES while retaining bespoke NPWS Farm Plan actions and monitoring. Despite remaining voluntary in nature, this could provide a scalable introduction for new participants and incentivise the adoption of Farm Plans nationwide. This also mirrors the transition of some historical NPWS Farm Plans into EIP-AGRI (e.g. Hen Harrier Project) and stand-alone RDP schemes (e.g. The Burren Programme), although such a move would retain the bespoke nature of each plan to maximise returns for participating farmers and biodiversity.

d) Restoration

The NRL calls for an increase in trends for grassland butterflies, common farmland birds, stocks of organic carbon and high-diversity landscape features. Organic carbon is largely addressed in Ireland by transformation of drained grazing land back to fen and peatland and grassland measures are addressed above. AES over time have addressed features of the farm landscape which provide key habitat for birds and other species and which include trees, hedgerows, riversides and ponds. Ponds have recently been receiving welcome attention and are islands of biodiversity, essential for species, including insects, whose numbers have collapsed due to decades of drainage (Williams et al. 2020). As well as the value for biodiversity anywhere in Ireland, the great virtue of enhancing and restoring these features is that they provide a rationale for incentives in the more intensively farmed parts of the country where there has been low uptake of AES.

e) Monitoring high impact farms

According to DAFM, 16,000 dairy farmers (11% of the national total) are using 20% of the land and apply 50% of the fertiliser. For these farmers, the maximum ACRES annual payment of €7,000 pales in comparison to the profits of intensification. While AES measures remain voluntary, uptake will remain extremely low and negative impacts on watercourses and farmland biodiversity will continue. Although the nitrates derogation limits apply to up to 7,000 of these farmers, with fines in place for breaches, this largely relies on self-reporting. Thus, if tangible biodiversity benefits are desired, increased DAFM monitoring is required to ensure compliance. Combining monitoring with the AES options presented in b) and c) may also improve engagement in incentivised biodiversity-positive measures. Biodiversity on such farms would benefit from an increase in the area of semi-natural habitat required for baseline conditionality from 5% to 10% as proposed by the Farming for Nature Technical Group (FFNTG).

f) Branding for biodiversity

The success of organic certification in lowering the environmental impacts of food production presents a model for similar biodiversity-friendly standards. For example, the BRIDE EIP is investigating a partnership with local creameries to certify products as biodiversity-friendly, thus providing a market incentive for dairy farms to engage with AES. Glanbia have also trialled a similar premium mark for biodiversity, which could provide a precedent. As with other recommendations, there is a necessity for increased monitoring and engagement, although market incentives may provide for this, as with 'certified organic' products.

4.2.10 Summary

With 59% of land in Ireland under agriculture, it is inevitable that the associated cost of maintaining farmland biodiversity through AES will be high. The issue, however, is not so much the total amounts that need to be spent, but rather the effectiveness of the measures. The PAF identifies a national spending need of **€42 million** for itemised protection of farm habitats and species, and for green infrastructure, but the area of grassland which could be returned to HNVf would account for well in excess of the amounts identified by Natura. The NBAP 2022-2026 now contains actions requiring DAFM and NPWS to work together on measures to support HNVf. Until recently, annual spending on AES on all qualifying farmland was around €228 million. Overall, a system is needed that can support the livelihoods of the many farmers who continue to farm at a less intensive level. This system does, however, need to combined with one which can provide incentives for more intensive farmers who have land available for habitat restoration or creation, including for the protection of watercourses. These incentives could be combined with measures to reduce carbon emissions. This implies a degree of targeting and the use of landscape or catchment-based approaches to maintain and restore habitats and species, strategies which have been little adopted to date.

The NPWS Farm Plan Scheme has demonstrated the value of conservation expertise and of building working relationships with farmers and farm advisors. The scheme has demonstrated the value of locally-led and results-based approaches that are now being adopted more broadly and which could ultimately replace activity-based schemes that permit excessive individual discretion in the selection of measures and which are often characterised by additionality in the measures chosen. In principle, much could be achieved with AES modelled along the lines of the measures supported by the NPWS. More resources could advance sustainability, but much could also be achieved by using existing funds more efficiently and effectively while supporting these with cross-compliance measures. Complementary measures are needed too with respect to other land uses and water quality.

Table 4.5. Agriculture Summary Table

Recent spend	Proposed PAF Natura spend	Minimum spend
€237 million	€43 million (€6.3m +€28.2m+€8.2m).	€28 million
Mostly AES activity-based measures plus some recent Agri-EIP, etc.	AES for agro-ecosystems, grasslands, heaths, hen harrier and other bird species measures	Replace prescription measures with locally-led and RBAPS schemes at same cost + €3.7m for AES advisors

4.3 Peatlands - Financing Ireland's peatland biodiversity

4.3.1 Peatland biodiversity

Peatlands are Ireland's most extensive protected terrestrial habitat and one of our most important for ecosystem service provision. Along with extensively managed upland farmland, they are also important for ground nesting birds such as curlew and golden plover, many of which are suffering serious decline due to predation and land use change (McMahon et al. 2020). The following section provides a brief overview of the status of Irish peatlands, calculates the estimated costs of restoring these, outlines current investment in peatland restoration and details progress to date on this. Further, recommendations for prioritised spending are made based on the findings of the FNA process.

Outcome 2C of the NBAP 2022-27 acknowledges the contribution of peatlands to biodiversity in the wider countryside. Target 2C1 requires the DHLGH, Bord na Móna, DECC, DAFM and other stakeholders to implement the National Peatlands Strategy and 2C6 calls for significant progress in restoring and rewetting protected raised and blanket bog. Target 2C2 requires Bord na Móna to update its biodiversity Action Plan. Action 4C3 requires DHLGH and Bord na Móna to implement the Enhanced Decommissioning, Rehabilitation and Restoration Scheme (EDRRS). The extent of peat soils in Ireland

Peatlands are actually a myriad of habitats. Prior to large-scale anthropogenic land-use change, a considerable area of Ireland was under some form of peatland (raised bog, blanket bog, fen, heath). Many of these areas have been lost, but it is estimated that between 1.2 and 1.5 million hectares of Ireland lies on peat soil, equating to around 20% of Ireland's land surface (DCCAE, 2019). Table 4.5 outlines these figures in greater detail and provides references for the various estimates. Much of this peatland (up to 30%) has, over the centuries, been drained and converted to agricultural land, mainly forestry and grassland of varying conservation or economic value and which largely accounts for the variation in the lower and higher estimates of peatland area (Figure 4.6). In addition, up to 23% of peatlands in Ireland are under large scale conifer plantations, either semi-State through Coillte, or owned by private forestry interests.

Of what remains, only a fraction is protected across 62 SACs and 36 NHAs. For example, the entire SAC network captures only 22,107 ha of raised bogs, representing less than 10% of their total extent. Furthermore, much of this protected area is in a degraded state, having previously been exploited for domestic turbary and industrial extraction. Indeed, according to the most recent report on Article 17 of the Habitat's Directive (NPWS, 2019b) there remains just 1,659 ha of Annex 1 habitat 'active raised bog' (ARB) (i.e. peat forming). The report acknowledges that negative trends still outweigh restoration works, i.e. 20 out of 28 sites assessed were bad and declining, with turf cutting still continuing on a number of SACs and NHAs. Nevertheless, there are 2,500 ha of the Annex 1 habitat 'degraded raised bog' (DRB) nationally which through conservation measures alone are capable of regeneration to ARB within 30 years (NPWS, 2019b). Rationalisation of the NHA network is continuing through the de-designation of 46 NHAs (7 partially de-designated) and their replacement by 25 alternative sites.

The ownership of peatlands in Ireland is still largely private. Bord na Móna hold over 80,000 ha, while it is estimated that Coillte hold 232,500 ha of peatlands in their forestry estate (81% of which is blanket bog) making them the largest owner of Irish peatlands (DAHG, 2015). As of 2016, Coillte had leased a further 4,000 ha of cutaway bog for commercial conifer plantations (BnM, 2016). In its Strategic Plan, Coillte has declared its intention to improve its estate's carbon balance by returning some existing low productivity forest to rewetted peatland or to semi-natural wilderness (Coillte 2022).

Table 4.6. Peat soils in Ireland, collated by Fernandez (2020) from various sources.

Category	Estimated area (ha)
Raised bog	221,755 - 287,925
…of which under conifer plantation	70,330- 95,500
Blanket bog	525,350 - 551,650
…of which under conifer plantation	205,700-232,000
Fens	27,400
Wet heath	159,851
Grasslands on peatlands	295,000 - 437,000
TOTAL	**1,229,356 - 1,463,826**

Sources:

- Fernandez, F. (2020) calculations based on Art 17 2019 Active Raised Bog (7110) conservation status assessment data (NPWS, 2019) (see "Raised Bog Resource 2019" sheet).
- Black K, O'Brien P, Redmond J, Barrett F, Twomey M (2008) The extent of recent peatland afforestation in Ireland. Irish Forestry 65: 71–81
- J. Connolly & N.M. Holden (2011): Object oriented classification of disturbance on raised bogs in the Irish Midlands using medium- and high-resolution satellite imagery, Irish Geography, 44:1, 111-135.
- Renou-Wilson F., Bolger T., Bullock C., Convery F., Curry J. P., Ward S., Wilson D. & Müller C. (2011) BOGLAND - Sustainable Management of Peatlands in Ireland. STRIVE Report No 75 prepared for the Environmental Protection Agency, Johnstown Castle, Co. Wexford.
- Duffy P., Black K., Fahey D., Hyde B., Kehoe A., Murphy J., Quirke B., Ryan A.M. and Ponzi J (2020) Ireland's National Inventory Report. Environmental Protection Agency.
- Long, M.P., Crowe, O., Kimberley, S. and Denyer, J. (2018) Backing document – National Conservation Status Assessments (NCAs) for three fen habitat types: 7140 – Transition mires and quaking bogs, 7210 – Calcareous fens with Cladium mariscus and species of Caricion davallianae, 7230 – Alkaline fens. Unpublished report to National Parks and Wildlife Service.
- Douglas C, Fernandez Valverde, F, Ryan J (2008) Peatland Habitat Conservation in Ireland. 13th International Peat Congress, Tullamore. Ireland.
- Conaghan, et al. (2000) Distribution, Ecology and conservation of blanket bog in Ireland. National Parks and Wildlife Service. Dublin.
- NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report

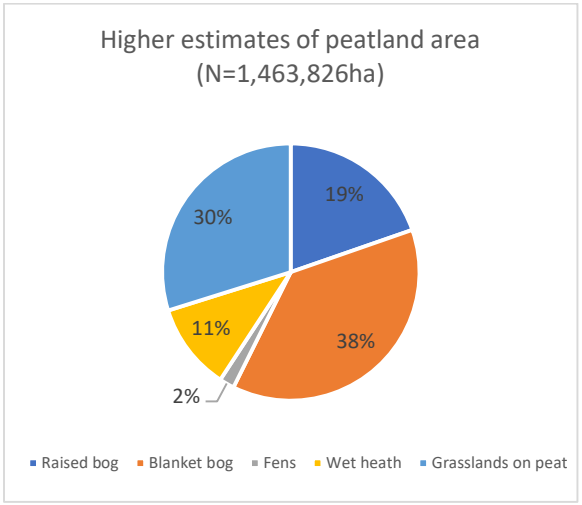

Figure 4.3: Proportion of peat soils in Ireland at the higher estimate. Sources of data as in Table 4.5.

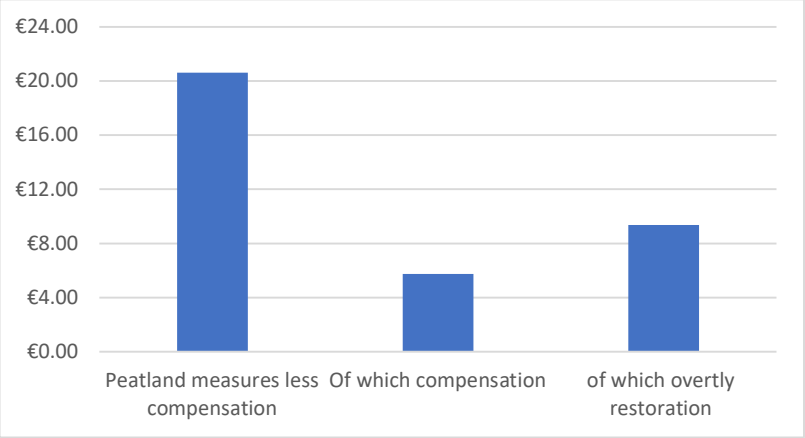

Figure 4.4: PAF peatland expenditure by type, less national government expenditure on restoration (c€55m).

Experts consulted at the beginning of this study, believe that there are up to 50,000 ha of high bog within the remaining raised bog network which is capable of regeneration within an immediate 30-year period. There is also a significant, but unquantified, area of cutover bog that is suitable for initiating peat-forming conditions. These areas have enormous potential value for biodiversity, which in turn provides spatially extensive long-term ecosystem services such as carbon storage and sequestration, flood attenuation, water filtration and amenity. The economic and social benefits are considerable. In the first instance, curtailing peat extraction would immediately begin to restore biodiversity, reduce sedimentation to rivers and reduce carbon emissions to air and water. Once restored, peatlands exist in a saturated state and retain huge volumes of water, but also release these gradually mitigating flood risk in contrast to the current situation of rapid water release. In relation to carbon, fully functioning peatlands capture on average c.180g CO_2 per square metre annually (Regan *et al.* 2020). In practice, however, peatland is a significant source of CO_2 in Ireland due to the long history of unsustainable management through drainage, land conversion to forestry and agriculture and commercial/domestic peat extraction. Current estimates are that peatlands are a source of c.6 Mt CO_2 (Wilson *et al.* 2013), although much uncertainty remains as to the true C emissions, especially for blanket bog, and estimates are being continually updated by advances via NPWS monitoring and various on-going research projects.

Peatland water and carbon cycling are tightly coupled, and engineering solutions are required to restore the hydrological balance of degraded peatland. Whilst the impact of management on the recovery of a Sphagnum-dominated ecosystem may take many years (> 10 years), restoration of the watertable can quickly reduce peat-oxidation and associated CO_2 emissions. National scale peatland restoration can thereby substantially reduce CO_2 emissions, and in time sequester carbon (c.500,000 ha of intact and/or restored peatland could potentially sequester 1 Mt CO_2 annually). Peatland restoration also has other benefits such as reduced loading of peat-silt and dissolved organic carbon (DOC) to rivers and sources of water supply, thereby reducing impacts on freshwater biodiversity and water treatment costs. Chlorination is still a widespread method for water treatment in Ireland, and when applied to water with elevated concentrations of dissolved carbon/organic matter can produce the suspected carcinogen trihalomethane (THM). Reduction of THMs is thereby of benefit to human health. In upland catchments, and peatlands bordering low-lying rivers, such as the Shannon, restoration can also improve the water storage capacity of the peatland and contribute to flood mitigation.

4.3.2 Costs of restoration

It has been conservatively estimated that the costs of rehabilitating and restoring all of Ireland's peatlands, as below in Table 4.6, would exceed €1 billion (*pers comm.* S. Regan, NPWS). Given the broad nature and condition of peatlands, from highly degraded cutover to nearly functional bog, and the lack of data on the full suite of Ireland's peatlands, accurately estimating the costs of rehabilitation and restoration is extremely challenging. The findings of the current study have revealed that costs vary considerably based on a wide variety of factors, including the type of peatland, the manner of previous extraction, the level of degradation, location and the stakeholders involved.

The PAF had identified expenditure needs of **€8.37 million** in recurrent expenditure and **€6.52** million in once-off expenditure over the course of the programme at Natura peatland sites. Of the itemised measures, the largest single sum is €5.73 million is for on-going compensatory payments to the owners of turbary rather than physical restoration. A total of **€22.09 million** is also listed for wider green infrastructure measures, including recurrent AES payments of €2.45 million per year and rewetting of €5.71 million per year, and once-off measures of €13.9 million. Measures relevant to peatland also feature in the Heathland habitat category which accounts for over €28 million of planned expenditure, of which agri-environment measures for upland habitats associated with birds such as hen harrier, red grouse and golden plover account for €15.6 million and non-production related investment accounts for €4.25 million. Of all of this spending, €5.73 million per year in expenditure (largely represented by once-off payments) is overtly directed at restoration supported

by other recurring expenditure such as AES., The PAF also identifies €171,000 for a review of National Raised Bog SACs and €300,000 per year for a peatland awareness programme. Under the heading of Other, the PAF also references mainly national funding of **€54.75** million for bog restoration, relocation and compensation.

The costs of basic rewetting of industrial cutaway have been estimated at €100/ha on the drier margins of raised bogs or more typically €250/ha for modified industrial bogs. By comparison, Bord na Móna proposes €400/ha as a baseline cost for basic rewetting and rehabilitation when carried out in-house on BnM land, including also initial surveying and blocking of drains under ecological supervision. However, heavily modified areas where the majority of peat has been stripped, cannot be quickly returned to functioning raised bog. Here, transformation requires more expensive pro-active efforts to re-establish sphagnum communities through 'inoculation' or other measures where baseline conditions are suitable (BnM, 2016). On areas with shallower peat reserves, remaining fen habitats are likely to undergo a long period of conversion to ombrotrophic status and raised bog formation.

Restoration works additional to basic rewetting have been contracted out to BnM by NPWS on lands which are more technically challenging. Restoration here is believed to cost five times as much, i.e. c.€2,000/ha. This figure does, however, includes compensation payments and the purchase of land where required, with actual restoration amounting to c.€1,200/ha. By comparison, the BnM figures apply only to basic rehabilitation on flat cutaway which is easier to rewet at a large scale. Restoration which restores CO_2 sequestration functions may require more resources.

It is partly for these reasons that a recent agreement between BnM and DECC, termed The Enhanced Decommissioning, Rehabilitation and Restoration Scheme (EDRRS) (also referred to as the Peatlands Climate Action Scheme), commits to long-term and wide-ranging restoration works on a variety of peatland conditions. This scheme, which is regulated by NPWS and will cost over €100 million over 4-5 years, has begun to provide BnM with €15 million annually to optimise hydrological conditions for stabilising emissions. These works are estimated to cost on average €2,500/ha are aimed at heavily degraded peatlands and will use extensive 'bunding'.

Similar considerations apply to forestry. At a minimum, rehabilitation would cost a minimum of €400/ha if drains are blocked and stumps left in situ after the trees have been cut so as to avoid disturbance of the soil. Greater interventions could be needed where soils have been improved and much brash remains to be removed. In Scotland, costs have averaged £1,878 /ha (Glenk et al. 2022). Future costs for peatland rehabilitation can therefore only be estimated very approximately based on the restoration costs estimates multiplied by the area of degraded peatland quoted in the National Peatland Strategy (DAHG, 2015) (Table 4.6). The range of these figures is wide, and is heavily dependent upon bog condition, highlighting the importance of widespread surveying. Between half a billion and nearly two billion euros would be needed for restoration of the full area.

Table 4.7. The cost of rehabilitating or restoring peatlands, using low and high cost estimates. Caveats for each of these are noted.

Degraded peat soil type	Coverage (ha)	Cost / ha (€): low	Cost / ha (€): high	Total cost (€)
Cutover (domestic) [1]	612,380	€400	€2,000	€245 – 1,225 million
Cutaway (industrial) [2]	70,000	€250	€400	€17.5 – 28 million
Afforested peatland [3]	300,000	€400	€2,000	€120 – 600 million
Farmed peatland [4]	295,000	€225	€400	€66 - €118 million
Fens [5]	22,180	€200	€250	€6 million
			TOTAL	**€440 – 1,977 million**

[1] Significant reprofiling required for most, with difficulty of access for some upland blanket bogs.

[2] Some not readily restored to raised bog, with creation of intermediate wetland instead on heavily mined areas.

[3] Predominantly upland blanket bog. Costs do not include the offset value of timber extracted from plantations.

[4] Costs for this form of restoration have not been estimated by conservation bodies. Conservative estimate used.

[5] Foss (2007) includes 10,307 of Annex 1 habitat. Most of this habitat is in bad condition requiring restoration.

4.3.3 Current funding for restoration

Large and Commercial peatlands

The current priority is being given to degraded land under the ownership of BnM given their cessation of commercial peat extraction. These are lands which have either been drained prior to extraction or have been extensively mined (DCHG, 2017b). Table 4.7, below, outlines the current investment in Ireland's peatland network as of 2020. It should be noted that, although obliged to remediate the damage caused over decades under Condition 10 of their Integrated Pollution Control (IPC) licence, BnM are not in a position to invest

in the full restoration of their estate. The EDRRS will instead allocate at least €15 million per annum over at least 5 years (up to €108 million), focussing on the restoration of up to 33,000ha of raised bog, the majority of which will be contracted to BnM.

In addition to BnM lands, at least 4,270ha of raised bog in Ireland is privately owned for the extraction of horticultural peat by companies other than BnM. Including the horticultural peat cut by BnM, this industry has been valued at €400m (GoI 2018). Extraction has been stalled by appeals to the High Court by Friends of the Irish Environment to prevent continued operations without planning permission. Should extraction resume, companies are subject to a requirement under their IPC license to rehabilitate lands. However, no rehabilitation actions would appear to have yet been considered by companies as most bogs were expected to continue in production. Retrospective permissions have been on hold while any new permissions might be too onerous to convince companies to recommence operations on bogs that are near to the end of their productive life. Whether or not this happens, the companies should be required to honour their commitment to rehabilitation.

Table 4.7. Current (2020) annualised spending on peatland conservation and restoration, showing responsible body and source.

Action	Responsible body	Source of funds	Annualised spend (€)
Cessation of Turf-cutting Compensation Scheme (CTCCS)	NPWS	Direct government payment	6,280,616
Voluntary buy-out scheme	NPWS	Direct government payment	700,000
Raised bog restoration programme (RBR)	NPWS	Carbon tax, through direct budget	5,000,000
EDRRS	DECC → BnM	EU Rescue and Resilience Fund	15,000,000
LIFE-IP (Wild Atlantic Nature)	NPWS	EU contribution	1,260,000
LIFE-IP (Wild Atlantic Nature)	NPWS	Gov. co-funding	840,000
LIFE Raised Bog – 'Living Bog'	NPWS	EU contribution	170,252
LIFE Raised Bog – 'Living Bog'	NPWS	Gov. co-funding	56,751
		ANNUAL TOTAL	**29,307,619**

Privately cut and other peatlands

At around €1,200 /ha before consideration of compensation payments, the costs of returning the hydrological and ecological conditions required for restoration in the entire area that have been cutover for turbary are prohibitively large. Although much could be achieved where drainage has been less severe or through possible future incentivisation schemes. Prioritised spending has thus been allocated in recent years to the most vulnerable areas of the SAC and NHA network, NPWS have been allocated €5 million per annum has been allocated for raised bog restoration until 2022, with incremental increases expected thereafter and an eventual spend of close to €47 million over 10-15 years. The Cessation of Turf-cutting Compensation Scheme (CTCCS) is managed by the DHLGH and provides a compensation payment of €1,500/annum up to a maximum of 15 years, in addition to a once-off payment of €500. Initiated on SAC land and now expanded to NHAs, the scheme currently includes 2,200 turbary right owners, with annual expenditure now in excess of €6 million (c €2,700 pp assuming an acre plot). Additional to compensation, the voluntary buy-out scheme pre-dates the CTCCS and disburses c.€700k each year to purchase land and provide replacement fuel or transfer ownership to non-designated bog. Two relocation sites on which cutting could commence had been identified in 2021, but turf cutters are required to relinquish their rights to areas before doing so. By removing a fundamental pressure on extant peatlands, the CTCCS provides the basis for peatland conservation, but does not include pro-active management supports.

Progress on restoration

As of 2020, the NPWS and its partners had commenced restoration of 1,800 ha per year, with a target of having 12,000 ha in progress by 2025. NPWS are on largely on track to meet these targets in addition to the €6 million per annum being disbursed to former turf cutters through the CTCCS. Although over 4,000 applications were made to this call, many applicants could not prove existing turbary rights.

Coillte, as the single largest steward of peatlands in Ireland, have made previous commitment to restoring peatlands under their ownership. Across the course of numerous EU-LIFE projects, Coillte have removed conifers and conducted remediation work on 1,967 ha of blanket bog and 1,207 ha of raised bog since 2002, within both SACs and NHAs (DAHG, 2015). However, this represents just 1% of their blanket bog ownership and 2.7% of their land bank within raised bogs. Proposals for future restoration include the Nephin Beg area of North-west Mayo adjacent to the Ballycroy National Park and SAC.

As part of Bord a Móna's ongoing Bog Restoration programme, up to 1,000 ha of bog have been restored as of 2021, in addition to trials for biomass growth on areas of industrial cutaway incapable of full regeneration. Furthermore, the BogFor project (forestry on cutaway), led by DAFM, targets afforestation on peatlands incapable of returning to raised bog in the short-term.

In 2021, Peatland Finance Ireland was established with support from the EIB and with the objective of channelling finance from corporates to peatland restoration for reasons of CSR, voluntary carbon or water offsetting. An initial investment has been made in the restoration of 60 ha of bog in Co. Wicklow. Similar initiatives have commenced through the IUCN in the UK and in other EU Member States, including in forestry. There are proposals to facilitate a market price through the development of a carbon standard, a pricing mechanism similar to one which has already been established in the UK. This would be based on average Irish peatland emissions and would provide both investors and the conservation sector with more assurance of the value of cuts in GHG emissions.

2021 also saw the commencement of the LIFE-IP 'Peatlands and People' project with a budget of €9 million over seven years. This is a seven-year project aimed at enhancing the carbon storage potential of peatlands through rehabilitation and restoration and will include the creation of a self-sustaining business and associated community development initiatives, together with a Peatlands Interpretative Centre.

LIFE-IP Wild Atlantic Nature (WAN), which also began in 2021, focusses on the farmed peatland and blanket bogs of West and Northwest Ireland. The project has an annualised spend of c.€2.1 million across a 9-year programme based on individual farm payments that are dependent on a results-based approach up to a maximum of €225/ha for the first 30 ha. The majority of this expenditure is now being appended with appropriate DPER indicators to facilitate connection with novel finance sources.

4.3.4 NRL financial needs

The WAN LIFE-IP is pertinent in that the NRL could eventually involve an increasing amount of marginal agricultural land to be returned to peatland. The question is how far this restoration should extend towards rewetting given that reduced emissions and improvements in biodiversity would follow from any significant improvement in hydrology and grazing management, even though this would fall short of renewal of carbon sequestration functions and full restoration on anything other than common land.

The interpretation of the NRL is key in that it calls for restoration measures to be put in place for 30% of the area of peatlands "drained for agriculture" by 2030, rising to 50% by 2040 and 70% by 2050. It is proposed that a quarter of these be rewetted by 2030 and at least half by 2050 and 2070. Rewetting has been defined as raising the water table to within 30cm of the surface. It is equivalent to full restoration and more costly than rehabilitation. Nevertheless, although the targets seem onerous, the short-term target could potentially be exceeded by a business-as-usual scenario if this area is defined *only* by peat extraction and agricultural lands. Indeed, the Climate Action Plan contains a target to rewet 80,000ha of grassland with an interim target of 40,000ha before 2030. The minimum area of farmed peatland is estimated at 295,000 ha of which 30% would be just 88,500 ha. As only one third of degraded peatlands would need to be rewetted by 2030, this target could be met by a continuation of existing policies at a cost of **€51 million** (€7m per year). However, expenditure estimates depend on how "drained peatlands under agricultural use" is interpreted. If a higher estimate of farmed peatland is assumed of 437,000 ha, the target would require that rewetting be extended to encompass the permitted 20% of forest lands, for which rehabilitation would be more costly at a minimum of €400/ha, but with full rewetting costing at least €2,100 based on the (UK) figure above. In addition, around 30,000 ha of drained agricultural land would be needed too under this higher hectare target. In this case, costs could be around **€110 million** (€15.7m per year), although this is still less than current spending amounts.

If on the other hand, peatlands "drained for agriculture" is ultimately defined as land use, i.e. all degraded peatland, then restoration would need to cover a larger area of c.825,000 ha based on the most recent NPWS figures for land under farming, forestry, turbary, and industrial peatland. The least cost option here would be to begin by restoring all industrial cutaway. This could be followed by the restoration of 50,000 ha of forest lands (given the maximum 20% contribution proposed), an amount which is higher than that the 30,000ha which Coillte is already committed to the rewetting or rewilding (by 2050). Most of the balance could be met by restoration of aforementioned 88,500 ha of farmed peatland at an annual recurrent payment of €225 /ha as represented by WAN's highest RBAPS payment (although the cost of full rewetting would be higher). The remaining area could be met by 1,500 ha of cutover bog representing a planned increase on the c.890 ha that is already compensated by CTCCS.

No option is ideal. Although the restoration of industrial peatlands is least problematic, the depth of peat remaining (the carbon store) is low and its contribution arises rather from the large area available than the depth of the peat itself. The restoration of domestic cutover bog and farmed grassland is contentious, but a proportion of the former has been abandoned while some of the latter is too wet for productive use. Bringing in the latter two options to satisfy the restoration targets would imply a substantial cost of around €300 million (or around €35m extra per year), although there is an opportunity to use finance from CSR and, potentially, voluntary carbon credits if supported by a peatland standard. After 2030, all industrial cutaway and allowable forest land would have been restored to peatland. At this point, to meet the 2040 target, most restoration would need to come from farmed peatland at an AES cost of at least €227 million. Assuming enough agricultural land becomes available, no additional land need come from cutover turbary in the short term as the cost of CTCCS compensation is so high (even accepting that these payments terminate after 15 years).

Table 4.8. Financial implications of interpretation of NRL baselines targets for all degraded peat soils 2030 & 2040.

		Of minimum area of drained peatland used for agriculture. Cost to 2030		Of maximum area of drained peatland used for agriculture. Cost to 2030		Of all land use aggregate cost to 2030		Of all land use aggregate cost to 2040	
Degraded peat soils	Cost / ha (€) av.	Area (ha) 2030	Cost / ha (€): Total	Area (ha) 2030	Cost / ha (€): Total	Area (ha) 2030	Cost / ha (€): Total	Area (ha) 2040	Cost / ha (€): Total
NRL target		88,500		131,100		247,500		+288,750	
Cutover (domestic)	€1,200 + €1,500pa					1,500	€15.7m	1,500	€15.7m*
Cutaway (industrial)	€400	75,000	**€30.2m**	75,000	**€30.2m**	75,000	€30.2m	0	0
Afforested peatland (20%)	€1,754 (average)		**€0**	< 26,100	€32.8	49,500	€62.9m	33,000	€78.6m
Farmed peatland	€225 pa		**€20.5**		€47.3m	121,500	€191.4m	130,500	€227.4m
Total to target year			€**50.7**m		€110.3m		**€300.0m**		**€306.4m**

* before subtracting current expenditure and excluding balance of CTCCS compensation from previous decade. Bold = more likely

4.3.5 The importance of community - The Abbeyleix Bog Project

In 2009, Bord na Móna completed drainage works on an area of raised bog outside the town of Abbeyleix, Co. Laois, in preparation for industrial cutaway extraction. Following local activism and subsequent community engagement, c.100 ha was leased under peppercorn rates for a period of 50 years to the Abbeyleix Bog Project under the stewardship of the Community Wetlands Forum. Since this time, an 11- year programme of surveys, restoration and community engagement has taken place, resulting in quantifiable and accurately costed conservation benefits. First, there has been an increase in active raised bog (a priority EU habitat) from 1.12 ha in 2009, to 13.78 ha in 2020. Additional to the biodiversity benefits, it is estimated that rewetting of the bog has reduced carbon emissions from 444 tonnes of CO_2 /yr to 210 tonnes CO_2 /yr (a 52.7% decrease worth €20,685 at the current value of carbon credit Dec 2022), although this is a minimum marker of social cost of emissions), although this figure excludes the subsequent sequestration of newly active raised bog. The verified baselines and record of the activities which restored this ecosystem services, provide the basis for estimating the potential for future capitalisation through voluntary carbon credits.

In total, the 11-year restoration project has cost €321,000, including €100,000 for a one-off PhD project. The net costs of drain blocking, signage, community work, installation of boardwalks, three ecotope surveys (pre, mid and post), implementation of a Conservation Management Plan and future surveying until 2021 amounts to €221,000, or c. €2,210/ha. The site was, however, relatively easy to restore compared with others owing to its flat topography and limited prior exploitation. It also benefited from the voluntary labour of numerous local supporters. The restoration has adopted a community-based natural resource management model from its inception. Abbeyleix thus presents a viable model for sustainable community-led restoration of peatlands, especially on contiguous tracts owned by larger entities which would otherwise lie outside the public realm post-remediation.

4.3.6 Peatland recommendations

a) Realising ecosystem service values

It no longer makes economic or strategic sense to continue the extraction of peat for either energy or horticulture. The industry provides economic and employment returns which are too small in relation to the public good benefits of restoring peatland ecosystem services. Consequently, Government needs to act to bring about large-scale rehabilitation based on existing license commitments by private owners, and extend this investment using the resources available from the carbon tax, by securing the low interest funding available from the EIB and or by formalising a carbon code that will attract further corporate investment in

carbon offsetting. To meet its international obligations, Ireland should also prohibit the import of horticultural peat from third countries while providing for a controlled alternative domestic source of compost. [5]

b) Statutory commitment for remediation

Although Bord na Móna, as the only entity licenced for the commercial extraction of peat, is under obligation from the EPA to remediate peatlands (DCHG, 2017b), investment has slowed of late. Formally, responsibility for remediation is limited to an obligation of ensuring "environmental stabilisation". BnM currently hold vast swathes of heavily modified bog and is funding the obligatory remediation, while the enhancement works needed for restoration are supported by the Irish government through the Recovery and Resilience Facility. With regard to forestry, replanting on peatlands post-clearance is now prohibited, although it is unclear whether statutory remediation is required for these lands or whether forestry can remain on peat under continuous cover forestry. The EU has predominantly supported remediation work by Coillte, but their own investment is unclear. In principle, a greater commitment to restoration would be expected from Coillte and BnM and would be the more cost-effective approach.

c) Expanded staffing / resourcing

At present the peatland division has a full-time staff of 3 ecologists and a hydrologist, although additional staff are working on the administration of the CTCCS. The Wild Atlantic Nature LIFE IP staff are also supported through the DHLGH. However, as the area of peatland is very extensive and requires much scientific input to decision making and liaison with communities, a significant increase in staffing is needed. The expanded agenda of peatland restoration needs additional expertise amounting to at least 10 people, including potentially an environmental scientist, climate scientist, engineers, more hydrologists, community liaison and education officers, accounting and administration, as well as legal and GIS support.

d) Community-based Natural Resource Management

The current model of commercial peatland remediation, although offering restoration at scale, provides limited returns to communities aside from short-term employment in requisite ground works. This model allows formerly extractive commercial interests to benefit from remediation contracts with limited community gain or benefits for Just Transition. In several non-commercial cases investigated by this project, a lack of long-term engagement or involvement of communities from project inception has resulted in poor acceptance of measures and inadequate long-term engagement beyond the life of projects. A form of 'community land trust', based on community-based natural resource management principles, could foster community engagement and contribute to surveying efforts, education and economic diversification without the need for contentious formal designation or expensive land acquisition. Valuable lessons can be taken from similar application of CBNRM in the developing world, such as sub-Saharan Africa and Southeast Asia, with international finance driving diversification of livelihoods along with conservation.

e) A Trust Fund for Peatlands or 'Bank for Bogs'

Numerous novel mechanisms for financing peatland restoration continue to emerge (see Section 6 of this report). However, as outlined above, current governance of these resources runs the risk of failing to engage with communities or to provide tangible evidence of efforts towards a Just Transition. From a financial perspective, it can be argued that a more cost-effective means of achieving scalable and sustainable peatland restoration could be by providing support to networks of local actors by de-centralising funding to regional trust funds. Disbursement of these funds could operate through a land cooperative system, or 'Bank for Bogs', providing micro-finance and advice to support remediation and diversification of incomes (e.g. entry into the carbon or paludiculture markets). This method is particularly suited to Ireland's complex matrix of peatland ownership and use, which includes a large number of smallholders. In this way, those holding turbary rights could receive an annual carbon credit income in return for an active contribution to restoration.

f) Restoration and an Irish Peatland Standard

Although most peatlands in Natura sites are in degraded condition and in need of restoration, the greater restoration challenge in the context of the biodiversity and climate emergency is on industrially and domestically drained peatlands outside of the Natura network. The cessation of most commercial harvesting provides an opportunity for restoration, but often from a position of a shallow peat layer and an absence of ecological function. The development of a Peatland Code or Standard can facilitate this restoration by appending value to land previously labelled as non-productive. Furthermore, the uptake of natural capital accounting in Ireland can be used to demonstrate peatlands' ecosystem service value (Farrell & Stout, 2019). A key component of this would be to calculate a verifiable carbon value linked to the voluntary carbon market. It is proposed that the development of an Irish Peatland Standard would achieve this, adapting existing models from the IUCN UK Peatland Programme (IUCN, 2015) or numerous other international examples reviewed recently by the German Environment Agency (GEA, 2019). As well as

[5] A case has been made by an industry working group to continue some domestic production of horticultural peat to avoid recent imports estimated by at 42,800 tonnes from Siberia in 2021 https://noteworthy.ie/peat-sake/news.

mobilising international finance, this would be of interest to domestic corporate entities and their desire to offset carbon emissions within their CSR or sustainability strategies. However, a barrier to an extension of the Peatland Standard to a wider number of peatlands than those currently undergoing rehabilitation, has been the concern expressed by BnM that a 30-year lock-in period for land (a likely condition of entry) would threaten their current commercial model. Related difficulties are being experienced at present by intermediary bodies in the UK (e.g. Forest Carbon) attempting to apply the UK Peatland Code. Thus, a level of de-risking is required before such an approach can be introduced in Ireland, perhaps through the provision of a guarantee from a government body. Further investigation is required to establish how an Irish Peatland Standard would operate in comparison to UK and global examples, including the structures required for its effective governance, or whether adoption of an international standard is more cost-effective.

4.3.7 Summary

The PAF identifies a need to spend over **€37.0 million** per year on peatlands of which at least €23.8 million is directed at restoration. This expenditure is also complemented by approximately €28 million for heathland which includes measures for upland farming areas and commonage on drained peatlands, with a large proportion of expenditure directed at hen harrier habitat. In addition, the PAF notes the existence of "other" restoration-related government expenditure of around €55 million including by recurring and once-off measures. These sums are a welcome increase on previous years even though they include compensatory payments to turf cutters which, at present, do not achieve conservation gains directly.

For Natura sites, restoration accounts for approximately 35% of proposed expenditure, but the larger proportion of peatlands (84%) are outside the Natura Network. In this context, it should be noted that restoration is also needed to mitigate carbon emissions for which Ireland is committed to a 55% reduction by 2030 and Net Zero by 2050. Under LULUCF, Ireland must also compensate for emissions from agriculture with CO_2 removal in land use elsewhere, including peatland by 2026. Although the costs will be significant, a perspective on the scale of this investment is provided by the income from commercial peat sales which, for example in 2009/10, was €216 million (albeit subsidised at the time through the Public Service Obligation).

Given this background, the NRL does not at first impose additional undue costs on Ireland in the near-term for peatland restoration amounting to around €8.5 million per year. Actual costs are likely to be higher once administration and other costs are included. Moreover, the figure could be closer to €18 million per year depending on how the land available for restoration is defined. However, the need to accelerate restoration of domestic cutover bog would involve significant costs post 2030 unless present rates of compensation are replaced by alternative strategies.

Table 4.9. Peatland Summary Table

Recent spend	Proposed spend under PAF	Minimum spend to meet NRL targets by 2030
€30 million pa	€37.0 million pa (peatland) + €55 million pa "Other" state spend	€8.5 million pa.
NPWS (inc CTCCS), EDRRS, LIFE Wild Atlantic and Peatlands & People.	"Other" relates to additional State expenditure and may be exaggerated by once-off measures. In addition, €28m is to be spent on Heath, including dry health habitat and upland bird measures.	Lowest annual cost of measures to meet 2030 target of the NRL. Higher = €18m.

4.4 Forests

4.4.1 Forest biodiversity in Ireland

Along with peatlands, Ireland's landscape was once dominated by forest. It is now one of the least forested nations in the EU (second only to Malta), with just 11% of our land area covered by trees. Despite this low baseline, Ireland has one of the highest rates of afforestation in Europe (2% annually, second only to Iceland 4.6%) (DAFM, 2020). However, only a very small percentage of this is deemed to be 'native species' and, although non-native forestry does support biodiversity (Irwin *et al.* 2013), its value is lower than that of native tree species. The National Survey of Native Woodlands, completed in 2008, found that Ireland holds 82,321 ha of native forest, around 13% of total forest cover. However, this coverage is highly fragmented across 1,320 sites and these fragments are small, with only 50% exceeding 6 ha and only 3.3% exceeding 50 ha (Perrin *et al.* 2008). Concurrently, the Forest Service (DAFM) conducted their own survey, finding 132,990 ha of native forest. Neither of these surveys, though, included the native woodland owned

by Coillte, the semi-state forestry company which owns and manages approximately 47% of Ireland's forests. Based on Coillte's BioClass project, about 20% of their holding is classed as biodiversity area, or 90,000 ha. Of this, 9,900 ha (11%) is native woodland (Coillte, 2018). Therefore, in combination, the total area of native woodland in Ireland currently stands at between 89,321–142,890 ha, consisting mostly of broad-leafs, but with a proportion accounted for by Scot's pine (*Pinus sylvestris*). Since these surveys, there has likely been a small increase through natural regeneration, conversion of former forestry sites now held by the NPWS, and the expansion of privately held native woodlands through the Native Woodland Scheme (NWS) and other incentives for private operators. The quality of remaining fragments of native woodland remains highly variable with ancient oak, alluvial and yew woodland in bad status (NPWS, 2020). There are significant issues with invasive understory species (rhododendron, cherry laurel, etc.) which are costly and difficult to manage, crowd out native species and suppress regeneration, while only a small proportion of woodland is mature or even of 'merchantable size' (Perrin *et al.* 2008). Furthermore, increasing deer numbers and their browsing behaviour limits natural regeneration and the success of new planting. Ireland's current coverage of native woodland thus necessitates significant effort to recover a fraction of its once dominant position in the Irish landscape, with substantial investment required to support this.

Under the NBAP Outcome 2B, Action 2B10 aims to ensure that Ireland's Forest Strategy and Forestry Programme has clear actions to enhance biodiversity. Action 2B8 supports this with aims to address key issues in relation the emerging risk of wildfires, while Action 2B9 aims to address issues of deer management. Action 2B17 commits Coillte to increased enhancement and restoration of the proportion of its estate which is managed for nature. Outcome 2H aims to control and manage invasive alien species on an all-island basis. Current native woodland conservation measures

4.4.2 DAFM and the Forestry Scheme 2014-2020

The dominant scheme related to woodland biodiversity in Ireland in the past decade has been the Forest Service's Forestry Scheme 2014-2020 (DAFM, 2014) which, although mainly focused on the expansion of non-native commercial forestry, has incorporated targets for the planting of native species, both for purely commercial purposes and for the establishment and conservation of commercially-viable native woodlands managed under 'close-to-nature' continuous cover forestry (CCF). The first element of this, the **Grant and Premium Categories** (GPC) scheme, offers generous grants for the establishment of native woodland under GPC 9 and 10 (aka: **Native Woodland Scheme (NWS[6]) - Establishment**), and had a target of 450 ha per year, with total expenditure of €16.5 million allocated across the Scheme. However, uptake has been much lower than anticipated. Although by 2016 overall afforestation rates were above target, only 293 ha of new native woodland had been planted versus a mid-term target of 900 ha (DAFM, 2018). Despite an increase in grant rates following this mid-term review, NWS-Establishment still accounted for only 8% of all annual grant-aided afforestation as of 2019. The majority (80%) of supported forestry continues to be mixes dominated by Sitka spruce (i.e. GPC 3), with the mandatory minimum of native species often planted as wind breaks or for appearance along plantation margins.

The second relevant element of the Forestry Scheme, the **Native Woodland Scheme – Conservation**, supports the management of existing commercial woodlands of native species or the conversion of existing non-native plantations to native, with target expenditure of €7.25 million between 2014-2020 across an aspirational 1,950 ha. Again, these targets were not met. Owing to slow uptake, no area was conserved and no payments were made for NWS-Conservation for the first two years of the Forestry Scheme (DAFM, 2018), despite having a target of 600 ha by 2016. By the end of 2019, €2.2 million had been disbursed on NWS-Conservation, representing 30% of targeted spending with only a year remaining.

A prominent limitation of both NWS schemes, as reported by prospective planters, was the costly and exacting ecological surveys required to justify planting (DAFM, 2018). These measures have since been somewhat relaxed, although the effect on the quality of woodland remains to be seen. Since 2019, significant delays have been experienced in the entire forestry sector relating to licencing for felling and planting. This has favoured native tree planting, which is deemed to be at less risk of appeals or objections. As such, native tree planting under GPC 9 and 10 reached its targeted annual planting levels, at c. 450 ha for 2020, to a value of almost €2.5 million (total grants disbursed for all forestry in 2019 amounted to almost €16 million (DAFM, 2020). However, once licencing backlogs are resolved, this situation may revert as a viable economic incentive is still lacking despite the fact that grants for native woodland are almost twice that of Sitka spruce mixes (GPC 3), underlining the latter's commercial value and the speed at which this species grows under Irish conditions.

The **Woodland Environment Fund** adds additional support to the NWS, by providing a mechanism for corporate co-funding of native afforestation. In this programme, a natural capital facilitator assesses the potential ecosystem service delivery of the new native woodland site over the 15 year premium period, while an additional €1,000/ha is offered by corporate funders on top of NWS grants, if access for corporate social responsibility, promotional or team-building purposes can also be arranged. Although originally intended to also offer the sale of carbon offsets for corporations, the fund was not deemed to be meeting carbon credit principles as it is 'additional' to existing government initiatives and government is credited towards its nationally determined contributions (NDC). The WEF thus remains limited in extent and spending. For example, 2020 WEF planting will amount to 75 ha.

[6] https://www.gov.ie/en/service/803ef3-native-woodland-conservation-scheme/#rates-of-payment

As part of the Forestry Scheme 2014-2020, the **Neighbourwood Scheme** supports the development of "attractive close-to-home woodland amenities" for public use, addressing three key areas: Establishment, Enhancement and Facilities. Covering 85% of eligible costs, this scheme is popular although has yet to fully recover the spending levels seen c. 2008. Grants of € 5,000/ha are available for establishment and €3,800 for facilities up to a maximum of 12ha. Limited uptake in earlier stages prompted an increase in the amounts available for any one application to stimulate interest and ambition (DAFM, 2018). Despite this, only €116,000 was spent on this scheme in 2018 and no expenditure was reported in 2019 (DAFM, 2020).

A scheme for **Woodland Creation on Public Land** was announced in 2020. This provides grant support for new afforestation only on suitable areas of bare public land owned by Government Departments and State-sponsored organisations, Higher Education authorities and Local Authorities. Grants are comparable with the NWS, but are supplemented by support for features such as trails, signage and forest playgrounds. Organisations can report the carbon captured, but cannot claim these amounts as credits unless they apply formally for carbon offsetting through the International Carbon Reduction and Offsetting Alliance. Although modest in its ambitions, the scheme sets a precedent for broader application. Irish Rail has been involved in one applications and interest has been shown from Transport Infrastructure Ireland, Irish Water, Local Authorities, and CAROs.

The disease 'ash back' (*Hymenoscyphus fraxineus or Chalara*) arrived in Ireland in 2012 and has now been identified in all 26 counties. Funding has been allocated for the removal of affected trees, the restructuring of existing plantations and replacement with other species if necessary. As ash is one of the few economically viable broadleaf species under the NWS, investment is particularly important to contain the spread of the disease to wild trees. In 2018 and 2019, the **Reconstitution and Underplanting Scheme (RUS)** for ash dieback (formerly the Chalara scheme) amounted to €1.8 million and €1.3 million respectively (DAFM, 2020).

The **Woodland Improvement Scheme (WIS)** mainly benefitted ash woodlands by providing grants of €750/ha for thinning to enhance the timber value of stands. Applications to the WIS have declined steadily due to the spread of ash dieback and with the replacement of some of measures by NWS-Conservation. As of 2019, only €6,000 was claimed under the WIS (DAFM, 2020). The scheme can enhance biodiversity value by permitting more light to reach the forest floor and allowing the growth of understory species. In 2020, it was supplemented with a **Continuous Cover Forestry Scheme** which provides the same level of payment for maintaining forest cover and discouraging clearfelling on more than 0.25 ha. Although this again has objectives in relation to timber, the scheme again allows light to reach the forest floor while maintaining a more uneven age profile that provides for a richer habitat.

NPWS

At present, the work of NPWS in relation to native woodland is restricted to Natura 2000 sites. Excluding bog woodland, these span three woodlands types: sessile oak, yew and alluvial woodland, of which the latter two are priorities for action. Ancient woodlands are also regarded as being of high priority, following on from the EU Biodiversity Strategy targets for old growth forest. Current scientific spending by NPWS on woodlands is limited to some surveying of woodlands and occasional invertebrate, bat and bird surveys and have not exceeded €135,000 in the past three years. There has been only a single scientific operative among the NPWS scientific staff dedicated to woodlands. The majority of spending on woodlands under NPWS protection is integrated into the staff costs of Rangers and General Operatives across the country and includes also rhododendron clearance and deer management. NPWS has been able to capitalise on the Woodland Creation on Public Land Scheme in the past year, although this has proceeded slowly and has been hampered by the different objectives of DAFM versus NPWS. For example, as trees are being planted on land classified as 'marginal' for forestry purposes, planting is required to be of lower density, resulting in lower grants. Four pilot applications (two NWS-Establishment and two NWS-Conservation) are in planning stages, but amount to only 20ha in total across three National Parks and a Nature Reserve. The introduction of an 'emergent woodland' GPC is regarded as positive by respondents for this study as it reduces the clearance of certain types of scrub and successional growth by farmers, although the uptake of this GPC to date is unclear.

Coillte

In managing the majority of Ireland's woodlands, Coillte's strategy for native species has a high impact on Irish biodiversity. Through their **BioClass** project, Coillte manage 20% of their estate for biodiversity with plans to increase this to 30%, although only around 4% is semi-natural woodland, , with the majority (52%) actually being open habitats such as bog and heath (Coillte, 2018). Coillte also runs the **BIOForest** programme which trains staff in continuous cover forestry (CCF) and composes Biodiversity Area Management Plans for regions of high biodiversity value. Coillte continues to spend c.€300,000 annually on the monitoring and management of biodiversity in their estate, although in recent years this has shifted from ongoing expenditure to one-off investment in flagship programmes such as the Dublin Mountains Makeover, an ongoing project to replace much the conifer forest around Dublin with native species. More recently, Coillte have created a semi-autonomous non-profit wing, **Coillte Nature**, to manage part of the estate in a biodiversity-positive manner and offset low biodiversity elsewhere in the conifer plantations that comprise the majority of the estate. Through annual funding of €1 million derived from the profits of Coillte's commercial operations, Coillte Nature has four strategic areas: 1) the establishment of increased areas of native woodland, most of which will be on former extractive peatlands in conjunction with BnM, 2) projects aimed at rehabilitating areas of existing woodland to promote biodiversity, 3) the creation of a network of public-amenity forest near urban areas, and 4) embedding ecosystem services-thinking into existing management, such as water quality and bird conservation. In addition, Coillte Nature aims to diversify financial sources, through either direct grants, service provision to

government agencies, or investor engagement at national and international levels. For example, **The Nature Trust**, launched in early 2021, is a collaboration between Coillte Nature and Forestry Partners (a social enterprise) to capitalise on the carbon capture and storage potential of Coillte's forests, ploughing the funds raised through sales of verified carbon units back into biodiversity investment across their estate. It is noteworthy that Coillte Nature is not within Coillte's *Forest* division, but is positioned under its *Land Solutions & Venturing* division. Further, Coillte Nature's annual budget represents <1% of Coillte's €159 million net income in 2021. This biodiversity spending appears therefore to have become more concentrated in a much smaller sub-section of the Coillte estate.

4.4.3 Current funding for native woodland

The existing main sources of funding for woodland biodiversity are listed in Table 4.14 below. This table only includes those schemes with the most impact on biodiversity to date, either through level of spending or potential impact. The activities and spending of other programmes would also promote native forest biodiversity as a secondary consideration, such as those related to water quality and peatland conservation, but which are accounted for in other sections of this report.

Table 4.14. Existing key sources of native woodland spending in Ireland

Programme	Coefficient	Source of funds	Annualised spend (€ 2019) *
NWS - Conservation	100%	DAFM	648,000
NWS - Establishment (GPC9 & 10)[1]	100%	DAFM	2,137,380
Neighbourwood Scheme [2]	75%	DAFM	87,000
Reconstitution and Underplanting Scheme (RUS) for ash dieback	50%	DAFM	655,500
NPWS woodland spending (Sci & Biod Unit, Ranger work) [3]	100%	DHLGH	1,081,425
Coillte Nature	100%	Coillte	1,000,000
Coillte biodiversity spend [4]	100%	Coillte	166,653
Coillte BIOForest	100%	Coillte	164,484
Total			**5,940,442**

* Coefficient applied to original figures. Amounts shown are adjusted.

[1] Average of 2019 + 2020 used to capture recent spike in native planting

[2] 2018 figure used: no payments made in 2019

[3] Mean annual spending between 2017-2019

[4] Spending within Coillte biodiversity areas, including IAS removal and drain blocking.

4.4.4 Future priority spending on native woodlands

The contributions of respondents to this study have indicated that building a costing framework for widespread native forest conservation and restoration is impractical owing to the widely varying quality of existing forest fragments, the limited coverage of surveys at a national scale, the modest uptake of relevant GPCs, and the wide mix of landholders including State, semi-state and private individuals. The most recent PAF figures for woodland habitats carefully consider the preservation and expansion of three key Annex I woodland habitats and one Annex I species (Lesser Horseshoe Bat). These figures also include conservative estimates of required GPC payments for these measures. Therefore, Table 4.13 below presents the priority spending requirements for woodland habitats within and outside the Natura 2000 network, constituting the PAF estimates, and combines these with ongoing spending by Coillte to conserve and restore native forest under their responsibility. Further, conservative estimates for the Neighbourwood and RUS schemes (based on most recent disbursement levels) are included, as secondary measures supportive of woodland biodiversity more generally.

In the table below, one-off expenses relate to tree planting, non-native tree removal, invasive alien species control, drain blocking and fencing. Ongoing expenses include supplementary planting, vegetation management, removal of regenerating non-native tree/IAS, fence maintenance and control of grazing levels. These expenses are covered by conservation costs. Less than 13% of all-species forest cover is located in a SPA with 4.5% located in a SAC and 4.9% in a NHA (Forest Service 2017). No figures are available in the National Forest Inventory on the extent of broad-leaf or native woodland which is in degraded condition, although 9.0% of all oak trees are classified as weakened, moderately or strongly damaged. By comparison, a survey of 1,312 native woodlands by Perrin (2008) estimated that 22% were in poor condition and 50% in only moderate condition. Premiums paid on NWS-Establishment relate to direct annual payments of between €350-€673 /ha for native woodland on privately held land outside of the Natura 2000 network. In general, average recurring expenditure on conservation is estimated at €280/ha per year plus €85 /ha for one-off works. However, rhododendron clearance in heavily infested areas can amount to more than €6,700 /ha.

The PAF strategy specifically targets a 1,500ha increase in sessile oak woodland and a 500ha increase in alluvial woodland, split equally between Natura 2000 sites and across the wider countryside. These expansions are designed to capitalise on the strengthened ability of public bodies to apply for NWS grants. Thus, the proposed figure for future annual spending on woodlands and forests in the PAF is €487,962, plus once-off costs of €313,049 million per year. In addition, green infrastructure accounts for spending of €1.43

million per year plus €177,205 per year for once-off measures. Of this, NWS-Conservation, at €963,184 as outlined in the PAF, would exceed current annual spending by the Forest Service (€648,000), but would still be modest in comparison to the Forest Service's own targets under the Forestry Scheme (c.€1.3 million/yr). NWS-Establishment grants and premiums similarly target just two priority habitats (sessile oak and alluvial woodland) and amount to €1.25 million in annualised spending on native woodland establishment within and outside the Natura 2000 network. This proposed NWS-Establishment figure is still only 1.5% of annual forestry grants and premiums disbursed by DAFM annually. It is important to note, however, that proposed NWS spending levels (both Conservation and Establishment) would be largely dependent on voluntary uptake by private individuals, as NWS grants awarded to public lands are currently limited.

Table 4.13. Projected priority financial needs for native woodlands in Ireland

Programme	Source of funds	Extent (ha)	Annualised spend €
Within Natura 2000 network			
Oak NWS-Conservation – one-off *	DAFM	996	626,484
Oak NWS-Conservation	DAFM	996	170,316
Oak NWS-Establishment – one-off *	DAFM	750	516,000
Oak NWS-Establishment	DAFM	750	150,750
Alluvial NWS-Conservation – one-off *	DAFM	172	93,396
Alluvial NWS-Conservation	DAFM	172	29,412
Alluvial NWS-Establishment – one-off *	DAFM	250	141,500
Alluvial NWS-Establishment	DAFM	250	47,250
Yew NWS-Conservation – one-off *	DAFM	54	33,966
Yew NWS-Conservation	DAFM	54	9,234
Lesser Horseshoe Bat measures *	DHLGH	5 counties	40,000
AES for Lesser Horseshoe Bat		6 counties	81,000
		Subtotal	**1,939,308**
Outside Natura 2000 network			
Oak NWS-Conservation – one-off *	DAFM	818	514,522
Oak NWS-Conservation	DAFM	818	139,878
Oak NWS-Conservation – premium	DAFM	818	286,300
Oak NWS-Establishment – one-off *	DAFM	750	516,000
Oak NWS-Establishment	DAFM	750	150,750
Oak NWS-Establishment – premium	DAFM	750	504,750
Alluvial NWS-Conservation – one-off *	DAFM	126	68,418
Alluvial NWS-Conservation	DAFM	126	21,546
Alluvial NWS-Conservation – premium	DAFM	126	44,100
Alluvial NWS-Establishment – one-off *	DAFM	250	141,500
Alluvial NWS-Establishment	DAFM	250	47,250
Alluvial NWS-Establishment – premium	DAFM	250	166,250
Lesser Horseshoe Bat measures	DHLGH	1 county	70,000
		Subtotal	**2,671,264**
Other spending			
Coillte biodiversity spend + programmes	Coillte		330,000
Coillte Nature [1]	Coillte		1,000,000
NWS-Conservation for Coillte Nature	DAFM	30	150,000
NWS Scheme GPC 9 & 10 (non-PAF)	DAFM	450 ha/yr	2,500,000
Neighbourwood Scheme [2]	DAFM		87,000
RUS for ash dieback	DAFM		655,500
Coillte BIOForest	DAFM		164,484
		Subtotal	**4,886,984**
		TOTAL	**€ 9,497,556**

* One-off costs have been annualised across the 7-year MFF

[1] Includes annual costs (€ 71,429) for conservation of Hazelwood SAC as listed in PAF figures

[2] 2018 figure used, as most recent year of payments

The further serious challenge is that of ash die-back. The airborne fungal disease threatens to wipe out 95% of the country's ash trees. The species is synonymous with the Irish landscape and is present in over 90% of woodland sites (Perrin et al, 2018). It is particularly prominent as a hedgerow species and one with a symbolic cultural value. The loss of so many ash trees is now being acknowledged as a 'national emergency', but ash die-back has also been an international disaster. The only current solution appears to be to cross

the small stock of resistant native trees with Asian ash species which have co-evolved with the disease (Clifford, Douglas, and Nemesio-Gorriz 2020). A package of just under €80 million has now been set aside to begin to address the problem, with €5,000 per hectare being made available to landowners to clear and replant ash plantations with new species. However, while a 2023 government review has admitted that inadequate efforts were made to address the problem, the focus has remained on the forestry industry rather than the environmental and landscape impact. The latest farm payments are in addition to an existing €160 million scheme that allows farmers to replant ash forests. For the wider environment, COFORD acknowledges that a programme of mass propagation and planting would be needed for up to 20 years (Clifford, Douglas, and Nemesio-Gorriz, 2020).

4.4.5 Restoration financial needs

As noted above, Perrin (2008) estimated that 22% of native woodlands were in poor condition and 50% in only moderate condition. Others could no longer be labelled as native woodlands because they contained too many non-native species such as beech, sycamore and sitka spruce. Common issues were invasion by rhododendron, deer grazing and also under-grazing. If the NWS Conservation grant and annual premia were to be applied each year to just 1% of the area identified by NPWS as being native woodland, the cost would amount to €6.13 million. However, biodiversity and ecosystem services are not restricted to native species woodlands alone and many other deciduous and mixed species woodland could also benefit.

Another major issue is the small size of woodlands. One fifth of the sites surveyed were less than the 3ha size that is used to categorise a 'small wood'. Expanding size and connectivity is a priority for the survival of woodland wildlife and the sustainability of the woodlands themselves. It would also offer public good benefits in terms of amenity, ecosystem services, and species movement in response to climate change. NPWS Establishment rates for native woodland or oak would amount to €4.98 million per year for 800 ha.

In common with other terrestrial ecosystems, the NRL requires an increase of at least 30% of the area of native forest that is not in good condition, rising to at least 60% by 2040 and at least 90% by 2050. If the area of native woodland that is in less than good condition is equivalent to that estimated by Perrin at 72%, then significant efforts are needed, mitigated only by the absolute small area of woodland of 82,321 ha. The NRL requires pro-active management to restore forest ecosystems as demonstrated by the presence of deadwood, forests of uneven-aged structure, connectivity, forest bird species and the stock of organic carbon to be found in standing wood and soils. A minimum ambition of applying **conservation management** at a cost given above of €280 /ha per year over the seven years to 2030 would amount to at least **€35 million** to achieve the 30% target by 2030. However, removal of heavy rhododendron infestation on just 10% of this area could add **€8 million** to this amount, or even up to €12 million. The alternative of applying NWS – Conservation payments to the 30% target would amount to between €66 and €89 million based either on past expenditure or the grants and premia relevant to established woodland only. Here, though, the low uptake of the NWS to date by private landholders suggests that practical issues would cause the level of restoration to fall short of this amount. A higher estimate (142,890ha) of the area of native woodland would cause all these financial estimates to increase by three-quarters to €75 million or **€10.7 million** per year .

In practice, it would seem that restoration, and the benefits of restoration, would be achieved more successfully by a mixture of conservation management, new planting on public land and strategic incentives that include other public good and ecosystem services benefits related to amenity, protection of water quality and carbon benefits. NWS payments would be only part of the solution given the problem of low uptake. Initiatives such as Coillte Nature can be part of the equation. There is therefore the question of whether restoration should be restricted to existing native woodland, as implied by the NRL, or should be considered for the entire forested area which would permit **new native species planting** of existing woodlands where these are not ancient woodlands and are too degraded to restore cost-effectively. Such a strategy could involve costs until 2030 of around **€40 million** (€6m per year), midway between those estimated above.

4.4.6 Recommendations for native woodlands

a) Properly incentivise NWS

Although the NWS is ambitious in spending and extent, uptake has been modest. Both NWS categories remained below target despite modified incentives from 2016 onwards. There was poor uptake of several key categories within the Scheme, for example no payments were made in 2019 for 'Scenario 5' "establishment or conservation on highly modified peat" (i.e. pioneer birch woodland). Responses to this study and to the Forest Scheme mid-term review indicate that slow growth rates and low value make native plantations uneconomic. Furthermore, the complexity of applications and restricted eligibility highlighted by forestry stakeholders also deters uptake. DAFM native woodland promotion could therefore include greater training of foresters in native woodland promotion and the integrated payments, including links to water course protection. Given that the PAF estimates of NPWS will largely rely on private uptake, better incentivisation is required to compete with more remunerative non-native Sitka mixes.

b) Streamline inter-departmental transfers

As a means of supplementing funding for native woodland protection and expansion, the NPWS have begun to capitalise on DAFM grants through the NWS. This effectively doubles the administration required for the one government grant supporting native

afforestation, and involves a department focussed on agricultural productivity (DAFM) disbursing grants to another government body with responsibility for biodiversity (DHLGH). As there is potential for deadweight competition for grants with private owners or Natura 2000, it also introduces a risk to compliance with EU Natura Directives. Therefore, it is recommended that a direct fund-transfer mechanism between both departments be implemented for the NWS, potentially through a Memorandum of Understanding. Furthermore, a targeted amount of the NWS should be ring-fenced for sub-schemes on public land through the NPWS or within the existing Coillte estate. This would assist the Forest Service in meeting its native woodland targets and would supplement the capacity of NPWS and Coillte in expanding (and protecting existing) native woodland.

c) Continued diversification of funding sources

The reliance on the NWS for almost all native woodland conservation and expansion is vulnerable to future economic austerity. There are numerous opportunities to expand the rationale for native woodland supports through cross-departmental collaboration on objectives. Expansion of the socio-economic model would be welcome to incorporate funding streams that encapsulate a wider range of the ecosystem services benefits offered by native woodlands including water retention, carbon sequestration, amenity, health and wellbeing. This synergy between biodiversity and cultural ecosystem services is recognised in Action 2B8 of the draft NBAP 2022-2026. There is the potential for linkages with the DAFM and DHLGH (Lawpro) through their support for buffer strips and other measures to protect water quality, including by permitting changes in licensing requirements for planting in connection with adherence to AES. At present, state sponsored forest planting is included in NDCs prepared in response to the Paris Agreement. However, there is an urgent need to explore opportunities around a Forest Carbon Code, similar to the UK Woodland Carbon Code, that encourage applicants, including corporations, to claim carbon credits through voluntary carbon markets. This route is now being investigated in relation to the Peatland Finance Initiative. Ideally, the necessary verified carbon units would be managed by a third party and overseen by NPWS or DECC. Similarly, the Neighbourwood Scheme could readily benefit from any mandated biodiversity offsets in exchange for built development, or as part of community gain initiatives.

d) Expansion of AES and NWS schemes

There has been very positive utilisation of existing government schemes to promote native forests and the ecosystem services they offer. However, these schemes should be expanded beyond the targeted three Annex I habitats, to include emergent woodland, riparian mixes and hedgerows, or at the very least to incentivise yew woodland establishment in the wider countryside through NWS-Establishment. At present, owing to the current incentivisation model, almost no level of private native afforestation exists which is not intended as a commercial crop. There are still commercial plantations that are not likely to ever support the same level of biodiversity as dedicated native woodland. This exclusive focus on minimum Natura 2000 obligations is reflective of a capacity gap in the NPWS to protect native biodiversity, reflected across this report as a whole. Thus, integrating native woodland elements into Farm Plans, EIP-AGRIs, or ACRES is strongly encouraged as the most cost-effective means of ensuring native woodland recovery in the wider countryside.

e) Restoration

Proposed one-off expenditure in the PAF Is largely focused on the re-establishment of oak and alluvial woodland, including as green infrastructure. Removal of invasive ground cover is included among recurring conservation actions at managed Natura sites, but, along with deer management, needs strategic attention as the survival of so many woodlands is threatened by invasives and browsing. As most native woodlands are small and woodland cover is so low, a substantial increase in planting is needed, but should occur on former conifer plantations or productive farmland rather than marginal land of ecological value. Noting the highly fragmented nature of forest in Ireland, the adoption of a landscape approach in the wider countryside would promote the connectivity of woodland using native species. Riparian woodlands and hedgerows represent important corridors and can now be supported by grant funding through the Woodlands for Water measure of the NWS (Establishment). This would strengthen the public good element by providing other ecosystem services benefits and bringing woodlands and their biodiversity in contact with more people rather than singularly rewarding private landowners with biodiversity and amenity gains.

f) Ash die-back

A extension of payments to all landowners to ensure that trees impacted by the disease are quickly removed and replaced with other species. Increased expenditure, and a commitment to a programme of breeding disease resistance with a view to a national programme of replanting supported by the recruitment of public assistance with such an initiative beginning with raised public awareness.

Summary

Although grants are available to encourage private applications to the NWS and similar schemes, uptake has been lower than projected. Planting requirements in relation to forestry generally have improved to avoid peatlands, to provide protection for remnant

small habitats and to protect waterbodies. Strong arguments remain with respect to the biodiversity implications of planting pastureland and upland locations with exotic commercial species, particularly for ground-nesting birds. The PAF has identified needs with respect to existing native woodlands, inside and outside of Natura sites, that could potentially be met though the NWS Conservation and Establishment elements to the sum of **€2.4 million** per year. However, the PAF targets Natura sites, mainly ancient woodland, oak and alluvial woodlands. Throughout the country there are woodlands and forests of mixed native species, beech and conifers that are of varying potential value to woodland species, but which are heavily infested by non-native understory species such as rhododendron and cherry laurel, or heavily browsed by deer. To these, a further critical challenge has arisen in the form of ash dieback. The NRL requires the restoration of 30% of degraded native woodland by 2030. The cost of implementation is manageable where woodlands are not heavily infested by invasive species. The target should be pursued by means other than just the NWS and the NBAP objective of encouraging cultural ecosystem services means that the focus must include publicly owned land. Coillte Nature is a welcome recent initiative and there would be a huge benefit from quadrupling its annual expenditure to replace large areas of non-productive conifer forest. Indeed, there is a need to expand the area of woodland generally to provide for ecological connectivity and the adaptation of wildlife to climate change.

Table 4.15 Native Woodland Summary table

Recent and proposed PAF spend	Additional NRL spend per year to 2030	NRL additional spend including to address ash dieback in natural landscape
€14.3 million pa	€6-€11 million pa	€10 million pa
Net additional NPWS spend of €8.4m pa (€24.1m in PAF) plus existing spend of €5.9m by Forest Service, Coillte and NPWS,	Including allowance for rhododendron eradication, lower and higher cost estimates of addressing the problem in remaining native woodland.	Minimum spend of €10m for dealing with ash dieback in hedgerows and native woodland.

4.5 Freshwater habitats

4.5.1 Freshwater biodiversity in Ireland

Being on the north-west fringe of Europe, Ireland receives a high volume of annual rainfall, up to 1400mm in the west or 2000mm in mountainous areas. Water is therefore a characteristic element of many Irish habitats and, consequently, water quality is extremely important to their ecological status. Rainfall is vital to peat bogs, while external sources of water, including groundwater, are important for the maintenance of fen habitat and turloughs. Water quality, and water levels, are evidently important for aquatic flora and fauna in rivers, riparian meadows and wetlands, and also for the biodiversity associated with lakes. Indeed, lakes are especially vulnerable given that pollutants are not flushed out as for rivers and can accumulate over time. Rivers, meanwhile, eventually empty out into estuaries and coastal areas where habitats can also be impacted by nutrient and pollutant loads.

The biodiversity within these habitats itself contributes a regulating ecosystem service through the assimilation of nutrients, helping to maintain water quality in circumstances where nutrient loads are not excessive. Unfortunately, most protected freshwater habitats are in an unfavourable status which compromises this service. Species such as Atlantic salmon and eel, which are associated with high quality waters, have declined, and while other factors are implicated, local losses of mayfly and stonefly species mirror those of water quality. However, some species such as common frog, are in favourable status and others such as otter appear to have increased, including in the 44 SACs designated for this species, albeit largely in response to factors such as reduced persecution. All freshwater environments are very significant for ecosystem services, including for drinking water quality, industrial cooling, flood mitigation and amenities such as riverside walking, angling and kayaking.

The quality status of rivers is related to ecological criteria, namely counts of certain invertebrates, as well as nutrient loads, dissolved oxygen and pH. After a period of some stability, water quality would appear from the most recent EPA report (EPA, 2019) to have recommenced a decline during the period 2013-2018, contrary to the targets contained in the Water Framework Directive (WFD) which originally foresaw all rivers achieving at least 'good ecological status' by 2015. Indeed, nearly half of surface waters (47%) are in an unsatisfactory status according to WFD criteria, being either moderate, poor or bad. The decline of water quality is particularly marked for high status waters, with pristine sites having declined dramatically from 500 to just 20 in only thirty years. Conversely, coastal waters showed a slight improvement, as did lakes to a small degree, but the quality of rivers has continued to decline (EPA, 2020).

There are 26 river SACs, 84 lake SACs and 31 turlough SACs, represented by seven Habitats Directive annex freshwater habitat types. Each of these is assessed as being of either Inadequate or Bad conservation status. As lakes are fed by rivers, and the quality of most rivers is dependent on catchment management, the specific role of the NPWS in influencing the management of protected areas can only do so much to maintain their ecology. The SAC network also covers 80-90% of the remnant freshwater pearl mussel

population which is now found in just 8 priority catchments. This formerly abundant, but now critically endangered species is an indicator of high water quality, and thus an 'umbrella species' for conservation of catchment-level biodiversity.

In comparison to catchments within other European MS, water quality in Ireland is mid-table. However, on the basis of its low population density and lack of heavy industry, Ireland's water should be of much higher quality. Furthermore, the status of Ireland's rivers is enhanced by the regular flushing effect of our high rainfall, without which water quality would be further diminished. Eutrophication remains the principal driver of this poor water quality, due to high nutrient loads mainly from agriculture (53%), but also urban wastewater (20%), forestry (16%) and domestic wastewater (11%) (EPA, 2020). Poor hydromorphology due to past drainage schemes and barriers such as weirs, is identified as another contributor (24%) to Ireland's failure to achieve good status and impacts on the migration and spawning of salmon and lamprey and the movement of other species. Sediment from agriculture, forestry and peat workings is an issue for fish spawning whose significance has been overlooked until recently. The use of chemicals, especially pesticides and herbicides, but also industrial pollutants, is also a problem. Furthermore, invasive alien species (IAS) continue to impact on freshwater ecology, including in lakes (e.g. *Lagorosiphon major*, zebra mussel, pike and mink) and rivers (e.g. crayfish plague).

Outcome 2D of the NBAP aims to conserve biodiversity and ecosystem services in the freshwater and marine environment. Diffuse and point pollution are major issues. Action 2D1 requires relevant bodies to deliver on measures in the River Basin Management Plans, while Action 2D2 requires Irish Water to implement its Water Services and Biodiversity Strategic Plan. Action 2D4 calls on DHLGH and LAWPRO to conserve or retore high status water bodies under the Blue Dot Programme while Action 2D4 requires DAFM to support nutrient management plans to reduce nitrogen and phosphorus seepage into freshwater bodies. Action 2D5 requires DHLGH to develop more catchment management and non-structural measures for flood risk.

4.5.2 Current freshwater conservation measures

This study interviewed key informants from DAFM, DHPLG, LAWPRO and the NPWS in relation to current water quality investment for biodiversity. A large collection of multi-sector and interdisciplinary programmes address water quality issues in Ireland. The NPWS has been much involved with lake ecosystems, while other Government Departments and Agencies are more engaged with rivers which also provide for abstraction, angling, amenity and tourism. The section below details the most prominent and well-funded of these.

Since 2010, **River Basin Management Plans (RBMP)** implemented under the WFD to improve the management of rivers and have brought together various stakeholders, including local authorities, Irish Water, OPW, IFI, Waterways Ireland and farmers. The third RBMP is currently in development for the period 2022-27. Over time, it has been realised that a more localised and holistic 'integrated catchment management' approach, based on a DPSIR (drivers, pressures, states, impacts, response) framework, has a higher prospect of success given the multitude of stakeholders and pressures. Furthermore, for high status waters, the **Blue Dot Catchment Programme** was established in 2019 as an initiative of the RBMP to maintain and improve the quality of the highest status rivers. These include rivers of the highest value to biodiversity. An **Fórum Uisce**, the national **Water Forum**, was added to the list of stakeholders in 2018 to provide strategic advice and vision to improve the quality of Ireland's rivers for biodiversity and for economic and cultural life.

The **Local Authorities Waters Programme (LAWPRO)** was founded in 2016 and given a remit to help coordinate agencies to implement the WFD and to increase awareness of water issues within communities, through *catchments.ie*. In addition to public outreach, LAWPRO undertakes detailed **in-stream catchment assessments** to pinpoint local issues. These have focused on 190 Priority Action Areas (PAAs), where water quality issues have been identified, but which have the prospect of improvement. LAWPRO also encourages local communities to apply to the **Community Water Development Fund** and related **LEADER** funding. A positive outcome of this community-based work by Local Development Companies has been a growth in community interest, including the formation of River Trusts. However, biodiversity remains a marginal motivation for communities and social projects predominate in LEADER applications even though a proportion of funding is set aside for 'environment'. The success of LAWPRO resulted in an expansion of staff from 22 to 70 in 2019, mainly in the catchment assessment group. Its focus on 'upstream thinking' also links in with the desires of Irish Water, to minimise nutrient and sediment inputs at point source.

The catchment assessments of LAWPRO also inform the work of the **Agricultural Sustainability Support and Advisory Programme (ASSAP)** which advises farmers on reducing nutrient discharges from farms. The programme supports 30 advisors, of whom 10 are contributed by the Dairy Cooperatives. Dairy herds have grown since 2012 and milk production has increased by 4% annually, raising discharges of phosphorus and nitrogen despite CAP derogations capping the level of fertiliser application. Between 2018 and mid-2020, almost 1,400 farm visits were conducted, with a further 180 follow-up consultations, resulting in recommendations from advisors on how to voluntarily mitigate impacts. Of the 190 PAAs, 80 had been visited by early 2020, although 90% farmer engagement has been reported. It is hoped that future revisions to CAP will include measures currently recommended by ASSAP, but delays in the revision of CAP make current ASSAP measures (running until the end of 2021) an important stopgap. In the absence of monetary incentives, respondents to this study have expressed concern that ASSAP, with only advice and no money to hand out, and with limited requirements for action and no inspections, is not equipped to achieve substantive change.

The **Environmental River Enhancement Programme** has the potential to improve habitats through coordination between the OPW and IFI on restoration works for rivers which were canalised under former arterial drainage schemes. However, it is argued by a diverse set of stakeholders, including anglers and NGOs, that on-going maintenance and flood mitigation works are continuing to have negative impacts on biodiversity, including fisheries. Rather, the programme has focused on research and appears also to have been scaled down in recent years. Some funding for restoration is available under the **Salmon Conservation Fund,** but requires upfront expenditure by local angling clubs without guarantees that plans will receive planning and environmental clearance. These upfront guarantees have discouraged the engagement of this important interest group in environmental improvement. Of barriers, dedicated work by IFI has removed 14 river weirs in recent years, but this a fraction of the estimated 2,500 larger barriers across the country. Moreover, there are tens of thousands of smaller barriers with 508 recorded for the Nore alone. Many catchments, such as the Boyne, would benefit greatly from their removal, not least for fish migration. However, removal requires substantial preparatory assessment and remains focused on key barriers rather than strategic catchment level strategies that could fully rehabilitate some potentially valuable salmonid rivers (Kelly-Quinn et al. 2021).

Numerous **EU LIFE and LIFE-IP projects**, co-funded through the EAFRD and other bodies at a national level, address water quality across Ireland either as a direct objective or resulting from related actions. Running until 2026, and with a total value of €20 million, the LIFE-IP Waters of Life targets high-status waters not already captured by ASSAP, Farm Plans or other LIFE projects, amounting to c.20 catchments mainly in the West. LIFE funding has also been provided for Lough Carra, a unique marl lake in County Mayo. This funding focuses on Blue Dot Catchments and aims for a holistic catchment-scale design using results-based agri-environment payments (RBAPS), while overlapping with the efforts of the LIFE-IP Wild Atlantic Nature programme operating in the same region. LIFE Dublin Urban Rivers seeks to address private wastewater discharge and overflows into river systems, and includes integrated constructed wetlands as a nature-based solution to improve river quality. Furthermore, numerous peatland projects affect water quality by reducing sediment and nutrient loading, although this expenditure is captured by other relevant sections of this report.

Several **EIP-AGRI projects** focus on high-quality waters, including the Pearl Mussel Project, Allow, Duncannon and Mulkear EIPs, all of which focus on engagement with farming communities and often involve some form of RBAPS which incentivise lower impact management practices and reward quantifiable improvements in water quality. Of note amongst these, the Pearl Mussel Project has receiving €10 million across 5 years and covers 8 priority freshwater pearl mussel catchments from Kerry to Donegal. The programme disburses payments to 454 farmers who manage in excess of 34,000ha of farmland, equating to 83% of all farmland in the catchments. Although numerous, a prominent concern expressed by consultees was the limited spatial nature of EIPs and the absence of a uniform landscape-level approach. Furthermore, the opportunity costs of involvement are high and so the voluntary uptake of measures means that buy-in remains limited to lower intensity or part-time farmers who do not account for the majority of catchment landholdings.

Each of the various activities detailed above will improve water quality. The natural heritage focus of these has mainly been on high status rivers and lakes, given their value to biodiversity and the urgency of arresting the trend of losses. However, current trends in quality and the changing priorities of government give the impression of an insurmountable challenge so long as farm supports continue to incentivise intensified productivity.

4.5.3 Current funding for freshwater biodiversity

Table 4.16 itemises the most significant spending lines on freshwater biodiversity for the year 2020, amounting to an estimated annual spend of €8.2 million once weighted by the biodiversity coefficients. This is predominantly funded by the Irish Government through DAFM and DHLGH, with the remainder funded by the EU (through the EAFRD), and from other sources such as LEADER, semi-states and the private sector.

Given the complex combination of responsible bodies and funders of freshwater biodiversity, much difficulty was experienced in obtaining relevant figures, with numerous sources unable to account for sources of funds or final spending. Furthermore, significant risks of double counting emerged, with multiple bodies claiming budgets (e.g. ASSAP), and with significant overlap in programme spending (e.g. LAWPRO and Community Water Development Fund). EIP and LIFE/LIFE-IP funding were, however, well defined.

Table 4.16. Annualised spend on freshwater biodiversity, listed by fund source and weighted using coefficients

Programme	Coefficient	Source of funds	Annualised spend* (€ 2020)
ASSAP [1]	50%	DHLGH	475,000
ASSAP [2]	50%	DAFM	62,500
ASSAP [3]	50%	Dairy cooperatives	269,016
LAWPRO (ex. Comm. Fund and ASSAP)	50%	DHLGH	2,667,998
Community Water Development Fund	50%	EPA-DCCAE	112,500
EIP-AGRI Allow	25%	DAFM	32,136
EIP-AGRI Allow	25%	EU	40,900

EIP-AGRI Pearl Mussel Project	100%	DAFM	733,333
EIP-AGRI Pearl Mussel Project	100%	EU	933,333
EIP-AGRI Mulkear	75%	DAFM	77,407
EIP-AGRI Mulkear	75%	EU	98,518
EIP-AGRI Duncannon	5%	DAFM	3,025
EIP-AGRI Duncannon	5%	EU	3,850
Salmon Conservation Fund	100%	Inland Fisheries Ireland	353,500
LIFE-IP Waters of Life	75%	DAFM, DHPLG, LA, Coillte, EPA, Teagasc, Forest Service, OPW, LEADER companies (x10)	1,165,586
LIFE-IP Waters of Life	75%	EU	1,017,857
LIFE Dublin Urban Rivers	25%	DAFM	91,045
LIFE Dublin Urban Rivers	25%	EU	67,920
		TOTAL	**€ 8,205,424**

[1] Ambiguity remains with ASSAP figures, through limited clarity from DHLGH/DAFM on precise annual contributions.
[2] DAFM claim contribution of circa. 125,000 annually.
[3] Cooperative estimated contribution based on average cost of advisor using DHLGH & DAFM figure (i.e.: €53,803 x 10).
[*] Coefficient applied to each figure, to provide spending related to biodiversity only.

By comparison with the modest figure of €8.2 million, €851 million was spent by Irish Water on capital investment in the water sector in 2020. Above and below ground wastewater expenditure accounted for 22% and 20% respectively of this amount. This expenditure is obligatory under the WFD, but is largely aimed at human health rather than biodiversity. Significant additional amounts would also have been spent by local authorities and private households (CRU 2022). Including any of these figures, would inordinately obscure funding for biodiversity and distort final calculations. Furthermore, it cannot be presumed that the c.€10 million spent by the EPA annually on ongoing and widespread water quality monitoring and research leads to affirmative action for biodiversity. For these reasons, this expenditure has been excluded to avoid exaggerating total expenditure. Future costs of freshwater biodiversity.

4.5.4 Future priority spending on freshwater

Given the variability in catchment size, ecological state, species assemblage and overlap with numerous other sectoral costing estimates made in this report (e.g. peatlands, grasslands), extrapolation to national level is highly impractical, especially given the absence of a common unit such as hectare, length of river or similar. Over €15 million per year is allocated to recurring costs for Natura freshwater habitats in the PAF, plus €185,550 for once-off expenditure and €1.29 million for once-off expenditure on green infrastructure. In addition, €12,856 in expenditure is included to elsewhere in the PAF to support wetland birds. The PAF figures provide the most pragmatic approach for estimating short term future costs of biodiversity within the Natura2000 network. As some of these estimated costs relate to actions that impact SACs or SPAs more generally, these PAF costs also offer more holistic catchment-level costings from an NPWS perspective. Combining the broader costs of existing priority cross-sectoral programmes given in Table 4.14 above with the itemised expenditure on Natura2000 sites under the PAF (Table 4.15 below), gives a conservative estimate of projected costs associated with freshwater biodiversity protection of **€23.4 million** per year.

While the PAF estimates do address some level of water quality measures in the wider countryside, green infrastructure measures are not built into longer-term strategies outside of LIFE and LIFE-IP funding in contrast to other habitat sets within the PAF. Green infrastructure is, though, especially important for water quality as is recognised by holistic catchment-level management. Across the wider countryside, more could be done to protect the water quality of Ireland's rivers and lakes at modest cost to central government through farm cross-compliance measures, catchment management, continued upgrading of urban waste-water treatment plants and firmer obligations for domestic rural wastewater treatment. In addition, the funding of LAWPRO and ASSAP could be increased to extend to more than just PAAs. Biodiversity specifically could be addressed through measures such as farm pond and wetland restoration incentives, the re-naturalisation of some rivers and upscaled removal of barriers. LIFE and EIP funding also have the potential to achieve significant improvement, including the restoration of some distinct aquatic ecosystems.

Table 4.15. Projected costs of freshwater protection in the PAF

Measure	Coefficient	Extent	Annualised cost (€ 2020)
PAF measures			
Agri-environmental scheme (AES) for FPM	100%	8 PAAs	2,000,000
Improved farm habitat for FPM* (one-off)	100%	8 PAAs	50,000

Forest management measures for FPM	100%	8 PAAs	2,000,000
Ex-situ FPM breeding development (one-off)	100%		14,300
Ex-situ FPM breeding costs	100%		100,000
Barrier removal for fish (one-off)	75%	Priority rivers from IFI	50,000
Crayfish plague biosecurity	100%		5,000
Crayfish re-establishment measures (one-off)	100%		15,000
AES for waterbirds on islands and lakeshores	100%	25ha in 4 SPAs	60,000
Land improvement for waterbirds (one-off)	100%	25ha in 4 SPAs	1,250
Predator control for waterbirds	100%	4 SPAs	10,000
AES for hardwater lakes	100%	8 PAAs	750,000
One-off investment for hardwater lakes (one-off)	100%	8 PAAs	35,000
AES for prioritised turloughs	100%		100,000
One-off investment for prioritised turloughs (one-off)	100%		20,000
Total			5,205,000
Measures to prevent pollution in Natura sites	100%		10,000,000
		TOTAL	**€ 15,205,000**

4.5.5 Example projects

Examples of LIFE payments the new Lough Carra LIFE project in County Mayo and the Pearl Mussel Project in County Kerry provide an indication of what could be needed to achieve necessary water quality improvements to support biodiversity more widely.

Lough Carra

In Lough Carra, payments of €200/ha are initially proposed for 10% of the total catchment area of 11,150 ha. Including payments for supplementary measures, costs are estimated at €366,250. Lough Carra is a marl lake and extremely vulnerable to pollution from nutrients. As such, it would ideally be necessary to recruit those farmers who currently apply most fertiliser which we assume here would be equivalent to the 75% of the catchment that is farmed.[7] In this case, costs would amount to €4.54 million per annum, which with staffing costs estimated at €108,000 per year and ongoing monitoring at €372,000, would equal total annual costs of €5.02 million. This is a minimum as other works are proposed including enhancement of forest plantation, works on bat habitat, and a domestic septic tank programme ((Pearl Mussel Project 2020a, b) and info from pers comm.).

Caragh Catchment Pearl Mussel Project

The Caragh catchment is 13,362 ha of which 7,055 ha is private farmland and 4,282 ha is commonage. A maximum payment of €225/ha is available on the first 30ha of habitat each farm in this catchment, followed by €50/ha on the remaining level up to 70ha and €17ha thereafter (the average farm size if 82ha). An ideal situation would require 100% of farmers to sign up as pollution from a single length of farmland could compromise investments elsewhere. This would involve costs of €1.46 million to cover all 163 farmers in the catchment, plus a further 20% top-up for each farm where the residual risk to water quality is regarded as negligible, making for a total of €1.75 million. Supplementary activities up to a maximum value of €1,200/annum per farmer could add a further €195,000. Staffing, at an ideal level of one advisor for every 100 farmers at an annual salary of €50,000, would add €81,500 per year.

However, these payments are based on a 10/10 score for the RBAPS method. In practice, not all farmers will engage and some landholdings will be of lower ecological value. The actual average score was 6.5 in 2020 and only one quarter of participating farmers have been receiving payment for an average of five supplementary activities at a cost of €48,900. Furthermore, only one advisor is employed. The actual total costs for 2020 have been €668,900. We do not know the *average* level of adherence needed in the long term to achieve good (if not ideal) results, but if this were to entail an average score of 8/10 at the respective RBAPS rates of €180/ha, €40/ha and €14/ha, and were to involve 75% of farmers, two-thirds of whom adopt supplementary measures, then the cost would be €874,500 excluding monitoring (included for L.Carra above). Adding a 20% top up and supplementary measures by two thirds of farmers would amount to €1.087 million, or €1.146 million with the cost of (1.2) advisors (*info from pers comm*).

[7] Farmers are paid on hectares up to their full holding, but we assume for simplicity that 25% of the catchment is forestry or unfarmed bog.

Farmers in both the Lough Carra and Carragh catchments would have been involved with GLAS in which case payments would have been reduced by 40% in cases where they have signed up for Low Input Permanent Pasture, or by 20% where they have Traditional Hay Meadow. This would reduce the effect of double counting assuming that some additional farm measures are needed to achieve the desired results in these sensitive catchments. The two locations comprise low intensity farms and so the opportunity costs of more intensive agricultural production would be low. The maximum RBAPS payment in the eight catchments of the FRM Project is €450/ha. The new ACRES AES contains three Tiers of measures of which Tier 1 includes low input farming and buffer strips to protect 'priority water areas' while Tier 2 is directed at farmers in 'vulnerable water areas'. Tier 3 measures are selected from a range of appropriate actions. Total payments cannot exceed a maximum of €10,500 per farmer. Measures aiming for similar results for water quality in more intensively farmed areas are perhaps less likely to focus on nutrient reductions than alternative measures that may be more palatable for farmers such as field margins, riparian buffer strips or wetland creation on the less productive parts of the farm.

4.5.6 Restoration financial needs

As with other habitats, the NRL calls for restoration of 30% of degraded freshwater habitat by 2030, rising to at least 60% by 2040 and at least 90% by 2050. Article 4 also makes the case to restore an equivalent amount of supporting habitat (green infrastructure) which is especially pertinent to rivers and lakes. To arrive at an estimate of spendings needs, we can begin with the 152 waterbodies identified by LAWPRO as needing elevation to good or high ecological status (of the total of 726 in the 190 PAAs). If seven of these could be progressively addressed for each of the years before the 2030 target by measures similar to those of the Carragh Catchment and Lough Carra, and at a similar average total cost (€3.07m) based on a similar number and type of farmer (both unreliable assumptions), then dedicated freshwater biodiversity measures could cost **€22.7 million per year**. This, of course, is a substantial sum, but would be higher if upscaled to estimates for sub-catchments of the 46 principal national catchments and a 47% estimate applied for waterbodies of unsatisfactory ecological status.

Lake and fluvial **wetland** Protected Areas fall more clearly under the responsibilities of the NPWS. Larger sites, such as Pollardstown Fen, have Conservation Objectives and therefore the basis for a restoration plan. For lakes, Lough Cara LIFE will be a good demonstrator of what could be achieved.

In addition, Article 7 sets an objective to remove **barriers** to permit the restoration of 25,000km of free-flowing rivers, or around 15% of EU river length by 2030. Barrier removal would complement water quality improvement by establishing the basis for the physical restoration of rivers. Removal cost depends on height and width with recent costs for seven larger projects having averaged €100,000 plus EIA survey costs averaging €42,000 (Kelly-Quinn et al. 2021). Assuming there to be five significant barriers per major river, this cost would present a bill of **€710,000 per year** until 2020 even if achievable given the long lead-in periods typically incurred. If 15% of all smaller weirs were to be added at an estimated average demolition of €20,000, the cost could be as much as **€4 million per year**. The costs would be borne by IFI as the responsible body. Alternatively, this process could be addressed more strategically by selecting rivers or key barriers most likely to improve as a consequence. This should be accompanied by an improved approach to bankside and flood management works which respect riparian habitat. Indeed, rivers across Ireland require large-scale re-establishment of riparian habitat. Data on river restoration costs has been prepared by the West Cumbria Rivers Trust, the West Country Rivers Trust and, in Ireland, for the Lough Melvin catchment. Across Europe, Logar et al (Logar, Brouwer, and Paillex 2019) found that costs exceeded €100,000/ha, while Szałkiewicz et al (Szalkiewicz, Szymon, and Grygoruk 2018), report average costs of €310,000/ha. These sums are substantial even for the 'small catchments' in Ireland which average 30km2.

4.5.7 Limitations to freshwater conservation

Despite the combined efforts of various stakeholders and initiatives listed above, there are several principal limitations to improving freshwater conservation in Ireland:

- **Sufficient urgency:** Given freshwater habitat dependence on water quality, and the failure of the significant spending to date to arrest declines in water quality, attention must be given to the effectiveness of measures. This requires continued investment in addressing point pollution, an area which has had some success, but leaves agriculture as the main cause of diffuse pollution and poor water quality.
- **Divided responsibility and resources:** The division of responsibility for water between so many Government departments, agencies and other bodies remains a problem, although one that RBMPs and catchment management can mitigate. Resources are spread thinly. While resources have been made available to LAWPRO, funding has simultaneously been reduced for enforcement activities by Local Authorities and for IFI. The demise of water charges has made Irish Water more dependent on central government for financing its €1.7 billion investment programme. Although there is good cooperation between LAWPRO and ASSAP, better coordination and follow-up is required between the findings of assessment teams and farm advisory services. Some desk studies have been completed for PAAs, but no catchment plans have yet been published[8]. Continued ambiguity exists around spending by sectors, especially for programmes with shared responsibility such as ASSAP. For example, despite repeated requests, both DAFM and DHPLG could not provide accurate figures for their contributions to

[8] https://www.catchments.ie/data/#/areaforaction?_k=u07l7f

ASSAP. Similarly, figures stated in the annual reports of LAWPRO for the Community Water Development Fund do not match the maximum call amounts. There is a risk of double counting expenditure in both instances.

- **Nutrient input**: Interviews as part of this study suggest a political reluctance to adequately address agricultural pollution. A meaningful combination of incentives and enforcement is necessary as poor nutrient management by a small number of farmers can compromise water quality targets for entire catchments. At present, the quality of nearly half of rivers in vulnerable to intensive agriculture, especially in dairy areas, but the situation is not being adequately addressed as demonstrated by water quality monitoring. As funding is increased for one agency, it has been reduced for another. At present, farmers incur an opportunity cost in removing land from production for wetlands, soakaways or buffer strips. Some solutions are relatively simple such as improved nutrient management or good management of farmyard waste (NFGWS, 2020), whereas others require financial incentives or penalties. Elsewhere, nutrient management in forestry is improving due to new Forest Service planting and management guidelines. Domestic septic tank management has improved due to new planning regulations and targeted inspections under the National Inspection Plan for Domestic Water Treatment Systems (2018-2021). However, the low number of inspections and lack of follow-up actions following failed inspections (over 30%) means that this continues to be a significant pressure.

Under the above circumstances, it is understandable that much funding has been directed at those catchments of most value to biodiversity, including specific programmes for freshwater pearl mussel accounting for €40m in the PAF. Other Natura supports are mainly directed at AES and the EIPs. Although NPWS invests heavily in this, its influence and that of some LIFE projects is limited given the predominance of private land ownership, non-designated areas outside of the Natura2000 network and the dominant role of agriculture which remains fundamentally focused productivity objectives and incentives without investment to mitigate these impacts.

4.5.8 Recommendations for freshwater habitats

Overall, the management of rivers and lakes in Ireland is improving. In-stream assessments are being conducted to identify precise pressures, and this assessment is informing integrated catchment management to achieve better coordination locally. Research projects, such as UCD's *ESManage*, are introducing new probability-based assessment methods to identify the particular impact of nutrients on aquatic biodiversity and to inform catchment management planning. Public awareness is rising due to the work of LAWPRO and several communities have applied for project funding, larger LEADER grants, or to form River Trusts. However, like many sectors assessed in this report, conflicting funding threatens the effectiveness of investments, while a lack of accurate accounting and inter-departmental cooperation lowers the ability the track this. Although this is changing through recent multi-stakeholder projects, agricultural pressures restrict any marked improvements. The following four simplified recommendations are presented for the freshwater sector.

a) Focussed inter-agency targets

More-so than any other habitat in Ireland, the management of freshwater requires coordinated cross-sectoral planning and targeting. For freshwater biodiversity, this should go beyond simplified incremental spending estimates focussed on water quality. There are biodiversity indicator species, such as the FPM or salmonids that can be used to set inter-agency targets with the protection of these sensitive species as an ultimate goal.

b) Green infrastructure for freshwater

As an important omission within the PAF for freshwater (excluding LIFE-IP funding), green (and blue) infrastructure outside of the Natura 2000 network should be an important part of long-term freshwater investment. This is especially needed in the upper reaches of catchments, commencing with Blue Dot catchments, but not being restricted to this category. Aside from clear biodiversity benefits both within Natura 2000 sites and in the wider countryside, this also supports Irish Water and OPW objectives. Other large land-holding semi-states who disproportionately affect these catchments (e.g Coillte and BnM) currently co-fund LIFE-IP plans to address water quality in the wider countryside, but could be obliged to commit to such investment in the longer term.

c) Point source targeting

Although good progress has been made to increase awareness of water quality issues across landscapes and within catchments through the work of LAWPRO and ASSAP, there are no measures to follow up on evidence of point source pollution from farms which cause the majority of nutrient loading. At present, there is only voluntary engagement by ASSAP. Nitrates derogation inspections have assisted with this, but water quality has not substantially improved. As a means of providing economic incentives for higher impact farmers, funding from agricultural cooperatives to offset the opportunity costs of green infrastructure would be welcome under the Polluter Pays Principle, especially from the dairy sector.

d) Continued public engagement

The efforts to enhance public engagement with rivers that have been undertaken by LAWPRO need to be continued, to raise awareness of the importance of rivers and of the biodiversity they support, to encourage the formation of more River Trusts and more applications for LEADER and other funding from communities.

e) Restoration

The principal requirement for conservation spending for freshwater is to improve water quality through the improvement of land management. Items relevant to the proposed new MRL include the removal of barriers such as redundant weirs to return more rivers to a free-flowing state. The draft NBAP 2022-2027 has a target of 300km of restoration (Action 2E2). Inland Fisheries and the OPW have responsibilities here, but more substantial resources are needed given that most large rivers have dozens of barriers. Barrier removal is much delayed by ownership issues and assessment needs such that removal is opportunistic rather than strategic with only a handful of barriers removed each year. If enough rivers are to be returned to a free-flowing state, then there is a need to upscale removals informed by a strategic assessment of benefits and costs for each catchment. However, for the full benefits of restoration to be realised, actions need to extend first to riverbanks and secondly to entire catchment management.

Summary

Given the range of pressures and the high number of government bodies which have a responsibility for contributing to improved water quality, it is impossible to place a figure on the amount that needs to be spent to protect and enhance freshwater biodiversity given that this is so intricately linked to water quality. Under the WFD, the State has a responsibility to protect and improve water quality for both public health and environmental quality, of which biodiversity is one component. What is evident is that water quality is not improving at the rate that it should. Climate change will present a further exogenous pressure. However, many pressures are entirely endogenous and relate to inadequate protection of surface waters in land management, particularly the failure to internalise the costs to the agricultural sector and in the level of urban and rural domestic wastewater treatment. Much could be achieved at modest additional cost by implementing the polluter pays principle through cross-compliance. However, water quality is not the only influence on freshwater biodiversity. **Restoration** actions can protect and enhance biodiversity, for example by recreating ponds, restoring wetlands and the modification or removal of around 2,500 weirs and as many as 73,000 barrier structures (NASCO) across the country to allow the movement of migratory fish and other species. As an indication of what needs to be achieved, it may be noted that between €10-€30 million for each small catchment would be needed to return rivers to a free-flowing state as sought by the new Restoration Regulation.

Table 4.17 Freshwaters Summary Table

Current and proposed PAF spend	NRL additional spend including sub-catchments	Additional restoration spend to restore rivers to free-flowing status
€24 million pa	> €22 million pa	+ €710,000 - €4 million pa
LAWPRO, ASSAP, AES, EIPs LIFE and forest management for FPM and lake catchments	Applying LIFE projects such as for Carragh and Lough Carra to 7 catchments per year (51 by 2030)	Removal of 5 major barriers per year *or* these and smaller barriers on 15% of rivers.

4.6 Coastal habitats.

4.6.1 Coastal biodiversity

Ireland's coastline, at 7,500 km, includes some of the country's most spatially restricted and endangered habitats. Some of these habitats, such as machair, are of international importance (NPWS, 2019b). The natural environment also provides valuable ecosystem services for human beings, including protection from storms by dunes, saltmarshes and mudflats (EPA, 2016a). With the imminent threat of sea-level rise through global warming, the importance of dune and wetland systems for coastal protection is being increasingly realised. Despite their importance, most of these habitats are in inadequate-to-bad conservation status. Estuaries, inlets, bays and reefs are in 'inadequate condition' and lagoons are in 'bad' condition due largely to nutrient inflows. All are vulnerable to coastal squeeze due to rising sea levels (NPWS, 2019b). Moreover, construction of artificial coastal protection infrastructure has impacted negatively on some habitats and biodiversity (NPWS, 2019a). Thus, there is a priority for nature-based solutions (NBS) to coastal adaptation through preservation and restoration of habitat.

Outcome 2D of the NBAP seeks to conserve and restore biodiversity and ecosystem services in both the marine and freshwater environment promote the restoration of coastal ecosystems along with freshwater, transitional and marine environments. Targets 2D9 and 2D10 require that transitional, coastal and marine environment are of High or Good Ecological Status in line with the Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD) by providing for sustainable use of resources and the conservation of biodiversity and ecosystem services. Targets 2D13 and 2D14 require that commercial fish and shellfish stocks are managed at maximum sustainable yield. Target 2D15 requires sustainable fishing and aquaculture without adverse effects on Natura 2000 sites, and Action 2D16 addresses the need to ensure that commercial fishing complies with the Common Fisheries Policy.

4.6.2 Current coastal conservation measures

Impacts on coastal habitats which undermine ecological status can be attributed to agricultural pressures (overgrazing, drainage, nutrient run-off), amenity usage (litter, erosion, disturbance), commercial fishing (fish, shellfish, aquaculture), pollution (plastic net and other litter), historical development (golf courses, coastal defences and housing), and alien invasive species. Considerable pressures remain, although measures have been adopted in recent years to reduce some impacts. For example, collaboration between farmers and environmental bodies has resulted in a reduction of run-off in some coastal catchments (DAFM, 2019; DHPLG, 2019), while AES payments have helped to limit grazing pressure on some dune habitats. NPWS Farm Plans also apply to sensitive coastal habitats including dunes, coastal grasslands and heath, although the extent of this is limited at present (DCHG, 2017a). Given the overlap between these habitats and various sectoral schemes dedicated to broader conservation, water quality and sustainable agriculture funding supports, identifying existing spending on coastal habitats has not been possible in previous expenditure exercises (Morrison & Bullock, 2018) as costs were embedded within the generalised costs associated within the former NBAP *Target 4: Conserve and restore biodiversity and ecosystem services in the wider countryside* and *Target 6: Expand and improve management of protected areas and species*.

4.6.3 Future priority spending

The PAF identifies a priority financing need for €894,000 for both the coastal and marine environment under one heading, comprising €570,000 in annual running costs directed mainly at ongoing conservation needs, but including also recovery of species numbers, and €324,000 in once-off expenditure directed more distinctly at restoration. Spending specific to the terrestrial element of the coastal environment is mainly directed at farmland nutrient management for lagoons and transitional waterbodies and amounts to €743,300 per annum and €110,000 in protection of tern colonies is included. If, in addition, AES spending on Machair and Dunes, along with the AES estimates for chough (*Pyrrhocorax pyrrhocorax*), a species mainly confined to coastal locations, and corncrake (*Crex crex*), a formerly widespread species now largely confined to offshore islands, would add total €3.43 million, almost all of which is recurring per year, to total spending on coasts, bringing total coastal expenditure to €4.28 million per year.

To estimate the costs of conserving these protected habitats at a national scale, experts in coastal habitat conservation were interviewed and this data combined with the specific cost estimates taken from the PAF. The itemised prioritised costs for the 15 protected coastal habitats under Natura 2000, as reported in the PAF (Table 4.10a), were extrapolated to a national scale based on their known extent (Table 4.9b). Data on national coverage was revealed in the most recent Article 17 report and the Standard Data Form (SDF). Both these sets of figures were regarded by consultees as underestimates of actual coverage, meaning the priority costs are themselves likely to be underestimates of the national picture. The estimates are a minimum as the conservation of several priority habitats is not costed in the PAF.

Table 4.10a. PAF proposed spending: Coastal and Marine

Itemised Activity / Habitat type	Target area (ha)	Annualised national cost (€)
Lagoon hydrological work (one-off)	681	285,800
AES measures for lagoons	1,000	450,000
AES for Machair		1,494,808
AES for Dunes		735,286
Fencing, drain management, etc (one-off)		7,500
Tern colonies		110,000
AES for chough		184,000
AES for corncrake		1,018,500
TOTAL		€4,285,894

Table 4.10b. Extrapolated cost of coastal habitat protection

Activity / Habitat type	Status	Art. 17 area (ha)	SDF area (ha)	PAF cost per ha	National cost Art. 17 area (€)	National cost SDF area (€)
Lagoons (1150)	bad	2,500	2,500	450	1,125,000	1,125,000
Annual vegetation of shingle/sand drift lines (1210)	inadequate	55	91	*(No PAF costs)*	-	-
Perennial vegetation of shingle banks (1220)	inadequate	129	1,548	*(No PAF costs)*	-	-
Vegetated sea cliffs of the Atlantic and Baltic coasts (1230)	inadequate	5,483	4,722	*(No PAF costs)*	-	-
Salicornia and other annuals pioneer saltmarsh (1310)	favourable	116	357	*(Included in other aquatic categories)*	-	-
Atlantic salt meadows (1330)	inadequate	2,719	2,342	*(No PAF costs)*	-	-
Mediterranean salt meadows (1410)	inadequate	964	824	*(No PAF costs)*	-	-
Mediterranean and thermo-Atlantic halophilous scrubs (1420)	bad	0.28	1	378.60	105	378
Embryonic shifting dunes (2110)	inadequate	217	167	*(No PAF costs)*	-	-
Shifting dunes along the shore with *A. arenaria* (2120)	inadequate	433	419	*(No PAF costs)*	-	-
Fixed coastal dunes with herbaceous vegetation (2130)	bad	1/3 * 8,084	1/3 * 5,752	518.60	1,383,480	984,385
Decalcified fixed dunes with *E. nigrum* (2140)	favourable	0.02	188	378.60	7,570	71,176
Decalcified fixed dunes (2150)	inadequate	21	295	378.60	7,760	111,687
Dunes with creeping willow (2170)	inadequate	261	455	378.60	98,815	172,263
Dune slacks (2190)	inadequate	271	356	28.60	7,750	10,180
Machairs (21A0)	inadequate	3,088	2,343	974.60	3,009,565	2,283,350
TOTAL		**23,341 ha**	**24,085 ha**		**€ 5,640,045**	**€4,758,419**

In Ireland, much coastal habitat is listed as being in inadequate condition. Extending conservation works to the total area of those habitats which, overall, are in bad condition would entail a cost of between **€**4.75 million and €5.64 million per year, or **€6.52 million** after including current spending on items not listed in Table 4.10b. Actual costs would depend on the proportion of this area which is in good or bad condition. Either way, this is a modest amount given the value we attach to dunes and lagoons for the multiple ecosystem services they provide in addition to biodiversity alone. Lagoons have been degraded more by nutrification than by direct physical damage to the habitat and the annual AES payments would need to continue for decades before water quality begins to recover. There

are also a number of key dunes and lagoons which could be targeted for restoration in the short term, for example Lady's Island and Tacumshane Lake in Co Wexford.

Of note is that the vast majority of annualised spending would be allocated to AES measures for just four of these habitats: lagoons, salix scrub, fixed dunes and machair. It is also noteworthy that the PAF measures focus on only a small proportion of the estimated national coverage of these habitats. For example, 1,500 ha of fixed dunes are targeted in the PAF, although Article 17 reporting of this habitat (currently in Bad ecological status) is estimated at 2,039 ha and 3,380 ha, or around one-third* of the total area (NPWS, 2019b). The remainder of prioritised spending is aimed at IAS removal, fencing and drain removal where appropriate

Given the importance of coastal habitats to numerous other taxa (especially birds and pollinators), there is considerable overlap in measures and associated spending, often covering those habitats in Table 4.10b which currently have no listed costs. In these circumstances, their conservation is proposed to be addressed through measures in other habitat categories which will "improve the resilience and conservation status of all the associated habitats".

Some cross-cutting spending is evident beyond that currently spent by NPWS or planned through the PAF, although this appears limited to the LIFE on Machair project, the LIFE Insular project (sand dunes), a single EIP-AGRI and several NPWS Farm Plans which have included the development of habitat plans for dunes or the inclusion of payments for modified management (grazing, fertilizer, etc.) (DAFM, 2019; O'Rourke & Finn, 2020). Some areas of protected coastal habitats may also be included in GLAS payments under the CAP, particularly along the west coast, although the extent of this cannot be ascertained without more detailed scrutiny of GLAS accounts which were unavailable at the time of writing.

4.6.4 Restoration financial needs

The NRL aims for the restoration of 30% of coastal habitats by 2030. These are listed for Europe as a whole in Annex I of the proposal as being principally Atlantic coasts, estuaries, mudflats/sandflats, wetlands and lagoons, salt meadows and machair. There is a crossover in the context of this report, in that other coastal habitats and species are listed under the NRL targets for Marine, including seagrass meadows, kelp and seaweed communities, shellfish beds, maerl beds, reefs, and sediment beds, including also spawning and nursery areas in line with the EU Biodiversity Strategy.

Restoration is of a different order to conservation costs. Perez-Maqueo et al. (2013) provide various examples of the cost of dune restoration of which perhaps the most relevant is a Dutch case study involving costs of €12,053/ha. In California, restoration of the ecology of the 13 acre Colorado Lagoon cost $400,000.[9] If just 20% of our dunes and lagoons were in this need of this level of restoration and 30% were restored by 2030, the cost would be over €7 million and €12 million respectively, or between **€1 and €1.7 million** per year.

Saltmarsh is another habitat identified as being in inadequate condition. Here, AES measures could address overgrazing, but physical modification, alien species and coastal squeeze are problems requiring physical restoration. In the UK there is much experience of saltmarsh restoration based on various managed realignment and conservation projects. Restoration of 322ha of Hesketh Out Marsh in Lancashire cost £8.57 million, but included some land purchase.[10] Costs are estimated by ABPmer from £3/m^3 to atypical heights of £122/m^3, while the unit costs of realignment schemes have varied from as little as £790/ha for basic restoration, to over £20,000/ha (e.g. Hesketh) for restoration where movement of substrate was needed. Schemes involving land purchase or materials movement inevitably cost more (up to £120,000/ha), but conservation cost savings can be realised from sediment disposal from tunnel and dredging works. At the minimum rate of €885 (£790), physical restoration of 20% of the area of Ireland's saltmarsh would cost **€92,000** each year to 2030.[11] Again, actual costs could be more if the level degradation is higher or the area under-estimated, or less if some of this area is in good condition. It should be noted that there are significant social co-benefits from savings on flood defences and the protection of residences and infrastructure from sea level rise and coastal surges. In the UK, a Saltmarsh Carbon Code is also being developed to attract investment given the habitat's carbon sequestration service. The greatest risk is possibly that saltmarsh could simply be submerged by the same rising sea levels it would protect against in the short-term unless new land is purchased inland.

In addition to the habitat measures, there is the need to scale up protection for machair and lagoon breeding birds. McMahon et al (2020) report that across Europe ground-nesting birds are in greater decline (74%) than other species (41%) with predation by foxes, gulls and crows being an important factor. Predator-proof fencing averages €250 per metre and has been successfully used as a strategy for Birdwatch Ireland's reserve at Annagh Marsh in Mayo and Inch Island in Donegal. However, less than €7,500 is set aside under the PAF for one-off expenditure on lagoon fencing. The cost of removing mink by 75% over an 800km^2 area of the west of Ireland (including inland waterways) has been estimated at €1,000-€1,328 per km^2 annually for five years (Sugoto, Reid, and McDonald 2009). The cost of more ambitious predator control in New Zealand ranges between €1,600/km^2 for rats to €8,400/km^2 for other

[9] Southern California Wetlands Recovery Project scwrp.org/projects/Colorado-lagoon-restoration-planning -project

[10] Climate ADAPT case study https://climate-adapt.eea.europa.eu/metadata/case-studies/saltmarsh-recreation-by-managed-realignment-hesketh-out-marsh-uk/#cost_benefit_anchor. Viewed Nov 2021.

[11] Average of area estimates in Table 4.9.

mammals (Clapperton and Day 2001). Given that predation is such a significant threat to the fauna of habitats it could be argued that expenditure on fencing should be increased significantly to protect at least an area of 3,000ha at a cost of €120,000 or **€17,140** per year until 2030.

No spending estimates have been allocated to some important habitats. In part, this is because no clear conservation measures are available, as in the case of vegetated sea cliffs, even though pressures to their flora arise from factors such as climate change. No spending is proposed on mobile dunes which are everywhere threatened by extreme weather events and recreational pressures. Some protection measures have been funded by local authorities, but in most cases, significant spending is not necessary. Rather access restrictions may be needed along with an avoidance of ill-conceived stabilisation measures. For other lagoons, dunes and saltmarsh there is a need for on-going conservation expenditure noted above to protect against nutrification and an accelerating rate of erosion from storms and sea level rise. If coastal squeeze becomes an issue, land purchase may even be needed to permit a movement of dunes inland.

4.6.5 Recommendations for coastal habitats

Based on these findings, the following recommendations for financing coastal habitats are presented:

a) Realising ecosystem services values

In the face of impending climate change, coastal ecosystems present significant ecosystem services benefits by protecting areas from seas level rise, storm events and coastal flooding. In many cases, these nature-based solutions (NbS) can be realised at less cost than installing structural flood defences. In addition, coastal ecosystems are very important habitats for biodiversity, migratory species and habitat or nursery habitat for commercial fish species and shellfish. They are also of considerable value for amenity and tourism. However, coastal habitats are themselves at risk from climate change due to coastal squeeze between sea and farmland. The public benefits of these collection of ecosystem services are not recognised in OPW or government expenditure, for which grossly inadequate sums are directed at environmental protection. What expenditure exists is directed at agricultural land, but transient habitats, including inter-tidal habitats, are neglected.

b) Expanded staffing / resourcing

At present, protected coastal habitats are the responsibility of a single scientific employee within the NPWS, following a period where no specific representation was present. In addition, regional structures exist to support enforcement, ecological assessment and licensing. Capacity remains extremely limited within coastal habitat protection in comparison to other NPWS sections and there is a reliance again on external consultancy input for monitoring, although this is understood to be working well. There is an urgent need for in-house expertise in, for example coastal geomorphology, site management and community engagement. Resources available from two recently agreed EU LIFE projects, will assist in this respect, but are time-limited in nature. Establishing additional entry-level positions to supplement the work of the current scientific employee would allow for long-term planning and the establishment of a Coastal Habitats Section.

c) Broader integration with expanded agri-environmental schemes

Reflective of recommendations in section 4.2 of this report, integration of coastal habitats currently used for agriculture (e.g. dune systems grazed at low intensity) with existing AES would provide supplementary incomes, incentivise lower impact farming practices and increase awareness of their importance. Such a system may also increase the protection of these habitats and encourage a landscape-level conservation effort which captures non-designated areas. This could, for example, include greater representation of coastal habitats within an expanded network of NPWS Farm Plans.

d) Recognising GI / NBS value of coastal habitats

A prominent omission from the PAF estimates of spending is the importance of these habitats as green infrastructure (GI) for NbS to mitigate the effects of climate change, such as sea level rise or coastal surge. For example, those habitats receiving AES spending are largely fixed dunes and not those which are providing any coastal protection functions (excepting fixed dunes). Also, some of these habitats have a recreation function, but likewise need to be protected from the impact of this recreation. As such, it is recommended that a 'coupling' of coastal habitats to other forms of NBS expenditure be specifically pursued, either at cross-sectoral state level (Climate Change Adaptation), or through semi-state or corporate levels (CSR, aquaculture protection). This would go beyond Natura 2000 obligations of arresting deterioration, would apply to the wider countryside and would build a robust blended finance model.

e). **Restoration**

Expenditure on the coastal environment is slight compared with other habitat groups, partly due to the more limited role of AES except in the case of lagoons. PAF expenditure is focused on recurring conservation costs. It includes estimates for the recovery of island breeding bird populations, but does not include physical restoration costs, for example for saltmarsh to increase its

resilience to climate change. Habitat protection and creation will also be needed in time in response to climate change and should be a co-benefit of all coastal protection.

Summary

There is an inter-relationship between the sustainability of coastal ecosystems and the health of the larger marine ecosystem which is as much policy as expenditure driven. Coastal habitats also provide important ecosystem service functions in the face of climate change, both for mitigation and in allowing species to adapt to change. It is, however, difficult to define from past expenditure the amount that would need to be spent to protect these habitats, some of which are addressed by AES measures. The PAF identifies a need for €927,300 in spending on specific coastal habitats and on species such as terns. The area of protected habitats identified in the Article 17 reporting suggests a need for up to an **additional €5.3 million per year**, primarily for the conservation of fixed dunes and machair which account for the largest areas and lagoons which are mostly in "bad" condition. In most cases, there is a broad transition of conservation actions into restoration as is the case for the restoration of coastal bird colonies through protection from predators mixed with habitat enhancement. However, no spending is identified for saltmarsh, vegetated cliffs or shifting dunes, which includes the nesting habitat of many seabirds whose numbers are either declining or which are at risk from climate change. If the minimum estimates listed above were added to those of conservation, this would suggest a need for additional spending of **€6.4** million per year. Even the maximum figures given below fail to account for the cost of protecting coastal habitats from climate change. If sea level rise presents an escalated threat of the erosion or submergence of coastal habitat, additional and very significant costs will be incurred in protecting coastal habitats.

Table 4.11. Coastal Summary Table

Recent and proposed PAF spend	Extrapolation to national area (€5.2m)	Additional spend to meet NRL targets by 2030
€4.3 million pa	€6.5 million pa	€4.5 million pa
With AES of around €3.43m including for coastal species.	Adds €2.2 million, mostly for conservation of habitats where costs are known	Restoration of 30% lagoons, dunes and saltmarsh.

4.7 Marine

4.7.1. Marine biodiversity

Ireland's maritime area covers an area roughly ten times its terrestrial area, extending to 200 nautical miles and reaching depths of 5,000m. In environmental terms, it is considered to be in good condition relative to other European seas such as the Baltic or Black Sea. This situation, obscured by the vastness and cleansing currents of the Atlantic, belies a long period of naïve misuse and over-exploitation, culminating in the devastation of previously abundant stocks of cod and herring, state-subsidised commercial catches off West Africa and the exploitation of deep-water fish species which only reach maturity after 30 years. Some stocks have now begun to recover due to the restrictions on 'Total Allowable Catches', although the over-exploitation of other species continues (Carpenter and Heisse 2019). However, the most recent assessments indicate an inadequate status for several marine habitats (DHPLG, 2020; EPA, 2020, Marine Institute, 2020).[12] Much is still not understood of marine ecosystems, including their relationship with commercial fisheries and how ecosystems will respond to climate change (EPA, 2020).The importance of marine biodiversity to that fundamental ecosystem service of wild fishery harvests and their economic value for coastal communities is amongst the most obvious examples of our dependence on natural capital and our failure to appreciate this dependence (Worm et al, 2006).

Outcome 2D of the NBAP seeks to conserve and restore biodiversity and ecosystem services in both the marine and freshwater environment and to promote the restoration of coastal ecosystems along with freshwater, transitional and marine environments. Targets 2D9 and 2D10 require that transitional, coastal and marine environments are of High or Good Ecological Status in line with the Marine Strategy Framework Directive (MSFD) by providing for sustainable use of resources and the conservation of biodiversity and ecosystem services. Target 2D11 further requires that Ireland will enable legislation to implement Marine Protected Areas and to support transboundary policies including those of OSPAR's North Atlantic Environment Strategy. Targets 2D13 and 2D14 require that commercial fish stocks are managed at maximum sustainable yield. Target 2D16 addresses the need to ensure that commercial fishing complies with the Common Fisheries Policy.

[12] Only 18% have achieved GES and 22% remain below GES, but 59% are unknown.

4.7.2 Current marine conservation measures

In principle, European marine fisheries are now managed according to an Ecosystem Approach subject to Maximum Sustainable Yields and Total Allowable Catches. This approach has led to some improvement in commercial fish stocks to a point where a reduced proportion of 18% are now over-exploited, compared with 26% in 2015 (although 35% are not known or defined) (Marine Institute, 2019). However, the health of both wild commercial fisheries and aquaculture depends fundamentally on the marine ecosystem and its biodiversity. Both activities depend on clean waters, coastal nursery and benthic habitats, and a functional food chain. Although the protection and conservation of marine biodiversity is one of the three high level goals of the MSFD, and of Ireland's own integrated Marine Plan (Harnessing Our Ocean Wealth, 2012), very little is spent on marine conservation in one of the EU Member States with the largest coastal and marine resource. There are only two scientific staff employed on the marine environment in the NPWS, a biologist and a marine mammal biologist, although support is available from Regional Offices and the Marine Environment Section of the DHLGH. Basic data collection is grossly under-funded. Most research is undertaken by the Marine Institute, largely on fishing-ecosystem interactions, although its role is only advisory.

Environmental management is improving. Marine Protected Areas (MPAs), including SACs, have been designated, bycatch is better managed. A Marine Spatial Plan is being developed and important seabed mapping work is underway. Although only 2% of the marine area is currently included in MPAs, the Programme for Government is now committed to the expansion of MPAs to 30% of Ireland's marine waters. Threats persist in the form of inappropriate use of fishing gear, unsustainable exploitation of stock, plastic litter, nutrient pollution, acoustic surveying, ocean warming and acidification, and inadequate enforcement. Additional resources would allow the NPWS to input beyond essential monitoring of protected habitats and reviews of project-scale Appropriate Assessments to collect biodiversity data that can support proactive strategic action. Sustainable management of the marine environment also depends on coordinated and rational policies. These would include the political acknowledgement of the critical importance of sustainability to coastal communities, open engagement on aquaculture licensing, satellite monitoring of the location of fishing vessels, prosecution of illegal shellfish harvesting or dredging, and monitoring and sustainable catch limits on important biodiversity or wild food-chain species such as native oysters and sprat. In this respect, consultations for this report identify deficiencies in the engagement by DAFM and sections of the industry with all stakeholders and a failure to provide pro-active management and targeted restrictions on catches for the long term economic and public good.

4.7.3 Current funding on the marine

SACs and SPAs account for 10,420km^2 of which the largest single area is for reefs, but with most other habitats belonging rather to the coastal environment. Out of a total allocation of €239 million from the European Maritime and Fisheries Fund (EMFF), between 2014-20, less than 15% was allocated to Natura 2000 measures and received by the Marine Institute directed mainly at the monitoring of fisheries rather than conservation (see Table 4.12). In total, on average, €8.9 million has been spent per year on biodiversity measures comprising mainly monitoring and assessment. It is proposed that the EMFF allocation to the Marine Biodiversity Scheme 2021-27 will be increased to €8.1 million with a 50:50 EU and National share.

At present, the Marine Institute, receives a small portion of the €10.6 million of funding from the EMFF that supports the CFP, amounting to 4.4% of the total allocation. Other funding is received by Bord Iascaigh Mhara and the Sea Fisheries Protection Authority. These bodies, together with DAFM, play a role in promoting sustainability which is essential for the management of fish stocks if GES is to be achieved. The DECC too has responsibilities for Maritime Area Planning. NPWS, however, receives no funding from the EMFF, although it does benefit in kind from this research while also contributing some funds itself (e.g. INFOMAR). Although a functioning marine ecosystem is needed to maintain commercial fisheries, dedicated expenditure on biodiversity is minimal. Spending on the conservation of biodiversity and management of protected areas fell consistently to negligible amounts up to 2015. Implementation of policy on aquaculture and fishing is the role of DAFM whose policies impact in turn on marine biodiversity.

Table 4.12. Current marine biodiversity spending

Marine Institute activities	EMFF (average annual € 2016-19)	National (average annual € 2016-19)	Total (average annual € 2016-19)
Conservation of commercial fish and shellfish species	156,266	264,956	421,222
Invasive species	24,286	24,286	48,572
Natural Capital Accounting and ES mapping	28,167	28,167	56,334
Assessment of aquaculture	53,270	53,270	106,540
Mapping	77,472	55,075	132,547
Species and habitat impact assess	222,153	222,153	444,306
Fisheries and deep sea reefs	246,364	246,364	492,728
Other data collection (including fisheries)	5,710,658	1,492,675	7,203,333
TOTAL	6,518,636	2,386,946	8,905,582

4.7.4 Future priority spending on the marine

A very small amount is therefore being spent at present on marine biodiversity considering Ireland's maritime territory and its EU responsibilities in this regard. This needs significant expansion if NPWS is to move beyond essential assessment work to protect the majority of marine species that are not currently protected and to proactively input to the management of the marine environment, achieve Favourable Conservation Status for protected habitats and species, and realise the targeted expansion in the area of MPAs by 30% by 2030.

The PAF combines proposed coastal and marine spending under one heading. Most of the PAF estimates relate to coastal waters which we take here to refer to terrestrial sites and lagoons. The PAF does include spending of €41,500 mainly to address the protection of island seabird nesting sites, mainly from predation. The document calls for more seabird counts and monitoring of fisheries licenses. Existing candidate MPAs include a range of SAC inshore areas and five small deep water sites off the Western seaboard covering 2% of the marine territory, An objective to increase these to 30% by 2020 preceded the NRL and recommendations for this process were published in 2020 (MPAAG 2020).

An independent review (RPS 2022) of submissions on the Government's proposals for MPAs was published in 2022 and is expected to be followed by the presentation of legislation and the identification, designation and expansion of MPAs. DHLGH, as the responsible body, is understood to be keen to ensure that sites are properly designated. Conservation measures could relate to a single species through to the protection of entire ecosystems within the vertical water profile. The process, together with the drafting of plans for adequate monitoring and management, is anticipated to cost between €1 and €2 million per year for the medium term. In the long-term, expenditure on monitoring and pro-active management, including protection from illegal fishing, will be needed if Favourable Conservation Status is to be achieved.

Table 4.11. PAF proposed spending: Coastal and Marine

Itemised Activity / Habitat type	Annualised national cost (€)
Island predator eradication (one-off)	21,500
Restoration sea anemone habitat (recurring)	10,000
Island monitoring (recurring)	5,000
Burrowing seabirds (recurring)	5,000
TOTAL	**€41,500**

4.7.5 Restoration financial needs

The NRL proposes that at least 30% of marine habitat types are in good condition by 2030, rising to at least 60% in 2040 and at least 90% in 2050, taking account of listed species' needs. Marine habitat types are listed in Annex II and include seagrass meadows, kelp and seaweed communities, shellfish beds, maerl beds, reefs and sediment beds. Member States would also be required to restore marine species listed in Annex III of the regulation. The NRL references the importance placed on the sustainable management of fish stocks, on migratory fish species and carbon-rich ecosystems, spawning and nursery areas, in line with the EU Biodiversity Strategy 2030. As most current marine biodiversity spending is attached to the Marine Institute, it is unclear who would take responsibility for the marine elements of the NRL.

Continued spending will be necessary for marine island bird species as for coastal species in the previous section. In Northern Ireland, up to £4.5 million is being spent on rat and ferret control to protect marine breeding birds such as puffins. By way of example of the potential restoration expenditure, there are 16 principal locations (mostly islands) at which puffins breed in the ROI and 18 principal locations for little tern. If 50ha of islands were protected each year by predator eradication and just 10ha of tern habitat fenced annually, the cost would be just over €1 million (before maintenance). Island monitoring and biosecurity would need to be multiplied by at least a factor of five to €25,000 per year.

An expansion of MPAs will contribute to the targets of the NRL, but would need to be complemented by improved sustainable management of fisheries in these areas and elsewhere. Globally, recurrent expenditure on MPAs averages $775 per km^2, a figure thought to cover only half of what is needed (Balmford et al, 2004). However, this figure relates to a variety of waters, including tropical reefs. More recently, the Nature Conservancy (2022) has prepared a detailed report on the costs and benefits of MPAs worldwide. It presents a typology of costs which includes establishment costs, management costs and opportunity costs; and benefits for ecosystems (species survival, ecological condition and refugia from climate change), people/communities (protection from natural disasters, carbon storage, food security, and cultural values and livelihood), and industries (tourism, fishing, linked employment and businesses, and reduced infrastructure costs). The report estimates that establishment costs for countries with less than 200,000km^2 to protect vary from $800 to $400,000 per year, although, based on its own experience, Nature Conservancy estimates a figure of $0.5-1 million per year. Management costs are estimated at around $20 million for higher income countries with less than 200,000 km^2 to protect. Opportunity costs were estimated to be negative for most higher income countries, indicating that the benefit of recovery of fish stocks outweighs the losses. For Ireland, which needs to protect 30% of approximately 500,000km2 of continental shelf, these figures can only represent a guide as they are global and include examples of coastal ecosystems protection.

Positive results for biodiversity in Ireland and the EU could be realised by more policing of catches and the prevention of activities such as bottom dredging which can cause lasting damage to delicate ecosystems. Much of the cost of managing Irish MPAs would therefore be accounted for by patrols and enforcement. At present, pelagic fishing is allowed in the respective Natura sites. Demersal fishing is prohibited, but Naval patrols are argued to be more focused on the busier fishing grounds, leaving MPAs vulnerable to illegal fishing. The Naval Service operates six vessels at any one time which spend 90% of their time on fisheries protection. A total of €37 million was provided to Ireland by the EU between 2014 and 2020 to conduct control and enforcement.[13] Predicting the cost of other conservation measures for deep waters off Ireland is impossible given our present state of knowledge of these ecosystems. The report of the MPA Advisory Group acknowledged that long-term economic benefits would be realised mainly by the fishing industry itself. There would be an opportunity cost in terms of lower catches of some pelagic and deepwater species, but there would also be benefits from the protection of fish populations, particularly as MPAs would provide islands of productivity that would replenish stocks outside of the protected area. A precise cost-benefit analysis is prevented by our imprecise knowledge of the contribution of deep water marine ecosystems to the recovery of fish stocks. Assuming that current navy patrols largely omit areas of ecological value, then one third of the enforcement figure could represent the additional emphasis on MPAs. Added to the estimated monitoring and management cost, this would suggest expenditure needs of €15 million per year based on expectations of natural restoration rather than interventions to physically restore ecosystems, together with an additional amount for protection from predators.

4.7.6 Recommendations for marine

Based on these findings, the following recommendations for financing marine habitats are presented:

a) Realising ecosystem services values

Wild fisheries are a classic example of a provisioning ecosystem services on which we depend highly. The provisioning service of fisheries and aquaculture are worth €473 million per year to Ireland's economy (Norton et al. 2022), with the seafood industry as a whole valued at €1.26 billion (BIM 2021). The CFP has adopted an ecosystem approach to management, and some good work is being done by the Marine Institute (using EMFF and some NPWS funding) to better understand and demonstrate the relationship between healthy fisheries and a healthy marine ecosystem at a scientific level. Resources are needed, and every opportunity needs to be taken, to inform and reassure coastal communities and remind politicians of the importance of a functioning and sustainable marine ecosystem.

b) Expanded staffing

Marine species and environment have been overseen by just two people in NPWS. The higher-level scientific officer role has been vacant, but this critical deficiency has been acknowledged (NPWS 2022). This will permit a renewal of a marine overview role. The two scientific officers have respective responsibility for the inshore environment and for marine mammals and for the wider marine environment. much activity is currently undertaken by consultants on behalf of the NPWS while core staff often heavily engaged in routine, but important tasks such as reviewing Appropriate Assessment. Given the importance of the marine environment and good environment status as objectives of the MSFD, combined with the fact that Ireland has one of the largest

[13] No figures could be obtained from the Naval Service or MFPA on the total cost of fisheries protection.

coastal territories in the EU, a significant increase in staffing is needed in the long term. The priorities in this regard would be for somebody to take over from the previous scientific officer's responsibility for reefs, a wildlife-conflict specialist who can address issues such as inshore fishing and seals (and who could be shared with Terrestrial Mammals), somebody to work with the rapidly growing marine energy sector and a staff member who can deal specifically with Appropriate Assessment and EIA. The MPA areas are currently dealt with by the Marine Unit of DHPLG.

c) Significantly increase for the budget for dedicated marine biodiversity research

Significantly more needs to be spent on our knowledge of the marine environment. In particular, our understanding of the seabed is grossly inadequate with only fragmentary knowledge of particular species or ecosystems. Baseline information has been provided by the €4.5 million ObSERVE programme which is surveying habitats and cetacean and mammal species distributions, including a recently announced extension of funding for the ObSERVE2 aerial surveys.[14] This data will also inform the assessment and siting of future offshore renewable energy investment. There is still rather little knowledge of the environment below 30m. Much of this information relates to the interaction with fisheries, including through the inspection of bycatch. While fishing is the principal pressure, there is a need for specific biodiversity surveying and research and an increase in the current NPWS budget of c.€200,000 by several multiples to ensure that the data collection is followed through sufficiently to make a case for improved policy and management. This includes the informed identification of MPAs to designate.

d) Improved collaboration and use of knowledge between Government and EU Departments and Agencies.

Although the EU Biodiversity Strategy requires commitments of Member States to achieve GES, marine biodiversity spending is delivered under the EMFF and is almost entirely within the responsibility of the Marine Institute whose remit is still guided by commercial fisheries. There is insufficient interaction between departments and agencies with environment and industry briefs, with both the NPWS, and the Marine Institute, inadequately empowered to influence activity on the ground in fishing and aquaculture. There is a pressing need for more informed engagement between DAFM and other agencies, and between DG Mare and DG Environment. This extends also to exchange of information between Member States on fisheries effort and management, including outside of territorial waters.

e) Restoration

There may be modest opportunities for restoration in the marine environment away from coastal locations even though some benthic habitats are known to have been severely damaged by bottom fishing and other practice. The overfishing of key prey species is known to be factor in the declines of some species while more research is needed to identify the reasons for severe declines in others such as Leach's Petrel. The best opportunity for restoration would be to allow the natural recovery of habitats and species through the expansion of MPAs, supported by restrictions on the use of unsustainable fishing practices, adherence to scientific advice on catches, enforcement of same, and monitoring of other impacts. This is estimated to require at least €15 million per year based on expectations of natural restoration rather than physical interventions to restore ecosystems.

Summary

Aside from some monitoring and policy work within the NPWS, most biodiversity-related activity is undertaken by the Marine Institute rather than the NPWS and has been subject to the same resource and personnel constraints. Fundamentally, just over a mere 2% of the EMFF budget is received for Natura areas. Most biodiversity relevant activity is in the area of marine fisheries protection and the promotion of sustainable fishing. Expenditure is reactive and protective, mostly with regard to commercial fish and shellfish species, although this includes the habitats and ecosystems of which these species are a part. Although Ireland anticipates designating 30% of its marine area as MPA, only 2.1% currently has protection as designated SACs or SPAs and much more will need to be spent in the future on proactive monitoring and management. However, marine spatial planning, fisheries and development policy and enforcement, supported by data and research, have the greatest influence on the quality of the marine ecosystem. Most often, restoration will be achieved by allowing marine habitats and species to recover once pressures are removed, but this will require fisheries protection and collaboration with other Departments such as DAFM.

Table 4.13 Marine Summary Table

Recent and proposed PAF spend	EMFF allocation & Natura 2000	Additional spend on MPA protection and to meet NRL targets for 2030
€31,500 pa	€8.9 million pa	€15 million
Mainly protection of seabird colonies	Average Marine Institute annual spend on monitoring and research	Completion of MPA designation. Increased island predator control. Mostly fisheries protection costs to permit natural recovery. Figures subject to much uncertainty

[14] https://www.gov.ie/en/press-release/7e376-government-extends-funding-to-protect-vital-marine-ecosystem/

5 Sectoral recommendations

5.1 A Qualitative Analysis of Spending Needs for Biodiversity.

5.5.1 Summary and updates

This section gives an account of emerging points relating to biodiversity finance and associated aspects of NPWS operations in relation to the habitats presented in Section 4. The recommendations here are based on more than 20 interviews across the majority of divisions within the Science and Biodiversity Unit of NPWS between April and August 2020, followed by subsequent continued engagement on matters relating to goals, spending and limitations. As much has changed since these original interviews, including an increase in funding for the NPWS as a whole, this section takes account of the broad changes at described in the NPWS Strategic Plan and contains observations based on the research and ongoing assessment of the broader biodiversity finance landscape.

A prominent emergent theme from the interviews conducted was an inability to effectively deliver on conservation expectations when restricted to business-as-usual resource allocations. However, throughout the majority of interviews with the Science and Biodiversity Units, there were also difficulties with accurately accounting for spending within the remit of individual operatives. This was partly due to overlaps between other experts, sections and sectors, the cyclical nature of reporting obligations and associated surveying costs (e.g. Article 17, etc.), and a perception that scientific staff needed to work within prescribed budgets. This makes it difficult for either NPWS employees or external assessments of expenditure to determine how much has been spent and to what end. Estimates of spending often differed between original allocation and eventual cost, although the latter were often below the original allocations, sometimes reflecting a practical inability to fully deliver on expectations. Funding was rarely an explicit limitation, but rather the ability to effectively administer work packages and plan beyond current programming. This lack of capacity was self-reinforcing as it hinders applications to other funding sources which could generate capacity. This includes LIFE and other EU funding, but also private investment.

In addition, routine habitat monitoring work is a responsibility of regional staff (mainly rangers), but more specific habitat and species monitoring is outsourced to external contractors. This is not necessarily a bad thing, but does inflate the costs of these activities. Survey and assessment is the core of the Scientific and Biodiversity Unit's work, but there is a distinction between this responsibility and measures to protect habitats or associated species. Few staff were confident in estimating these costs of the latter, even though most experts could readily propose specific measures that could be taken if funding allowed.

Since the preparation of the initial draft of the FNA, a Strategic Action Plan has been published. This contained proposals for a new Directorate structure, including a new Conservation and Protection Directorate. It is proposed that the Science Unit and Biodiversity Unit, will all be included in the new Directorate which will also look after Regional Operations, the LIFE Programme, conservation planning and agro-ecology. This should improve consistency and enhance coordination and awareness of monitoring work. A new Conservation Measures Unit is working on the priority of completing management plans for SACs. It should, in time, improve strategic planning and the selection and implementation of effective measures for protected and non-protected habitats. This should include the tagging of expenditure against NBAP and CBD objectives and assessment of cost-effectiveness to provide stronger policy implementation, including of the Habitats Directive. It is proposed that this coincide with improved data management to permit more transparency with respect to costs of measures and how these compare between different habitat classes.

There has been a significant increase in exchequer funding since the initial FNA draft, including for individual units. In response to the 2021 NPWS Review, the limitations of long-term over-reliance on temporary staffing have been recognised. Increased staffing forms part of the NPWS Strategic Plan 2022-2024 with a need for 87 new posts in the short-term having been identified, 35 new posts having been filled and recruitment for an additional 44 posts underway, with more planned. This includes urgent appointments in the Marine Unit and of a Communications Officer. The Strategic Plan proposed that the new recruitment be accompanied by a review of HR practices and career development. This will help to address the apparent erosion of morale which preceded the review, and which would have implications for the efficiency of financing, notably in relation to appropriate remuneration and retention of highly skilled staff without whom costly outsourcing is needed. Although employment legislation and human resourcing is beyond the scope of the FNA, the administration of limited resources is inherently linked to staff capacity and so to biodiversity conservation. Given the heightened costs of compliance associated with our EU and international obligations in this regard, spending on staff can be considered as an investment representing value-for-money.

In addition, a Business and Biodiversity Forum has been established to attract CSR, funding, and to encourage businesses to assess biodiversity impacts within their operations and supply streams. Private Finance has also been identified as an opportunity, particularly for restoration actions around water use and carbon offsetting. Peatland Finance Ireland has been established with supports now available through the European Investment including proposals to develop a carbon peatland code.

5.1.2 Allocations misaligned to remit

Biodiversity funding is administered by several government departments, coalescing both direct exchequer and EU sources, including the EMFF and the EAFRD and the substantial funding streams supported by the latter (ACRES, EIP-AGRI, etc.). This division is largely unbalanced as, despite the emergence of objectives in relation to biodiversity or sustainability in land use and marine policy, funding has not been re-directed to those departments holding responsibility for biodiversity protection. The findings of the NBER revealed that the majority (79.5%) of spending on biodiversity in Ireland between 2010 and 2015 was through DAFM, including agriculture, marine and forestry, with the DHLGH and its operation only accounting for less than 10% of biodiversity spending. However, the core remit of DAFM is growth in the value of agricultural production, forestry and marine sectors. As a means of rendering this remit sustainable, EU and exchequer funding is rather allocated towards ensuring biodiversity is not unduly compromised by these activities. Nevertheless, biodiversity spending is secondary to the primary remit of DAFM, even though it is allocated eight times the biodiversity spending NPWS for whom it does represent the primary remit).

The findings of the current study have shown that in some cases, contributions of funds are even made in the opposite direction to support the biodiversity activities of other Government Departments. For example, a Memorandum of Understanding allows for funds to be transferred from DHLGH to DAFM to support marine biodiversity. There appears to be no reason why funding could not flow in the other direction through similar MoUs. This pattern of divided responsibility of biodiversity allocations extends to a wider selection of government departments, including the DCCAE (Local Agenda 21, EU LIFE, etc.) and DRCD (LEADER) and other sections of the DHLGH (Heritage Officers, Marine Spatial Plan, etc.).

Although mainstreaming of biodiversity concerns across departments and decentralisation of its administration have been promoted by numerous assessments of biodiversity policy (Kettunen *et al.* 2017), this has led to the majority (in excess of 90%) of funding for biodiversity being spent by departments for whom the main focus is mitigation of impacts rather than ensuring conservation status or effecting restoration as is increasingly being required by EU policy. Indeed, an assessment of the disbursement of EU funding relating to biodiversity across a selection of other EU Member States (European Parliament 2020) found that Ireland's system does not markedly differ from that of Finland, Denmark and Scotland, whose large biodiversity-related funding allocations from the EU are received by 2-3 central Managing Authorities, usually centred on agriculture or forestry. France is a prominent exception to this as they de-centralise this funding to a set of 30+ local authorities directly, by-passing central government.

5.1.3 Support voluntary external assistance

It is apparent that the work of the NPWS is reliant on the knowledge and dedication of a much broader sphere of associated organisations, NGOs and private citizens. Much of this assistance contributes greatly to species surveys and maintenance of extensive databases which are a major part of NPWS's role. However, these in-kind contributions are rarely accounted-for and even less-frequently costed in future projections/estimates. Organisations contributing knowledge, data and time include BirdWatch Ireland, the Vincent Wildlife Trust, Bat Conservation Ireland, the Irish Whale and Dolphin Group, the Botanical Society of Britain and Ireland, and the National Biodiversity Data Centre, in addition to a broad network of passionate amateur experts. Although NPWS pays for the administration of some programmes (I-WEBS, CBS, etc.), the majority of data is collected by volunteers. An estimate of the time commitment would be excessively complex, while calculating financial costs would be even more challenging. For example, the Irish Garden Birds Survey of BirdWatch Ireland relies on a network of over 1,000 volunteer data collectors nationally and has been an invaluable barometer of bird populations since its inception in 1989. The British Trust for Ornithology (BTO) ringing and census programme is of an even larger voluntary scale. Without suggesting a full recompense for these services, incentivising their operation and facilitating their administration represents good value for money in collection of data and has the added benefit of promoting behaviour change at a deeper social level. The "Small Grants for Recorders" scheme, first presented as a Seed for Nature at the National Biodiversity Conference of 2018, represents a positive model to base future expansion of support upon, in incentivising voluntary services without fully monetising their contribution.

5.1.4 Landscape conservation

At present, the vast majority of scarce resources committed by the NPWS are dedicated to Natura 2000 compliance, which is not being fully achieved, often due to counteractive activities, limited cooperation from other Departments and chronic underfunding. Conservation of biodiversity in the wider countryside, a key objective of the NBAP remainsa distant aspiration in most cases. Some respondents to the FNA see this focus on Natura Directives and Protected Areas as counterproductive, top-down and inefficient and regard the Annex species and habitats as a "straight-jacket" to conservation. A modified 'site complex' conservation approach has been proposed, adopting a landscape level outlook that is already applied by the Water Framework and Marine Spatial Planning Directives, the Burren Programme and numerous EIP-AGRI schemes. Ecological restoration can be fitted into this landscape approach.

5.1.5 Adopting a broader advocacy role and policy remit

The Policy and Institutional Review of biodiversity finance in Ireland (McGuinness & Bullock, 2020) identified a de-coupling of climate finance from biodiversity concerns at a national level, despite well-established co-benefits between the two. The role of biodiversity in addressing the UN's Sustainable Development Goals is increasingly being recognised through a myriad of ecosystem services. The

role of NPWS (as the responsible body for biodiversity conservation) in contributing to policy discourse at an EU and international level relating to climate change and the SDGs, should be recognised at a national level and adequately supported. Similarly, given the co-benefits and interdependencies of climate, biodiversity and development, the NPWS should be an integral partner to fulfil Ireland's SDG, climate change and EU Green Deal commitments, both in terms of advocacy and policy development and on-the-ground actions already offering nature-based solutions. The NRL, including opportunities related to nature-based solutions (NbS), offers a means to address biodiversity loss as well as climate mitigation and adaptation, and SDGs dealing with climate, health, well-being, water, and sustainable communities. The role of the NPWS as an environmentally focussed public body guided by scientific rigour offers a level of objectivity and expertise ideally suited to the climate-development-biodiversity nexus, which justifies greater recognition and support.

5.2 Non-governmental organisations - The role of eNGOs for Irish biodiversity

Although representing a much smaller portion of spending on biodiversity in Ireland, the contribution of environmental NGOs to conservation – through education, data collection, advocacy and protection – is disproportionate to the funding they receive. The following section outlines the current level of spending by eNGOs and assesses a representative sample in much greater detail.

5.2.1 Existing spending

According to the NBER, only 1.3% of spending on biodiversity between 2010-2015 was through the budgets of environmental NGOs (€20 million; €3.3 million annually), much of which was supported by government funding through various intermediate bodies such as the Irish Environmental Network (IEN), Local Authorities, the Heritage Council and the NPWS. These State sources of funding were found to account for 77% of eNGO incomes. Similarly, a comprehensive assessment of eNGOs by Harvey (2015) found that they represent only 6% of voluntary organisations in Ireland. Furthermore, they represent 0.7% of the total inputted value and 1.1% of the operating expenditure of the voluntary sector. These proportional representations are significantly lower than those of other EU Member States. The NGO sector's vulnerability is demonstrated by the economic downturn of 2008-11, resulted in a 30% drop in funding up to 2015.The current assessment also identified prescient systemic differences in the Irish model of funding eNGOs in comparison to their international counterparts, such as the absence of national lottery funding and heightened levels of international sources. These differences are outlined in greater detail below.

Following prioritisation of the targeted actions of Ireland's NBAP, the expenditure of those eNGOs best positioned to address these priority actions were assessed. Table 5.1, below, shows the aggregate share of spending on biodiversity by the seven largest eNGOs of Ireland in terms of annual turnover. For this study, annual audited accounts for each were publicly available up to 2018, while semi-structured interviews were held with representatives of these organisations, where available.

Table 5.1. Audited biodiversity expenditure of the 7 largest environmental NGOs in Ireland, for 2017 and 2018.

NGO	2017 (€)	2018 (€)
An Taisce (Env. Ed.) **Role:** To preserve and develop Ireland's physical heritage including the environment, through advocacy, education and a number of properties. Biodiversity-related expenditure of Environmental Education Unit is estimated at 50%. **Staff (FTE):** 64 in Environmental Education **NBAP targets addressed:** 3: Increase awareness and appreciation of biodiversity and ecosystems services 4: Conserve and restore biodiversity and ecosystem services in the wider countryside	1,785,593	2,009,260
BirdWatch Ireland **Role:** The conservation, protection and promotion of wild birds and their environments, and the education, research and encouragement of field studies. **Staff (FTE):** 33 **NBAP targets addressed:** 4: Conserve and restore biodiversity and ecosystem services in the wider countryside 3: Increase awareness and appreciation of biodiversity and ecosystems services	1,715,256	1,886,410
Irish Whale and Dolphin Group **Role:** The conservation and better understanding of Irish cetaceans and their habitats through research, education and interpretation. **Staff (FTE):** 3 (supplemented by consultancy operation) **NBAP targets addressed:**	317,569	468,730

5: Conserve and restore biodiversity and ES in the marine environment 2: Strengthen the knowledge base for conservation, management and sustainable use of biodiversity		
Eco-UNESCO **Role:** 'The Irish Environmental Conservation Organisation for Youth - UNESCO Clubs'. To protect the environment and empower young people by promoting their personal development through practical environmental conservation, education and training. Average biodiversity co-efficient of 50% is applied to total grant-supported activities. **Staff (FTE):** 12 **NBAP targets addressed:** 3: Increase awareness and appreciation of biodiversity and ecosystems services 4: Conserve and restore biodiversity and ecosystem services in the wider countryside	338,982	338,852
Vincent Wildlife Trust **Role:** Conserving mammals at risk (focussing on rare bats and smaller mustelids) by developing solutions based on scientific evidence and innovative outreach. Main operation in England and Wales, with small Irish operation limited to the Lesser Horseshoe Bat and Pine Martens. **Staff (FTE):** 2 **NBAP targets addressed:** 4: Conserve and restore biodiversity and ecosystem services in the wider countryside 6: Expand and improve management of protected areas and species	197,056*	301,766*
Bat Conservation Ireland **Role:** Conservation of bats throughout the island of Ireland, through awareness raising, training, erection of bat boxes, biometrics, field surveys and collection of distributional data by working with county bat groups and tidy towns groups. **Staff (FTE):** 2 **NBAP targets addressed:** 4: Conserve and restore biodiversity and ecosystem services in the wider countryside 2: Strengthen the knowledge base for conservation, management and sustainable use of biodiversity	183,396	154,962
Irish Wildlife Trust **Role:** Conservation charity committed to raising awareness of Ireland's rich nature and heritage, and protecting it for future generations, through education, advocacy and outreach. **Staff (FTE):** 3 **NBAP targets addressed:** 3: Increase awareness and appreciation of biodiversity and ecosystems services 4: Conserve and restore biodiversity and ecosystem services in the wider countryside	124,350	130,751
TOTAL	**€ 4,664,219**	**€ 5,292,749**

Notes: Figures for Eco-UNESCO are subject to a 50% coefficient based on their activities in relation to biodiversity. Figures for An Taisce only relate to their Environmental Education Unit costs and are also subject to a coefficient of 50%. All other figures are at 100% coefficient for biodiversity. * Figures for the Vincent Wildlife Trust include significant support from the larger UK branch of this organisation: available funding derived from Ireland amounted to €98,742 in 2018.

As with other sectors, constructing detailed costing frameworks for future activities was not feasible for those eNGOs sampled. Given the extreme budgetary restrictions of their operation and the unpredictable nature of funding sources, these organisations operate a simplified 'incremental' budgetary process; raising funds and canvasing support to sustain the next year's activities, with the hope that these funds will exceed that of the previous year. Further detail on the source of these funds is provided below.

5.2.2 Recurrent themes for NGOs

Through appraisal of the results of the NBER, most recent annual financial statements and interviews with key informants, the following key themes have emerged relating to the role of the most prominent eNGOs and their financial needs.

The remit of eNGOs in Ireland varies widely, from outreach and education, advocacy, citizen science, grant-based science and consultancy work. Finance to support this, however, remains extremely limited, despite the public good provided. eNGOs provide high value-for-money in comparison to government departments and semi-states, as they are supported by a dedicated and knowledgeable workforce which is largely voluntary. As one respondent noted when asked about funding constraints, "*we make it adequate*". The individual funding models of these organisations is widely divergent, from membership subscriptions, philanthropic linkages, direct government support through to statutory mandate, scientific grants, and consultancy contracts. Core funding for the organisations sampled in this study is received from the DECLG via the IEN. Although this had averaged just €15,000 annually, a 66% increase in annual funding was secured in 2020. Additionally, numerous eNGOs supplement this income through CSR donations. This latter category of funding, although substantial in nature, is reliant on distinctive personal connections and fortuitous alignment of industries (e.g. an agri-food brand supporting rural biodiversity surveys). Additionally, organisations capable of providing scientific expertise have the ability to capitalise on funding through public contracts or private consultancy, whereas those solely focussed on outreach and education rarely benefit in this way. Larger NGOs, with the capacity to fulfil scientific deliverables, also benefit from involvement in large EU-LIFE and INTERREG projects. In this regard, funding provides the capacity to catalyse further funding. The benefits of international linkages and connections with parent bodies (e.g. Vincent Wildlife Trust) or international consortia (e.g. BirdLife International) will continue to support a limited number of NGOs, in the absence of more diversified domestic funding sources.

Secondly, a common characteristic of these organisations is the low level of salaried staff, and the disproportionate reliance on volunteers. In most of the organisations sampled, there are less than 10 full-time equivalents (FTEs), while two organisations were supported by just two salaried staff. It is noteworthy that these organisations, which are not 'voluntary' *per se*, provide substantial public good benefits and hold significant levels of expertise, experience and data. Thus, the predominant limitation, as broadly expressed by all respondents, was a lack of staff to realistically consider any future expansion. It was strongly expressed that any future increase in direct funding would require the appointment of new staff in advance, and that this should offer medium-term prospects for appointees because strong teams cannot be built on short-term contracts with poor recompense. There is thus a necessity for this funding to be separate from the ephemeral funding associated with defined-length consultancy or research.

Third, it is apparent that eNGOs provide important connectivity within more dispersed communities and between other bodies working in similar roles. For example, though a small operation focussing on the conservation of a limited number of small mammals, the Vincent Wildlife Trust operates in conjunction with EIP-AGRI projects, the NPWS, the Forest Service, the Native Woodland Trust and the Irish Creamery Milk Suppliers Association (ICMSA), as well as numerous Local Authorities nationwide. Similarly, the outreach work conducted by BirdWatch Ireland, An Taisce and Eco-UNESCO provide invaluable support to rural communities through networks of regional branches and voluntary input often at slight expense or with the support of CSR sponsorship.

Fourth, the necessity to compete for contracts with large-scale commercial interests, even in cases where organisations may have led these programmes for decades, is leading to what some respondents identify as a "race to the bottom", with established consultancies depriving eNGOs of the vital stream of income provided by grant overheads. For example, BirdWatch Ireland is increasingly required to compete for contracts to deliver programmes they originally developed and currently coordinate. It was felt that this perpetuates existing funding limitations and deprives communities of numerous benefits, including social cohesion, engagement, environmental education and positive behaviour change, which are not provided by consultancies. With expansive administrative capacity and corporate structure, consultancies (particularly those of scale) are often able to outcompete eNGOs.

Finally, the priority spending needs of these organisations could not be estimated by those interviewed, even though most could offer suggestions on ecological, social and governance interventions if capacity and political support allowed. For example, the Irish Whale and Dolphin Group want to increase engagement with marine spatial planning and protected areas by appointing a Science Officer; the Irish Wildlife Trust have targeted expanded membership through investment in online customer relations management systems; and the Vincent Wildlife Trust have proposed an extensive set of conservation actions for Lesser Horseshoe Bats and Pine Martens.

5.2.3 Recommendations for NGOs

a) Diversify funding streams

According to Harvey (2015) and Somper (2011), several notable sources of funding are largely absent from the Irish eNGO sector or remain under-exploited, including funding from environmental protection agencies, the National Lottery, industry and philanthropy. Ultimately, this results in a lack of medium- to long-term funding to support these organisations. For example, it was noted that the All-Ireland Pollinator Plan is financially supported in Northern Ireland by a wider set of funders than in the South, resulting in a more action-oriented Plan. Although gains in industry and philanthropy have increased, improved resilience of funding should be targeted through diversification. Some of these novel sources of funding are investigated further in Section 6 of this report.

b) Establish long-term contracts with Statutory bodies

The establishment of long-term (5-10 years) contracts with eNGOs already involved in providing such services should be considered, as a means of providing certainty of income. This serves to retain capacity internally, allow the hiring of longer-term

staff, improves the quality of deliverables by utilising established experts, and supports the broader added-value of resource-efficient eNGO sector. Bat Conservation Ireland and BirdWatch Ireland, which both fulfil various medium-term contracts (<5 years), would benefits from longer-term certainty, which should be considered across a wider suite of eNGOs where feasible.

c) Exhibit greater appreciation and support for voluntary efforts

At present eNGOs make an extremely valuable contribution through citizen science and a wealth of expert knowledge held by dedicated amateurs. The coordination of activities and centralisation of data from these eNGO sources does, however, require financial support. This is not to suggest full recompense for voluntary contributions, but to provide tangible recognition for such activities. The Small Grants for Recorders scheme, presented as a "seed for nature" at the Biodiversity Conference of 2018, and run by NPWS (see section 5.1.6), should be bolstered in this regard, while an awards scheme similar to Eco-UNESCO's Young Environmentalist Award could be offered for the general public.

d) Foster cross-border connectivity

The divergence in capacity between those eNGOs with international connectivity, versus those lacking these connections, is stark. Indeed, some NGOs are heavily supported by much larger parent organisations overseas (e.g. VWT), which are in turn supported by a longer legacy of public support and a larger population base. Promoting membership of international networks provides opportunities for joint funding applications, offers shared legal, administrative and resource capacity where possible, and assists in the implementation of cross-border conservation plans. The success in implementing the All-Ireland Pollinator Plan in Northern Ireland demonstrates the benefits of this connectivity.

e) Diversify the eNGO business model

The diversity of funding sources supporting Irish eNGOs is borne out of necessity, but presents a variety of options to supplement incomes and build resilience against wider economic change. For example, establishing a formalised consulting wing (e.g. IWDG Consulting) may provide steady income if sufficient scientific expertise is held. Similarly, several eNGOs offer curriculum-linked educational programmes (primary, secondary and third levels) at minimal cost to educators. Numerous commercial operations have already built upon this expertise. With careful consideration of the market, existing outreach and education, eNGOs (e.g. Eco-UNESCO, IWT) could render this aspect of their model self-sustaining. Finally, limited paid tourism opportunities have been promoted by some eNGOs who retain landholdings or responsibility over reserves. For example, there is a suggestion that limited eco-tourism could supplement the operation of Rockabill Island without impacting the bird colony.

f) Support dedicated fund-raising officers

An important component of core funding for Irish eNGOs is that shared from the Environment Fund through the IEN which, although limited in nature (less than €18,000 per annum, depending on NGO size), provides predictable income. Given that this fund is, by definition, designed to dwindle through positive behaviour change (i.e. reduced plastic bag usage and lowered landfill), this threatens eNGOs reliant on its predictable support. In the absence of greater support from the numerous alternative sources listed by Harvey (2015), and given that several respondents highlighted a lack of capacity to apply for large grants (LIFE, INTERREG, etc.), dedicated fund-raising support is required. However, given the small catchment available to sustain this at an organisation-level, in comparison to the larger population and environmentalist traditions of the UK (e.g. RSPB), a shared fund-raising officer within the IEN or similar umbrella body may be more feasible. It is recommended that there should be funding to support this as eNGOs as their needs are unlikely to diminish in the near-term. This could be ring-fenced for environmental investment.

g) Centralised coordination and support

The final recommendation is aimed at addressing the debilitating lack of capacity and expertise, which limits current operations and prevents consolidation or expansion. It is proposed that an expanded suite of centralised supports should be offered by the IEN, NPWS or similar umbrella organisation, to assist with funding applications, GIS, legal, financial, education and HR, supported in turn from additional central resourcing. For example, it is recommended that a dedicated LIFE coordinator be appointed to both coordinate consortia for applications, link eNGOs to national and international networks and streamline the administration of numerous programmes simultaneously. Once more, committing this capacity would yield a positive return-on-investment.

5.3 Local Authorities and the Heritage Council

The Heritage Council has an important role to play, particularly at a community level in advancing the protection and understanding of natural heritage, including biodiversity, and in linking this to other aspects of heritage, namely built and cultural heritage, that are important to communities' identity and pride. The Heritage Council supports Heritage Officers who are based in Local Authorities through the County Heritage Plan programme. It also funnels funding to the National Biodiversity Data Centre (NBDC).

Local Authorities have a considerable influence on biodiversity protection through spatial and local development planning, in their granting of planning permissions for new development, and activities in the areas of education, transport and road maintenance, drainage, parks and green infrastructure. Environmental impacts are assessed in relation to larger developments, but Heritage Officers make a specific contribution in helping to review planning applications and impact assessments and ensuring that new development considers biodiversity. The responsibilities of Heritage Officers are inevitably split with other aspects of heritage, with different officers having personal interest or expertise in pursuing one aspect or another of heritage, influenced also by other local county interests including community groups and tourism. The funds available to Heritage Officers are shared with built and cultural heritage, leaving little or any funding for tangible biodiversity works. Evidence of the respective share of expenditure on natural, built and cultural heritage is often not available. Budgets are generally modest with income received from the Heritage Council and the NPWS Biodiversity Grant Scheme which supports Local Biodiversity Action. Local Authorities are obliged to contribute of 15% of funding, although matching funding is often provided. Awareness raising is an important function and has often been further supported through funds from Creative Ireland. Its value can be difficult to demonstrate and may be long-term, as with grassroots engagement or work with schools. Other activities include biodiversity surveys and mapping which are of evident importance to local biodiversity protection, particularly for planning authorities, and which are becoming increasingly accessible through improved virtual and spatial databasing. The Biodiversity Grant Scheme also supports action to control invasive species. The total funding that is available to support Heritage Officers is, however, modest, and generally of a level that is comparable to the officer's own salary. This inevitably limits what can be achieved, although some interviewees rather referred to administration burdens and desk-bound activities as being the greater constraint and expressed also a need for training.

Since the initial draft of the FNA, there has been funding for a substantial increase in the number of local authority Biodiversity Officers who are able to take an active role in pushing the biodiversity agenda, particularly in relation to strategic planning and works including in areas of green infrastructure. As of February 2023 there was approval for the appointment of 25 Biodiversity Officers. Annual funding of €2.8 million was made available to local authorities in May 2024 through the Local Biodiversity Action Fundy.

Potentially, there is an opportunity for Local Authorities, Heritage Officers and Biodiversity Officers to have a much more proactive role in the protection of biodiversity in the wider countryside given the priority focus of NPWS on Protected Areas. Indeed, for SACs within their county, Local Authorities are often partially filling the NPWS funding gap with on-the-ground actions to protect areas from fires and IAS. This is especially so where SACs or NHAs have an important local amenity role and are vulnerable to visitor pressure. Biodiversity Officers have more funds for practical works together with the capacity to focus proactively on biodiversity. Responsibility for parks, green infrastructure and adaptation to climate change resides mostly elsewhere within Local Authorities, but Biodiversity Officers have been successful in increasing biodiversity awareness within councils and encouraging other departments to design and manage schemes in a way that benefits biodiversity. This is an on-going process, particularly in changing the mindset of engineers and workers, but is one that could evolve with more nature-based solutions in the future. However, Ireland's Biodiversity Officers are as challenged as the Heritage Officers in keeping pace with the multitude of development, recreation and other pressures given the limited resources available.

Heritage and Biodiversity Officers have, in some cases, promoted the use of Biodiversity Management Systems within councils, for example to advance the use and management of plants for pollination, and undertake numerous local and awareness-raising projects through Agenda 21. Officers have been successful in obtaining modest amounts of funding from Agenda 21, but the greater opportunity for active works comes from engagement in LIFE, LEADER or Interreg projects. However, Heritage Officers have limited capacity to input to these applications. In particular, there is an opportunity for Heritage Officers to support communities in applying for LEADER funding given its focus on local projects and development, but active local interest in the natural environment is often confined to a small community of citizens and the application process is onerous. It is one factor that contributes to the Rural Environment theme of LEADER being underspent each year.

Consequently, for the Heritage Council, Heritage Officers and Biodiversity Officers, insufficient capacity and funding emerge again as the most significant constraints on implementing the objectives of the NBAP and of leveraging access to external funding sponsorship or private finance.

5.4 Semi-state and related bodies

5.4.1 National Biodiversity Data Centre (NBDC)

The National Biodiversity Data Centre has a mandate for biodiversity data management and outreach on biodiversity. In 2021, this contract amounted to direct payments totalling €1.25 million, a significant increase on the €771,193 transferred in 2018. Additional to this Heritage Council funding, the NBDC also receives smaller grants to fulfil contracts from a variety of sources, including Bord Bia and.

Until recently, the continuity of NBDC funding had persistently been under threat. In 2019, the NBDC was transformed into a limited private company, granting it more independence and flexibility to overcome a dependence on short-term funding. With NPWS monitoring work focused on protected species, the NBDC has the ability to cost-effectively expand its monitoring and surveying, particularly of species found in the wider countryside, building on existing citizen science initiatives with bees, dragonflies and butterflies,. The NBDC has helped bring together data on biodiversity, making it available for use, supporting research and increasing awareness, including it's the promotion of the All-Ireland Pollinator Plan. Its initiative on Biodiversity Indicators has potential to tie-in closely with financial needs assessment. The recent increase in the organisation's budget will allow it to deliver an expanded remit and better coordinate its extensive citizen science network. .

5.4.2 Bord na Móna (BnM)

Bord na Mona is the semi-state company formerly responsible for the exploitation of Ireland's peatland resource for commercial energy, the production of briquettes for household fuel and the harvesting of moss peat for horticultural sales. Until recently, the company was harvesting 4.3mt of peat per year. It manages 81,000 ha of land which represents 24% of raised bog or 7.5% of total peatland cover in Ireland. BnM was not the only commercial operator and private commercial peat operations account for around 20,000 ha with much of this peat supplied to horticulture, including the mushroom industry.[18] There are six large private operators and around 30 smaller ones. Although many of these private operations commenced on already degraded bogs, much of this large-scale industry was only licensed in the nineties when the significance of the loss of Irish peatland was already apparent. The total output of horticultural peat (including BnM) was estimated to be worth €437 million in 2018 (GoI, 2018). However, since 2019, there has been a cessation of harvesting following a High Court ruling on the need for planning permission for peatland operations at sites larger than 30 ha, which would likely necessitate environmental impact assessments. The horticultural sector has expressed strong concerns over the availability of alternative compost.

In 2018, BnM committed to a cessation of peat extraction by 2027 and to the decarbonisation of its business. In fact, peat harvesting had already ceased on the majority of the company's bogs and the company announced in 2024 a formal end to all peat harvesting. Opposition from Midland communities about the loss of employment has been mitigated by the EU's establishment of a commission on 'Just Transition' to progress towards a low carbon economy and a consolidation of the work force has begun.

.BnM has been trialling alternative business models for some years, including wind energy, solar, biomass, landfill, fish farming, herb cultivation and cranberry production. At first sight, these would not all appear to be promising options given the Midland setting of most commercial bogs. However, the land is extensive, has little immediate alternative value and is often located close to power transmission infrastructure. The company have thus identified opportunities for wind farms on 5-10% of its lands with a prospective target of producing enough energy to power 616,000 homes by 2030. Wind and solar energy have reputedly some potential to be combined with ecological restoration and could become a component of community gain.

Of BnM's landholding of 81,000 ha, c.20,000 ha have never been significantly cut. However, some of this area is represented by parcels of larger bog that were cut or that were partially drained in preparation for cutting, so are hydrologically compromised. Those areas that were, until recently, actively harvested, remain largely devoid of any functioning ecology. They do, though, have the potential for rehabilitation as, in contrast to smaller scale domestic turbary, industrial harvesting permits have required that the blocking of drains commences immediately post-exhaustion The company has created added amenity value, through its creation of the 2000 ha Lough Boora Discovery Park, where the central features are trails and lakes which formed in former peat workings. Its Mount Lucas site has been developed for wind energy, but also for recreation and peatland restoration. Both sites attract large numbers of visitors.

In principle, BnM requirement to rehabilitate worked bogs derives from their Integrated Pollution Prevention and Control (IPPC) licensing conditions. Recovery and rehabilitation are represented in the activities listed in its Annual Report with a provision set aside each year to cover the future costs of "decommissioning and reinstating" peatlands. The nature of rehabilitation is not defined, however, but it is clear that this has not been interpreted as restoration of all ecosystem services. BnM does though have a Biodiversity Action Plan which commits the company to five objectives including *best practice* in rehabilitation to stabilise former peat working and to enhance biodiversity. It is now argued that the company's reserves are financially extended by the costs of decommissioning. As of March 2020, a fund of €30.5m had been accumulated for the statutory decommissioning and reinstatement of peatlands post-production under International Accounting Standard 37 applying to the future assessment of liabilities. There is now an acceptance that rehabilitation will need to involve ecological functioning which, in some cases, will involve wetlands, whereas elsewhere 'restoration' to fully functioning raised bog is proposed. BnM notes that State and EU funding is needed to support these activities, adding that the rehabilitation now required goes beyond the expenditure needed for standard mandatory decommissioning and rehabilitation that was a condition of its extraction licence (BnM 2020).

Rehabilitation costs have been estimated at €400/ha for basic drain blocking, but as much as €2,500/ha for more intensive rewetting and topographical works that can optimise hydrological conditions to permit carbon sequestration. Not all of BnM's land would be suitable for a full restoration of ecological functions and many are adjacent to turbary or private company extraction whose presence

[18] Irish Peatland Conservation Council http://www.ipcc.ie/a-to-z-peatlands/peatland-action-plan/over-exploitation-of-peatlands-for-peat/

would undermine full hydrological restoration. Under the Climate Action Fund, €15 million has been received from government through the EDRRS. A sum of €108 million has been dedicated to the EDRRS for a period of at last 4-5 years, with an eventual target area of over 30,000 ha. The LIFE-IP 'Peatlands and People' project which is being led by BnM and is providing €27.8 million between 2020 ansd 2027 for peatland restoration and public outreach in the Midlands. The EU will contribute almost 36% of this funding. A considerable amount of finance has therefore been directed for peatland restoration with the capacity to deliver climate and biodiversity gains.

The legacy of BnM in the Irish landscape is both intensive and extensive. By providing numerous long-term jobs, the company has supported Midlands communities and generated affordable electricity and solid fuel for an entire generation. However, these unsustainable practices have also drastically modified vast swathes of the Irish landscape with long-term consequences for biodiversity and the ecosystem services it provides. With the pressing priorities of reducing national emissions and adhering to (if not exceeding) our Natura 2000 obligations, BnM has been under pressure to financially pivot its business model. Given its founding as a fossil fuel mining company, this transition will be challenging and expensive. Community trusteeship is an option for some cutover bogs and could give agency to local people in biodiversity, climate and development.

5.4.3 Coillte

At present, Coillte remains the largest single landowner in Ireland. It owns and manages almost 47% of Ireland's forest, across an estate of 440,000 ha of which over 20% is managed for biodiversity. This 'biodiversity area' ranges in habitat type, from bogs (28%), heath (23%), conifer forest (15%), native forest (11%) and other broadleaf forest (7%) (Coillte, 2018) and is highly fragmented across 2,300 sites of widely varying size. Much of this area is accounted for by river setbacks, open areas within plantations, unproductive areas (especially uplands that were never afforested) or areas with good potential for restoration or enhancement (Coillte, 2018). Approximately 96,000 ha of Coillte land is formally designated for biodiversity, through either SAC, SPA, NHA or proposed NHA status. Furthermore, Coillte forests currently receive more than 5 million visitors annually, providing an invaluable amenity. Thus, the current and future importance of Coillte for Irish biodiversity and the ecosystem services this provides is highly significant.

Coillte's current business model, as a for-profit semi-State enterprise with a single shareholder (the Minister for Agriculture), rests on three divisions: *Forest*, *Land Solutions and Venturing*, and *Medite Smartply*, with the forest and Smartply Divisions representing the bulk of turnover at around one third and two thirds respectively. In 2023, this yielded EBITDA (earnings before interest, taxes, depreciation and amortization) of €106 million, the majority of which originated from the production and sale of plywood (mainly to the UK). Coillte has also entered into an agreement with ESB to provide 1 gigawatt of onshore wind energy on its estate by 2030.

Of the substantial income of Coillte's commercial enterprise, €1 million is given annually to the operation of Coillte Nature (held under its *Land Solutions and Venturing* division) to provide for native species planting, while on average a further c. €170,000 per annum is spent on ecological monitoring and biodiversity management across the Coillte estate. In addition, Coillte has run the BIOForest programme since 2019, costing €328,968 across two years, which trains staff in continuous cover forestry (CCF), composes Biodiversity Area Management Plans for areas of high biodiversity value, and has designed a mobile portal for the recording of biodiversity by field staff.

According to respondents of this study, the investment in Coillte Nature is intended to catalyse much greater investment in biodiversity and carbon across several key designated sites. The Nature Trust has been established to attract private CSR investment in native forestry. Eventually that there will be an opportunity to establish long-term investment in verified carbon units from native afforestation to national and international voluntary carbon markets. Other potential strategies include the provision of service level agreements for government biodiversity contracts or offering savings to utilities such as Irish Water through reduction of nutrient and sediment loading at upper reaches at catchments.

Given the scale of the Coillte estate, the potential ecosystem services this could provide (carbon sequestration, sediment retention, water regulation, amenity), and the potential for high ecological impact if properly managed, are significant. Coillte gains too from a reputational, commercial and transitional perspectives. Annual expenditure by Coillte on biodiversity has amounted to around €3,000 / ha (€1.3 million/440,000 ha) and, though this is concentrated on key areas, it represents significantly higher investment in biodiversity spending per hectare than many other landowners in Ireland. The continued transition of high-density plantations to CCF practices, and with greater obligations for native species integration, should yield biodiversity benefits on Coillte land if appropriately incentivised by market demand and government grant assistance. Potentially, this investment could be offset against dividends paid to the Exchequer.

5.4.4 Recommendations for semi-states

Although semi-states may recognize that they have a responsibility for managing public goods to the public benefit, they are also under an obligation to be profitable and not require resource subsidization from the State. If it chooses, the State as the sole shareholders can require a business mode which delivers returns in terms of biodiversity and climate adaptation, generating values through ecosystem service provision. In BnM, the business model was completely changed with the new emphasis on realising targets in relation to carbon emissions. BnM is now being financially supported by government to restore peatlands and is in receipt of funding

from EU LIFE for the same. In this case, government did essentially change the financial model to achieve public good benefits, pushed by the need for continued subsidization of peat energy and the political writing-on-the-wall for carbon-intensive fuels.

Similarly, for Coillte, there is a responsibility in managing a public land resource and has acted to improve biodiversity and to support its delivery through Coillte Nature and the Nature Trust. While the majority of resources are currently re-invested in the timber-related part of its business, it also senses an opportunity to attract possible future carbon offsetting investment.

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6 Some key questions for Ireland's Biodiversity Finance

6.1 Where do we need to spend money to halt biodiversity loss in Ireland?

The Article 17 reports on the Status of Protected Habitats and Species provide pointers to where we need to prioritise biodiversity spending. Clearly, we need to do more to protect and restore our peatlands. There is a need to do more to protect our semi-natural farmland habitats if we are to hold onto such breeding species of corncrake, curlew, lapwing, redshank and yellowhammer. We need to achieve, not just an increase in the area of native woodland, but to protect our remnant and ancient woodlands from the effects of invasive understory species, the browsing of deer and from fire. We have to ensure coastal habitats such as dunes, mudflats and saltmarsh are in good condition if they are to withstand recreational pressure and the effect of sea level rise. We also need to protect our marine environment while we still can, as not doing so will simply involve greater expenditure, or lost commercial fisheries production, down to the line.

Some of these actions will require significant expenditure and new investment compared with what has gone before. However, there are also opportunities to generate new revenue, deliver better, realign expenditure and avoid future costs. New sources of finance can be investigated to realise other policy goals. For peatlands, for example, there are opportunities to generate new revenue given the need identified by the Climate Action Plan 2023 to reduce the country's carbon emissions and the parallel interest of private corporations in buying carbon credits, together with possible policy change that permits national offsetting at state level in the future. The same new sources of finance are also available in the case of native woodlands given their capacity to store carbon. Wildfires, which have recently occurred in the Wicklow and Killarney National Parks, need to be vigorously investigated and followed up with penalties of a scale that will be a deterrent that avoids future costs to the state. The improved integration of farming and environmental protection that is expected of a reformed CAP has the capacity to improve the status of farmland habitats and wildlife, but this opportunity should be combined with improved policy design and delivery based on the delivery of results and which adheres more closely to the principles of farmer-led approaches and landscape scale ecology and restoration. More integrated policies that complement activities by EPA, NPWS and LAWPRO would be more cost-effective than previous policies and would save future expenditure on the protection of water quality and the restoration of the status of lake and rivers. Improvements in the condition of coastal habitats will enable them to play a role in adaptation to climate change, maximising their ecosystem services value as nature-based solutions and reducing the cost of future coastal or flood defence. A better understanding, respect and protection of our marine ecosystem will benefit its biodiversity, but also avoid the lost opportunity cost imposed by restrictions on commercial fish catches.

6.2 How should we divide spending between PAs and non-PAs?

At present, the modest budget available to the NPWS means that most expenditure is related to Ireland's commitments in relation to the Habitats Directive and therefore for protected areas. However, many species in protected areas are not dependent on these confined areas, but have territories or migration paths that extend into the wider countryside. The resilience of species populations within confined areas requires that these be refreshed regularly and naturally. Climate change means that some species, and habitats, will need to migrate if they are to survive. This reinforces the need for a landscape approach to conservation in the wider countryside. This requires expenditure on both protected and other habitats outside of protected areas as has now been identified by green infrastructure spending within the PAF, although there are opportunities for improved cost-effectiveness as noted above in the case of agriculture.

6.3 What proportion of spending is dedicated to those species/habitats most at risk?

At present, a high proportion of spending is directed at habitats at most risk, for example peatlands. However, some of the spending, for example compensation to the holders of turbary rights, is substantial, and of uncertain effectiveness. Considerable spending also goes towards the protection of species such as corncrake, hen harrier or freshwater pearl mussel. However, some of this expenditure is compromised by other policy objectives, notably in agriculture and forestry, that are the cause of pressures on species in the first place. There is no evidence that a biodiversity portfolio risk assessment has been undertaken to assess the benefits of spending against the resilience of species and habitats to changes in climate or changes in water quality.

6.4 What steps can be taken to make agriculture spending 'biodiversity net gain'?

To date, AES have been an add-on to agricultural policy to mitigate the effect of increased intensification or specialisation. The greater integration of biodiversity objectives with agricultural objectives that is anticipated of the new CAP could change this situation. There is, however, still little awareness in agricultural policy or among representative organisations that farming benefits tremendously from the ecosystem services provided by natural capital, including soil fungi and fauna, pollination, parasitoids and good water quality. The opposition to the NRL demonstrates the detachment of many farming organisations from a fundamental recognition of the value of the

natural capital with which farmers must work to ensure a sustainable future for themselves and the natural environment. There are also many farmers, including those working marginal lands, but also, as noted in this report, farmers with an intermediate level of intensity, whose livelihoods would improve due to the adoption of more environmentally-friendly farming and from being associated with the marketing of environmentally-sound, high quality food in a country where this is a natural comparative advantage. As managers of the land, many farmers would respond positively to incentives for creating new features such as diverse species meadows, wetland soakaways or riparian buffer strips that can deliver biodiversity net-gain.

6.5 Where can spending, as opposed to policy changes, turn things around?

There are a great many areas where improved mainstreaming of biodiversity and more enlightened policy could reverse declines in biodiversity by delivering better, realigned expenditure and avoiding unnecessary future expenditure. This is already occurring with peatlands and potentially with policies towards agriculture and the marine. Spending is needed for biodiversity protection to go beyond monitoring to ensure restoration of the quality and integrity of sensitive habitats in protected areas. In many cases, these restored habitats will lead to an avoidance of future costs by providing for protection of severe climate events.

6.6 What are the most promising sources of biodiversity finance for Ireland?

There is a need for government to realise that biodiversity is the source of ecosystem services that are crucial to both our economy and quality of life and to ensure that funding is comparable with these benefits. Promising sources of new finance include that linked to climate change such as voluntary carbon offsetting, for which Ireland is leading the way by offering through a prospective peatland standard for carbon offsetting. Finance is also available from the NCFF of the European Investment Bank for both blended and public-private investments.

7 Conclusions

"It is through knowledge of wholes that we gain understanding of components, and not vice versa."

- Meadows et al. (1972) The Limits to Growth

7.1 The FNA process

The exercise of conducting a Financial Needs Assessment of biodiversity in Ireland has uncovered important limitations to its application and yielded key lessons on how best to repeat the process in future. Some key findings are:

- The NBAP should guide the activities and deliverables of individual units and permit engagement with stakeholders to derive realistic time frames and budgets.
- Much greater capacity is required to achieve and monitor KPIs. This needs the support of a team of people with skills that cover accountancy, ecology and agri-ecology, applied across a long time period.
- Applying FNAs in a developed world context is very different to the developing world. There is a myriad of complex intertwined funding sources, responsibilities, and actions, built up over a long time that would require a wholesale reorganisation of how departmental accounting is conducted.
- Current data sources do not allow for easy extraction of either existing spending or future target spending due to high levels of double-counting, opaque co-funding arrangements, and discrepancies between allocated budgets and money actually spent.
- Properly constructing a costing framework for even a single sector is a significant undertaking. Top-line guidance should be provided for each sector/business/department to conduct their own in-house FNA.
- Integration of biodiversity accounting tagging within each department's spending. The CSO is attempting to do this with SEEA, but significant discrepancies exist. Guidance is needed from the Department of Finance and/or Dept. of Public Expenditure and Reform.
- As a living document, the FNA should be reviewed at minimum every two years, as spending commitments and departmental portfolios continually change under the current system, meaning figures are often redundant as soon as they are reported. This recommendation is especially important given the need to develop and monitor national plans under the NRL

7.2 Spending on biodiversity

Although direct comparison with the NBER is not advised, the FNA found similar patterns in the priority spending on biodiversity. As with the NBER, priority spending on biodiversity remains focussed on the activities of the farming sector, predominantly sourcing its funding through DAFM.

- The budget available to the NPWS for biodiversity expenditure is significantly below what is needed to properly provide for conservation in protected areas and to enhance existing habitats.
- A minimum level of spending is required for priority NBAP actions.
- A larger budget would permit more attention to be given outside of protected areas to the wider countryside and marine, including common habitats whose quality has often declined.
- Significant spending is required for to increase the Protected Area network and for habitat restoration as proposed by the EU Biodiversity Strategy, Green Deal and NRL.
- All spending, including that for biodiversity, should adhere to the principles of cost-effectiveness.
- Government, planning and the business sectors need to realise the importance of biodiversity for the ecosystem services on which we all depend, and the retention of which, combined with investment in nature-based solutions, will be essential to allow us to adapt to climate change. Avoiding future unnecessary costs makes economic sense and should stimulate investment in the conservation of biodiversity.
- A realignment of expenditure is necessary to remove policies and harmful subsidies that run counter to the protection of biodiversity and to design policies that, at least, avoid biodiversity impacts, and which rather deliver net gain.
- Realignment of expenditure would grant greater responsibility for biodiversity expenditure to the Department with the expertise to deliver. For example, at present, the majority of spending on biodiversity remains within DAFM, despite the Department not having a remit.

7.3 Options for future finance

Various options exist for new sources of finance, for some of which current circumstances provide the ideal opportunity. These include:

- EU LIFE funding. Under the Green Deal, the EU is very open to providing LIFE funding which currently provides one of the few sources of funding for habitat restoration. LIFE funding can be combined with Strategic Nature Projects (SnAPS) to better mainstream biodiversity policies and integrate these with policy design in other government departments.

- Green lending. The Natural Capital Financing Facility of the EIB provides an opportunity for significant new blended private or public-private finance that can deliver ecosystem services and biodiversity benefits, though, for example, impact bonds, expertise with which already exists with funds and businesses working in the developing world.
- Carbon finance. This is an opportune time for investment and promotion of the prospective Peatland Standard that can provide the verification for voluntary carbon offsetting investment by the private sector.
- Biodiversity offsetting and net-gain. Given the prospect of renewed economic growth, there is an opportunity to ensure ecosystem services delivery and introduce biodiversity net-gain in combination with new residential and office development on both green-field and brown-field sites.
- Investment in green infrastructure is needed to address priority areas such as public health, water quality, flood management and coastal protection. Biodiversity benefits can be integrated into this infrastructure. In many cases, nature-based solutions are possible that combine biodiversity protection with ecosystem services delivery.

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Appendix A: Costing Conservation – A Literature Review

Financial Needs Assessments

A Financial Needs Assessment for biodiversity, or FNA, is undertaken to estimate the total projected costs of reversing biodiversity decline. In the context of national biodiversity governance, FNAs are designed to answer the question of how much it will cost to '*save biodiversity*' at the national level, or more precisely, *"what financing is really needed for the country to achieve its stated biodiversity targets?"* FNAs aim to produce detailed and realistic costing of the resources needed to implement targets in national biodiversity related action plans (i.e. NBSAPs), over a medium-to-long-term planning horizon (see BIOFIN 2018; 2019).

By estimating the total cost implications for implementing each NBSAP activity, National scale FNAs have produced some of the first comprehensive estimates of the financial resources needed to halt biodiversity decline at the national scale, and budgets for NBSAPs. When combined with a Biodiversity Expenditure Review, which tracks existing financial flows for conservation, FNAs can also potentially provide a realistic estimate of the '*finance gap'* for conservation and thereby provide targets for resource mobilisation. FNAs are inherently aspirational documents in that they identify the necessary resources required for effective delivery, even if this may not be immediately achievable in practice.

BIOFIN (2018)

The FNA is meant to help policy makers and senior managers to:

(i) understand the total cost implications for implementing each NBSAP activity and aggregate the total cost for all strategies and actions within the NBSAP;

(ii) be in a position to prioritise the set of costable actions that comprise the strategies and actions within the NBSAP; and

(iii) recognise the need to manage annual fluctuations in biodiversity financing, and therefore anticipate the need for increased mobilisation of funds for biodiversity and conservation.

FNAs are also thought to have a number of secondary uses, including (i) helping to inform the development of financial solutions (ii) improve cost effectiveness/return on investment, and (iii) prioritising actions based on costs. In summary, by completing an FNA, Ireland will have a more complete understanding of how much it will cost to reverse biodiversity decline, a platform from which to understand where resource mobilisation is most needed or could be improved.

Costing approaches

BIOFIN (2018) advocates that FNAs should ideally be bottom-up approaches which involve starting from zero and building up a cost estimate from smaller costable actions and budget line items using a catalogue of unit costs. There are three methodological challenges which impede any estimate of the funding needs:

i) How to concretely define the halt of biodiversity loss?
ii) What are the required actions to achieve this goal?
iii) How to estimate their costs?

To the best of the authors' knowledge only 8-10 FNAs have been formally undertaken by parties to the CBD, often guided by the BIOFIN workbook (2018). The majority of these existing FNAs have focused on using NBSAPs as the starting point for costing conservation. However, if the actions described in the NBSAP are vague or lack quantitative or spatial definition, estimating budget costs will be arbitrary. In some cases, estimating the costs to halt biodiversity loss may also require moving beyond short term NBAPs and strategies, to look more broadly at the cost of the actions which will need to be taken to reverse the current trajectory of biodiversity decline (NPWS 2019a).

A variety of different costing approaches can be taken to calculate the cost of biodiversity conservation in a FNA.

Activity-based costing

Activity-based costing focuses on estimating costs using specific programmes including associated overhead and administrative figures, to estimate future costs. ABC focuses on *activities* as the fundamental cost objects and assigns costs to each step in the process, these costs are then associated with the end product. Activity-based costing requires the '*details of biodiversity activities to be well known and quantified and tracked*' (BIOFIN 2018). However, project or programme "outputs" (immediate results of actions) and the "outcomes" (longer-term results) of activities can be difficult to quantify or track. ABC generally requires a catalogue of costing units to help cost different programs and activities.

Results- or performance-based costing

Also known as 'Outcome Costing', results-based costing is an expansion of activity-based costing (and subject to the same issues), based on the costing of specific medium-to-long-term results and outcomes instead of activities. By focusing on the cost of achieving the 'results', i.e. the effort allocated to the achievement of the specified outcome, instead of 'activities', results-based costing shifts costing towards *outputs* rather than inputs, enabling organizational management to better understand the cost of its 'vision'. Results

based approaches allow planners to track performance and compare the cost-effectiveness of different approaches, ensuring that the "outcome" of the activity is the budgeting focus and not the activity or short-term outputs (BIOFIN 2018). The implementation of results-based costing uses a *logical framework* to work backwards from results or outcomes, outputs, and actions.

To adopt a results-based approach, 'aims' first need to be broken down into achievable and measurable milestones for progress to be judged. Implementing results-based costing has faced difficulties over consistent outcome definitions across multiple government bodies, as outcomes or results have often been too broad to make any measurement possible or meaningful. For example, some results may relate to aspirational or visionary statements that are framed in a manner which is difficult to realistically determine their successful attainment. Clarity is therefore needed to ensure costs can be readily allocated to outputs or results.

Accounting for some of these issues requires visionary outcome statements to be clearly broken down into achievable, measurable objectives, measurable milestones. Stakeholder engagement can be crucial to translating vague or aspirational targets into more practical results, so that there is a clear consensus and agreed definition of outputs and outcomes causal linkages will be possible. The starting point when adopting an RBC approach is to determine the outcomes necessary to halt biodiversity loss. Benchmarking has a key role to play in helping to establish what achieving these outcomes looks like.

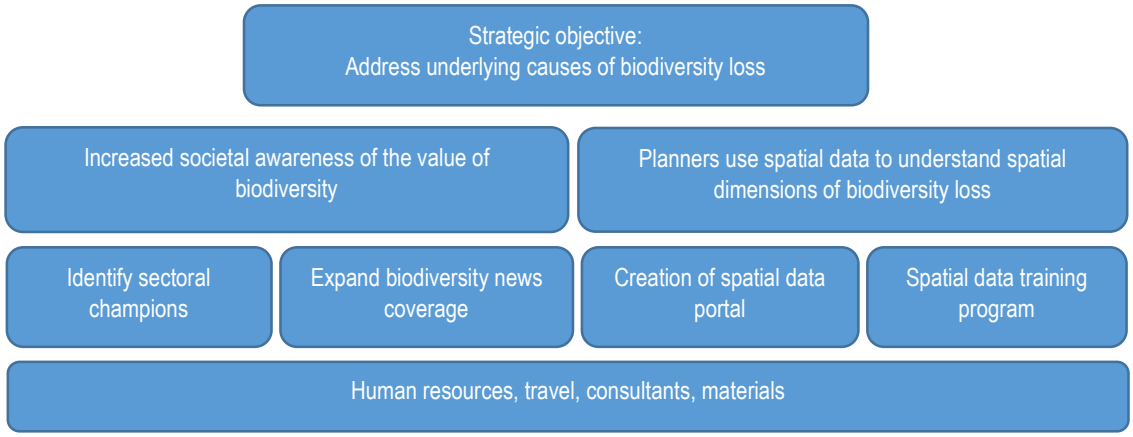

Figure. A1. Logical frameworks for Results Based Costing (BIOFIN 2018)

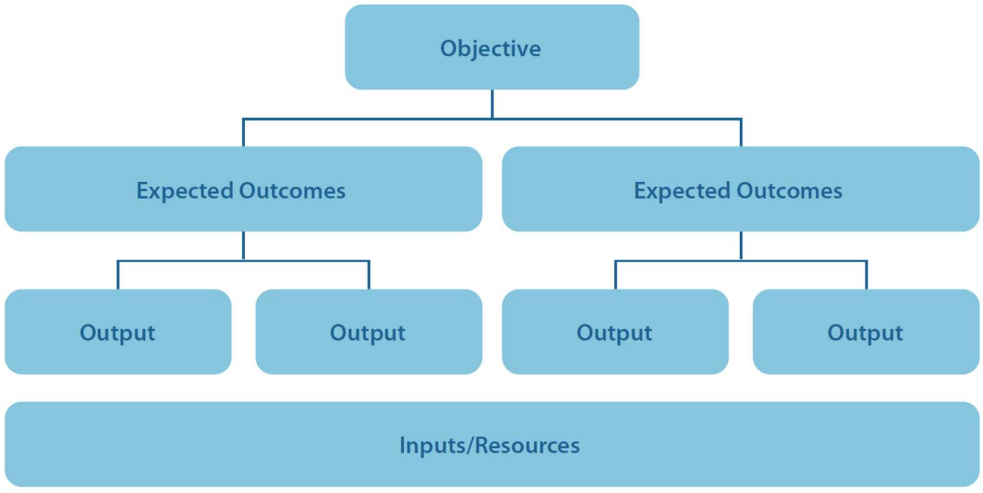

Figure. A2: Logical frameworks for Results Based Costing (Source: BIOFIN, 2018)

Historical projections

Historical projections build on detailed historical data to project future costs. Undertaking an historical projection works by accounting for the full costs of previous activities, alongside future costs such as inflation and other factors which may cause cost variability. This

approach also requires that detailed historical costs are known. For example, the costs for replanting a hectare of native woodlands in the past can be used to estimate the costs of replanting a targeted amount in a specific country or area in future. BIOFIN (2018) highlight that "*when using historical costs, it is important to: 1) make sure they are accurate and cover the entire cost of an activity; 2) base the new costs on specific biodiversity management targets (i.e. number of hectares, days of ranger missions); and 3) account for inflation, diminishing marginal returns, economies of scale and any other issues that would affect future costs*".

Incremental budgeting

Incremental budgeting simply takes the previous year's budget as a starting point and uses a percentage increase or decrease approach to project future costs. Although commonly used, this approach is likely to have very low accuracy levels due to a focus on existing budgets (constrained) rather than actual costs. Ideally, FNAs should indicate realistic needs independent of available budgets.

Cost modelling

Cost modelling uses a quantitative model with various inputs, one-off and recurrent costs (Frazee *et al.* 2003). It can be as simple as multiplying a unit cost by the number of units needed, but "*typically, this approach uses complex, non-linear models with multiple variables to make predictions about costs"* (BIOFIN 2018). Development of a costing model requires a clear understanding of what costs will have to be borne by conservation agencies in order to implement action requirement to achieve explicit conservation targets. Cost modelling is generally suitable when there is no historical precedent or comparative actions to be costed and is therefore not thought to be suitable for the Irish FNA.

Comparison of costing methods

Each of the different methodological approaches to costing in an FNA have different strengths and weaknesses (as shown in Table A1). Arguably, the approaches most likely to produce accurate costings are thought be activity-based costing and results-based costing, which all employ detailed bottom-up budgeting. These approaches however necessitate a strong understanding of what actions are needed to reverse biodiversity decline and access to detailed costing data. In contrast, both incremental budgeting and historical projections rely on extrapolating from historical expenditure information, and therefore are inherently limited by existing budgetary constraints and cannot fully answer the question of what should be being spent.

Table A1: Strengths and weaknesses of different means of estimating costs

Costing Approach	Common Uses	Opportunities	Challenges
Incremental Budgeting Approach	Annual increments allocated to most budgets	Gradual change	Limited vision. Lack of connection with results
Historical Projections	Empirical data used for budgeting	Accurate, based on real experience	Not comprehensive, based on limited budgets
Cost Modelling	Extrapolation from small cases, for new activities	Alterative scenarios, understanding cost effectiveness	Lack of empirical data; specific context
Activity-Based Costing	Project budgeting, programme budgets	Detailed bottom-up budgeting	Not necessarily focused on outcomes
Results-Based Costing	Planning by objectives, log frame, programme-based budgeting	Best practice, detailed, focused on outcomes	Advanced approach, but not used in most countries

Existing studies

Alongside proposed methodologies for national FNAs, there is an existing body of literature around costing conservation at a variety of different scales from individual programmes or protected areas to global estimates which can provide further insight into costing approaches and methodologies. This section reviews some of the existing academic attempts to cost conservation at a variety of scales and highlights the methodologies they have applied.

Global or multinational

Attempts to estimate the cost of halting biodiversity decline at global and multinational scale (see table A2) have adopted a range of methodologies with a number of common elements. Global studies have often accessed costing data and generated average unit cost data on conservation through large scale questionnaires and surveys with experts in the field of conservation. The development of cost estimates has also been undertaken through participatory workshops with multiple stakeholders (Bruner *et al.* 2003). Large scale reviews of sample-sites, e.g. protected areas, have also delivered cost information, either directly from conservation programmes or protected areas or via other academic and non-academic published studies and project reports. Other studies have simply stated

that they have 'consulted experts'. Once costing data has been gathered, this has often then been extrapolated through the development of cost models, e.g. Balmford *et al.* (2002) Vreugdenhil *et al.* (2004) and McCarthy (2012). Researchers have also tried to incorporate whether spending is sufficient to meet conservation goals and have made efforts to estimate additional finance needed. Different approaches have been taken for species-based vs protected area-based conservation costing:

International case studies

James *et al.* (1999; 2001)

- Estimate was based on assessments by more than 600 protected-area agencies of their own needs and on extrapolation of regional averages to nonreporting countries.

Balmford *et al.* (2002)

- Obtained data on the recurrent management costs per unit area of effective terrestrial field-based conservation programs (expressed in year-2000 U.S. dollars) from United Nations Environment Programme–World Conservation Monitoring Centre (UNEP-WCMC) surveys of protected area agencies (ref. 6; 57 sites), from correspondence with local experts (21 sites), from the published and unpublished literature (20 sites), and from the World Wide Web (41 sites).
- Compared variation in costs with a suite of measures of development, built a simple model capable of predicting costs elsewhere, and explored global variation in likely conservation benefits.
- Correspondents were explicitly asked whether current spending was sufficient to meet conservation goals and if not, how much extra would be required.
- All data from the literature and web sites referred to total costs for effective conservation and, for all but 13 of these cases, this was broken down into current spending and unmet costs.
- Cost dataset spanned 37 nations -consisted mostly of reserves but also covered conservation programs in the wider landscape, and included 64 projects from less developed countries.
- Unable to obtain figures for our sample of sites for other costs of conservation besides on-site management, such as opportunity costs, land purchase, transactions costs, or the costs of tackling larger-scale threats such as landscape-wide overexploitation or changes to fire or hydrological regimes

Bruner *et al.* (2004)

- Draw on published cost studies, working sessions on protected-area costs from the Fifth World Parks Congress (WPC) in 2003, and post-WPC analyses to quantify the funding shortfall for terrestrial protected areas across developing countries and to assess necessary actions to close the gap.
- Describing the major components of protected-area system costs and how these vary.
- Costs of a protected-area system can be usefully divided into three categories: (1) recurrent management costs for existing areas, (2) systemwide expenses needed to support a network of protected areas, and (3) costs of bringing new areas into the system.
- Studies we include use a range of methodologies to estimate financial needs, including (a) providing questionnaires to allow protected-area managers to identify their own needs, (b) consulting independent experts, and (c) building on participatory processes such as management plans, and defining general rules for deciding when given expenditures are appropriate.
- Combined the two data sets, removing 33 nonprotected areas from Balmford and colleagues' (2003) data, as well as duplicates of three protected areas common to both data sets. Following Balmford and colleagues (2003), we used forward and backward stepwise regression, with the alpha-to-enter and alpha-to-exit value set at 0.05, to test the explanatory power of (a) protected-area size; (b) gross domestic product (which differs from GNP in that it includes only the goods and services produced within the borders of a nation or territory), standardized by country area; (c) PPP; and (d) human development index (HDI) rank (a measure of wealth that includes data on life expectancy, literacy, school enrolment, and per capita GNP; UNDP 2004). All variables except HDI were natural logarithm–transformed (ln[x + 1] for each variable x) to approximate normality.

Vreugdenhil *et al.* (2003)

- Developed a model of protected-area management that estimates the cost of 50 management components according to national prices and protected-area size.
- Model works by predicting staffing needs from protected-area size, with additional parameters (e.g., number of vehicles or technical staff per park guard) set as fixed ratios.
- Does not consider non-core management activities such as development projects.
- Application of this model to all protected areas in developing countries suggests total costs of $1.1 billion per year to cover basic management and administration.

Feger and Pirard

- Not less decisive question of how much needs to be spent to halt global biodiversity loss also has to be tackled. All figures provided so far have been indicative: they have not been reviewed by governments and no official funding needs estimate has so far been produced by the CBD Secretariat.

- Clearly, three methodological challenges impede any estimate of the funding needs: i) how to concretely define the halt of biodiversity loss?; ii) what are the required actions to achieve this goal?; iii) how to estimate their costs? This article is based on a literature review of 36 studies from academic or non-academic sources. It aims at giving an overview of the various approaches, and at ultimately questioning the feasibility of estimating the required financial resources to halt biodiversity loss by 2020.
- Estimating PA funding needs thus appears as the first step in building a comprehensive funding needs assessment methodology.
- Most studies have therefore assessed funding needs by adding up the supplementary management costs necessary to make the existing PA network fully functional and effective.

McCarthy *et al.* (2012)

- Costs estimated for *Species* and *Protected Areas*.
- Species
  - Expert-based costing – survey of experts then took the middle of the range.
  - Extrapolated these estimates to all globally threatened bird species, incorporating various factors affecting cost variabilities. For example, the distribution or range size of the species might affect it: a species which breeds only in a small locality may be cheaper to save that one which is spread out over a large area (McCarthy 2013).
  - Developed a cost model a factor to account for the degree of dependence of each species on a specific habitat (McCarthy 2013).
  - Acknowledged the limitations of species-specific approaches, as in reality most conservation actions benefit more than one species.
  - Incorporated cost-sharing by assessing the overlap between species ranges to provide a lower bound cost estimate
- Protected Areas
  - For protected area, sample taken of 352 of those sites that are currently covered by protected areas and constructed a similar cost model to the one used for estimating species costs
  - Estimated management costs per ha based on sample.
  - Management costs for protected areas in rich-world countries are significantly higher than those in lower-income countries, probably due to higher wage and other costs in the former
  - Used crop productivity, livestock density, and prices to produce a global map of the gross economic rents from agricultural lands.
  - Applying this model to all IBAs spread around the world, and combining this with purchase costs

National

Alongside the academic studies, a number of national FNAs have now been completed and are published on the BIOFIN (2019) Knowledge Platform (https://www.biodiversityfinance.net/), (see Appendix B). On the whole, FNAs completed thus far have generally tried to use NBSAPs as their core costing framework. The majority have approached costing via activity-based costing or results-based costing. A few studies have applied incremental budgeting, but often found this approach remained limited in the resulting resolution. Notably, many international FNAs report that their NBSAPs are of too poor a resolution to operate well as a costing framework.

To compensate for the poor resolution of NBSAPs, many FNAs have instead used workshops or consultative meetings as a means of enabling experts to provide costing data. Many national FNAs have deliberately designed studies as a descriptive and participatory *ex-ante* budgeting exercise and focused on participatory costing and evaluation throughout. Participatory approaches have used workshops and consultation to provide initial estimates while further workshops can be used to validate and refine final recommendations. Other data sources used in national studies have included: (i) official documents and reports, (ii) data estimates from discussions with ministry and NPWS staff members, from office visits and sharing of soft copies of work plans, current and previous ministry and NPWS budgets, and draft and current strategic plans, and (iii) unit costs that the departments themselves use when they prepare their departmental budget for approval by cabinet each year.

The time periods used for analyses have ranged quite considerably, from single short periods of around 4 years to more medium- (10 year) and long-term analysis (20 years - or to 2030). However, long-term studies have proved hard to cost due to the complexity of determining the value of recurrent expenses over long time periods. Some studies have also provided a range of cost estimates; e.g. low, mid and high, or costs under a range of scenarios; e.g. (i) business-as-usual i.e. no changes to the rate of increase in annual budget allocation (ii) scenario B cost estimate is the additional investment that would make it possible for certain key agencies to execute the measures and activities included in their 20-year strategic plans. (iii) most likely estimates.

Some of the issues reported in these national FNAs included (i) only having access to a relatively small group of individuals during the data collection stages (ii) unit cost figures could be underestimations (iii) official figures do not necessary reflect the current costs for procurements of those services but rather what the line agencies can request for specific budget items, and (iv) the financial gap was

not quantified as the estimated biodiversity expenditure baseline review are not comparable because the NBSAP does not capture all on-going biodiversity conservation activities.

National case studies
Frazee *et al.* 2003
Found that determining a realistic conservation price tag requires a systematic analysis of at least five components: - estimates of the area of land and water required to represent and maintain biodiversity in a region; - identification of a system of protected areas that will achieve these biodiversity-based targets; - the costs of acquiring and establishing the protected area system; - the annual expenditure required to effectively manage the system; and - information on the costs of off-reserve conservation in the unprotected landscape. Additional economic considerations include the costs of foregone production on protected areas or the costs of building local and institutional capacity for conservation policy-making and implementation (Faith and Walker, 1996; James et al, 1999b, 2001). Developing an understanding of each of these components, with the possible exception of acquisition and establishment costs, can require years of research and determine the costs of protecting sites that are currently less than fully protected.
Howard and Young, 1995; Young and Howard, 1996
A comprehensive study in New South Wales estimated that the cost of establishing and maintaining a representative system of protected areas for habitats in the state would cost US$75m annually, or the equivalent of US$10 per resident per year (Howard and Young, 1995; Young and Howard, 1996). (Frazee *et al.* 2003
Culverwell, 1997
• Culverwell (1997) estimated the annual management costs for an expanded system of protected areas in Cameroon to be US$2.2 million. (Frazee *et al.* 2003).

Individual interventions

Programme-level cost data are the shared costs of running an entire program (e.g., costs of removing an invasive species as a part of an island-restoration program). Estimating the costs of an intervention is acknowledged to be difficult (Barnett 2009; Iacona *et al.* 2018). Existing studies have often used engagement with existing staff of conservation programmes to obtain cost estimates or consultation with experts. Proxy values such as 'costs forgone' have also been applied to estimate the acquisition costs of land.

Individual interventions
Feger and Pirard (2011)
• Most studies have assessed funding needs by adding up the supplementary management costs necessary to make the existing PA network fully functional and effective.
Frazee *et al.* (2003)
• Obtained survey data on the ideal staffing and operating costs for effective management of a protected area unit. - Data obtained from PA managers who were asked to estimate an ideal number of staff for each profession category required for each protected area unit (Frazee *et al.* 2003). - Asked regional manager to allocate overhead costs (counted as for scientific research and for head and regional offices) across all PA under their jurisdiction. - Asked PA managers to allocate the % time each staff member would spend in each PA unit (e.g Ha) under an ideal management scenario. - Checked by comparing with detailed estimates of salaries of profession categories required for each PA unit • Acquisition cost - Land acquisition cost per ha estimated from consultation with experts. - Developed average price per ha for each habitat class from at least 4 values. - Land located close to the coast (within 5km) given a premium price per ha (5x greater than avr). - Land under some form of cultivation assumed to have a price 2x that for undeveloped land. • Management costs - Staffing vs. operating cost to derive total exp required for management of each PA unit. Adopted a 65% proportion of total costs allocated to staff for each PA unit, plus an additional 40% operating cost.
Green *et al.* (2017)
• Opportunity cost of the reserves from the most likely profitable alternative, or the net present value of future profits from the land (i.e.: assume the most likely alternative use is agriculture). • Forgone agricultural opportunities/ profitable alternative to land conservation • Direct cost of reserve management

Cost categories

"The financial costs of an intervention represent what has been spent by an organization to achieve a conservation outcome. Many different 'types' of costs are incurred through conservation activities, programmes and projects (Naidoo *et al.* 2006, 2008; Lantke and Schneider 2009; Adams el al. 2010; Armsworth *et al.* 2010; Schneider *et al.* 201 l; Shwiff *et al.* 2012), these can be divided into a number of categories used to describe project components. This can include one-off capital costs, such linked to protected areas and habitats restoration, and long-term recurrent costs, such as annual management costs.

Acquisition costs

In the conservation sphere, capital costs can include the purchase of materials or consumables for actions, acquisition costs linked to protected areas or nature reserves. Acquisition costs refer to the costs of acquiring new sites (e.g. land purchase or leasing). Acquisition costs also come with legal and administration transaction costs and reflect the market value of alternative land uses (Armsworth *et al.* 2010). Acquisition costs can also be estimated from the opportunity costs of land in terms of forgone use (Adams *et al.* 2010; Albers *et al.* 2017).

Establishment costs

Establishment costs refer to the costs of establishing new protected areas, including designation costs or boundary demarcation, habitat survey and stakeholder consultation (Bruner *et al.* 2004).

Management costs

Management costs refer to the annual running or operation costs of established conservation projects or programmes, e.g. the site managements costs or annual payments to farmers for AES on grassland, enforcement etc. Estimates can vary depending on management options and aspirations (Armsworth *et al.* 2011). Recurring management costs cross-over with labour costs i.e. the allocation time from salaried staff, training costs, and recurrent equipment and material costs such as fuel and materials for community engagement (Bruner *et al.* 2004). Generally, there is a lack of correlation between management and acquisition costs (Armsworth *et al.* 2010).

Equipment and material costs

Equipment costs can also be vital to access the tools necessary to delivery habitat creation or restoration, species monitoring or surveying. Material or consumable costs are items used up during the project, for example herbicide, vehicles or fuel. Meeting costs can also be considered consumable costs (Iacona *et al.* 2018). These costs represent the financial costs of project implementation and are crucial to project completion and management (Shwiff *et al.* 2012).

Labour costs

Human resources or labour costs refer to the staff costs associated with a project. These can be some of the highest costs of conservation projects. Labour costs are generally recurrent costs.

Overhead or systemwide costs

Overhead costs refer to the cost of administrative and logistic necessities that ensure a project can be implemented, this can include - electricity for offices, insurance for vehicles, administration and legal costs. This category may include staff costs linked to legal and administrative staff. At the national scale, overhead costs can be referred to as system-wide costs of national or regional administration, new site section, securing financial allocation. in Ireland this may be considered the cost of running the NPWS and the staff costs.

Miscellaneous costs

Additional costs for consideration in cost-benefit analysis include external costs and opportunity costs. External costs arise where conservation projects induce losses elsewhere such as livestock predation, crop losses, exclusion from resources or job loss (Butler 2000; Nyhus *et al.* 2000; Ferraro 2002; Naughton-Treves and Treves 2005; Brockington and Igoe 2006 ; Brockington el al. 2006; Cemea and Schmidt-Soltau 2006). Opportunity costs account for factors such as reduced agricultural production, lost recreational opportunities and other forgone uses of the conserved land (Naidoo and Adamowicz 2006; Naidoo and Ricketts 2006; lantke and Schneider 2009; Adams el al. 2010; Naidoo el al. 2008; Armsworth el al. 2011). These costs often are more burdensome at the local level, affecting communities surrounding the conservation site the greatest (Adams and Infield 2003). However, data on opportunity and damage costs is often rare as these costs are reported much less often (Shwiff *et al.* 2012).

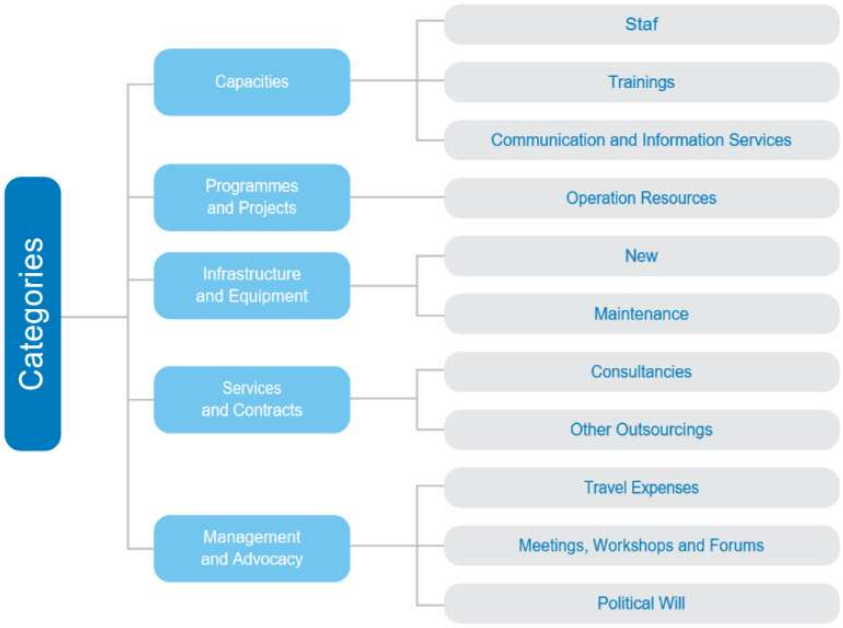

Figure A3 Cost Categories (BIOFIN 2018)

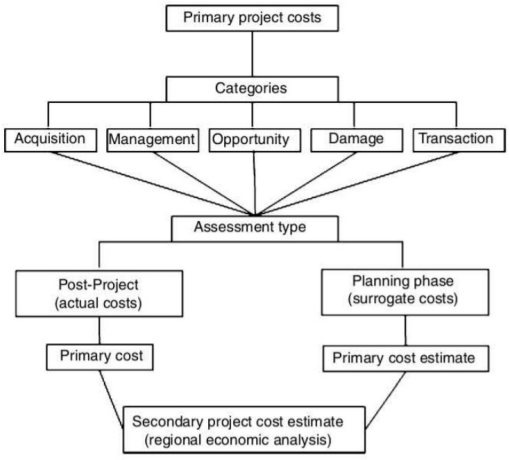

Figure A4. Framework for assigning cost values to conservation projects (Shwiff *et al.* 2012)

Costing data

FNAs need to be based on "*justifiable costs and actions directed specifically at achieving identified results*" (BIOFIN 2018). A key barrier to undertaking large scale costing studies for conservation is that the average costs of conservation are not generally known i.e. "*estimates of the costs of conservation are rare and in-consistent, despite their importance in decision making (Naidoo et al. 2006; Wilson et al. 2006)"* (Iacona *et al.* 2018). Although costing data, is published a lack of standardised reporting format means that it is rarely in a form which can easily be used to undertake costing and to understand average unit costs.

To be useful, cost data needs to be clear about the units, scale, and context of the costed intervention (Armsworth 2014), the intervention outcomes and cost conversion factors (Bayraktarov *et al.* 2016; Iacona *et al.* 2018). A catalogue of unit costs can be collated. Several different sources of cost data can be examined to this end (BIOFIN 2018), including historical government data, published project documents, expert input, academic research and case studies.

Standard Government costs

Some states have standard government cost scales, these are unit costs of standard items such as government salary scales, office resources, vehicle millage, services, vehicle hire, equipment, materials, capital purchases, consultant days etc. Standard government

costs should, ideally, be checked with actual data (if available) to determine, for example, if the price of one salaried person is consistently costed in relation to pay scales.

Historical data

One of the major sources of data for conservation costing is historical cost data from previous government budgets, project or NGO spending (e.g. protected areas management or afforestation grants per ha). For example, the Irish NBER contains records of spending for different programmes, but does not break down into unit costs or costs per ha or different costs components.

Academic and research data

Existing economics and biodiversity literature provides some useful cost estimates for particular actions such as reforestation costs, coral reef restoration, and seagrass restoration (BIOFIN 2018).

Expert estimates

An alternative approach to using proxy value is to ask experts to provide cost estimates. For example, Frazee *et al.* (2003) asked site managers to estimate the ideal amount of resources needed to manage protected areas effectively. While, Balmford *et al.* (2002) obtained data on recurrent management costs per unit area of effective terrestrial field based conservation programmes through correspondence/ surveys with local experts. Local experts can also be asked "*whether current spending was sufficient to meet conservation goals and, if not, how much extra would be required*" (Balmford *et al.* 2002; Frazee *et al.* 2002).

Unit costs

Annual unit cost may be available for specific items. In some cases, these can be based on official government budgetary unit costs e.g. standard units costs for administration (audit fees, maintenance and repairs), equipment (e.g. vehicles or computers), human resources (e.g. salary bands and consultant or service fees), and travel costs. There are of course likely to be accuracy issues with the use of average costs (e.g. Culverwell, 1997; James *et al.* 1999a, 2001; Myers *et al.* 2000). Frazee *et al.* (2003) also find that assuming a fixed management cost per unit area may overestimate total required expenditure.

Proxy data

In the absence of reliable and detail cost figures, many authors have relied on proxy values to estimate conservation costs (Armsworth et al. 2011) Proxy, or surrogate, costs are used to approximate actual costs (Adams *et al.* 20l0; Shwiff et al, 2012). Proxy data is essentially a crude approach to providing broad estimates of financial outlay, but is often necessary for regional, national and global scale spending programmes (Frazee *et al.* 2003). Early conservation planning studies simply used area as a measure of cost and sought strategies that would protect as much biodiversity as possible in the smallest area (Kirkpatrick, 1983; Margules *et al.* 1988).

A range of different examples of proxy day for conservation costs can be found in the academic literature. Proxy values for acquisition and management of protected areas are often taken from the average value of agricultural land in the surround area or country (Ando *et al.* 1998; Strange *et al.* 2007), or the gross market value of a subset of agricultural commodities produced nearby (Naidoo and Iwamura, 2007; Cawardine *et al.* 2008; Armsworth *et al.* 2011).

However, the actual costs incurred by conservation groups show much greater variability than has been suggested by available proxies (Davies *et al.* 2010). Studies such as Armsworth *et al.* (2011) point out that "*such measures could still be useful for informing larger scale conservation planning exercises that examine what regions should be priorities for conservation investment, rather than what sites within regions should be prioritised*".

Standardised reporting and capturing cost data

Capturing and reporting of costs data needs to be done in as standardised a way as possible

- State date for which costs were incurred to ensure constant purchasing power (Iacona *et al.* 2018).
- Capture generic units (e.g., person hours or days) rather than monetary estimates due to context dependence (e.g., geographic and temporal variation) of costs (Baltussen*et al.* 2003)
- State the objective and outcome of the costed intervention.
    - This identifies what the incurred cost aimed to achieve. For instance, the objective may indicate the intensity of an intervention (e.g., eradicate invasive weed vs. maintain invasive cover at 5%) or describe the scope of the intervention (general protected-area management). (Iacona *et al.* 2018).
- Define the context and method of the intervention (ACTION COSTED)
    - Describing these permits interpretation of the costs relative to what was done, at what intensity and under what conditions (Iacona *et al.* 2018).
- State when, where, and at what scale interventions were implemented.

    - This determines the magnitude of recorded costs. It is also important to record because economies of scale which cause costs to accumulate at a decreasing rate. The length of time an intervention is applied can also influence the cost per unit time or area if learning or other efficiencies occur (e.g., Adams & Setterfield 2013). (Iacona *et al.* 2018).
- Break down by cost categories
    - Including labour, capital assets and equipment, and overheads.
- Labour costs should be detailed because staff time is a large cost in most projects. It can include paid, contracted and casual employment directly involved in project implementation, managers, and support staff. It may include staff training. Volunteers commonly contribute to project success, and their time has significant value (Armsworth *et al.* 2013; Santangeli et al.2016; Iacona *et al.* 2018).

Cost variability

Some costs are fixed and remain unchanged despite changes in a project, while others can vary. Fixed costs include for example, buildings or office expenses. Whilst variable costs are often stated as fuel, equipment rentals. Understanding whether a cost is fixed or variable can improve the accuracy of estimation (Armsworth *et al.* 2011, 2014; Iacona *et al.* 2018). The identification and acknowledgement of fixed or variable costs is, therefore, crucial to the validity of costing studies. The main approach to identifying potential costs variability is to understand the activities or drivers which could cause costs to change.

A number of factors are generally thought to driver costs variability in conservation sphere these include:

Site size

A large body of research in the conservation field highlights that the costs of site-based conservation varies depending on the size of the site (Jantke and Schneider 2009; Naidoo *et al.* 2008; Armsworth el al. 2011; Schneiderelal 2011; Shwiff et al, 2012). Variability in costs with scale are thought to derive from management costs which have frequently been found to strongly positively correlate with site area. Armsworth *et al.* (2011) find that management costs increasing approximately as the square root of site area.

Site location

The chosen location for the conservation action can also have cost implications. A site's geographical, ecological and socio-economic characteristics are thought to shape around 50% of the variation in management costs. For example, choosing a site which is currently in use as highly productive cropland and has a high opportunity cost, will have higher cost implications than poor quality or poor productivity agricultural land (Naidoo and Ricketts 2006; Rondinini *et al.* 2006 ; Rondinini and Boitani 2007; Mackenzie 2012, Shwiff eta l, 2012).

Staff time

The amount of staff time devoted to or required to complete a conservation activity is also though to strongly correlated with higher costs (Armsworth *et al.* 2011)

Biodiversity complexity or richness

The complexity of the biodiversity to be conserved, i.e. the habitat class, has also been found to influence management costs. Armsworth *et al.* (2011) find that in the UK context sites that contain a greater number of priority habitats for conservation, as classified under the UK's Biodiversity Action Plan, cost more to manage. Costs associated with different species or habitats were also found to be influenced by the amount of monitoring they require, with long-lived or less vulnerable species and habitats requiring less frequent monitoring. Therefore, habitat class or species can also be an important determinant of management costs although the variance explained was relatively low, probably because of collinearities between habitat and protected area size and surrounding land use: many of the smaller reserves occur in mesic lowland areas supporting habitats that are expensive to manage.

Barriers

Costs of field conservation have been found to vary widely (Balmford *et al.* 2002). This is a critical issue for studies at the national, regional and global scale which often have to rely on unit costs or proxy data. One of the main barriers to costing studies remains the lack of costing data, as highlighted in section X, or data which has not sufficiently been broken down into categories or been supplied without context information. As highlighted by Iacona *et al.* (2018) "*In a review of 30 peer-reviewed articles with costings for a conservation intervention, we confirmed that critical information was often omitted, ultimately hindering comparison across studies*". Institutional constraints can be a key cause of poor resolution. Furthermore, the true costs of conservation actions are invariably underestimated due to factors such as institutional overheads, temporal economic discounting, and free or subsidised labour (Iacona *et al.* 2018).

Appendix B: Review of FNA Case Studies

Country	Methodological approach	Keywords
Georgia (2018)	- Unclear what budgeting model was used. Potentially a combination of incremental and historical. - Based on the NBAP - Found that the NBAP too poor resolution – had to be improved via workshops with the authors - Workshop organised to enable experts produce costings - Results of these workshops were aggregated into a unified table, detailing the calculations for the cost of each action. - Cross-check with BER was conducted. For each action, experts were asked to identify the existing/planned projects relating to the completion of the action in question. - A final unified consultation workshop was held with all participants to provide comments and suggest changes if necessary - NBAP actions ranked (prioritised) - Established finance needed for 2018-2022, compared to BER of 2013-2017. - Created a costing catalogue or 'NBSAP pricing assumptions table' (e.g. *Conservation Plan Implementation: Class 1*). Application of this unclear. - Valuations submitted by Departments highly speculative (e.g. requests 50% salary increase for all staff and purchase of 30 off-road cars) - Largely focussed on EIA costs around hydroelectric plants and mining. Assessment: Highly generalised costing, with questionable figures presented. Sectors covered seem very limited. Excessive detail in report could be seen as obfuscation.	4-year outlook; Costing catalogue; NBAP; Activity-based; Workshops & consultation
India (2017)	- Incremental budgeting model - Closely follows FNA steps described in the BIOFIN Workbook (2016). Extrapolates budgetary projections to arrive ministry/thematic area wise financial needs assessment related to implementation of NBAP. Plan schemes and programmes used as a baseline. FNA framework allows for the gross initial estimation of financial needs and prioritization of programmes/schemes for NBAP implementation. - Trends in National Planning and Budgetary Process assessed to derive estimates of financial needs/ requirements to achieve activities listed in India's NBAP. i.e. incremental budgeting. - Detailed, budget-based financial outlay of schemes and programmes that India undertook as part of its Planning process cannot be replicated under the National BIOFIN Initiative. i.e. no immediate comparison leading to straight-forward mobilisation. - FNA estimates are conservative and minimalist. Initial attempts shed light on the magnitude of financing requirements. - Compilation of all the working group/steering committee documents for 12th Five Year Plan (2012-2017). Total of 178 schemes relevant to biodiversity across 26 ministries / departments. Adopted as baseline for FNA assessment. Protocol Step 1: - Identification of biodiversity relevant schemes proposed during the12th FYP along with enumeration of financial outlay and objectives	Incremental Budgeting model; attribution methodology; extrapolates from existing budgets; 5-year needs projection

	Step 2: - Mapping and clarification of scheme/programme actions and connectivity to NBAP objectives Step 3: - Preparation of scheme/programme budget table, linking to NBAP thematic areas based on attribution methodology. Depending on linkages to thematic actions of NBAP and to corresponding action points, financial estimates were defrayed from the scheme outlay using pivot table. Step 4: - Refining of budget tables with expert/stakeholder input Step 5: - Analysis of budget tables to identify priority NBAP actions for financing Step 6: - Estimate finance gap for priority NBAP actions • Stated limitations - Study did not comment on additional financial needs for selected sectors. i.e. not aspirational - Data reported and analysed are essentially the sectoral wish list of the Sectoral ministries and departments - Captures only projected budgetary requirements under the Plan Documents. Assessment: Good iterative process, with extensive reference to existing plans/strategies/schemes and broad-ranging data mining. Good quantification of unit costs of biodiversity (e.g. km^2 of forest). No direct reference to costs of achieving specific NBAP aims. •	
Kazakhstan (2016)	- Bottom-up costing for period 2016-2020. - Generalised mid-term (2021-2025) and longer-term (2025-2030) estimates also made, where possible and meaningful. Step 1: - Consultation with stakeholders by "expert on budget planning", mainly through budget quotations from companies involved in implementation. Step 2. Calculations of costs for NBAP objectives (10) and mechanisms (4) - Series of consultative meetings were held with national experts in the sectors. During the meetings the procedure for implementing activities, as well as expected actions for implementation were discussed in detail. - Experts collected budget quotations from companies for services and/or materials required for activities implementation. - As a result, the budget for NBAP implementation was calculated from a bottom-up approach. • Step 3 - The NBAP implementation is divided into three stages: (1) 2016-2020 – short-term, (2) 2021-2025 – mid-term, (3) 2025-2030 – long-term. - The budget of expenses was calculated for short-term and medium-term measures, taking into account the annual inflation. The budget for the long-term measures was not calculated due to the complexity in determining the value of recurrent expenses over long periods. • Step 4. - Costs cross-tabulated with Aichi targets, CBD targets and NBAP targets • Step 5 - Assess one-time and reoccurring costs in detail. • Step 6	Bottom-up approach; expert /workshop led; NBAP based; timescale short-term; mid-term; (2025)

	- Compare business as usual expenditure (Republican + local + international budgets) with estimated costs derived from FNA process. • Stated limitations: - Prices based on 2014-2015 estimates, adjusted for inflation. No attempt made to estimate future price changes. • • Assessment: Simplistic approach, with longer term outlook than most other FNAs. Lack of clarity on how costable actions were derived and how quantification was derived. Bottom-up, but was this activity-based, results-based, other? •	
Rwanda (2018)	- Low vs. high estimates of cost - Scope of FNA was further defined based on national stakeholder consultations. - Designed as a descriptive and participatory ex-ante budgeting exercise. - Participatory evaluation comprised a stakeholder workshop and meetings, as well as several bilateral meetings with key ministries and agencies Assessment process followed the following steps: Step 1: - Preparation: make relevant arrangements for secondary data collection and literature review Step 2: - Scoping and clarifying the NBSAP actions. Early engagement with stakeholders provides clarification on the NBSAP goals and action plans, the institutional arrangements Step 3: - Desktop study and preparation of initial costing tables. Disaggregating the NBSAP II implementation and timeline into cost elements, i.e., costable actions or specific cost elements and units to be calculated. Step 4: - Stakeholder engagement during and after the costing activities through key informant meetings and a consultation workshop in the early stages as well as a validation workshop, at a later stage, to discuss the complete findings and final recommendations Step 5: - Refining cost models drawn from the NBSAP with expert input, tailored for proposed timeline. Improved understanding of relationships for implementation. Step 6: - Analysis of costing results, aimed at providing a clear aggregation of actions, activities, targets and goals and ultimately the entire NBSAP over the proposed timeline Step 7: - Estimate financial needs, calculated as the final aggregation of the costing of the NBSAP actions, targets and goals Step 8: - Produce report detailing the biodiversity finance needs and finance gap. - Consultation workshop undertook a budget prioritisation exercise using the total costed activities that were generated in the full Country Cost Tables. - Country Cost Tables provided estimates for all the activities listed in NBSAP II.	NBAP action; costing tables; consultation; timescale 2020 and 2050; Three different cost estimates (low, mid and high).

- Workshop participants asked to rank all of the costed activities in terms of their direct impact and importance on biodiversity protection and mitigation, just as might commonly be done in any organisation's budgeting cycle. The participants arrived at a total of 110 priority actions out of the original 168 costed actions.

Cost Data

- Data collection was carried out using three primary sources: (i) official documents and reports, (ii) data estimates from discussions with ministry and NPWS staff members, and (iii) consultative and review meetings with a range of national biodiversity stakeholders
    - Documents comprised the work plans and budgets for 2018/19. included in the initial Country Costing Tables.
- The Country Costing Tables were later revised to adopt standard categories and cost units, the initial data were used as guidance in the subsequent meetings with stakeholders.
- Data were collected through office visits and sharing of soft copies of work plans, current and previous ministry and NPWS budgets, and draft and current strategic plans.
- Stakeholder consultations covered a wide scope of private sector, civil society, and public sector and development partners - The stakeholders reviewed the templates of the Initial Country Costing Tables and suggested improvements. The stakeholders then reviewed the Initial Country Costing Tables and the Explanatory Notes at a stakeholder meeting held in March 2018. In May 2018, a national consultation workshop was held during which stakeholders made a comprehensive review of the Country Costing Tables, the Explanatory Notes, and the draft FNA report
- Picked specific stakeholders for different goals of the NBAP

Cost methodology

- A bottom-up costing approach was used, entailed the converting of the NBSAP goals, actions and activities into cost elements and cost units (or cost-able units), and the establishment of cost rates and quantities of the different units of actions to be implemented.
- The Initial Country Costing Tables were designed to collect data on both the estimated finance needs for the initial year as well as the estimated effort for biodiversity activities, programmes and projects over the course of the 12-year projection period. Therefore, with data on the expected effort per year over the course of the projection period, an estimate could be made on the finance needs for each year of the projection, based on the following formula -Where FNyt stands for the year of finance needs for year of projection, ALyt stands for the activity level for the year of projection, UC stands for unit cost, F for frequency of activity in the year of projection. The starting year of the projection 2018/19 was counted as year zero, with an annual inflation rate of 5 %. [$FNyt$=Σ$ALyt$∗UC∗F∗(1.05)yt−1].
- Three different cost estimates were generated, each of which includes both a high and low calculation of costable actions.
- Low - The first estimate, using the formula above, is simply the average of costable actions per year over the 12-year period.
- Mid -The second estimate uses the statistical tool of ordinary least squares as a way of "smoothing out" the data over the time period in order to more closely fit the estimates into likely budget cycles that change incrementally. The decision to run a least squares estimate was taken based on discussions with MINICOFIN and REMA staff about the best way to make cost projections, given the many "unknowns" in budgeting over a 12-year period.
- High - The third estimate uses the least squares calculation but derives a prioritised list of costable actions, in other words, what costable actions would have the most direct and significant impacts on protecting and restoring biodiversity.
- The exercise was used as a way of ranking 11 programmes and projects so that the workshop participants could understand the trade-offs in selecting among multiple potential activities, an issue that is commonly encountered in virtually every budgeting exercise. Prioritisation exercise -The participants ranked the costed actions using four criteria: (i) Directly improves biodiversity management; (ii) Creates strong incentives for biodiversity management (iii) Responsible actors have capacity for implementation; and (iv) Leads to fast action on biodiversity management

	• • Stated Limitations - Levels of spending on biodiversity have fluctuated highly across the past decades, meaning forecasting expected spending needs may not be a fair reflection of spending needs. -	
Seychelles	- The NBSAP was aligned to Aichi Biodiversity Targets and that it was detailed enough to have well defined activities. - This Financial Needs Assessment (FNA) presents the detailed costing of the NBSAP that took place in 2015 through an iterative process of stakeholder and expert consultation. - Worked to identify costable-activities Step 1. - Each NBSAP project was categorised as per categories of strategies defined by BIOFIN initiatives methodologies as indicated below Step 2. - Key reference documents were analysed and key technical experts were consulted on an individual basis to determine the cost of the different elements, activities and projects using a results-based approach. Step 3. - Discussions were held on an individual basis to determine if costs were one-time costs or recurring costs. Step 4. - Finally, the results of the costing of the NBSAP were presented and discussed in working groups during a BIOFIN stakeholders Workshop in November 2015. Step 5. - Comments received during the Workshop were integrated in the costing of the NBSAP. Step 6. - The revised costing of the NBSAP was subsequently presented and validated during the May 2016 BIOFIN Workshop. *Analysis of one off vs. recurring costs.	NBAP actions; stakeholder and expert consul; costable activities;
Thailand	- Tried to use a bottom up approach based on reviewing strategic plans of key government department - Followed by focus group discussion with two of the chosen departments - During these meeting and works the relevance of the NBSAP was discussed as well as relevant data that would be required from the respective departments. - Reviewed the department budget estimates and the unit cost. - Conducted preliminary calculation and discussed with key department whether the estimates were acceptable in terms of items, unit cost and assumption - concept of unit costs is widely accepted by government and use in the FNA. - Made use of the unit costs that the departments themselves use when they prepare their departmental budget for approval by the cabinet each year. - Final estimations were produced by discussions with departments - Involved quantification and costing of key strategies under the NBASP.	'Bottom up'; stakeholder and expert consult with key departments; departmental budget estimates and unit costs used; NBAP/agencies;

	- Scope of the analysis extended to include three agencies which account for around 80% of the national budget spending - Provided detailed cost tables - Considered financial needs under different scenarios (i) Business as usual i.e. no changes to the rate of increase in annual budget allocation (ii) scenario B cost estimate is the additional investment thay would make it possible for certain key agencies to execute the measures and activities included in their 20-year strategic plans. (iii) more realistic estimate. Employed close engagement with key stakeholder and consultative and participatory workshops and meetings. - Assess departments strategic plans for actions related to bd. - Reviewed area coverage and costing specific actions – then made use of unit costs to estimate financial needs. - Process of estimating the bd finance gap detailed in BIOFIN workbook – adapted to Thai context benefited ffrom close engagement with key stakeholders through consultative and participatory workshops - Relied on unit cost information for the basis of the calculation. - Picking a timeframe – NBSAP period 2019-2021. - Assess cost distribution etc. Challenges - Limitation of only having access to a relatively small group of individuals during the data collection stages - The FNA is limited by the fact that the unit cost figures could be underestimations. . i.e the official figures do not necessary reflect the current costs for procurements of those services but rather what the line agencies can request for specific budget items.	scenario analysis; unit costs; time frame 2019-2021 – 2 years.
Uganda	• Compared the financial needs and the expected biodiversity expenditures over a medium-to long-term planning horizon. • The Financial needs Assessment present the detailed costing of the NBSAP (2018-2025). The total cost of the implementation of the NBSAP. • • Step 1. Review of National Biodiversity Strategy and Action Plan (NBSAPII) To obtain information on costable actions, small groups of the TSC on each of the NBSAP strategic objectives were constituted. The members of the group were nominees from government Agencies and Local Government (MALGs), academia, and civil society. The groups reviewed the NBSAP II strategic objectives, related specific objectives outcomes, outputs, actions and activities with their related inputs. Step 2: Costing of biodiversity related activities: - Activity Based Costing (ABC) was used to estimate the cost of implementing the proposed actions. In addition to the estimated cost from the market, experts from the stakeholders were also interviewed to assess if the proposed costs and magnitude of the actions could deliver desired conservation outcomes. - The activity-based costing involved mainly four steps namely: o Identify and classify activities, o Estimate the cost for whole activity, o compute a cost driver rate o Apply activity costs using cost driver.	NBAP; time period *2018-2025) 7 years; costable actions; activity based costing; stakeholder and expert consutlation

	- The National Biodiversity strategy and action plan (NBSAP) was costed for the whole period. Each biodiversity strategy was costed including recurrent and capital costs. Costs were then grouped into categories e.g. Strategies on cost of mainstreaming biodiversity; **sustainable use; Strategies on cost of protection; Strategies on cost of restoration strategies**: etc. • Step 3: Consultative workshop - Data validation and compilation workshop was then organized 12 stakeholders who reviewed the activities, their costs, outputs and outcomes. - The costs of implementing each identified activities of the specific objectives of the NBSAPII were aggregated to establish the overall cost of implementing the strategy. Final excel sheets that detail the inputs and costs for implementation of the NBSAP II were developed. The costs were then summarised by summing up by specific actions and categorisation as capital development (one off) and recurrent costs. The aggregated costs were then projected in the future using average inflation rate obtained from Uganda Bureau of Statistics (UBOS). • • Limitations The financial gap was not quantified since the NBSAP1 and the estimated biodiversity expenditure baseline review are not comparable because the NBSAP does not capture all on going biodiversity conservation activities.	

Appendix C: List of Potential Data Sources for FNA

Following the NBER and PIR processes, the following list of potential sources of financial data were identified. Owing to the Covid-19 pandemic and the prioritisation of NBAP targets, some of these sources became impractical. See revised table of data sources at: BIOFIN Ireland\3. FNA\1. Working Group, Methodology and Data Sources\FNA data sources.xlsx]

Activity	Possible data sources
Habitat creation or restoration	• NPWS - PAF. Internal Doc, NPWS. - NPWS historical budgets and discrete project funding - IAS removal budget • LIFE project funding - final end of project finance and costs per ha. • NGO (Birdwatch, IPCC, Native woodland trust etc) reserve management • Forest Service - Native Woodland Establishment and Conservation grants • BnM (peatland rewetting/environmental reinstatement) • EPA (river restoration) • OPW - Parks and river restoration - IAS removal cost • Burren farming for conservation • IFI - Invasive species removal programme • Transport for Ireland - Invasive species removal costs • AES schemes (AEOS or GLAS) • Coillte - Coillte budget spent on maintaining and enhancing biodiversity areas on the estate - Coillte Nature activities (x 4 strands) • NGOs - Native Woodland Trust - nature reserve management? - IPCC - Bog acquisition costs • LEADER - Green infrastructure grants • Heritage Council - Grants for IAS • CAISIE LIFE - IAS • Irish Water – ICW instatement
Pollution control or remediation	• DAFM - Farm waste management • EPA expenditure on waste management and waste water treatment costs? • An Taisce - Clean coast program • Irish Water
Species protection or reintroduction	• NPWS - Tern programme - Red kite, White-tailed eagle etc species reintroduction programmes - NPWS species farm plan scheme - Curlew and corncrake species programmes - Nature reserve species management & vet costs • DAFM species programme etc. hen harrier • Inland Fisheries Ireland - Aquatic species reintroduction - Salmon conservation fund • NGOs - Bat Conservation Trust Ireland - Birdwatch Ireland - Marine watch - Irish Seal Sanctuary

	- Irish Whale and Dolphin Group - Vincent Wildlife Trust - Irish Grey Partridge Conservation Trust - StreamScapes - Butterfly Conservation Ireland - Curlew Trust • LEADER grant funding - species reintroduction focused • LIFE programmes (update to most recent) - Raptor LIFE - Roseate term • LIFE – IP - PAF Wild Atlantic Nature - Waters of Life
Education and Awareness	• NPWS - PAF. Internal Doc, NPWS - Awareness funding and events, leaflets, posters, campaigns • Irish Forum on Natural Capital • Heritage Council grant funds • Local Agenda 21 grant funds • LEADER grant funds • Local Authority - Heritage Officers - Biodiversity Officers • NGOs - Birdwatch Ireland - Irish Whale and Dolphin Group - IWT - An Taisce (Green Schools, Climate Ambassadors, etc.) - IPCC - Eco-UNESCO - OWLS - Irish Environmental Network (e.g. bd week) - Streamscapes - Butterfly conservation Ireland - Zoological Society of Ireland - Biodiversity in Schools • Forest Service - Neighbourwood Scheme
Habitat and species plans	• NPWS site plans for the NPWS Farm Plan scheme - NPWS Farm Plan scheme: plan creation or compliance report - Site conservation objectives for SACs/SPAs/ expenditure on the setting of conservation objectives, creation of conservation plans or strategies. - Species specific threat management plans • BWI – Group species plans • RBMP – revised: see activities of LAWPRO et al.
PA / nature reserve site Management costs	• Recurrent costs for National Parks and national nature reserves • Recurrent costs for NGO reserves (e.g. BWI, IGPCT) • Recurrent costs for BnM sites • Coillte site management costs for ecological focus areas. • Agri-environment schemes (GLAS, EIPs, etc.)
Staff/Administration costs or overhead	• NPWS staff costs and consultancy costs • Inland Fisheries Ireland staff costs • NGO staff costs (unlikely to be realistic) • Forest Service labour payment rates for afforestation • Coillte staff • IPCC administration costs • Heritage Council – Heritage Officer network
Monitoring	• Costs associated with Article 17 reporting (NPWS mainly)

	• NGO species monitoring programmes e.g. - Irish Wetland Bird Survey (I-WeBS) - The Countryside Bird Survey (CBS) • NBDC - Citizen Science - All-Ireland Pollinator Plan - Biodiversity indicators • DAFM - COFORD programme - Research Support Fund (RSF) - observer programme - Common fisheries/EMFF • EPA - WFD monitoring - Strive programme • National seabed survey • IFI monitoring of species • Local agenda 21 • LEADER
Enforcement	• BIM - Aquaculture in Natura 2000 sites • Marine Institute - Natura implementation/ EMFF biodiversity scheme • NPWS - NPWS enforcement of Birds and Habitats Directives and Wildlife Act outside of Natura 2000 (e.g. hedge cutting) - Appeals - Expenditure on legal fees associated with appeals on designated sites. • EPA - Environmental enforcement and licencing
National Policy and strategy	• NPWS cost for: - All-Ireland Pollinator Plan (NBDC with NPWS?) - NBAP - Many others, including species management plans, SAC management plans, etc. • IFI policy development • EPA integrated catchment management programme
Conservation of genetic diversity	• National Botanical Gardens • Seed Bank at Trinity • DAFM/Teagasc - Genetics grants programme • Local agenda 21 • Leader • Various NGOs (see PIR findings)
International biodiversity governance	• NPWS - CBD (6th) reporting costs - Cartagena Biosafety Protocol - OSPAR - Stockholm convention - Geneva convention - GEF - European environmental bureau

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