

Policy, Restoration & Stakeholder Analysis for EU LIFE Bog Sites in Ireland



POLICY FRAMEWORK DEVELOPMENT FOR BOG RESTORATION



Trinity College Dublin
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Preface

As a fourth year Delta Management student at the HZ University of Applied Sciences in The Netherlands, I was drawn to the project of raised bog policy analysis provided by Trinity College Dublin. The project has provided me with knowledge I did not have before; the Irish bogs are a valuable natural resource with global significance, as shown by the increased research into, and awareness of, ecosystem services and their importance to human society. Experiencing in research and drawing conclusions in the context of producing a thesis has been incredibly educational and was a great expansion of my horizon.

This report is meant to serve as collection of important aspects related to policy and European legislation frameworks concerning bog conservation and restoration, which can be used by stakeholder groups concerned with the protection of raised bogs in Ireland.

I would like to thank everyone who helped me with my research. In particular, thanks to my supervisor Shane Regan for his advice and support. I would also like to thank the people who provided me with information on the current state of affairs in terms of bog development in Ireland; The LIFE team, the Community Wetlands Forum, Abbeylax bog expert Chris Uys, and former senior scientist Jim from the National Parks and Wildlife Service. They provided me with guidance and insights on the complexions associated with bog management and how partnerships are to be fostered and maintained between relevant experts in their restoration and conservation.

Dublin, 5-6-2017

This is a precious resource, one that has been lost in much of Europe, particularly since the second half of the 18th Century and is under threat in some of the most important ecological spaces on our planet. Many organisations and local groups like those within the Community Wetlands Forum have wholly embraced this role of custodian and have not just protected but have restored and re-created valuable habitats. With their hands they have toiled to encourage flora and fauna to once again flourish and to introduce once more to achieve a symmetry between the surrounding human community and the natural wonders in their neighbourhood.

**Quote from speech by President Michael D. Higgins
concerning wetlands – Abbeylax event - 25-5-2017**

Executive Summary

In recent years, the recognition of the importance of ecosystem services provided by peatlands has become increasingly topical (Clarke, 2006). It is now known that peatland degradation and loss of habitat has large negative impacts, particularly with regards the loss of the habitats natural carbon sink function and role as a terrestrial carbon store, in addition to the significant loss of biodiversity. However, current policy frameworks and legislation do not adequately include the benefits of conserving and restoring peatland, which further contributes to public unawareness concerning their benefits to society. In order to promote restoration of peatland, the ecosystem services and affected stakeholders must be assessed.

A European Union (EU) funded LIFE programme project (LIFE14 NAT/IE/000032) was awarded to the governmental Department of Arts, Heritage and the Gaeltacht (DAHG) and commenced in January 2016. The aim of this project is to restore twelve raised bogs designated as special areas of conservation (SAC) under the Habitats Directive and which form part of the European Natura 2000 network (European Commission, 1992). This thesis aims to create awareness by collecting important data surrounding raised bog restoration and conservation and providing suggestions on how to improve methods of bog restoration. This is partly done by comparing the Irish ways of land and water management with the Dutch way.

Raised bog ecosystem services have shown to be of utmost importance both globally and nationally. The provision of services like nutrient cycling and carbon sequestration are invaluable. The surface area of raised peat bogs has diminished over the years, amongst others due to the practice of peat cutting. The restoration of bogs has to be executed before the bogs are damaged beyond repair. To promote this process, **the peatland management in Ireland** has been analyzed. Governmental cooperation seems to be limited in certain cases which slows down the restoration of the bogs.

Stakeholder and community involvement are crucial to the successful development of any project, this also includes raised bog preservation. Top-down approaches from the government have resulted in negative outcomes for both the public and the bog, inclusion of one of the most important stakeholders; the public, is something that can be improved upon massively. Networking groups like CWF play a large role in the connection of bogs and the public, the Irish government need to recognize this and act accordingly.

The governmental perception of bogs is changing for the better with new recognition of bog restoration, however, there is still a long way to go, as turf cutting is still being executed in non-protected bogs.

In order to improve the restoration processes of raised bogs, the **policy and legislation** has to be closely analyzed, this way, a framework for restoration can be made which includes the boundaries of applicable legislation and policy. This prevents fines and unneeded work in case of restrictions.

The recognition of the benefits of raised bog restoration is on the rise in Ireland. The contents of this report hold the most important subjects in bog conservation and restoration and gives suggestions on how to improve communication, involvement and protection of the raised bogs.

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Abbreviations

CWF:	Community Wetlands Forum
DAHG:	Department of Arts, Heritage & the Gaeltacht
EIA:	Environmental Impact Assessment
EPA:	Environmental Protection Agency
IFA:	Irish Farmers' Association
IPCC:	Irish Peatland Conservation Council
NHA:	Natural Heritage Areas
NPWS:	National Parks and Wildlife Service
OPW:	Office of Public Works
SAC:	Special Areas of Conservation
WFD:	Water Framework Directive

1. Introduction

The ecosystem services provided by peatlands have become topical in recent years (Clarke, 2006). The governmental decision to make a national peatland strategy in 2011 increased the attention towards peatlands (NPWS, 2015). A major consequence of peatland loss and degradation is the loss of carbon storage and sequestration potential, a key ecosystem service (Irish Peatland Conservation Council, 2017), the cost of which is often not factored into land-use management (NPWS, 2015). Moreover, the gains to be had from restoring the functions that provide ecosystem services are absent from current policy frameworks and legislation. The absence of these factors are a large loss for land-use management planning and thus have to be included for maximum efficiency of policy and management on land-use projects. To evaluate the benefits of the restoration, the impacts of ecosystem services on the environment and affected stakeholders must be rigorously assessed.

The focus of this research lies on the EU funded LIFE restoration project consisting of twelve raised bogs designated as SAC (Special Area of Conservation) in Ireland, more information on this topic is included in appendix 1. The motive behind the project is to improve the conservation status of the designated SAC bogs. As part of this LIFE project, land management plans, environmental impact assessments and eco-hydrological monitoring are being implemented. The EU project aims to improve the conservation status of the monitored bogs by implementing measure, primarily remediating drains to raise water tables (EU LIFE Team, 2016). Although this will reduce the export of dissolved organic carbon (DOC) in water, as well as improve the hydrological conditions necessary for sustainable bog ecology. However, the effect of drainage on the export of DOC has not been factored into the environmental policies in ecosystem protection, or in the economic costs associated with restoration (NPWS, 2015). While the bog-problem seems relatively straight forward to deal with from this perspective, other forces also play a role in the bigger picture. Factors like stakeholders, money, tradition and ownership can uphold any development or implementation on the bogs, resulting in further deterioration. This final thesis project continues at that point and focusses on examining restoration and its potential benefits, such as carbon export reduction, and encountered difficulties, such as conflicting land management desires and stakeholder interests. In addition to an analysis of literature related to environmental policy, the study uses information available from the NPWS (National Parks & Wildlife Service) and the LIFE project on topics related to stakeholder interests, land management and existing policy objectives. Data has also been collected through interviews with bog experts. The combination of this information forms a broad thesis including different perspectives on raised bog restoration.

1.1 Research question

The focus on drain management plans is important in the context of this project. Since the way of drain management determines the restoration process of raised bogs. The stakeholders concerned with peatland management seek to use or maintain drains for different purposes. For example, LIFE wants to dam the drains to raise the water table; the Office of Public Works needs to dredge to alleviate flooding; and farmers want them deep and with conveyance to improve drainage in their arable fields. The research question aims to address these issues. The research question and sub-questions have been decided upon after meetings with TCD (Trinity College Dublin) and the EU LIFE team. In these meeting, the objectives and goals of the project were discussed following a presentation of the subject. The following questions are essential for this thesis.



Research question:

- How can a framework for bog restoration be realized while focusing on drain management?

Sub-questions:

1. What ecosystem services are provided by the EU LIFE bogs?
2. How do the Irish currently deal with peatland management?
3. What are relevant stakeholders and their concerns in the restoration of the LIFE bogs?
4. How do governmental bodies perceive bog restoration and are there differences with regards to management the different LIFE bogs?
5. What are the most important steps to be taken in the process of bog restoration according to the relevant policy documents?

1.2 Objective

The largest project undertaken in Ireland to restore areas of raised bog, impacted by a history of mismanagement, is currently being undertaken by the NPWS courtesy of an EU funded LIFE project (EU LIFE Programme, 2017). The LIFE programme is the EU's funding instrument supporting environmental, nature conservation and climate action projects throughout the EU. Restoration work on bogs aim to restore conditions that support peat-forming, or "active" bog. However, restoration work, which seeks to mitigate against water loss by controlling drainage, is complicated by the need to develop drain management plans that satisfy a number of stakeholders and interest groups with a role in bog management. The objectives of this thesis project are to identify the stakeholders relevant to the twelve sites scheduled for restoration by LIFE, review the drain management policy by relevant authority bodies and to reconcile how stakeholders and drain policy can be incorporated into the Raised Bog life project's drainage management plans, whilst adhering to external policy instruments, such as the Habitats Directive (European Commission, 1992) and Water Framework Directive (European Commission, 2000), as well as environmental impact assessment (EIA) and environmental protection agency (EPA) requirements.

1.3 Scope

This thesis project focusses heavily on policy. Next to this, several other subjects come into play, like environmental, social and economic factors. The goal of the project is to collect and process the information on these topics. The line is drawn at actual technical research, like collecting water samples in the field which contain useful data for the project. The function of this research is to ultimately provide a method to create a framework which can help stakeholder managers in the process of dealing with policy and restoration. This framework will combine relevant directives and shows what types of legislation the user is dealing with in their corresponding area.

1.4 Thesis Outline

The contents of this thesis from start to end: firstly, the theoretical framework is discussed, here, the boundaries and important background of the thesis are described. Followed by the method, which includes the way of research and execution of the thesis. Then, the results are elaborated upon which covers the five sub-questions of the thesis, focused on ecosystem services of raised bogs, peatland management, actors, governmental perception of bogs and raised bog policy. After which, the discussion, conclusion and recommendations are discussed.

2. Theoretical Framework

The theoretical framework includes the outline of the thesis, the boundaries of the report and examples of similar projects have been included here. Sources have been closely analyzed and tested on their reliability. Important information from these sources has been included in this chapter. To start off, a list of relevant terms and definitions has been included to clarify the intentions of the project.

The following terms are critical for this project, the definition will be included in the following sentences. The terms have been taken from the research and sub-questions.

- **Restoration framework:** The ultimate goal of the project, the idea for the creation of a framework, is to be a collection of overlapping policy on restoration on raised bogs. The framework is also meant to hold all the important elements that are present in the process of raised bog restoration, this way, the bottom line of restoration work can be displayed in a readable manner.
- **Raised bog:** A peatland that gets its water and nutrient solely from rainwater. The bog gets its dome shape from the buildup of decaying materials in the bog.
- **Drain management:** the way of dealing with drains. For one bog, this would mean blocking drains by implementing dams, while another bog will leave the drains open. Drain blocking maintains the water levels of the bog and thus encourages restoration.

In terms of similar projects, there are multiple options. One of the options illustrate the combination of different policy documents and how these overlap. This is very similar as to what this thesis is researching. The mentioned similar project is called "*Policy Development for Biodiversity Offsets: A Review of Offset Frameworks*" (Kiesecker, 2009). It includes the following policy documents: US wetlands mitigation, US conservation banking, EU Natura 2000, Australia offset policies in New South Wales, Victoria, and Western Australia, and Brazilian industrial and forest offsets. Overlapping data is researched and correlated to policy goals which shows some similarity with this thesis project. Therefore, this document proved useful for the execution of the project. Relevant documents that are applicable for the project can be found in appendix 2. In the appendix, a list of articles can be found. These articles have been analyzed and used as background, however, as the articles cover mostly the same topic, these will not be summarized any further in this chapter.

Sub-question 1 is discussed on the next page, the inclusion of the question in the theoretical framework is done because question 1 requires solely literature research. The ultimate results of the question, however, has been included in the results chapter.

2.1 Peatland Ecosystem Services

Benefits of ecosystem services are progressively being recognized (Mitsch, 2000), ecosystem services have large positive benefits for any natural system, being peatlands or other systems. The following four categories are identified as main services provided by ecosystems: **provisioning services**, which are products obtained from ecosystems, like energy, food and transportation, **regulating services**, which include the benefits gathered from the regulation of ecosystem processes, including flood prevention, climate regulation and erosion control, **cultural services**, which are nonmaterial benefits focused on educational, recreational, heritage and spiritual values, and lastly **supporting services**, which are services necessary for the production of all other ecosystem services, like nutrient recycling and biological diversity maintenance (Millennium Ecosystem Assessment Board, 2003). The services of raised bogs are explained in subchapter 2.1.2.



The LIFE project lays its focus on a particular type of peatland, namely the raised bog, therefore, an explanation is in order. In this chapter, the ecosystem services of raised bogs will come to light. This will be done by providing an ecosystem analysis along with a SWOT analysis on raised bogs. Background information on the raised bogs can be found in the theoretical framework. Lastly, the role of conservation and restoration will be discussed. This chapter will be focused on answering the first sub research question; which ecosystem services are provided by the EU LIFE bogs? Background information on raised bogs can be found in appendix 3.

2.1.2 Raised Bog Ecosystem Services

Raised bogs provide many benefits. Since over 10,000 years ago, raised bogs have been unique landscapes with a broad biodiversity, making them invaluable wetland habitats. Especially in Ireland, raised bogs are of great importance, even playing part in the Irish culture and tradition (NPWS, 2015). They are often called Ireland's rain forest due to their importance for biodiversity, flood control and carbon emission control (Bonn, 2010). Many of the benefits, or services, provided by the raised bogs can be placed in the categories mentioned at the beginning of this chapter, being; provisioning services, regulating services, cultural services and supporting services, which is expanded in the following paragraph.

- **Provisioning services:** Literally a product that the bog provides. Examples of ecosystem obtained products are fresh water, peat, wood fuel and transport routes.
- **Regulating services:** This service is focused on the natural processes of a bog, including carbon sequestration, climate regulation, water purification, natural hazard regulation, contaminant removal and air quality regulation
- **Cultural services:** Examples of cultural services are recreation, aesthetics, cultural heritage, biodiversity, education and spiritual purposes.
- **Supporting services:** Supporting services need to be in order before any other service can take action. Services include nutrient cycling, soil formation and photosynthesis (Bonn, 2010).

Figure 4 shows the use of the bog named the "Raised Bog Ecosystem Functions". There is either the choice of peat extraction or letting the bog develop naturally. Obviously, this results in very different services or benefits, with the general outline of peat extraction being for economic purposes and leaving the bog alone aims for an ecologic approach.

The approach of peat extraction is one that has been done for many years during the history of peatlands. Peat was cut from the bogs and left to dry, this results in usable peat, referred to as 'turf', for domestic and industrial use. In the past, peat was mainly used to warm houses and other domestic purposes, while presently it is mainly used for power stations (Clarke, 2006). The power stations get its supply of peat from the state-owned company Bord na Móna, which is responsible for peat production. Next to peat, bog moss is extracted for the purpose of garden cultivation. Until relatively recently, peat extraction was the logical thing to do in case of raised bogs for the Irish (Irish Peatland Conservation Council, 2017).

Bogs and peatlands are able to capture and store carbon dioxide from the atmosphere, which fits in the regulating function of bogs. This is called carbon sequestration. Naturally, when peat is extracted for fuel purposes, this carbon dioxide is released into the atmosphere, which in its turn contributes to global warming (Gorham, 1991). When global warming became topical, the emissions of peatlands were investigated, this resulted in the knowledge present today which states that bogs and peatland are major stakes in carbon dioxide emissions. Even though bogs and peatlands cover only 3% of

the world's surface, they store 30% of the soil's carbon. This is twice as much carbon as all the forests in the world (Irish Peatland Conservation Council, 2017).

In case of a waterlogged, or flooded, bog, cultural values are also present. There have been many findings of items and bodies throughout waterlogged bogs. The aspect that the bogs are waterlogged, provides favorable conditions for the preservation of these items and bodies. This means that everything that has been found is in relatively good condition, even though it has been in the bog for hundreds of years. The history of Ireland is preserved in the bog. This also means that bogs are unique sources of information of past human activity, climate and vegetation. Bogs can also be utilized as leisure grounds, which gives opportunity for tourism and recreation. Naturally, this has to

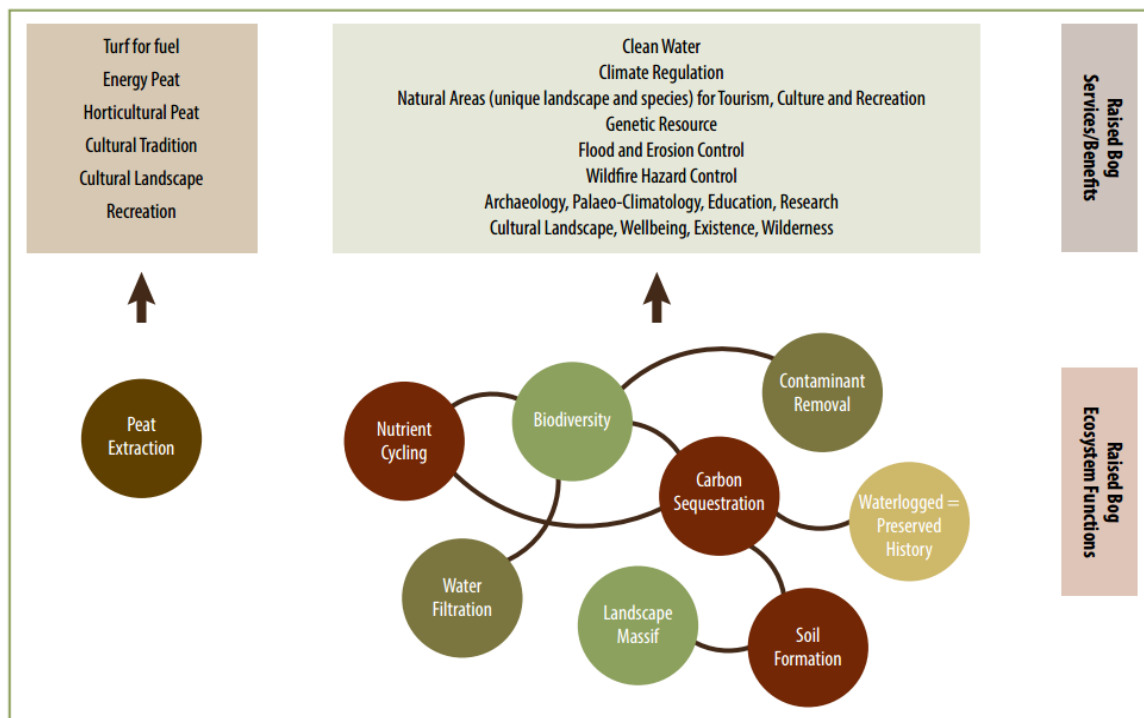


Figure 4: Raised bog benefits (National Parks & Wildlife Service, 2015)

be coordinated correctly in order to give the bog and its flora and fauna space to develop. Next to this, spiritual values also surround the bog providing a special place for some people (Bonn, 2010).

Flood and erosion control is also of great importance for Ireland. Raised bogs provide natural retention areas in case of high water levels within rivers nearby, overtopping of rivers is hereby largely mitigated (LIFE, 2016).

2.1.3 The Habitats Directive

An important directive in bog restoration, The Habitats Directive is an EU based directive, initiated in 1992, which focusses on the conservation of rare, threatened or endemic plants and animals. Many different types of habitat are targeted under this directive, including raised bogs. The goal of the directive is to maintain biodiversity without forgetting about economy, society, culture and regional requirements (European Commission, 1992). The EU Habitats Directive establishes the Natura 2000 network of protected areas which is against potential damaging developments in protected nature areas. In case of no compliance to the set rules and regulations of the Habitats Directive, the European Commission takes infringement action for failure to comply with EU law. All sites under the EU Habitats Directive are to be conserved and maintained in favorable conditions (NPWS, 2008).

2.1.4 Raised Bog Restoration

Now that the services and benefits of raised bogs have become clear, the importance to preserve them is undeniable. Drainage for the purpose of peat extraction has left much of the remaining bogs severely damaged, with, for some bogs, almost no way to restore themselves. For the Raised Bog LIFE project, tackling drainage problems is the main way of improving bogs and promoting restoration. Since bogs work best in waterlogged conditions, it is essential to keep water in the bog, the LIFE project aims to achieve this by implementing plastic or peat dams at problematic locations where water loss is large. The actual restoration of the bogs relies mostly on the natural restoration abilities of the bog, small, man-made, actions will attempt to set this in motion. Next to the implementation of the dams for infilling the drains, the following actions are taken; improvements to interfaces, removal of certain flora, fencing and walkway improvements, fire plans and amenity provision (LIFE, 2016). The aim is to recreate the hydrological and ecological conditions under which bog moss habitats will form new peat which will be able to sequester carbon. After the man-made actions, the bog can utilize its natural powers to, once again, fill up with water and begin the repair of its ecosystem.

2.1.5 Bogs As Mitigation Strategies For Climate Change

The importance of bog restoration has been briefly touched upon in the former subchapter. The many natural services it provides are invaluable, with examples like flood control, climate regulation, water regulation, nutrient cycling, water treatment, habitat creation and culture being major benefits from bogs. These natural forces also save large amounts of money when compared to executing similar, man-made, actions aimed to generate the same services, like chemical wastewater cleaning (Newell, 2016). These are all benefits that cannot be turned down. The most topical benefit of all is of course carbon sequestration, and with the global fight against climate change, bogs will turn out to be large factors that can either be saved and benefitted from, or they can be lost and cause major carbon dioxide releases which will accelerate the process of the climatic change the world is fighting against (Costanza, 1997).

This last service of bogs as carbon storage is globally the most important reason for conservation and restoration. Since recent years, this has become more and more present in Irish decision making and this will only increase in future years (Clarke, 2006). Important is that once nothing is done for the bogs, they deteriorate and will not come back. This means that action has to be taken quickly, so that the decline of bogs can gradually turn around and bogs can grow again.

Two subjects are incredibly important for the bogs, namely, the physical restoration, as discussed in this chapter, and conservation which focusses on rules and regulation. Both are equally as important, as without conservation, restoration will not be able to be executed efficiently on a large scale. Conservation will be elaborated upon in chapter 2.2 and chapter 4.2.

2.2 Bog Conservation in Ireland

There is a general thread throughout the history of raised bog conservation in Ireland which started out slowly around 1970, and accelerated after involvement of the EU Habitats Directive adopted in 1992. The perception of the urgency of raised bog conservation also started to develop after 1970 (Cross, 1990). With this, the effects of peat extraction also came to light. This beginning was the result of the European Conservation Year, which ended up being the first step toward bog restoration and conservation. The European Conservation Year was a yearlong campaign that alerted Europe on the importance of conserving and protecting the environment. The realization came too late for many of Ireland's raised bogs, however, it was just in time to save some of the wounded remainders. Out of these remainders, 53 of the most hopeful and



promising examples were designated as Special Areas of Conservation (SAC) and Natura 2000 areas under the EU Habitats Directive between 1997 and 2002. The Habitats Directive is explained in further detail in the next subchapter. These examples are being conserved and monitored, with the aim to revitalize the raised bogs and its characteristics. The twelve LIFE bogs originated from this group of 53. These twelve bogs were chosen by the governmental Department of Arts, Heritage & the Gaeltacht (DAHG) based on status and circumference, after which the raised bogs were appointed to the LIFE project (EU LIFE Team, 2016).

The introduction of this chapter already mentioned the SAC's, Natural Heritage Areas (NHA) also play a large role in bog conservation. For the raised bogs, most SAC's have seen a cease of peat extraction due to the "Cessation of Turf Cutting Scheme" introduced in 1999. In this cessation, turf cutters were given a ten year notice to cease turf cutting and plan out their new fuel supply. The ten years notice was determined to prevent abrupt changes which would have caused agitation among the turf cutters, as well as a governmental way on deciding how to manage SAC's (Irish Peatland Conservation Council, 2017). Out of the 128 designated raised bogs, 32 SAC's received the cease of turf cutting in 1999, 21 SAC's received the cease of turf cutting in 2002 and the remaining 75 NHA's received the cease of turf cutting in 2004, which was reconfigured in 2013 for 61 NHA's to be done with peat extraction in 2017. The cessation of turf cutting is only applicable to raised bog SAC's and NHA's, and blanket bogs are only included in cases where turf cutting is largely affecting the conservation value of the bog (Irish Peatland Conservation Council, 2017). The turf cutters who were active on the designated SAC sites received compensation for the cessation. The compensation was divided into three different options, drawn up by the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs. The following options were available, as quoted from the original compensation application forms (NPWS, 2017):

- *The first is a legal agreement for qualifying turf cutters who are signing up to the annual payment of €1,500, index-linked, for 15 years.*
- *The second is a relocation interim legal agreement for qualifying turf cutters who have expressed an interest in relocation but no relocation site is currently available for them to relocate to. This relocation interim legal agreement provides for the payment of €1,500, index-linked, or a supply of 15 tonnes of cut turf per annum, while these turf cutters are awaiting relocation to non-designated bogs.*
- *The third is a relocation final legal agreement. This agreement is for qualifying turf cutters where a site has been assessed as suitable for relocation and is ready, or can be made ready, for use for domestic turf cutting.*

These options provide roughly the option that land owners have, while option three is tied to some criteria. By 2013, over 2600 applications for compensations have been received, 2150 payments have been issued and almost 200 turf deliveries have been executed (Deenihan, 2013). The table of figure 5 shows the amount of cut turf in the history of Ireland. The approach of the cessation was, by many, perceived as abrupt, but it was completely necessary. Land owners still had ten years to cut turf, which resulted in even more damage to the already damaged bogs (Irish Peat Society, 2006). It quickly became clear that the Irish government could have handled the protection of the designated bogs in a better way (IFA, 2011). After the cessation, the government still lacked control over many designated conservation sites and land owners continued cutting turf after the cessation date was over. In many other cases where peat extraction sites turn into protected areas, land owners have received the compensation with much negativity. The concerns of many land owners are uncertainty about turbary rights, access to alternative fuel and its quality, property rights, not enough consultation, floods,

Year	Millions of tonnes per annum
18th century	5
19th century	5
1921	6
1926	6
1933	3
1941	5
1946	4
1950	3
1982	1
1995	1
2003	<1

Figure 5: Turf cutting in Ireland (Clarke, 2006)

afraid of not getting paid, fire hazard and insufficient compensation. Among these uncertainties, the most important reason for wanting to keep their land for many land owners is the historical and emotional value to the land (Convery, 2012). The continuance of turf cutting after the cessation period contributed to negative effects on the bog, while the SAC designation had a lot of potential of reviving many raised bogs. This revival, naturally, had to continue in order to see the raised bogs thrive again, but, to do this, the land owners had to stop cutting turf. Along with the public agitation in relation to bog conservation and the failing methods to do so, the European Union set up cases against Ireland for infringements of EU law. The Court of Justice of the European Union have threatened with fines in case the country does not carry out the mandatory conservation activities. Cases occurred in 1999 and in 2011, the following issues were claimed against Ireland, as noted in pages 34-35 of the National Peatland Strategy (National Parks & Wildlife Service, 2015):

- *Continued peat extraction on raised and blanket bog SACs and NHAs is causing negative environmental impacts and that the legal provisions in relation to protections under the Habitats and Environmental Impact Directives were not being applied in practice;*
- *Ireland is under an obligation to repair, or compensate for, the damaged to SAC habitats since sites were selected;*
- *The obligations under the Directive, and Irish regulations, to assess turf cutting were not applied in practice as a result of the non-statutory "derogation" for domestic turf cutting introduced in 1999;*
- *Ireland had never sought an exemption for continued cutting, for overriding public interest, in accordance with the Habitats Directive of 1992, (including the requirement to show that no alternatives existed or that compensatory measures could be taken); and*
- *Notwithstanding changes to Environmental Impact Assessment regulations in response to the 1999 judgment²⁶ of the European Court of Justice that Ireland is still not applying that Directive to peat extraction projects in Ireland in practice.*

After the cessation period, it could be implied that currently, no raised bog SAC's or NHA's have peat extraction activities going on. However, after a study launched by the Irish government in 2013, the "Raised Bog SAC Management Plan" and the "Raised Bog NHA Review" which included key decisions which mentioned that turf cutting is to be allowed on one raised bog SAC (O'Connell, 2014). But with the positive changes of peat extraction decline in mind, the natural restoration abilities of the raised bogs can work without disturbance, greatly enhancing the chance of successful restoration of active raised bog. The continuation of this topic is included in chapter 4.1.

2.3 Peatland Carbon Storage Capacity

An important reason for restoration of bogs is to maximally utilize the natural values of a bog. With these values comes the ability to store carbon. Only when the water levels of the bog are relatively high, can the carbon be stored in the peat. This process has been active for thousands of years and have declined by peat extraction.

The storage capacities of a bog are of major importance; the peatlands in the northern hemisphere store around 450 billion tons of carbon (Gorham, 1991). Raised bogs hold more carbon than blanket bogs and fens in most cases, and an average carbon rate of 0.7 tons per hectare per year is stored in undisturbed peatlands (Pearse, 1994). Irish peatlands are measured to store 1085 megatons of carbon, which is 53% of all soiled carbon in Ireland on only 16% of the land area. With peat extraction, 23 megatons of soil carbon has been lost between 1990 and 2000 (Irish Peatland Conservation Council, 2017).

2.4 Community Involvement

Academic research in Sweden concerning local participation in cultural landscape maintenance has shown many advantages about the use of local participation instead of top-down governmental approaches. The project includes farmers in decision making processes surrounding land management. The focus of the research lies on land-use policy, which makes it relatable to this thesis. The main outcomes of the research were the positive way of working together with farmers which provided good relations between farmers and government, inside knowledge of the area and local influence. Issues also came to light, like inflexible top-down directives that were in place surrounding land-use which prevented room for discussion and cooperation with outside actors. This provided hindrance towards the smooth partnership of government and public. The main conclusion of the research is that the importance of public support is great, community involvement provides this and thus often results in more favorable outcomes for most parties involved. Without the bottom-up approach, this support is not present, which results in some actors taking action and working against the project. The research report is very applicable to the Irish situation and will be used as background for community involvement (Stenseke, 2009).

2.5 Raised Bog Policy & Legislation

There are a number of policy and legislation pieces that have to be taken into account when initiating development in a raised bog, like setting up a boardwalk or implementing peat dams for drain blocking. These articles include limitations and subjects that need extra attention for the benefit of the environment. Policy and legislation applicable to raised bogs comes from several different levels, each with their own amount of influence and power on the activities on bogs. The levels of policy are regional, national, European and international. The European and international policy covers a lot of countries and therefore lacks in depth control over project sites, however, their decided goals still have to be met in order to prevent being fined. An example of this is the earlier mentioned EU Habitats Directive. In other words; even though the direct influence of these policy levels are limited, the possession of power and steering is very large. The International policy is dependent on the involvement of Ireland, this mainly means that the international policy consists of United Nations legislation regarding wetlands, climate change and biodiversity. Like the European policy, Ireland has agreed to the terms and thus has to comply with the set-up borders. National policy has a larger influence in raised bog management and has the responsibility to comply with the EU laws. This means that national policy is setup to urge bog developments to be executed in a responsible manner to avoid national fines by the EU Commission. Regulation surrounding landowner compensation and natural protection area designation is also included on the national level. The national level is responsible for the steering of the Irish raised bogs. An example of this is the National Peatland Strategy. Regional legislation depends on the aims of the correlating county. Heritage and development plans play a large role in this. The regional plans are catered to the higher levels and have, along with the national legislation, the most direct influence on the raised bogs in the area (Flood, 2017).

The European and International policy is all focused on the environment and the restoration of raised bogs, on the national level, most of the policy also aims to this matter, however, national and regional policy have possibilities to utilize bogs in other ways in case of non-protected bogs. The earlier mentioned attitude of the government towards restoration is a big factor in the land-use of the raised bogs of Ireland.

Out of the policy and legislation, the following documents are the most important for raised bog restoration and land-use because of the influence and consequences in case the rules are not followed, these require the most attention when developing on a raised bog: EU Habitats Directive, EU Water Framework Directive, National Peatlands Strategy, Natural Heritage Areas and County Development plans. Adhering to the Environmental

Impact Assessment (EIA) and the Environmental Protection Agency (EPA) is also of great importance. A full list of legislation and policy applicable to raised bogs can be seen at appendix 4. The figure has been drawn up by the Community Wetlands Forum.

2.6 Summary

This chapter has been focused on ecosystem services, restoration, conservation, community involvement and policy of raised bogs. The aim for chapter 2.1 was to provide background to answer the first research question; which ecosystem services are provided by the EU LIFE bogs. The results have been included in chapter 4.1. The entirety of the theoretical framework includes the main topics that are important for the background of the results and the thesis as a whole. Further conclusions on the basis of this framework have also been included in the results.

3. Method

The method is the way of collecting data. This is the way to answer the sub-questions and overall research question. The method goes into rather large detail, it focusses on the actual way of collecting data and analysis, which means the instruments and tools used for this. It also provides boundaries for the project, like the size or the amount of data that has to be collected.

This research is mostly based on literature research and observations. The reason for this is the availability of many national policy documents on land-use. A large part of the research is collecting these policy documents and reviewing them, therefore an extensive literature research has been conducted on topics of land ownership, bog restoration, bog conservation, land management, stakeholders and partnerships. Sources available to TCD have been used in this instance, as well as publicly available literature. The literature mainly consists of articles and reports, organizational websites have been included as well. Observations have also been made by on-site visits, in terms of gaining background information about bogs and experiencing being on a bog, the Clara and Abbeyleix bogs have been visited. These sites have been visited respectively on the 22nd of February and the 25th of May. The visits benefited the perception of the project areas, which has generated a clear image of the sites and understanding of the restoration urgency. Another useful method of collecting data is by conducting interviews, this has been focused on qualitative research. Meetings have been held with bog experts and groups in order to take in their perspective on raised bog restoration and the way the experts see the current progress of raised bog restoration. The following experts were interviewed and shared their experience and information about raised bog restoration:

- Former senior scientist at the National Parks & Wildlife Services, Jim Ryan on the 7th of April at Trinity College Dublin.
- Abbeyleix expert and major driver behind the Community Wetland Forum, Chris Uys on the 13th of April in Cloughjordan.

Next to the experts, the following groups have given insight in the developments surrounding bog restoration in early 2017:

- The EU LIFE team consisting of project manager Jack McGauley, ecologist William Crowley, hydrologist John Cody and public awareness manager Ronan Casey on the 16th of February and the 31st of May in Mullingar.
- The Community Wetlands Forum consisting of many bog experts and influential organizations on the 13th of April in Cloughjordan.

Questions asked mainly revolved around their perceptions of the developments of raised bogs in Ireland. This included restoration, conservation, their opinion on the process of bog protection; positive or negative, and their opinion on what should be changed in the current situation to enhance the future. Next to these questions, the bog experts and groups gave a lot of insight and information themselves surrounding the earlier mentioned topics, and gave examples and background on bog topics which greatly benefitted the background of this thesis.

The main challenges for the project have been the many policy documents with overlaps and the difference in stakeholder groups per bog site. Stakeholder participation is crucial for success in bog restoration, the different mentalities throughout different sites makes

this a broad research topic. After the first meeting with the LIFE team, the main conclusion regarding stakeholders is that some farmers are not willing to participate in interviews because of the sensitivity of the subject. Therefore experts and involved locals have been the main target, as stated before.

The tools for collecting the research data are the computer and a camera. For one, the computer is used for the literature research of the project, while the camera is used for observation. Results of interviews have been documented and results have been included in this report.

For the literature research, several sources have been looked at and used, until a clear image and idea for the areas was generated. Bog experts have also provided useful articles. For the observations, multiple pictures of the Clara bog have been taken on the 22nd of February, and of the Abbeyleix bog on 25th of May.

Furthermore, two of the twelve LIFE sites are examined in order to compare the areas on restoration and community involvement. These two sites are Clara Bog and Carrowmagappul Bog and were selected following advice from the LIFE team during the first meeting. The background of the LIFE project and the sites can be found in appendix 1. Land management plans have also been compared internationally to compare the Irish methods with the methods of The Netherlands.

For the finalization of this report, all outcomes of the researched articles, meetings and observations have been put together which form the results and conclusions.

3.1 Relevant Tools for Analysis

In this report, several tools and methods of processing data have been used. Among the tools is the SWOT analysis. The SWOT analysis proves useful in supporting the background of the project by analyzing strengths, weaknesses, opportunities and threats. The ecosystem services of raised bogs in chapter 4.1 has been analyzed in this way. Next to the SWOT, a stakeholder analysis has been executed. The way of illustrating the stakeholders and actors can be done in several ways, one of which is the following matrix. Figure 6 shows the matrix which divides stakeholder in terms of influence and interest. This can be very beneficial when trying to figure out which stakeholder to contact first and which to contact later in the process. The diagram can be created rather easily, but with great result. The content of the matrix can be changed to match the appropriate project.

Next to the stakeholder involvement matrix, it is necessary to find the corresponding functions of the stakeholders which helps determining which stakeholder to involve the most.

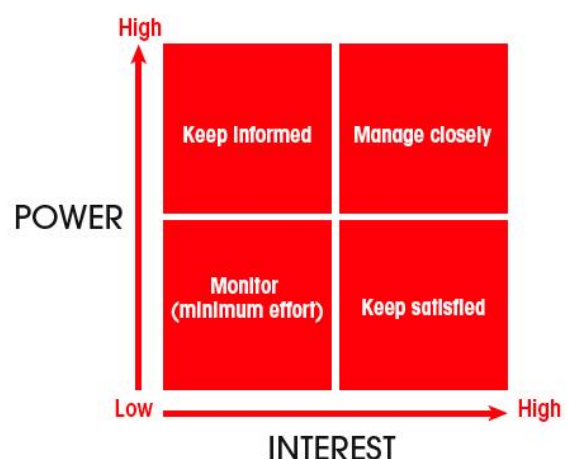


Figure 6: Stakeholder involvement matrix (World Heart Federation, 2017)

4. Results

The outcomes of the research surrounding this thesis are included in the results. This chapter is built around the five sub-questions. The following five subjects form the headlines of each sub-question; raised bog ecosystem services, peatland management, actor analysis, governmental perception of bogs and raised bog policy. Each of the following chapters starts with a compact introduction about the topic, and ends with a short conclusion which will later all be collected into the overall conclusion, and elaborated upon in the discussion and recommendations.

4.1 Raised Bog Ecosystem Services

Coming back to the data included in the theoretical framework about ecosystem services of raised bogs, it is very clear that raised bogs provide significant value through natural ecosystem services, however, there is a clear distinction between the ecosystem services of a raised bog that has been cut for peat, or a raised bog that has been left alone. Peat extraction has been the main ecosystem service in the past, now it is time to make the switch to the natural forces of the bog, which can provide services like water regulation, nutrient cycling and carbon sequestration (Bonn, 2010). The main ecosystem services provided in chapter 2.1 form the basis of this report, and are summed up on the next page in the SWOT analysis. Upon this background chapter, the report can continue. It will become clear that, as mentioned before, carbon storage will be one of the main focusses of the services of raised bogs. A SWOT analysis has been made on the topics of the first sub-question, raised bogs. This analysis focusses on the strengths, weaknesses, opportunities and strengths of the bogs and their systems. Since these topics have been covered in chapter 2.1, the SWOT analysis will function as conclusion of this subject. The SWOT analysis makes a distinction between positive and negative factors and internal and external effects. Internal focusses on the benefits and problems of the raised bogs, while the external effects focusses on the opportunities and threats that lie in the future.

	Positive	Negative
Internal	<u>STRENGTHS</u> <ul style="list-style-type: none"> • Water regulation • Habitat provisioning • Flood prevention • Climate regulation • Nutrient cycling • Water treatment • Recreational values • Carbon sequestration • Cultural values • Soil formation • Educational values 	<u>WEAKNESSES</u> <ul style="list-style-type: none"> • Turf cutting • Drainage • Water shortage • Land decline • Overexploitation • Diverse land ownership • Public awareness • Protection • Regulation
External	<u>OPPORTUNITIES</u> <ul style="list-style-type: none"> • Drain blocking • Land owner cooperation • Increase restoration • Increase conservation • Educate the public • Cooperate internationally to find solutions • Restoring bogs to former glory • Expand living area of flora and fauna • Expand protected natural areas 	<u>THREATS</u> <ul style="list-style-type: none"> • Time shortage • No cooperation • Damaged to the point of no return • Carbon release • Neglect • Continued peat extraction • Decline of flora and fauna • Decline in provisioning services • Decline in regulation services • Decline in supporting services • Decline in cultural services

4.2 Peatland Management in Ireland

Now that the importance and the qualities of raised bogs have been determined, it is time to evaluate the legal side behind the story. The aim of this chapter is to determine the current activities on raised bog lands in Ireland and to see what plans the country has made for the future. Next to the activities, the focus lies on the way of conservation and protection of peatlands. In order to put the Irish methods in perspective, its peatland management ways will be compared to land and water management in The Netherlands, where there is a long history in peatland management. This way, the strengths and weaknesses of the Irish methods will become clear, which gives insight in how to change for the better. Background information on bog conservation has been given in chapter 2.2 of the theoretical framework. The goal of this chapter is to clearly answer the second research question, which is: How do the Irish currently deal with peatland management?

The content of this chapter will be largely covered by the currently active peatland strategy (NPWS, 2015), which was developed following major governmental decisions in April 2011 related to conservation and management of Ireland's peatlands particularly aimed at sites designated as Special Areas of Conservation (SAC) and Natural Heritage Areas (NHA). The intention was drawn up in consultation with bog owners and other stakeholders, with the underlying intention to deal with long-term issues like restoration, carbon accounting, tourism potential, land management and development, conservation and community participation. The National Peatland Strategy focusses, as the name says, on all kinds of bogs, this means both raised bogs and blanket bogs. The goal of the strategy is to lead the way in terms of peatland management, and to give insight in the benefits delivered by peatlands (National Parks & Wildlife Service, 2015).

4.2.1 Dutch Involvement

The Netherlands is a big actor in terms of water and land management (Rijkswaterstaat, 2011). Like Ireland, The Netherlands used to possess a respectable amount of peatland. Due to turf cutting, however, the peatland declined quickly until 1974. It became clear that almost all of the country's peatlands had been overexploited due to hand- and machine turf cutting which left the peatlands damaged beyond repair. Only 8000 hectares of peatland remained in acceptable condition, which is only a small fraction of the original bog area. This resulted in the government setting up a five step plan *The Peatland Conservation Plan (1974)*. The price of the peatland restoration in The Netherlands is currently coming up to €100 million. The duration of the plan is 50 years and the following steps cover the headlines of the plan, as stated by the IPCC (Irish Peatland Conservation Council):

1. *Make an inventory of all the remaining peatlands.*
2. *Purchase the remaining peatlands.*
3. *Stop drainage and restore the peatland hydrology.*
4. *Draw up management plans for the peatland reserves.*
5. *Provide public relations materials and information about the Dutch peatland conservation plan.*

After gathering experience in peatland restoration through the plan, Dutch conservation experts came to Ireland after the leading example of a Dutch student in 1983. The Irish bogs clearly needed conservation and restoration, so the *Foundation for the Conservation of Irish Bogs* was set up. Through this foundation, the Dutch bought several peatlands in Ireland and gifted them to the Irish government with the purpose of conserving the bogs. These bogs were the Scragh Bog, Cumberagh River Bog and Cloghar na gCon Bog. Afterwards, an international governmental cooperation was founded between Ireland and The Netherlands which had great benefits for the conservation of the targeted Irish bogs (Woodworth, 2013). This allowed Dutch researchers to inspect and work in the bogs to gain knowledge and aid the restoration process. The international bond is still active to this day and is particularly helpful for exchanging information and techniques on bog restoration and conservation (Irish Peatland Conservation Council, 2017). Successfully

restored bogs in The Netherlands like the Bargerveen serve as examples that the Irish can learn from. The Bargerveen bog can be seen at Figure 7.



Figure 7: The restoring Bargerveen bog (Ministerie van Economische Zaken, 2017)

4.2.2 Natural Area Management

Now that the general guidelines of the Irish way of peatland management have been covered, it is worthwhile to compare this to the ways of other countries like The Netherlands. As stated before, Ireland is still busy with the time consuming process of turning regular bogs over into protected sites

where the natural qualities can thrive like before. The overall trend is that stakeholder and community participation is on the rise, but the largest stakeholders and project initiators still have most of the say in the management and development of land. This means that Ireland currently still leans towards the top-down approach of project management (National Parks & Wildlife Service, 2015). While Ireland is on its way to the bottom-up approach, there are still ways to accelerate the process. This can be done by looking at examples where management has been executed successfully. Case studies and pilot projects are perfect for this. This subchapter gives further insight in land- and water management, with comparisons between Ireland and The Netherlands.

Much of the initial steering in terms of land and water management, is done through the EU for both Ireland and the Netherlands. The EU sets up guidelines which every country must follow under the EU Habitats Directive (European Commission, 1992). The Dutch government has picked this up and showed initiative in conservation and restoration of nature areas, like wetlands, over the last decades. For the Dutch, there is not much choice but to work on these areas, especially in the coastal regions, as the top priority of the country is safety. With much of The Netherlands below sea-level, neglect of the coast would result in massive floods with countless damage and casualties. In other words, The Netherlands does not have a choice but to protect themselves. For the coastal regions, the country has adapted to risks (Rijkswaterstaat, 2011). In many parts of Ireland, there is not enough recognition of the importance of the conservation of the bogs (Clarke, 2006). Flooding is a relatively small danger when compared to the Netherlands, so there is no sense of urgency like the Dutch have in this matter. Even though, recently, recognition of bog qualities have increased, land-owners still see much of the bogs as potential turf. The sense of bog importance is essential to turn the tide and fuel the need for conservation and restoration.

According to the paper a research paper on peatland importance (Convery, 2012), The Irish Peatland Forum 2012 brought together 240 landowners, where their opinions could be stated to officials. All landowners possessed land which had the aim to be conserved. The fact that the forum was held because of European pressure instead of through own initiative of the government shows the unawareness of bog qualities. The EU Habitat Directive set up boundaries that every country must comply with, it is unfortunate that only after the influence of the EU, action was taken in this particular case, since the positive outcomes of projects like this are of great benefit to Ireland rather than the EU (Convery, 2012).

In terms of bog restoration and conservation, the first steps are the most difficult. Acquiring land ownership and designating the land are examples of subjects that can be improved upon. The overall management and restoration, however, are stories the Irish

have become adept at. After years of working together with Dutch researchers, exchanging information and data, and visiting the Bargerveen bog through the Dutch-Irish cooperation, The Irish have gathered large amounts of knowledge on the restoration techniques.

4.2.3 Conclusion

One of the main differences between The Netherlands and Ireland is the sense of urgency on the matters of conservation. Even though this sense has been on the rise in Ireland among the public and the government as can be seen from recent developments, there still is potential for improvement (C. Bullock, 2012). Ways of improving this have to be focused on involvement, which will be covered in chapter three. It is clear that the conservation and restoration of bogs in Ireland is still on the rise, while many bogs have been designated as SAC or NHA, there are still bogs with potential for restoration which have been left in bad condition. This matter requires recognition for the sake of the global environment and the national environment of Ireland. Currently, with the guidance of the EU Habitats Directive, the management of Ireland's peatlands is changing positively, but the Irish government itself will also have to make major efforts in order to keep up with the standards set by the EU Habitats Directive. Research on the restoration of bogs in Ireland has increased in recent years, particularly with the Dutch-Irish research programmes conducted in the 1990's, resulting in improved knowledge for restoration protocols and ultimately improvements in peatland conservation.

4.3 Actor Analysis

As briefly mentioned in earlier chapters, there is a large group of stakeholders and actors present in any management related to bogs. The raised LIFE bogs are no different in this matter. With bog conservation and restoration on the rise, conservation groups have come up over the latest years with an interest in the activities in and around the bogs. When in the past it was mainly the landowners or farmers, now, the wider public plays a large role as well. This chapter will cover the general actors and stakeholders in raised bogs. These will mainly consist of larger groups as to make it applicable to all twelve LIFE bogs. Next to this, stakeholder involvement will also play its part in this chapter as this subject is of great importance for the continuance of bog restoration and conservation. Community participation will be illustrated with the aid of successful examples that had positive consequences for its related situation. This chapter will aim to answer the following research question as best as possible: What are relevant stakeholders and their concerns in the restoration of the LIFE bogs?

4.3.1 Stakeholder Groups

Concerning the average raised bog, there are several groups that come to mind when thinking about stakeholders. Even though some may not have any direct influence in the development of the bogs, there are still parties that want to make their voices heard. These groups are the main topic for this subchapter in which information and interests of the groups is displayed. This gives an overall image of the influences that surround raised bogs in restoration and conservation. The stakeholder groups start off with the major organization of importance for raised bogs. After which, the public groups will be discussed. Their level of importance will be indicated by a stakeholder analysis matrix at the end of this subchapter. Importance and influence go hand in hand in this assessment. Firstly the groups will be described, after which the matrix will indicate the placement of the groups.

An Taisce

An Taisce is a non-governmental organization and a charity. The focus of An Taisce lies heavily on the preservation of the built and natural environment. Conservation of natural sites is the main concern of the group and work is focused on three subjects; advocacy which focusses on the promotion of the conservation of nature, biodiversity and built heritage, it focusses on properties which holds historic buildings and nature reserves, and it focuses on education in which it is a major player in the organization of environmental campaigns and programmes. The connection of An Taisce to raised bogs projects is obvious and their interests in this matter are clear; conservation and restoration of natural environment is the top priority (An Taisce, 2017).

Bord na Mona

Bord na mona is a semi-state company focused on the mechanized extraction of peat. Their main concern is providing economic benefit for Ireland. As mentioned in earlier chapters, Bord na Mona is responsible for large quantities of peatland loss over Ireland, however, the organization has adopted its techniques in recent years to cater to the raising environmental awareness of today's society. Bord na mona is a large stakeholder with €726 million total assets, it holds the ownership to large amounts of peatland in the country (Bord na Mona, 2016).

Coillte

Coillte is a state-sponsored company mainly focused on forestry. It holds 7% of Ireland's land, some of which, is raised bog. Coillte aims to execute forestry in a sustainable way where trees are replanted and overexploitation is prevented. As a major landowner, Coillte is an important stakeholder in the raised bog conservation (Coillte, 2017). Coillte have conducted two LIFE projects on raised bogs, mainly consisted of removing forestry.

Department of Arts, Heritage & the Gaeltacht (DAHG)

The department of Arts, Heritage & the Gaeltacht is a governmental body focused on the conservation, preservation and presentation of natural and built heritage. The department promotes sustainable ways of working and is therefore also involved in raised bogs. Since the department is derived from the Irish government, it has big voice and steering power over decision-making on Irish grounds. The department overlooks all activities in bogs and can be considered one of the most influential stakeholders (Department of Arts, Heritage & the Gaeltacht, 2017).

Environmental Protection Agency (EPA)

The Environmental Protection Agency (EPA) is a public body formed after the implementation of the Environmental Protection Agency Act in 1992. It focusses on environmental policy and protection. The EPA has multiple responsibilities, all for the benefit of the environment and the inhabitants of Ireland. Subjects the EPA cover are; environmental law, education, environmental monitoring and analyzing, environmental research development. The link to raised bogs is made through the EU Water Framework Directive which requires the EPA to protect the quality of water resources (European Commission, 2000). The protection of residents against hazards is also part of the tasks of the EPA. When combining this, the EPA strikes as an important stakeholder in raised bog conservation with an annual budget of €61.5 million (European Union, 2016)

Irish Farmers Association (IFA)

The Irish Farmers Association is a broad group that aids farmers in several different areas, among which, is a team that helps farmers deal with problems in SAC areas. This means that the association is a very useful stakeholder which has a large outreach towards the private landowners of raised bogs. The importance of the Irish Farmers Association is therefore great, as the private landowners need to be satisfied with developments in order to assure optimal conditions for restoration and conservation of bogs. A total of 73.000 members are involved and organized through branches, this is made up out of many different groups including farmers (IFA, 2016).

Irish Peatland Conservation Council (IPCC)

The Irish Peatland Conservation Council (IPCC) is a non-governmental charity organization with a specific focus on the conservation of bogs. Their main activities are fundraising in order to fund the restoration of bogs in Ireland. The IPCC is a large provider of knowledge when it comes to bogs, be it hydrology or policy. Education is important to the IPCC as this increases awareness of the situation of bogs in Ireland, a visitor's center at the Bog of Allen was opened to benefit this (Irish Peatland Conservation Council, 2017).

National Parks & Wildlife Service (NPWS)

One of the major tasks of the National Parks & Wildlife Service (NPWS) is to maintain and improve the ecosystems of Ireland's flora and fauna. SAC's and NHA's are also part of the work of NPWS, as it advises on the protection of certain species present in the designated sites. The NPWS is part of the governmental department of Arts, Heritage & the Gaeltacht, with an in-depth focus on the living systems of natural areas. NPWS is considered a major stakeholder in the development and rehabilitation of raised bog's ecosystems (National Parks & Wildlife Service, 2015).

Office of Public Works (OPW)

The last of the major organizations is the Office of Public Works. This is a governmental organization with a focus on flood risk management and heritage services. Like the other governmental organizations, the Office of Public Works has a large influence in the decision making related to bogs. Since their focus lies on flood risk management, research of the bogs has to be done which makes them a respectable stakeholder in eventual developments in the bog that may compromise safety boundaries (Office of Public Works, 2017).



Now that the major organizations have been covered, it is equally important to look at the smaller scale. Local groups may not always have a large amount of insight in bog conservation and restoration developments, however, their influence is strong. The following groups can be identified as local stakeholders.

Private landowners

Private landowners are one of the most influential stakeholders. This originates from the fact that these landowners can decide, what happens on their land. Land owners will receive compensation when their area is designated as a natural protection site. In this case, peat cutting is prevented from the landowners, however, this does not always result in an immediate stop (McDonald, 2012). Even in some cases, contrary to appropriate EU guidelines, landowners choose to ignore the boundaries, where the government does not have a suiting answer to. Overall it is important to keep landowners satisfied through compensation to ensure an optimal situation for the bog.

Research groups

Another group is a collection of different groups. These are the research groups that visit and investigate the bogs. Often, water levels, water flow and methane are measured. The research relates to the health and activities of the bog in relation to restoration and conservation of the bog. The research groups mostly are present in small numbers, and work in order to provide benefits to the bog. Institutions like Trinity College Dublin sends out experts to work on the bog and find out the trends and developments of the natural forces in the bog. These research groups often consist of universities with a combination of experts and students.

Locals

The final major group in the raised bogs LIFE projects is the public. Locals form a large voice when it comes to development of projects in their area. Sometimes, awareness of the subject is low, but, when this is enhanced, locals can really influence decision-making. The interest of this group is also high since the locals live in the area of the development and do not want to be negatively affected by the activities along the bog. Lastly, locals get to enjoy the qualities of the bog and spend time in nature, therefore, if the bog were to be damaged, this leisure time would not be possible.

On the next page, figure 8 is portrayed. This matrix includes the stakeholder groups relevant for the LIFE raised bog conservation project. In figure 8, the stakeholders have been placed in relation to their influence and interest in the conservation and restoration of bogs. Each stakeholder has been carefully analyzed and explained after which the placement in the matrix could be done. The matrix gives a clear overview of the amount of stakeholders, their identity and their influence and importance to the project. This can be used in case of stakeholder outreach; the matrix shows which stakeholders are the most important for the project, planning accordingly makes the matrix a useful tool. The main factors that have been taken into account in the creation of the matrix are the amount of land possession, organizational type, amount of participation in bog restoration and the involvement of each group. These have been acquired through the interviews with bog experts and involvement in restoration projects (National Parks & Wildlife Service, 2015).

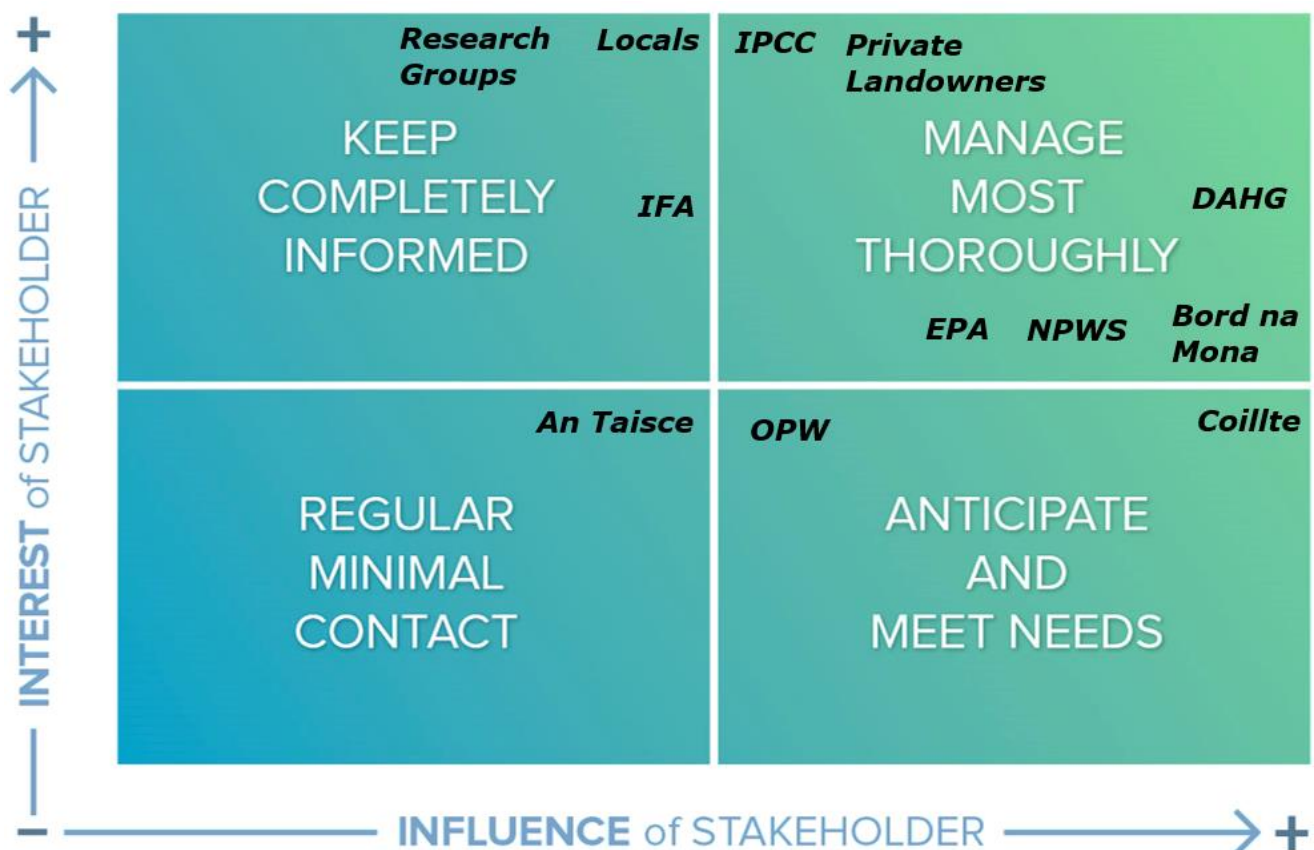


Figure 8: Stakeholder Analysis Matrix

4.3.2 Stakeholder Participation

In order to execute a project in a way that satisfies as many parties as possible, stakeholder participation is needed. When all decisions are made in a top-down approach, unrest can be caused and stakeholders can turn against the project due to lack of inclusion (Liedl, 2011). To prevent this, the ways of involving different stakeholders have to be analyzed before initiating developments. Realistically, not every stakeholder can be included as much as the other, as this will drive up the time too much resulting in slow development of the project. In order to decide which stakeholder needs the most attention, the Stakeholder Analysis Matrix from figure 8 can prove as a useful source of information. This clearly states that participation is essential, especially when dealing with the landowners in the project, like Coillte, Bord na Mona or private landowners. This subchapter focusses solely on the inclusion of stakeholders in the project process of raised bog restoration.

The Abbeyleix Bog has active community and stakeholder groups. Discussed in the interview with Abbeyleix expert Chris Uys, the main factor for the success of Abbeyleix is because of involvement and time. Stakeholders and the public were involved from the very start in 2000. After this, the groups were kept involved at each step which developed strong cooperation between the Abbeyleix Bog managers and the actors. This way of stakeholder participation has clearly payed off for Abbeyleix Bog and is a good example of stakeholder participation for other bogs.

For the larger organizations, stakeholder participation can be relatively easy when compared to private parties. In this particular case, bog conservation and restoration is in the interest of all of the groups, this means that the groups would want to stay informed on the developments in a bog. When, for example, a drain is blocked by a peat

dam with the purpose of bog restoration, many of the larger organization will need to voice their opinions on the action. Law and policy also plays a role in this in terms of the legality of the proposed actions. The most important aspect in the stakeholder participation of these larger groups is to get them together in a group in order to discuss the developments and to exchange ideas and opinions (Flood, 2017). This facilitates communication and creates insight in different ways of working. This method of coming together has great benefits over one on one interactions between groups, as information and data will not be distributed along every group, leaving some groups uninformed. When comparing the stakeholder involvement methods of Ireland and The Netherlands, there is a noticeable difference in the amount of communication between groups. In The Netherlands, group meetings and stakeholder participation are very large, in most cases, in the process of a project, there are many opportunities to sit together and exchange information. This is considered very beneficial in staying updated on the project and having a say in the decision making of the project (Organisation for economic co-operation and development, 1998). Even though this is positive, sometimes this can be overdone in terms of the amount of times that meetings are being held. It is essential to find the balance between too little involvement and too much involvement, since too little will limit exchange of information and ideas, and too much involvement will unnecessarily extend the duration of the project. But, when comparing this to Ireland, the amount of stakeholder participation groups is noticeably less (Clarke, 2006). This has to receive more attention because of its many benefits for the development of raised bogs. There are, however, groups coming up in Ireland with the focus on connecting bogs and exchanging data and information with the purpose of learning from each other (Flood, 2017).

An example of a group that works together for the benefits of bog conservation and restoration is the Community Wetlands Forum (CWF). CWF is a group consisting of representatives of different wetlands throughout Ireland. The network is a means to combine bogs into one system from which ideas and data can be shared. The following infographic shows the general circumference of the CWF.

After attending one of the meetings of the CWF, it was very clear that the concept of the network works very well and that groups like CWF deserve a lot more recognition than they currently receive. Meetings of the CWF are held at a different wetland each time in which the host guides the CWF members through the wetland and shares its recent developments. Other wetland representatives can learn from mistakes and pick up on suggestions through this. Important to know is that CWF is run by volunteers, attendance is optional which leaves the most enthusiastic group. This group is keen to conserve the wetlands and educate the public on developments in the field of conservation and restoration.

Private parties can prove to be more difficult to involve. When trying to involve locals, the project and intentions of the development must be made clear in order to keep the locals updated on the matter at hand. Education is key in this. After this, locals must be included as much as possible, not only because of their interest in the project area, but also because of the knowledge locals have on the location. Many



Figure 9: CWF Infographic (Community Wetlands Forum, 2017)

locals can provide information on the culture and history of the bog in this case. This data can prove to be helpful and is important to keep in mind when making decisions on the future of the bog. Again, a network group like CWF includes locals who are willing to participate and provide local knowledge of the area.

Generally, the same applies to private landowners. Landowners have the most knowledge of their land out of all groups and can be a very powerful aid in the continuation of bog conservation and restoration. The private landowners, however, need extra management, as it is their land which is developed. Next to inclusion in working groups like the CWF, the landowners have to agree on developments in the bog. In the past, it has become clear that occasionally, landowners react negatively to developments. For instance, when their bog becomes designated as SAC or NHA, their normal activities may change. Especially for turf cutters, this has to be dealt with in a cautious matter, since as many stakeholders as possible need to be satisfied with the proposed strategies. The matter of unsatisfied landowners has been mentioned before in chapter 2.2. In order to prevent unrest between stakeholders, some matters have to be attended to. In the case of private landowners, the following actions can be very beneficial for bog development, since landowners have had disagreements in these areas; improving communication by setting up implementation plans to cater to the demands of the EU Habitats Directive (Convery, 2012) set up a team with the sole focus to gather property rights, with this, appoint an expert per bog who helps landowners in their decision making in terms of what to do with the owned land. One on one cooperation is very important in case of private landowners.

4.3.3 Community Involvement

Community involvement is of great importance for the development of raised bogs (Selman, 2004). Background information on community involvement is included in chapter 2.4. More recognition means more attention for raised bogs which can be a tool to accelerate the motion of the need for bog conservation and restoration in Ireland (EU LIFE Programme, 2017). The involvement of locals in the activities in and around a project is beneficial for both the project and the locals. Locals get the feeling their opinion matters and that they are included in the process. This improves the atmosphere which makes the development on the project smoother and results in less disturbance. Ways of involving the public will be provided in the following paragraphs.

The main focus of community involvement is often on education, awareness creation, recognition and promotion. An example of successful community involvement in The Netherlands is that of a yearly coastal defense competition on five coastal locations organized by the dredging company Van Oord. Van Oord provides a sponsorship policy to provide back to the public in which the company is active. Working together with locals is of great importance for Van Oord. The company funds the annual competition "Battle of the Beach" where around 1300 children from elementary school attempt to build a sandcastle with a surrounding wall to keep the tide from coming in (Ons Water, 2017). The team with the last standing castle wins the competition. The competition is a large success among the children and educates the group as well. The theme of the event is to create awareness among young students about the risks of water and the importance of the defense of the coast. The event also receives publicity which aids the educational outreach even further. An event like this, adapted to a bog, can be very beneficial for the distribution of awareness on bog conservation and restoration.



Figure 10: Battle of the Beach by Van Oord (Hoogheemraadschap van Rijnland, 2016)

A good example of community involvement in Ireland was the event at the Abbeylax bog, organized by the CWF on May 25th 2017. This event was a celebration of the release of their strategic plan and national biodiversity week. The president of Ireland, Mr. Michael D. Higgins, attended the event and gave a speech on his perspectives of the environment and the importance of bog conservation. Naturally, the presence of the president attracted a large crowd which is very important for the exposure of the CWF. Along with children from local schools, small projects were executed on the subjects of ecosystems, flora and fauna of the Abbeylax bog. The event also provided larger organization to hand out information and communicate with the locals of the area. The event resulted in a successful day with an abundance of education, promotion and recognition of raised bogs. The awareness of the importance of bogs was also a major topic of the event which was strengthened by the projects of the children. The day ended with a walk over the boardwalk of the bog with the president as can be seen at figure 11. The Abbeylax bog has seen multiple forms of successful community involvement. An example of this is the boardwalk of figure 11, this had been built by local volunteers after the timber had been donated to the bog. There is a clear conclusion in this; community involvement is essential for the development of a bog. Other areas can learn from the Abbeylax bog and the approach of the CWF.



Figure 11: President Mr. Michael D. Higgins visits Abbeylax bog (CWF, 2017)

4.3.4 Conclusion

As can be concluded from this chapter, working together with stakeholders and community groups is essential for the development of bogs. Groups like the CWF are very important for the protection of bogs and need to get more recognition for their activities. Lastly, like the examples portrayed, community involvement provides possibilities for recognition, promotion, awareness and education can be major drivers for success in the continuity of bog preservation. When these topics are in order, the road towards a conserved, rehabilitating bog is closer than ever.

4.4 Governmental Bog Perception

Following the identification of the key stakeholders in chapter 4.3, the perception of the Irish government on raised bog restoration will be examined. This includes the way of dealing with bogs: from bog restoration to conservation. Their positive or negative attitude towards bogs will also be included. Answers to these topics result from several interviews with bog experts regarding the government's way of involvement in the restoration of bogs. Next to this, two of the twelve LIFE bogs will be analyzed; the Clara bog and the Carrownagappul bog. The analysis will include background information on the bogs and each individual way of raised bog management. The research question tied to this chapter is as follows: How do governmental bodies perceive bog restoration and are there differences with regards to management between the different LIFE bogs?

4.4.1 Bogs from Different Perspectives

Even though the recognition of the urge for bog protection is changing for the better, there have been times in the past where this was not the case. As discussed in chapter 2.2, the need for conservation and restoration was only really recognized since relatively recently. The governmental body responsible for this, the Department of Arts, Heritage & the Gaeltacht, has been working actively to conserve natural ecosystems in Ireland, however, there are multiple projects and processes going on in and around the bogs of Ireland which makes close management for each bog a hard task. The sheer amount of bogs and other natural heritage sites are difficult to keep track off and this is noticeable in the way of response of the government (Convery, 2012).

Governmental participation is essential for the development of local bogs. In terms of network groups, governmental support is also needed for the purpose of funding. The government also often has the last say in certain developments which empowers the need for their participation. Bog conservation groups like the CWF provide added value to the areas which helps the government to stay inside the boundaries of the EU Habitats Directive. This saves the government large amounts of money since there are fines applicable to countries who ignore the agreed upon rules of the EU (European Commission, 1992). Therefore, the government is economically better off by supporting bog conservation and restoration groups with funding, this approach also improves the situation for Ireland's bogs. Non-governmental organizations and bog protection groups recognize the importance of the government and work together with each other. This, however, does not always go as well as it should go, since, especially in the past, there have been multiple complaints about the methods of the government.

Over the period of this thesis report, multiple meetings were held with bog experts; the first being with Jim Ryan; a retired senior scientist at the NPWS, then with Chris Uys; involved in the Abbeyleix bog project, major actor in the CWF and organizer of the Abbeyleix event attended by the president. Lastly a meeting of the Community Wetland Forum was attended in which multiple opinions of bog experts were voiced. The meetings mainly consisted of gathering different opinions on the current state of bog conservation, restoration and bottlenecks in this process. A clear trend among the answers was the involvement of government in the work processes and the amount of support received from this. It was still the case that, aside from positive changes, government is not involving itself enough in most cases. Main concerns were the slow decision making and answering of questions, along with not recognizing the problems at hand in the different bogs. Outreach for support takes too long; these are all topics for improvement even though the ways of the government have improved massively when compared to the past. The priorities of the government concerning peatlands has changes for the better but communication can be improved upon. The recent visits of the president to nature related sites for the biodiversity week has been beneficial for the awareness of bog protection and should motivate the DAHG to focus extra attention to the protection rather than the utilization of bogs.

In 2011, illegal turf cutting occurred on raised bogs designated under the EU Habitats Directive. The government only recognized and took action after the minister at the time was urged by the IPCC to take action in order to prevent fines filed by the European Commission (McDonald, 2012). Visitors of the bogs also claimed to stop visiting the bog as long as no action was being taken. Since 2014, the minister of the DAHG has changed, Heather Humphreys, the new minister, focusses largely on unrest among turf cutters in designated conservation zones. Even though Minister Humphreys aims to follow EU Habitats Directive guidelines, she published legislation including the de-designation of 39 raised bog NHA's and the part de-designation of 7 raised bog NHA's. The de-designation will allow turf cutters to cut again where this was previously prohibited. As compensation, the minister has appointed 25 publicly owned bogs to be designated as protected habitats (Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, 2016). While this measure is claimed to have 2500 fewer active turf cutting plots, many actors do not agree with the decision. The compensation of turf cutters is often the problem in this, when this is in order, the dissatisfaction of turf cutters in designated areas will subside.

4.4.2 LIFE Bogs Analysis

After agreement with the LIFE project team, Clara bog and Carrowmagappul bog were chosen to be analyzed on the current management of the bogs. Differences between the two sites will become clear and will determine if raised bog protection approaches can be applied to all LIFE projects, or need to be catered to each individual site. Next to background information on the bogs, restoration of the bogs will also come to light, in which, drain management plays a large role in terms of drain blocking for the rehabilitation of raised bogs. Maps of the drainage patterns for each bogs will be included for the purpose of aiding the restoration works. This analysis only focusses on the main topics surrounding the raised bogs due to limited access to data concerning Carrowmagappul.



Figure 12: LIFE bog locations (Gatewayabroad, 2017)

CLARA BOG			
County	Offaly	Ownership	State-owned (NPWS/DHARRGA)
Background	Clara bog is one of the most important raised bogs in the country, and is one of the few examples of a relatively intact raised bog. With a size of 840 hectares, Clara bog is 2 kilometers south of Clara Village, which is a source of visitors for the raised bog. Clara bog is protected under several designations including National Nature Reserve, SAC, NHA and Ramsar Wetland Site. The SAC designation happened in 1995.		
Restoration	Implementation of peat dams and plastic dams on drains that require blocking. Research is being done on Clara bog in order to determine drainage flows and to find out where drains must be blocked. General drainage patterns have been found and can be seen at figure 13.		
Community	Clara bog has a lot of partnerships going, being with communities and agencies. A visitor's center is also present in Clara, here, the public can learn about the bog and its qualities. Boardwalks have been implemented to provide access to the bog. Clara has an active community and the management of the bog has a healthy balance of outside influences like locals (NPWS, 2016).		

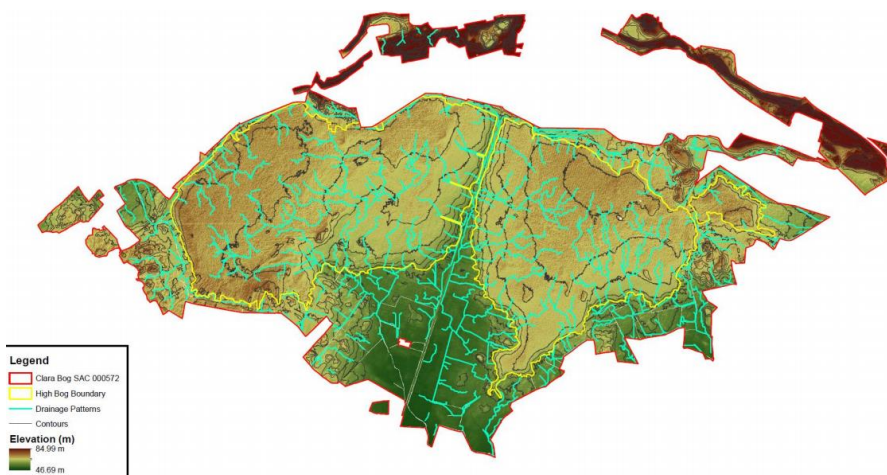


Figure 13: Clara bog drainage patterns (NPWS, 2016)

CARROWNAGAPPUL BOG			
County	Galway	Ownership	NPWS
Background	Carrownagappul Bog is a 487 hectares raised bog located 3 km from Mount Bellew. Several bog tracks and drains reach into the heart of the site. The site was heavily cut for peat, but there is still a large amount of uncut high bog present. The site has been a Special Area of Conservation (SAC) since 1995.		
Restoration	Restoration of the Carrownagappul bog will be focused on drain blocking for the rehabilitation of the bog. This can be managed the same way as Clara bog; peat dam and plastic dam implementations. Peatland cutting has been going on until relatively recently, especially among the borders of the bog.		
Community	Next to the partnership with the LIFE team and the local community, the outreach of Carrownagappul is limited (NPWS, 2015).		

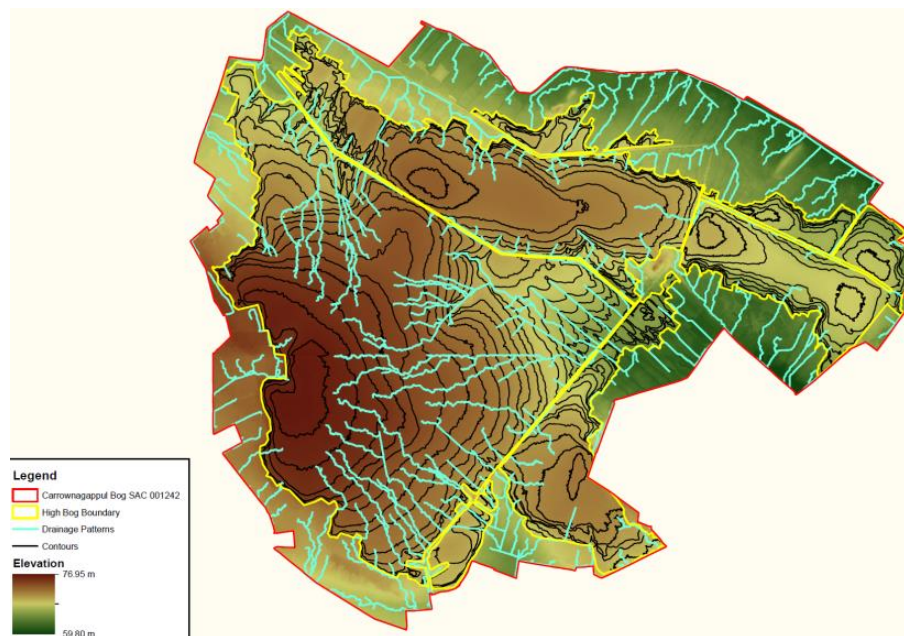


Figure 14: Carrownagappul bog drainage patterns (NPWS, 2015)

The management ways of the bogs are relatively similar. However, activity levels differ; Clara bog has an active community with several communities and agencies. There has also been the development of the Clara bog visitor's center, which attracts visitors and educates them on the bog and its values, and the implementation of a boardwalk on the bog. Along with this, a website for Clara bog has been set up, connecting the site with the rest of the world. Clara bog is also one of the bogs participating in the Community Wetlands Forum. Aspects like this are relatively limited in Carrownagappul. There are still people in Carrownagappul that want to cut turf, while this has been phased out in Clara. This complicates restoration objectives and management under the Life project for Carrownagappul. Carrownagappul bog is not known to have a great outreach to the public, with no boardwalks or visitor's center. Carrownagappul bog's activities are severely limited when compared to Clara. Due to the lack of outreach, management in Carrownagappul seems one-sided (NPWS, 2015), while the active bog of Clara can be sure to receive several different points through partnerships in case of new developments. The management of Clara bog is therefore executed in a bottom-up matter, which greatly satisfies the actors involved in and around the bog of Clara (EU LIFE programme, 2017).

4.4.3 Conclusion

Governmental involvement has had beneficial changes over the recent years. With projects like LIFE, bogs in general get recognition for their natural values to Ireland. Along with this, the government has agreed upon the EU Habitats Directive's guidelines, which it is required to follow. While the interest of the government in local developments is still relatively limited due to the sheer numbers of projects, attention is on the rise because of events like biodiversity week. Community groups are aiding the connection of stakeholder groups involved in bog development with the public and the Irish government. It can be concluded on the basis of the meetings and previously referenced articles that the governmental perception of bogs is improving by the year, as global trends promote the environmentally friendly development of nature sites, including bogs. This development almost leaves the Irish government with no choice but to keep transferring bogs into designated protection areas. The way of management on designated sites can hereby improve through cooperation with the public.

4.5 Raised Bog Policy

The final research topic is the review of different ways of utilizing drains in raised bogs. Next to that, the collection of policy and legislation present in surrounding raised bogs and development of raised bogs is important for this topic. This has been covered in chapter 2.5. The policy documents in chapter 2.5 have been categorized on their level of applicability. Lastly, a plan for raised bog restoration will be included, this holds the steps from beginning to end and which subject to take into account when initiating a restoration development on a bog, like drain blocking.

The last research question to be answered in this chapter is the following: What are the most important steps to be taken in the process of bog restoration according to the relevant policy documents?

4.5.1 Raised Bog Land Management

As mentioned in chapter 2.1, there are multiple ways of restoring raised bogs. The occurrence of restoration depends entirely on the ownership and designation of the land. For the LIFE raised bogs, the obvious measure is the restoration of the bogs to restore the raised bog and re-wet peat to aid the growth process. This road is the only logical one for the LIFE bogs, as all of the bogs have been designated as SAC and have the obligation to comply with EU law which encourages bog conservation and restoration (European Commission, 1992). But, different groups have different intentions, especially when it comes to drain management of raised bogs. Restoration parties like LIFE aim to block drains with plastic- or peat dams in order to set the natural processes of the bog in motion which heals itself over time. But parties like the Office of Public Works are focused on the water safety of inhabitants of Ireland. The OPW ensures safety against flooding throughout the country, naturally, this also applies to bogs. In terms of drainage, OPW aims to keep the situation safe and manageable which restricts the blockage of drains (Office of Public Works, 2017). Therefore studies have to be executed to ensure the safety of surrounding areas outside raised bogs in order to initiate safe drain blocking without flood consequences. Many of the landowners who are farmers also have an opinion on drain management. Farmers are against the blockage of drains, the group even deepens the drains in undesignated areas to gather drainage water for crops, drying out the bog. Next to this, farmers also drain the bog for its peat. In the cases where this is legal, peat extraction and bog drainage has to be done with moderation to prevent the bog from reaching the point of no return in terms of restoration. These three mentioned groups have strong preferences for bog usage, while other groups like the public can have mixed preferences.

An example of a bog with the aim for restoration, but with the need for flood risk management is the earlier mentioned Dutch bog, The Bargerveen. In the Bargerveen, restoration has been successful (European Commission, 2006). Through the Dutch-Irish partnership, several Irish bog experts have travelled to the Bargerveen bog in order to learn from and spread the success of the raised bog restoration. The process of restoration in the Bargerveen and the problems encountered on the way are highly beneficial for other restoration projects of raised bogs, since other projects can learn from mistakes that were made. The Bargerveen bog encountered difficulties in the early 1990s because of lack of surface water control and low groundwater levels (H. Bressers, 2010). After this, approximately 40 kilometers of peat dams had been built to block drains and control the water in the bog. But, after heavy rainfall in 1998, the area became a hazard as the peat dams trapped the water in the area and eventually inundating the peat dams, threatening a nearby village. After this, land-use re-ordering was proposed which required ministry approval. The proposed solution involved creating a new dike and water retention areas within the Bargerveen, which aimed to stimulate peat growth and to stabilize water levels. The plans were of great importance for the area, as flood risk decreased, and the retention areas were supplied with clean, cheap

fresh water by the bog. The many positive effects motivated the EU to fund part of the development (H. Bressers, 2010).

The Bargerveen example combines the objectives of OPW and restoration in Irish raised bogs; drains were blocked while flood risk decreased, satisfying both parties. For farmers, retention area water can be used on crops, however, peat cannot be cut. Therefore, farmers and landowners of raised bogs deserve compensation in case of turbary rights possession for the cease of turf cutting. This compensation has to be improved to cater to the needs of the landowners, as explained in chapter 4.3.2.

4.5.2 Raised Bog Restoration Process

This subchapter includes the steps to be taken when restoration plans are being developed for a raised bog. The focus of this is on the restoration part of the sub-question, as the policy has been examined in earlier chapters. The steps include both policy and planning steps, as well as, restoration methods. The goal of the steps are to give an overview of the process from damaged raised bog to restored raised bog. The steps are given in the following figure to aid the visibility of the process.



The steps have been inspired by the methods of adaptive management, which includes the aspects of figure 15. The cycle gives a general image of the ways of adaptive management, which is based around planning, executing and monitoring, and is important for a successful execution of land development, being raised bog or other natural areas. Overall, the management and restoration of raised bogs depend heavily on the conservation status of the specific bog. When designated under the Special Areas of Conservation, or the Natural Heritage areas, successful restoration is much more likely when compared to a raised bog privately owned by turf cutters. Therefore ownership is an important factor in the initiation of raised bog restoration.

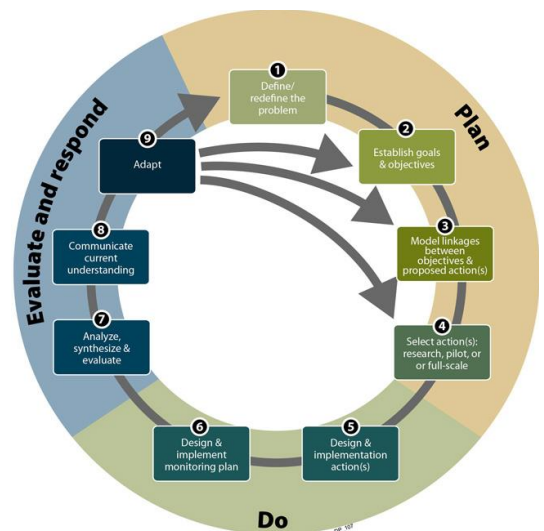


Figure 15: Adaptive management framework (CDFW, 2017)

4.5.3 Conclusion

Overall it can be concluded that the amount of policy and legislation surrounding raised bogs and the development in and around raised bogs is relatively high. Different levels provide different policy which requires extra attention and expertise. This makes especially the beginning phase of bog restoration a difficult task. A list with steps can aid with the process, however, policy experts may need to be included in the process to ensure the correct way of development without disturbing any special flora or fauna in the area. For projects like LIFE, a general baseline document including the most important factors of present legislation has been made with information on the raised bogs restrictions for restoration. This should at least include the European and National levels of legislation and can greatly benefit bog restoration. This can also help the development of the bogs without receiving fines for violation of rules due to clear outlines. The difference in bog management as discussed in chapter 4.5.1 is also vital for bog restoration, as restrictions on drain blocking and deepening of drains generate risks for the health of the bog.

5. Discussion

This report has analyzed the importance of raised bog ecosystems and the key elements that must be considered in peatland management. Whilst the concept of ecosystem services has helped improve awareness for the conservation and restoration of raised bogs in Ireland, and elsewhere, the current situation of bog conservation is still not desirable. However, the onset of project such as a current EU funded LIFE project of twelve SAC raised bogs, is helping to improve the situation. A comparison with peatland management in The Netherlands, who have a long history of drain management and restoration, indicates that while improvements have been made in Ireland, national governmental methods tend to lean towards the top-down approach, which is the opposite approach to that in The Netherlands in most cases and has hampered public and community engagement, imperative for successful management.

Following this, one of the aims of the project was to understand the mechanisms of societal engagement in the context of deciphering frameworks for peatland management. To this end, an attempt was made to liaise with local stakeholders and landowners, potentially affected by peatland restoration works, about their opinions on bog restoration. However, contrary to expectations, most landowners are not willing to talk, especially to government officials. This resulted in a change of the interviews towards bog experts involved in peatland restoration, both from scientific and management perspectives. This study has given light to many subjects surrounding raised bog restorations, making the report relatively broad. Therefore, it can be concluded that this report is usable as baseline study on which further research is possible.

The key findings of this thesis are the answers to the sub-questions in the results. This included the undeniable values of raised bog ecosystem services and the need to conserve these. Along with biodiversity, carbon sequestration is of great importance on a large scale. Next to the ecosystem services, it became clear that the urgency on the matter of conservation is not as high as preferable. Though, this trend is rising, there is still potential for improvement. This has to be done through active involvement of stakeholders. This process is not being done nearly enough as it should and it would have benefits for the success of restoration projects, promotion and education are key in this. The inclusion of stakeholders, particularly those at the community level, is especially essential in land management as stakeholders often possess useful information regarding the background of the land. Lastly, the policy and legislation has to be made available in one document on National and European level including the key boundaries of each legislation. Currently this amount is high and slows down the restoration process due to the many underlying policy. This would also help communicate why restoration of peatlands is incentivized in EU level legislation frameworks, to local stakeholder, as this is often seen as the reason for the conflict between top-down and bottom-up approaches to management.

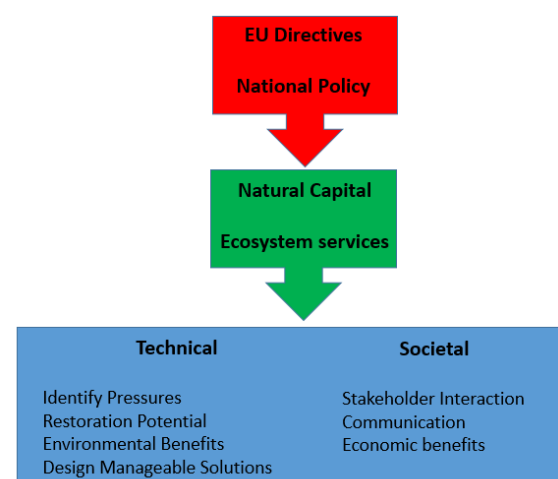


Figure 16: Outline Restoration Framework

There is conflict in drain management as different bodies want to maintain or restore drains, for different reasons. The stakeholder interaction and approach in management would help focus the levels at which different groups must carry out restoration. With the results combined, the research question is answered, which is: How can a framework for bog restoration be realized while focusing on drain management?

The main elements of peatland restoration play a large role in this. The elements of the framework have been collected through the sub-questions, only application and further development of a framework has to be done to improve the bog restoration process. The elements of the framework are visible in figure 16.

It is heavily recommended to continue this research with an in-depth study into the development of a framework for bog restorations. This should include the most important boundaries of the legislation and policy applicable to raised bogs. The list of the documents can be gathered from this report, however, analyzation of the policy has to be done in greater detail. A broad framework could benefit the growth of raised bogs in Ireland, this development will be welcomed both globally and nationally due to the qualities of the bogs.

6. Conclusion & Recommendations

Raised bogs are a magnificent part of the Irish landscape, providing unique ecosystem services and a habitat for flora & fauna. The ecosystem services provided by raised bogs are beneficial on global level, as well as on national and regional level. Services like flood prevention, climate control, education, culture, recreation and nutrient cycling all make raised bogs worth protecting. Out of this, arguably the most important service is the carbon sequestration. Release of carbon has negative effects on the environment and on the ongoing topic of climate change. It can be concluded that raised bogs need to be conserved to allow these natural benefits to work optimally. Peat extraction degrades the bog and has to be prevented. The Irish government is slowly making the move of designating more raised bogs as SAC or NHA, however, to optimize results of the natural processes of bogs, more have to be protected.

Bog restoration and conservation is being executed on the LIFE project raised bogs. Restoration is mainly done by blocking drains; water is trapped inside the bog and builds up, this re-wets the peat which initiates the growth process of the bog. Drain blockings are done by either peat dams or plastic dams. Conservation is possible when landowners of the bog stop cutting peat. Ownership is one of the main priorities when initiating a restoration project, but this is not always easy to achieve. Private landowners often value the bog they own because of culture and history. They are not always willing to give up a tradition that has been in the family for decades. Compensation helps the landowners to stop cutting peat or relocate to a non-protected bog. However, the compensation package is often considered insufficient, and some landowners continue to cut peat. Increasing the compensation package as well as increasing the penalty for illegal bog cutting will improve the chances of this policy succeeding.

Stakeholder involvement in bog restoration is an incredibly important topic. In The Netherlands, many projects are being executed with partnerships between stakeholders for the entire duration of the process. Stakeholders are given the ability to put in ideas which improves the quality of the project. In Ireland, this concept seems to be present in some cases, but in nearly enough cases. Even though this trend is changing in a positive direction, the approach in raised bog restoration is still leaning towards top-down, while a bottom-up approach would result in higher quality and satisfaction among stakeholders. Groups like the CWF are examples of how this should be done; connection is key. The local community should also play a larger role in decision making of local bogs, as they often possess valuable historical insight in the development of the bog.

When initiating a bog restoration project, more attention should go to reviewing similar, successful cases in which bog conservation and restoration had positive effects on the area. An example of this is the Bargerveen bog in the Netherlands. Examples like this can prove to be extremely useful as most of the information is applicable to other raised bogs. The policy analysis made clear that the network of international, European, national and regional levels of legislation and policy are all to be taken into account when developing a raised bog. The amount of this can result in confusion and is very time consuming. Therefore, further development of the framework for bog restoration needs to be done. This would contain background information on the bog, restoration techniques, conservation, stakeholder participation, community involvement and the most important aspects of the relevant policy documents which have to be adhered to. A guideline of all applicable National and European policy would also greatly benefit bog restoration. This report contains much of the information and serves as a collection of data applicable to raised bog developments.

Many people can agree on the qualities and beauty of raised bogs in Ireland. The values and services it provides are invaluable to the inhabitants of the country. Any more loss of raised bogs would be a tragedy, this should be prevented. This report supports this statement and promotes major actions in restoration and conservation of raised bogs.

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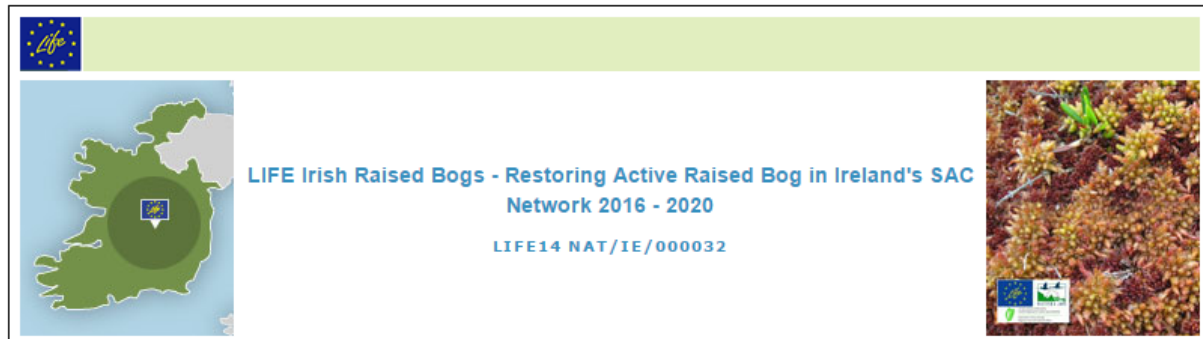
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Appendices

The following appendices have been used in order to aid the project.

Appendix 1: LIFE Project Background



[PROJECT DESCRIPTION](#)

[ENVIRONMENTAL ISSUES](#)

[BENEFICIARIES](#)

[ADMINISTRATIVE DATA](#)

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PROJECT DESCRIPTION:

BACKGROUND

The conservation status of active raised bogs in Ireland is under increasing pressure due to a long history of mismanagement, most notably turf cutting and associated drainage. It is estimated that there has been a 99% loss of the original area of actively growing raised bogs; while only about 1 650 ha of the remaining 'intact' high bog can now be classified as 'Active Raised Bog'. There is an urgent need to reverse this decline and improve the conservation status of active raised bogs, by developing and implementing restoration measures to restore these sites to favourable condition.

OBJECTIVES

The overall objective of the LIFE Irish Raised Bogs project is to improve the conservation status of the Annex I Habitats Directive habitat 'Active Raised Bog', through the protection and restoration of 12 Natura 2000 network sites in the midlands of Ireland.

The specific objectives of the project are:

- To secure landowner cooperation and local community involvement and support;
- To raise water levels to create the necessary conditions for Active Raised Bog;
- To remove naturally regenerating trees and shrubs;
- To put in place fire protection measures; and
- To fence project sites where necessary.

Expected results:

- An initial indication of an improvement in the conservation status of Active Raised Bog (although it could take 10-30 years for definitive results);
- A total of 752 ha of Active Raised Bog restored across the 12 sites;
- A total of 2 649 ha of raised bog habitat improved by restoration works across the 12 sites;
- Around 182 km of drains blocked on high and cutover bog areas using over 15 000 dams to raise water levels;
- The clearance of naturally regenerating trees on up to 2 649 ha;
- Fire plans prepared for all project sites and a fire prevention campaign run;
- Up to 6 km of fencing erected where necessary;
- A heightened public awareness of the importance of Ireland's 53 raised bog SACs and support from local communities for the urgent long-term conservation and restoration measures needed;
- Increased employment opportunities for rural communities;
- EU added value provided in demonstrating how to implement policies requiring engagement with rural-dwelling citizens, who represent about half the total EU-28 population; and
- Project techniques' manual for transferability and replication of best practices.

(European Commission, 2016)

Appendix 2: Relevant articles

- The Use of Wetlands for Flood Attenuation Report (Williams, 2012)
- Wetlands as natural assets (Barbier, 2011)
- What are ecosystem services? The need for standardized environmental accounting units (Banzhaf, 2007)
- Restoration of ecosystem services and biodiversity: conflicts and opportunities (Bullock, 2011)
- The Value of the World's Ecosystem Services and Natural Capital (Costanza, 1997)
- The value of wetlands: importance of scale and landscape setting (Mitsch, 2000)

Appendix 3: Raised Bog Background

A bog is a freshwater wetland normally found in northern climates. The composition of the ground is mainly soft and spongy, and consists of partially decayed plant matter called peat. The soggy wetlands have developed in poorly drained basins created by glaciers during the most recent ice age. Generally, bogs need hundreds of years to develop. The bog develops when a lake fills with plant debris, this debris builds up and spreads, eventually covering the lake. The plants then slowly decay as floods prevent oxygen supply, resulting in layers of decayed plants (National Geographic, 2007). An example of a plant commonly found in bog buildup is the sphagnum moss, which, simply, is called bog moss (Hall, 1992). The decaying plants are the main components of the bog's soil, called the histosol, on which fungi grows (EPA, 2017).

There are many factors that influence the development of a bog, like the location and the underground. Because of this, bogs can be divided into several distinct types as stated by the Environmental Protection Agency; firstly, the blanket bog can be found in highland areas with significant amounts of rainfall. The name blanket bog is derived from its behavior; it covers the entire area, including hills and valleys, functioning as a blanket (Barry, 1954). The next type, the cataract bog, is an ecosystem that relies on a permanent freshwater stream. Then, the quaking bog is developed over a pond or a lake, with thick layers of vegetation on top of the bog. The quaking bog bounces on impact, hence the name. The string bog is a system of varying landscapes with low-lying islands interrupting the bog ecosystem. The valley bog develops, naturally, in shallow valleys. Lastly, the bog type that dominates this project, the raised bog (Hammond, 1981). These bogs all differ from each other.

Many of Ireland's inland bogs can be identified as raised bog, and, as stated before, all the bogs included in the LIFE project are raised bogs as well. In this regard, the raised bogs deserve to be explained in a broader fashion.

According to the IPCC, raised bogs are located throughout the midlands of Ireland (Irish Peatland Conservation Council, 2017). Figure 1 gives a clear picture of this. Their name originates from their shape; decaying plants form a dome-shaped mass which fills former lakes or shallow depressions in the landscape. Water and nutrients are mainly supplied through rainfall onto the bogs acid peat soil. Figure 2 portrays the Clara bog which is part of the LIFE project. As the photograph shows, the raised bog is characterized by low-growing, open vegetation mainly consisting of mosses, sedges and heathers (Irish Peatland Conservation Council, 2017).

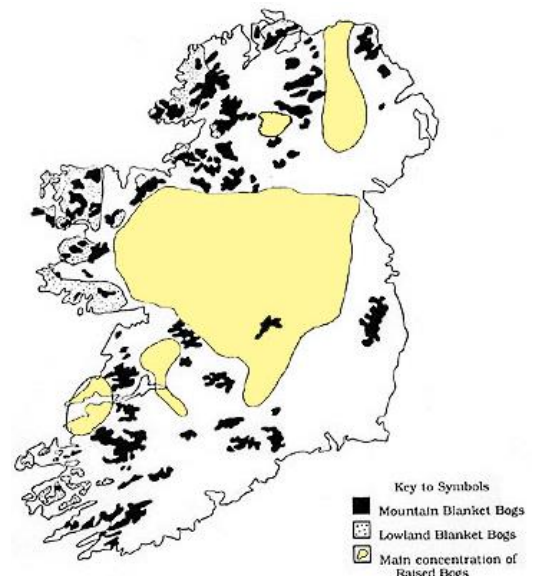


Figure 1: Ireland's bog distribution (Irish Peatland Conservation Council, 2017)



Figure 2: Clara bog (Witte, 2017)

The formation of Irish raised bogs started its development 10,000 years ago. Figure 3 illustrates the process from lake to raised bog. The filling up of lakes with decayed plants

set this progress in motion, however, plants did not decompose entirely, and the plant material formed a layer of peat that rose to the surface of the lake. At the surface, sedges invade the peat layer which forms a fen, this fen layer thickens which leads to plant roots not being able to get in contact with the groundwater. After plant roots can no longer contact the groundwater, minerals can only be acquired through rainwater, however, these minerals are very scarce when compared to groundwater minerals. After this, Sphagnum mosses invade the fen, turning it into a raised bog (Hammond, 1981).

Raised bogs function best when certain factors are in order. The most important factors are a nutrient poor eco-hydrology and full inundation at the surface. The amount of water on the bog is critical for its state; when slopes are shallow, rainwater flows over the surface of the bog in a slow manner, but, in case of steeper slopes, rainwater runs off the bog quickly resulting in a loss of water. When the outflow of water on the bog is higher than the incoming rainwater flow, the peat forming capabilities deteriorate. Next to surface outflow, natural bogs also lose water from the bottom of the bog via seepage (Hendrick, 1990).

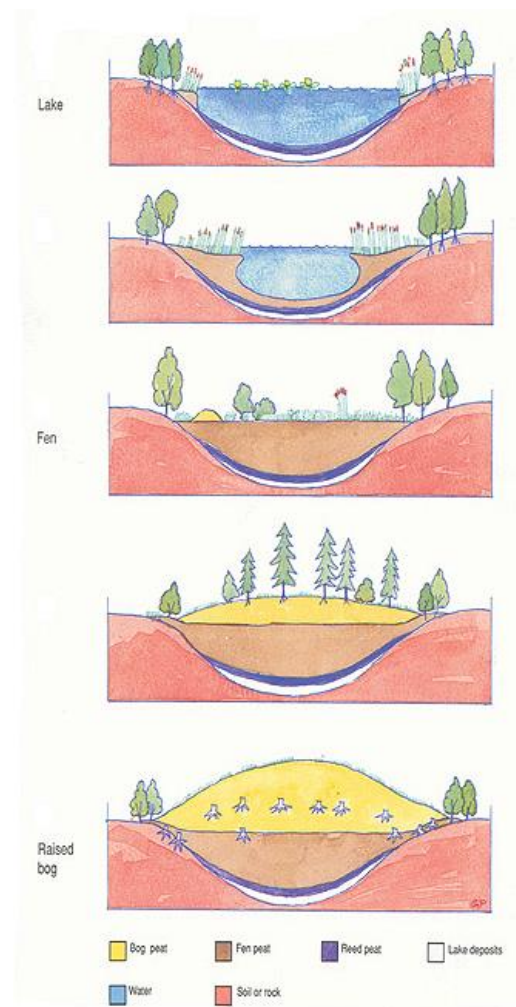


Figure 3: Raised bog formation (Irish Peatland Conservation Council, 2017)

Appendix 4: Policy/Legislation on Raised Bogs

Context	Legislation / Policy	Legislation Body
REGIONAL	County Development Plans	County Council / Planning and Development Act 2000
	County Biodiversity Action Plans	County Council
	Heritage Plans	County Council
NATIONAL	Natural Heritage Areas (NHAs)	Wildlife Acts 1976 and 2000
	Flora Protection Order 1999	Wildlife Acts 1976 and 2000
	National Peatlands Strategy 2015	Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA)/National Parks & Wildlife Service (NPWS)
	Raised Bog NHA Review 2014	DAHRRGA/NPWS
	National Landscape Strategy 2015-2025	DAHRRGA/NPWS
	Draft National Biodiversity Plan 2017-2021	DAHRRGA/NPWS
	Framework Policy for Community and Local Development 2015	Department of Housing, Planning, Community and Local Government (DHPCLG)
EUROPEAN	Habitats Directive	European Union/ DAHRRGA
	Birds Directive	European Union/ DAHRRGA
	Water Framework Directive	European Union/Department of Communications, Climate Action and Environment
	Environmental Impact Assessment Directive	European Union/ Department of Communications, Climate Action and Environment
	European Landscape Convention	European Union
	European Charter for Sustainable Tourism in Protected Areas	Europarc Federation
INTERNATIONAL	United Nations Framework Convention on Climate Change	United Nations (Kyoto Protocol)
	Ramsar Convention on the Protection of Wetlands	Ramsar Convention Secretariat
	United Nations Convention on Biological Diversity	United Nations

Figure 15: Wetland conservation policy context (Flood, 2017)