LAYMAN'S REPORT

LIFE14 NAT/IE/000032

Restoring Active Raised Bog in Ireland's SAC Network 2016 - 2020

An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
Department of Housing, Local Government and Heritage

LIFE14 NAT/IE/000032
Irish Raised Bogs

Beneficiary Data

Co-ordinating Beneficiary
Department of Housing, Local Government and Heritage (DHLGH)

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LIFE Funding

The total cost of 'The Living Bog' project was €5.45m, 75% of which was funded by LIFE (the EU's financial instrument for supporting environmental, nature conservation and climate action projects) under the LIFE 2014-2020 programme. Co-funding for the project (25%) was provided by the project co-ordinator, the Department of Housing, Local Government and Heritage.

The project

'The Living Bog' project aim was to improve almost 2,600 hectares of protected raised bog habitat, which supports a unique array of flora and fauna, and many of Ireland's rarest animals, birds and insects.

Raised bogs are valuable wetlands that have been continually declining over the centuries as a result of human activities. Dating back over 10,000 years they once formed extensive wetland complexes over much of the central lowlands of Ireland covering an estimated 350,000 hectares of land.

These living bogs are of great importance for biodiversity, flood control and carbon storage. It is estimated that although bogs and peatlands cover just 3% of the world's total surface, they store 30% of the soil's carbon, twice as much carbon as all the forests in the world. Given that Ireland's greenhouse gas emissions have been on the rise, restored and intact raised bogs are highly efficient carbon sinks.

Raised Bogs – the Irish context

Raised bogs are among the world's oldest living, near-natural eco-systems. Many of Ireland's great raised bogs date back almost 10,000 years. They are found mainly in the midlands.

The conservation status of bogs has been under increasing pressure due to various land use activities – most notably turf cutting/ harvesting and associated drainage. This is not a new phenomena and, over millennia, bogs were intricately linked with Irish culture, tradition and as a source of winter fuel. The mechanisation of turf-cutting, the demand for peat by the horticultural sector and the use of peat as a fuel for electricity generation accelerated peatland reclamation in Ireland to such a level that by the middle of the twentieth century all raised bogs in Ireland were affected, to some degree, with many irreversibly damaged. What remained was damaged, drained and drying out bog habitat. It is estimated that there has been a 99% loss of the original area of actively growing raised bogs; while only about 1,650ha of the remaining 'intact' high bog can now be classified as living, 'Active Raised Bog'.

A realization of the need to conserve Ireland's peatlands developed pace in the latter part of the twentieth century. The National Parks and Wildlife Service, other state agencies, NGO's, individuals, groups, land-owners, Dutch Government and scientists and organisations played an important role in saving some of the best examples of natural active raised bog habitat in the world (such as Clara Bog Special Area of Conservation and Nature Reserve in Co. Offaly).

53 RAISED BOGS HAVE BEEN SELECTED AND DESIGNATED UNDER THE EU HABITATS DIRECTIVE AS SAC'S (SPECIAL AREAS OF CONSERVATION) WITHIN THE NATURA 2000 NETWORK WITH A FURTHER 9 SMALLER SITES ADDED IN RECENT YEARS.

However, there was also an urgent need to reverse habitat degradation and improve the conservation status of active raised bogs in Ireland. Although there were significant ad hoc restoration projects there had never been a dedicated programme of implementation of restoration measures. So, in 2014, €5.4 million of funding was allocated under the EU's LIFE programme to address the threats to raised bog habitats and put in place concrete actions, monitoring programmes and greater public awareness to address the issues. This LIFE project was titled 'The Living Bog' and its objectives, deliverables and outputs were:

1
SECURE LANDOWNER COOPERATION AND LOCAL COMMUNITY SUPPORT INCLUDING FORMULATION OF A STAKEHOLDER COMPENSATION SCHEME

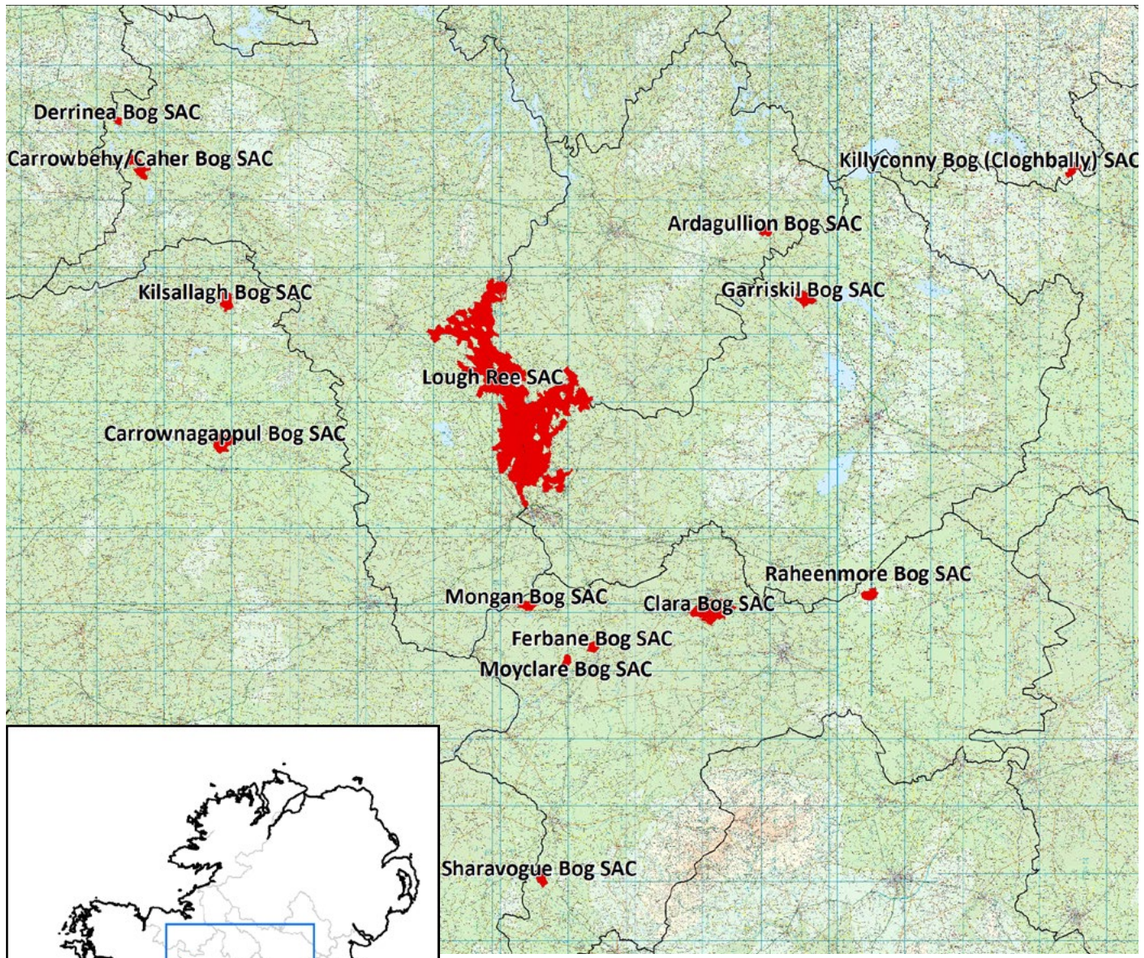
2
CARRY OUT RESTORATION ACTIONS TO ACHIEVE A TARGET AREA OF 752 HA OF ACTIVE RAISED BOG WITHIN AN OVERALL AREA OF 2,649 HA OF RAISED BOG HABITAT.

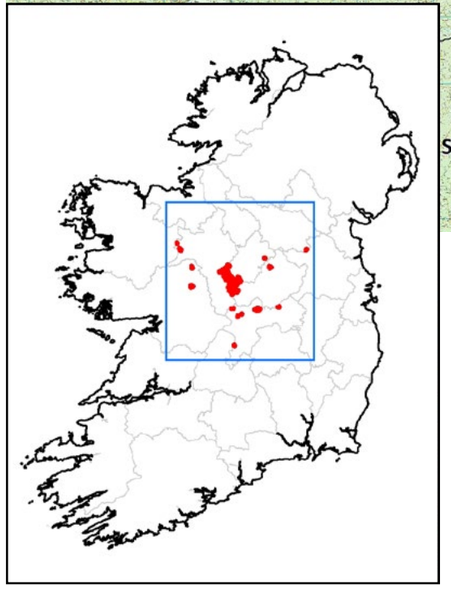
3
DEVELOP A PUBLIC AWARENESS CAMPAIGN TO DISSEMINATE INFORMATION ABOUT THE IMPORTANCE OF CONSERVING THE NATURA 2000 NETWORK OF SITES

4
CARRY OUT COMPREHENSIVE SURVEYS BEFORE AND AFTER IMPLEMENTATION OF RESTORATION MEASURES FOR SCIENTIFIC MONITORING PURPOSES

5
PRODUCE RELEVANT TECHNICAL INFORMATION/ DOCUMENTS TO INFORM FUTURE PROJECTS

General location of project areas





LIFE Project Site No:	SAC Code	Site Name	County
1	IE000006	Killyconny Bog (Cloghbally) SAC	Cavan/Meath
2	IE000572	Clara Bog SAC	Offaly
3	IE000575	Ferbane Bog SAC	Offaly
4	IE000580	Mongan Bog SAC	Offaly
5	IE000581	Moyclare Bog SAC	Offaly
6	IE000582	Raheenmore Bog SAC	Offaly
7	IE000585	Sharavogue Bog SAC	Offaly
8	IE000597	Carrowbehy/Caher Bog SAC	Roscommon
9	IE000604	Derrinea Bog SAC	Roscommon
10	IE000679	Garriskil Bog SAC	Westmeath
11	IE001242	Carrownagappul Bog SAC	Galway
12	IE002341	Ardagullion Bog SAC	Longford
13*	IE000285	Kilsallagh Bog SAC	Galway
14*	IE000440	Lough Ree SAC	Longford/Roscommon/Westmeath

Legend

SAC Boundary

N

1:700,000

Restoring active raised bog (7110) in Ireland's SAC Network

An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreachta
Department of Housing, Local Government and Heritage

* 'The Living Bog' initially concentrated on 12, with two additional sites added later, of the then 53 Raised Bog SAC's in Ireland with the intention of expanding such restoration measures in future years learning directly from the Living Bog experiences.

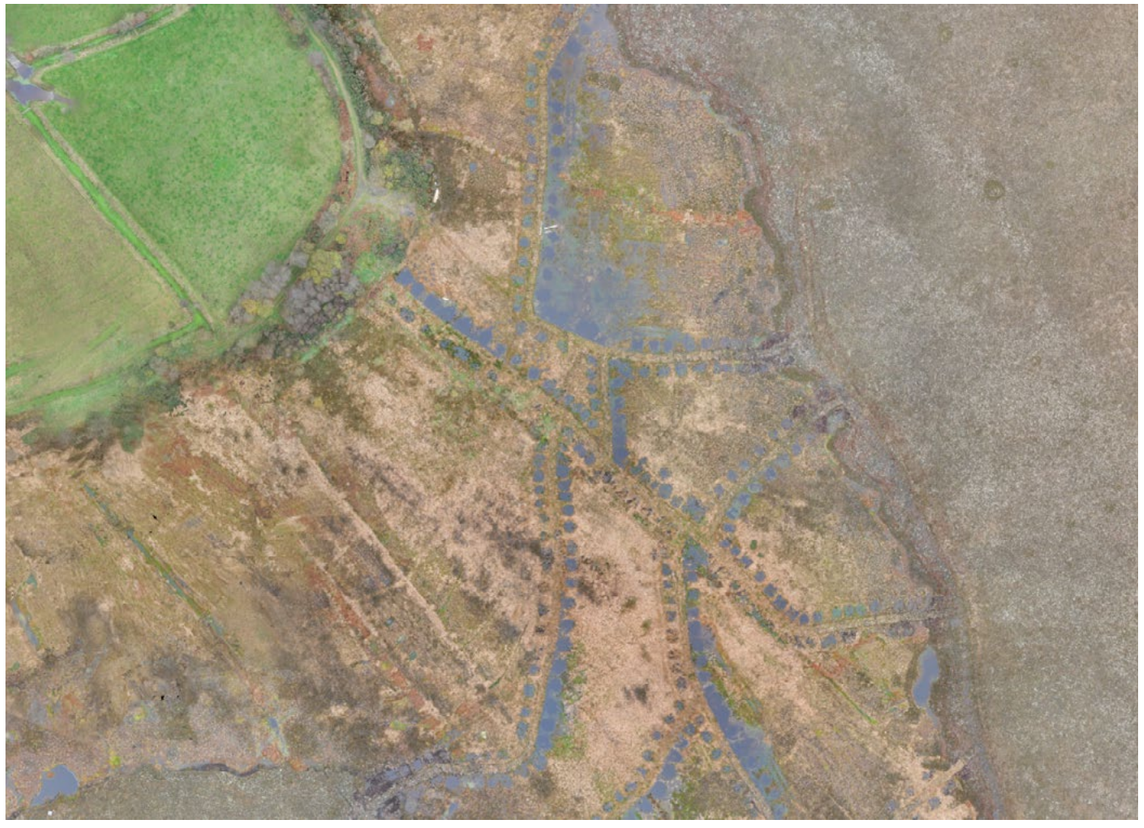
The method

Restoration of active raised bogs is a complex endeavour, re-creating the hydrological and ecological conditions under which water-dependent sphagnum moss habitats will form peat. It requires agreement from landowners, removal of invasive, damaging species, and cessation of damaging activities all to allow the unique vegetation communities to flourish. 'The Living Bog' initially concentrated on 12 of the then 53 Raised Bog SAC's in Ireland with the intention of expanding such restoration measures in future years learning directly from the Living Bog experiences. The aim was to increase the area of Active Raised Bog on the remaining portion of intact peat bog (High Bog) and on the low lying portion of bog which has been subjected to peat removal (Cutover) using a variety of restoration measures which included:

- Working with landowners to initiate the works required
- Installation and maintenance of water retaining structures within existing damaged bogs to raise water tables
- Controlling natural regeneration of trees and shrubs that had colonised the damaged bog
- Fencing to prevent livestock access to allow the bogs to regenerate naturally

Monitoring the impact of the project

Monitoring the impact of the project was an important element of 'The Living Bog' and a programme was developed to test effectiveness of the project actions and make recommendations that could be developed future projects working on bog restoration. For the monitoring programme the project concentrated on **hydrology**, **vegetation**, **water chemistry** and **climate change monitoring** to determine the impact of the restoration works on the bog. This involved installing 246 permanent hydrology data collection monitoring points, 151 vegetation monitoring quadrats and equipment that measured water chemistry, greenhouse gases and water flow conditions so that pre and post restoration work could be compared. The results provided by other raised bog monitoring surveys indicate that approximately a decade is needed to achieve significant increases in the area of active raised bog after restoration works are undertaken. However the short term monitoring within the life of the project showed positive results and some within a shorter time frame than 10 years.



Achievements of ‘The Living Bog’ project

1 **Creation of over 43.6ha of Active Raised Bog (ARB) habitat** on high bog in just three years on five sites, which equates to nearly 20% of the long-term target for new ARB on High Bog for all 12 sites. **Modelling predicts that over 95% of the ARB targets of the project will be achieved**.

2 **Confirmation that restoring ARB on cutover bog is achievable** but that it will take longer than restoring ARB on the High bog with some species such as the Great Sundew and particular Sphagnum species (e.g. *S. beothuk* and *S. austinii*) appearing to take longer to return to the cutover.

3 **Increase of nearly 5ha of ‘High Sphagnum’ habitats on the cutover to over 23ha** across the eight sites surveyed post-restoration with a positive trajectory recorded across much cutover areas and the target of 41ha of ombrotrophic High Sphagnum habitat expected to be achieved.

4 **Development of a habitat classification system for cutover bog** that was published as an Irish Wildlife Manual* by the National Parks and Wildlife Service. This classification system was constructed by Project Ecologist William Crowley, in such a way that it can be used as a metric to gauge restoration success as areas go from bare peat and Low Sphagnum environments to moderate and High Sphagnum ones. It will also be invaluable in calculating the impacts of restoration on Greenhouse Gas balances with studies of the carbon balances of the different habitat types underway.

5 **First time that ARB has been recognised as occurring on cutover bog in the Irish context** with a definition given within the Irish Wildlife Manual.

6 **Results from the project have been published in two separate scientific papers** in the journal Biology and Environment with a further paper currently being prepared.

7 **The positive impacts of enhanced measures such as berms on the vegetation of cutovers was confirmed** through a study on Killyconny Bog SAC where approximately 10 years post construction of a 1.8km berm, **5ha of Sphagnum-rich vegetation has developed**.

8 **The key importance of topography in determining restoration potential** was highlighted in the Killyconny Bog SAC study as extremely fine variations in topography resulted in significant differences in the vegetation that developed

* Smith, G.F. & Crowley, W. (2020) *The habitats of cutover raised bog*. Irish Wildlife Manuals, No. 128. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

9 **The Living Bog had a massive public awareness campaign** detailing both the works of the project and information on the importance of the restoration and maintenance of Irish Raised Bogs. This work was recognised in the European Commission’s Natura 2000 Awards where the project was included amongst the finalists.

10 **Establishment of a network of high bog and cutover monitoring plots linked with hydrological monitoring points**. A selection of these will continue to be monitored as part of the after LIFE project. Results of the continued monitoring will greatly enhance the understanding of the relationship between hydrological conditions post-restoration that lead to specific bog vegetation types. This will significantly improve the setting and achieving of restoration targets.

11 **Installation of a comprehensive hydrological monitoring network**, that includes 246 monitoring wells, making the Living Bog project one of the most intensively monitored peatland restoration projects in Europe. Monitoring wells were dipped on a monthly basis, before, during and after restoration, to investigate the impact of restoration measures on groundwater levels across the bog.

12 **Manual data was supplemented with the installation of 49 high-resolution data loggers, recording water levels at 15-minute intervals**. This comprehensive dataset ensured that all fluctuations were accurately captured to characterise the hydrological regime. Across the Living Bog project, more than **5 million data points were recorded** using the water level loggers. This not only highlights the intensity of the survey effort but will also provide a high-resolution dataset which can provide a baseline for numerous future research projects and policy decisions on peatlands in Ireland.

13 **Analysis of the water level data demonstrates a clear improvement in hydrological conditions across all sites**, with the water table being brought closer to the surface and helping to create the hydrological conditions suitable for the establishment of Active Raised Bog (ARB) on the high bog and Peat Forming Habitats (PFH) on the cutover.

“
INSTALLATION OF A COMPREHENSIVE HYDROLOGICAL MONITORING NETWORK, THAT INCLUDES 246 MON T ONE OF THE MOST INTENSIVELY MONITORED PEATLAND RESTORATION PROJECTS IN EUROPE.
”

IN TOTAL 7,948 MANUAL READINGS OF WATER LEVELS WERE COLLECTED THROUGHOUT THE PROJECT AND WERE USED TO QUANTIFY THE OVERALL SUCCESS OF THE MEASURES IMPLEMENTED

14 **Originally, it was anticipated that this increase in water level would take up to 10 years to equate to an improvement in the ecology**. However, over **43ha of Active Raised Bog (ARB) habitat has already been observed to have been re-created on the high bog in just three years and 18ha of High Sphagnum habitats established on the cutover.**

15 **Figure 1 below highlights the success of the restoration measures.** The monitoring well presented is from Ardagullion Bog SAC, Co Longford. Prior to restoration (2018), the water table fluctuated extensively, dropping to more than 50cm below ground surface. Conversely, following restoration water levels rose and stayed consistently at or above ground surface for the majority of the remainder of the monitoring period. Most notably, the capacity for significant water-table drawdown appears to have been reduced following the successful completion of restoration. In the two years of data collection following restoration only two periods of significant drawdown are evident, with the greatest of the two occurring in 2020, briefly lowering the water level to approximately 3 cm below ground surface before rapidly rebounding to pre-drawdown levels.

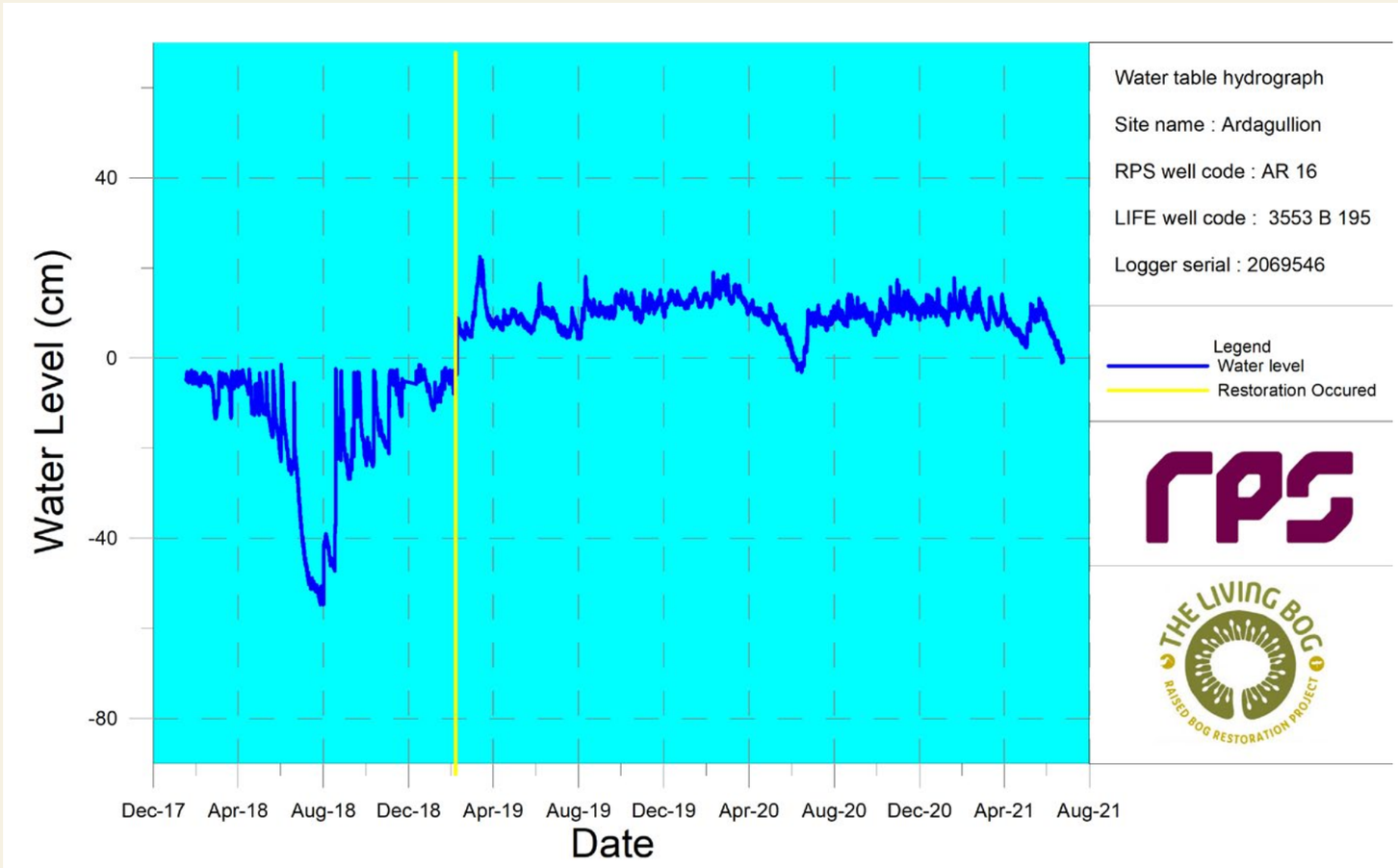


Figure 1
Level logger data recorded between May 2018 and July 2021 at well AR 16, Ardagullion Bog SAC showing a retained rise in water level after restoration works.

16 **Hydrology-focused scientific papers, with two competed already, are currently under preparation** with the aim of publishing them in relevant peer-reviewed scientific journals and disseminating the results of the Living Bog project to a wider audience.

17 **Results from the project will be used to design best practice methodologies** related to the hydrological monitoring of peatlands and shared with future restoration projects in Ireland and across the EU. The results highlighted the importance of collecting baseline measurements, determined an optimised sampling frequency that should be used and demonstrated the pros and cons of using manual data compared to using logger data to accurately characterise the hydrological conditions on raised bogs.

18 **Various drain blocking methodologies were implemented or trialled during this project**. These have been summarised in the project techniques manual detailing the measures and commenting on their effectiveness.

19 **The results presented in the hydrology report highlight the success of the eco-hydrological model used to predict the areas of the bog that will re-wet and therefore provide suitable hydrological supporting conditions for ARB/PFH**. However, the positive results illustrated through ecological and hydrological monitoring demonstrate that the current cutover model may underpredict restoration potential in some situations. The data collected during this project provides a platform to review and update this model, to enable better predictions of restoration potential.

20 **Through the AfterLIFE plan, long-term hydrological monitoring will be carried out in tandem with routine NPWS ecological monitoring** (as part of Article 17 commitments to the Habitats Directive), providing a robust scientific evidence base to demonstrate the success of the conservation measures. This dataset will ensure that the long-term impacts of restoration measures are better understood and will contribute to improving our understanding of how these unique habitats function.

The benefit and impact

At a national level The Living Bog project developed new methods of monitoring carbon emissions to contribute valuable information to this area. The project also developed a habitat classification system for cutover bog that can be used to measure restoration success as areas go from bare peat and low Sphagnum environments into moderate and high Sphagnum ones where peat formation will have commenced. This will aid in calculating the impacts of restoration on Greenhouse Gas balances with studies of the carbon balances of the different habitat types underway.

Cost-benefit discussion on the results

Economic and environmental benefits

For the project area there was a significant socio-economic spin-off for local communities as a result of this project. The amenity value of most of the sites is very favourable and although the bogs won't be used for fuel, they can still play a key role at the heart of local communities.

Transferability of project results

The technical aspects of this project were developed bearing in mind that there are over 40 more raised bog SAC sites in Ireland and a proposed network of 61 raised bog Natural Heritage Areas (NHA) that are proposed for restoration. Lessons learned around action planning, best practice restoration measures, procurement competitions, site survey, plant hire works, quality control, community engagement, public awareness and post works assessment have been documented in guidance notes to benefit future projects. Following on from The Living Bog project there are a range of other bog restoration projects that have followed our approach and using the information gathered to aid implementation such as FARMpeat (https://www.farmpeat.ie/) funded through the EIP Agri programme.

The development of innovative uses for heavy gauge plastic sheet piles as damming and weir structures trialled by the project were successful and can be transferred to a range of other sites to help re-create the right hydrological and ecological conditions for an active growing bog.

Bringing the people in to the heart of the bogs.

To re-connect communities to the bogs for different reasons than past associations, visitor facilities were constructed on Carrownagappul Bog SAC (aka 'Galway's Living Bog') in Mountbellew; on Clara Bog and on Ferbane Bog SAC in County Offaly. This work secured local community co-operation, and fostered a greater national understanding of the importance of Ireland's raised bogs and Europe's Natura 2000 Network through a variety of outreach and public awareness projects which is continuing after the project. The amenities, including boardwalks, all came from community suggestions and were mapped and developed by the community with the assistance of the project team and local contractors.

Communication

The restoration of Raised Bogs in Ireland is a major departure from past policy within Ireland. Peatlands have been exploited in Ireland for over a thousand years. From the 17th century there was pressure to develop bogs, seen as wastelands, for agriculture.
In the 19th and early 20th centuries the emphasis changed to encouraging the development of Ireland's peatlands for fuel and improving the quality of turf as a fuel, a practice that has continued to the present day. Changing perceptions, educating the public on the other importance services bogs offered and the detrimental effects of continued damage and promote awareness of Natura 2000 network was an equally important part of 'The Living Bog' project.

To develop this, the project employed an experienced public awareness manager with responsibility for the implementation of a suite of public awareness actions required to deliver the successful implementation of the project.

To achieve this, educational events were conducted ranging from site visits, school and college visits, attendance at local shows and local community events. These events explained the biodiversity of the bogs, their history, importance for biodiversity, flood control and carbon storage and sequestration as well as their significance at a national and international level.

The main target groups were farmers and the local community, local school children (primary and secondary), universities and the wider public. The use of information sheets, public notice boards and other beneficial materials informed people of 'The Living Bog' project and the importance of Natura 2000 sites. The project (and local communities on several project sites) were featured in national and international media, with much TV, radio and print coverage given to the project on and off its sites. A wide range of nature guide booklets were produced to provide accessible information for and the wider public along with a strong social media presence and a website detailing the project. Indeed, the projects work in communications and communities was rewarded by the European Commission with a nomination for a prestigious Natura 2000 Award in October 2020.

Socio-Economic Study

'The Living Bog project' actions have contributed towards maintaining one of Europe's unique habitats, supporting a unique assemblage of its biodiversity and cultural heritage, and its role in carbon sequestration and storage.

A study into the socio-economic impacts of the project actions on the hinterlands of the 12 project sites was completed to quantify the benefits of the project to the local communities. In addition to the obvious benefits arising from increased economic activity generated by the project budget, this assessment evaluated benefits such as rare habitat restoration, increased biodiversity, ecosystem services (e.g. cleaner water supplies), and added-value effects such as improved recreational amenities and rural tourism opportunities.

The study detailed the range of ecosystem services associated with raised bog, ranging from visual education aspects to physical attributes including flood and erosion control, carbon sequestration and climate regulation. Using monetary values based on national and international research on the valuation of relevant ecosystem services for wetlands, peatlands etc., values can be attributed to each of each of ecosystem services.

Conclusions

IN CONCLUSION, WHILST THE PROJECT FACED SOME CHALLENGES, PARTICULARLY THE ADVENT OF THE COVID 19 PANDEMIC, THE PROJECT WAS ABLE TO MEET ITS OVERALL OBJECTIVES.

THE PROJECT TEAM WORKED WITH THE LOCAL COMMUNITY TO HELP SECURE SUFFICIENT LANDOWNER CO-OPERATION TO COMPLETE RESTORATION WORKS AND AMENITY PROVISION ACROSS DIFFERENT PROJECT SITES. ASSOCIATED WITH THIS WAS THE PRE AND POST WORK SURVEYS WHICH IDENTIFIED THE SITE RESPONSES TO THESE WORKS IN RELATION TO HYDROLOGY, ECOLOGY AND WATER CHEMISTRY. RESULTS FROM THE MONITORING WORKS ARE PROMISING INDICATING AN UPWARD TRAJECTORY IN SITE CONDITION.

ASSOCIATED WITH THIS WORK WAS A STRONG PUBLIC AWARENESS CAMPAIGN THAT HIGHLIGHTED THE IMPORTANCE OF CONSERVING THE NATURA 2000 NETWORK OF SITES THAT RAN AT LOCAL AND NATIONAL LEVEL. THIS CAMPAIGN ALLOWED FOR ONGOING DISSEMINATION OF THE PROJECTS WORKS, THE ECOSYSTEMS SERVICES ASSOCIATED WITH ACTIVE BOG AND HELPED TO CREATE AN INTEREST IN THE WIDER PUBLIC.

THERE ARE OVER 50 MORE RAISED BOG SAC SITES IN IRELAND AND A PROPOSED NETWORK OF 61 RAISED BOG NATURAL HERITAGE AREAS (NHA) THAT ARE PROPOSED FOR RESTORATION.

THE IMPLEMENTATION AND CONTINUATION OF THE COMPENSATORY SCHEME (PRBRIS - PROTECTED RAISED BOG RESTORATION INCENTIVE SCHEME) AND THE LESSONS LEARNED AROUND ACTION PLANNING, BEST PRACTICE RESTORATION MEASURES, PROCUREMENT COMPETITIONS, SITE SURVEY, PLANT HIRE WORKS, QUALITY CONTROL AND POST WORKS ASSESSMENT HAVE BEEN DOCUMENTED IN GUIDANCE NOTES TO BENEFIT FUTURE PROJECTS.

OVER 200 KM OF DEEP DRAINS ASSOCIATED WITH PEAT HARVEST IN SPECIAL AREAS OF CONSERVATION WERE BLOCKED ON HIGH AND CUTOVER BOG AREAS USING UP ON 10,000 PEAT DAMS, PLASTIC DAMS AND OVER 3000M OF TRENCH BUNDING ALL TO RAISE WATER LEVELS AND REWET THE BOGS.

THE LIVING BOG
RAISED BOG RESTORATION PROJECT

LAYMAN'S REPORT

IRISH RAISED BOGS:
The Living Bog

Life

NATURA 2000

Rialtas na hÉireann
Government of Ireland