

# AQUACROSS Case Study 4: Managing Nutall’s pond weed in Lough Erne

## Summary for Local Stakeholders

The interdisciplinary research project [AQUACROSS](#)<sup>1</sup> supports European efforts to protect biodiversity in Europe’s lakes, rivers, coasts and oceans. These aquatic ecosystems provide numerous economic and societal benefits to Europe – but they are at risk of irreversible damage from human activities. To counter this and to support achievement of the EU Biodiversity Strategy to 2020 targets, AQUACROSS has developed practical guidance on identifying threats to biodiversity, understanding links between ecosystems and the services they provide, data management, modelling and scenario development, and policy analysis, which fit together as parts of the integrated AQUACROSS Assessment Framework for ecosystem-based management of aquatic ecosystems<sup>2</sup>. We have developed, tested, and applied this research in eight case studies across Europe to solve local biodiversity challenges. This brief summarises our work in **Case Study 4**, and makes recommendations for local policy.

### Introduction

In 2014, in order to meet its obligations under Aichi Target 5 of the Convention on Biodiversity, the European Union introduced its regulation on Invasive Alien Species (EC, 2014). Under the directive a suite of Invasive Alien Species (IAS) of union concern has been drawn up. Where these species are widespread members state are obliged to put in place effective management measures<sup>3</sup>.

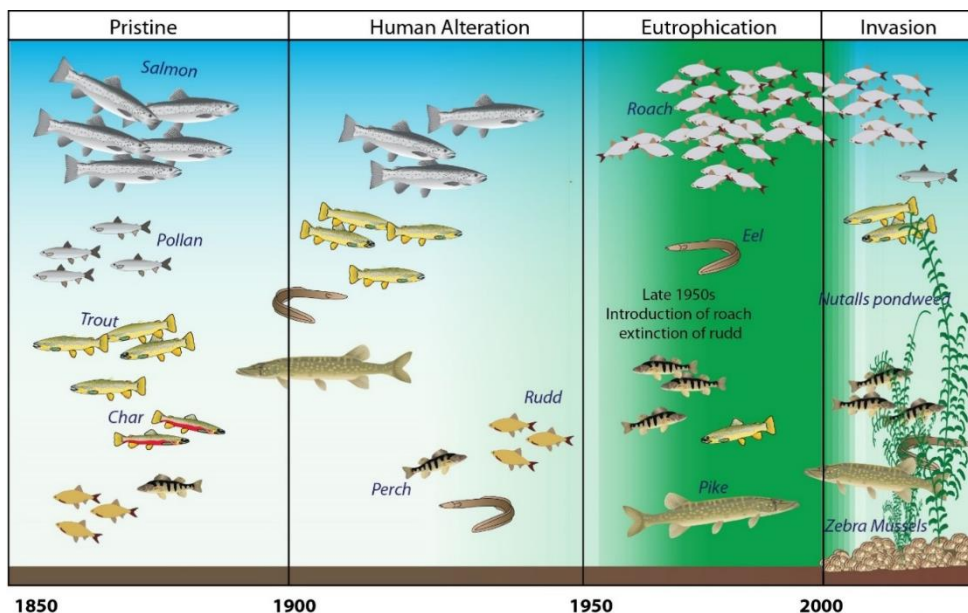


Figure 1: Overview of the major changes in the ecology of Lough Erne since 1850

Upper Lough Erne and Lower Lough Erne, Co. Fermanagh Northern Ireland are widened channels of the River Erne, the second largest river in Ireland. The lakes lie within the jurisdiction of Northern Ireland but a substantial part of the catchment is situated within the Republic of Ireland. The Erne is connected to the Shannon river basin (the largest on the island) by the Shannon

<sup>1</sup> AQUACROSS (Knowledge, Assessment, and Management for AQUatic Biodiversity and Ecosystem Services aCROSS EU policies), 2015-2018, has received funding from the European Union’s Horizon 2020 Programme for Research, Technological Development and Demonstration under Grant Agreement no. 642317. More information: [aquacross.eu](http://aquacross.eu)

<sup>2</sup> All AQUACROSS guidance and outputs are freely available online at <https://aquacross.eu/outputs>

<sup>3</sup> See Gould (1998) Davis et al. (2011), Chew (2015) and Davis and Chew (2017) for detail on the controversy surrounding invasive alien species and their impacts.

Erne Waterway. The major historical developments in the ecology of Lough Erne are summarised in Figure 2. Hydroelectrification in the middle of the last century was a major driver of ecological change in the system but also marked one of the first examples of north–south governmental cooperation, providing electricity for the south and reducing flooding in the north. The non–native species Nutall’s pond weed (*Elodea nutallii*), which the European Union (EU) considers an IAS, was first observed in Lough Erne in 2006 (Kelly et al., 2015) and has spread rapidly in subsequent years due to the high nutrient levels and high water clarity in the lake. *Elodea* has significant impacts on recreational activity, clogging watercourses and the engines of recreational boats and incurring management costs for removal of up to €91,000 (Kelly et al. 2013). The Lough Erne case study applied the AQUACROSS Social Ecological System Assessment Framework, combining ecological modelling and economic valuation to the application of policy in order to develop and assess ecosystem–based management measures for Nutall’s pond weed in Lough Erne.

### Policy objectives

There are many competing management objectives for the lake stemming from a range of European directives and policies as well as sectoral activities. Upper Lough Erne is designated a Special Area of Conservation under the Habitats Directive (EEC, 1992), and as such must achieve favourable conservation status. Under the Water Framework Directive, the lakes are designated as heavily modified water bodies due to the physical alteration caused by the hydroelectric dam, under the directives, the lakes must reach good ecological potential, but currently achieve moderate ecological potential due to the eutrophication. Most of the Erne catchment is comprised of agriculture and farm practices within the catchment are strongly influenced by the Common Agricultural Policy (CAP). At the national level the Erne Drainage and Development Act (EDDA) regulates the levels of the lake, to accommodate the generation of hydroelectricity and to avoid flooding in the catchment. This agreement restricts the allowable water level within a range of 1.2m (4ft) during the summer period during which *Elodea* proliferates. Tourism is a major sector in the area and recreational use of the lake for boating and fishing fundamental to the industry.

### Ecosystem based management measures and modelling

Based on stakeholder meetings as well as construction of a mathematical model using Fuzzy Cognitive Mapping, two potential ecosystem based strategies for the management of *Elodea* were identified and modelled. One strategy includes the alteration of lake levels within the bounds allowed by the EDDA,

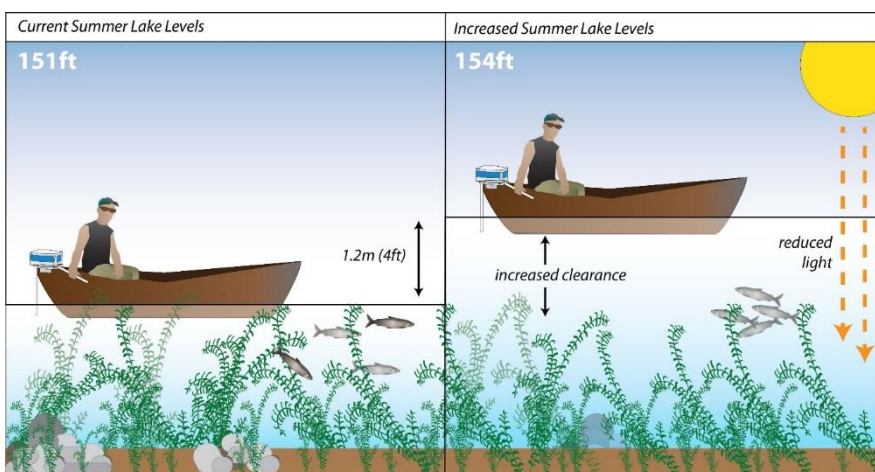


Figure 3: Illustration of how raising water levels within the constraints of the EDDA might affect recreational boating activities and light availability to Nutall’s pond weed.

with the aim of reducing light penetration to the invasive weed as well as increasing clearance between the weed and the engines of recreational boats (Figure 3). This strategy was modelled using a digital elevation model of the catchment and using Geographic Information Systems (GIS) to identify the location of areas with elevations within 1.2m of the lake level. The Fuzzy Cognitive Mapping model was produced by taking stakeholder

knowledge on the interrelationships between different components of the system. The model was used to project likely changes in the system based on these interrelationships between system components. Interrogation of the model indicated likely further decline in water quality forced by continuing agricultural activity. Therefore, a second management strategy focussed on reducing diffuse agricultural nutrient pollution through a series of farm management measures.

## Evaluation of measures

Each of the ecosystem based management strategies identified entails costs and benefits. Raising the lake levels would result in increased inundation of farmland but increased capacity to generate electricity. The GIS modelling suggested that raising the levels of the Lough by 1.2m in summer would result in the inundation of 416ha of farmland. Based on the standard output (annual production) of farms in the Fermanagh region, the annual cost to farmers for raising the lake levels (to their maximum legal limit) was estimated to be approximately £330,000, if the inundated agricultural land was to be purchased from the farmers the same area would cost approximately £2m. This measure does not address the water quality of the Lough specifically but is designed to manage the impact of pond weed proliferation on recreational activities within the Lough. Inundation of agricultural land may also produce co-benefits in terms of biodiversity by increasing the area of semi natural riparian habitats.

Nutrient management measures would involve costs to farmers but would have benefits in terms of water quality and reduced proliferation of pond weed. Estimates of the cost of sequentially introducing a range of farm management measures to the agricultural land in each of the sub catchments in the system across Northern Ireland and the Republic were made. Some such measures improve farm efficiency and involve cost savings while

others result in net costs to the farmers. The analysis showed that about 26% reduction of diffuse phosphorus inputs could be achieved through cost saving measures, while for a cost of £15m an estimated 56% decrease in phosphorus loading could be achieved.

The costed measures were presented to stakeholders at the second AQUACROSS Lough Erne workshop on the 1<sup>st</sup> of August 2018. The fact that cost estimates were provided to allow intercomparison between the different ecosystem based management measures was seen as a very practical and useful output from the case study. But concerns about the efficacy of changing lake levels were raised and the potential effects on local infrastructure were also identified as another important factor which should be included in further analysis.

### Final local policy recommendations:

Though the future shape of environmental legislation in Northern Ireland, and its alignment with the directives and regulations of the EU is uncertain, the shared legacy of management in the Lough with mutual benefits across boundaries, provides a basis, and an obligation, for continued cooperation and joint management of the Lough Erne Social Ecological System.