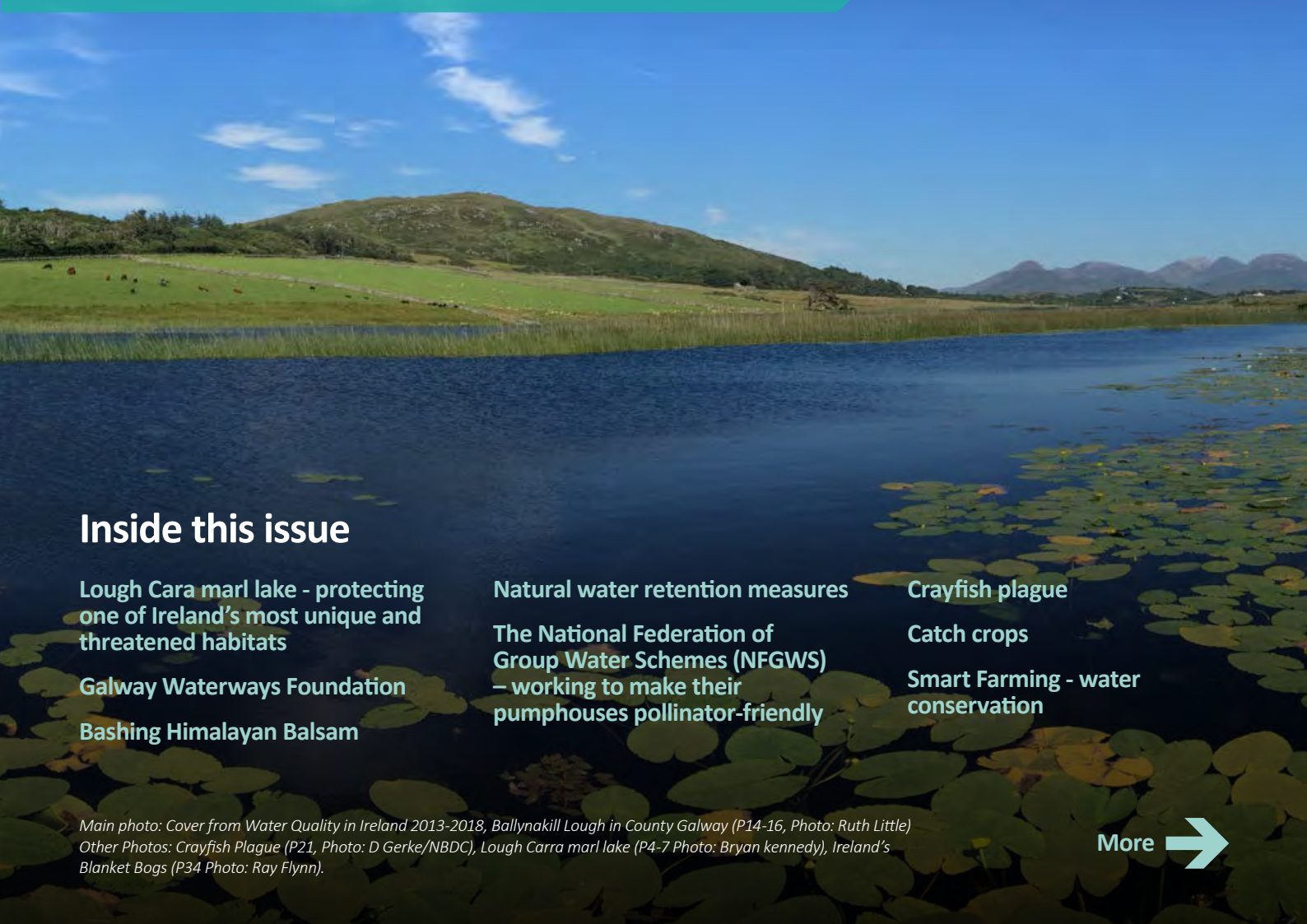


Catchments Newsletter

Integrated Catchment Management: sharing science and stories



Water Quality 2013-2018: water quality is deteriorating



Inside this issue

Lough Cara marl lake - protecting one of Ireland's most unique and threatened habitats

Galway Waterways Foundation

Bashing Himalayan Balsam

Natural water retention measures


The National Federation of Group Water Schemes (NFGWS) – working to make their pumphouses pollinator-friendly

Crayfish plague

Catch crops

Smart Farming - water conservation

*Main photo: Cover from Water Quality in Ireland 2013-2018, Ballynakill Lough in County Galway (P14-16, Photo: Ruth Little)
Other Photos: Crayfish Plague (P21, Photo: D Gerke/NBDC), Lough Carra marl lake (P4-7 Photo: Bryan Kennedy), Ireland's Blanket Bogs (P34 Photo: Ray Flynn).*

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Winter 2019 Editorial

As we prepare to close out another decade, it is useful to reflect and take stock of where we are, what we have achieved, and what has still to be done on the journey towards achieving good outcomes for our water environment.

The latest EPA Water Quality in Ireland report, which looked at data from 2013 to 2018, has shown that only approximately half our surface water bodies are in satisfactory ecological condition, and that there is a continued decline in water quality overall, which is disappointing. Our estuaries and rivers have the greatest challenges: our estuaries are in the worst condition overall, and our rivers have suffered the greatest number of declines in ecological health in the recent monitoring period. We have also seen an increase in fish kills, an increase in nutrient concentrations, an increase in the number of waterbodies at Poor and Bad status, and a continued loss of high status sites.

However, it is not all bad news. Our groundwaters and coastal waters are in relatively good condition and there has been improvements in water quality in a number of lakes. What is really encouraging is that there has been a net improvement in the 190 Areas that were prioritised for Action in the 2nd cycle River Basin Management Plan 2018-2021. This improvement highlights the on-going efforts of Local Authorities and other public bodies who have been working collaboratively to improve water quality during this monitoring period in these areas. So, it shows what can be done when the effort is targeted and focussed. You can read about the report on pages 14-16. You can also check water quality status for anywhere in the country on www.catchments.ie/maps and find trends and charts for nutrients for all water bodies on www.catchments.ie/data

With these latest water quality data in hand we are now also preparing to develop the 3rd cycle river basin management plan for the period 2022-2027. One of the key steps in the lead up to the publication of the draft plan at the end of 2020 will be taking a deeper dive into the data with the local authorities and other public bodies, to figure out what measures have worked to drive these improvements, what has caused the local declines, and where the gaps are in knowledge or policy that need to be filled to move us forward. New Areas for Action will be proposed and will be published in the draft plan so that local communities can have their say. If there is one thing that is very clear, it is that we will all have a part to play, and we will all need to redouble our efforts if we want to reach our goal of having a healthy environment which we need to underpin our health and wellbeing, our livelihoods and our economy.

This sentiment is reflected in two very significant European reports that were published recently, the Commission's fitness check of EU Water Policy and the European Environment Agency's State and Outlook report. The EU Commission has carried out a review of several large pieces of water policy including the Water Framework Directive, and has concluded that it is 'overall fit for purpose, with some room for enhanced effectiveness. Despite improvements in

the protection of water bodies and flood risk management, the evaluation has pointed to **insufficient level of implementation** by Member States and by sectors with a heavy impact on water such as agriculture, energy and transport'. So as far as the Commission are concerned, we are going in the right direction but we are not moving fast enough.

The European Environment Agency has a similar message in their State and Outlook report. They say that the environmental challenges facing us are 'of unprecedented scale and urgency' and 'at a tipping point'. They state that 'Europe will not achieve its 2030 goals without urgent action during the next 10 years... The SOER 2020 comes at a crucial time of urgent sustainability challenges that require urgent systemic solutions. The overarching challenge of this century is how we achieve development across the world that balances societal, economic and environmental considerations. Sustainability needs to become the guiding principle for ambitious and coherent policies and actions across society'. As the EEA Executive Director Hans Bruyninckx said: "The focus now must be on scaling up, speeding up, streamlining and implementing the many solutions and innovations — both technological and social — which already exist, while stimulating additional research and development, catalysing behavioural shifts and, vitally, listening to and engaging with citizens".

The EPA is currently preparing the next Irish State of the Environment report which is due to be published in 2020. Reflecting on the EEA report as context for our Irish assessment, Laura Burke, EPA Director-General said:

"We in Ireland are living beyond our carbon and environmental means and, like our European counterparts, are signed up to shared international targets to meet our sustainability challenges. As the EPA prepares to publish a national four-year assessment of our environment in 2020, indications are that many of the issues highlighted by the EEA chime with many of the challenges we are facing in Ireland. These include persistent and complex issues in the areas of water quality, air quality in urban zones, resource use, climate change, biodiversity, ecosystem loss, and environmental risks to health and well-being."

We have learnt a lot from the 2nd cycle river basin management plan. We have seen the early signs of the benefits of taking a collaborative approach and working together in these Areas for Action to get the right measure in the right place. We have the structures and many of the tools in place. Communities are engaging as you can see from the wonderful stories and achievements that are reported in this, and every, issue. We must now just all get our shoulders to the wheel.

Jenny Deakin and Paddy Morris, EPA Catchment Science and Management Unit

Learn more:

EU Commission WFD Fitness Check: www.ec.europa.eu/environment/water/fitness_check_of_the_eu_water_legislation/index_en.htm

EEA SOER 2020: www.eea.europa.eu/soer-2020/intro

Lough Carra marl lake - protecting one of Ireland's most unique and threatened habitats

Lough Carra in County Mayo is a unique lake in the west of Ireland and indeed in Europe, due to its marl habitat and its ecology consisting of unusual habitats and rare species.

The lake is included as a Priority Area for Action under the River Basin Management Plan for Ireland 2018-2021 and is currently the focus of local catchment assessment work. Peter Mitchell, Catchment Scientist with the Local Authority Waters Programme, outlines the work that is underway in the Lough Carra catchment and tell us about plans for managing the lake into the future.

The Local Authority Waters Programme (LAWPRO) first started working in the Lough Carra Catchment in 2016 and 2017, when the idea for a community association was being discussed, with many locals living within the catchment of the lake vocalising a real concern about the deteriorating quality of the lake, and what could be done to reverse the decline.

Our Community Water Officer covering County Mayo Mick Kane met with several individuals in the catchment, and from there the seeds for the Lough Carra Catchment Association (LCCA) were sown. Part of the work of the LCCA was raising the profile of the lake amongst the local community, but also amongst key local and national stakeholders as Mayo County Council and the Environmental Protection Agency. Focused resources to investigate the causes of water quality deterioration observed in the lake were needed. As a result, Lough Carra was included as a Priority Area for Action (PAA) under the River Basin Management Plan for Ireland 2018 – 2021.



The lovely Lough Carra and its unique habitats – images are taken from an EPA-supported video highlighting the unique features of this marl lake which can be viewed at www.bit.ly/epaloughcarravideo

The Lough Carra Catchment Association (LCCA) was established after initial meetings held between the Community Water Officer and Lough Carra stakeholders in January 2018. Following an agreement from all parties the LCCA formed in April of 2018 with financial support for set up provided by The Local Authority Waters Programme. There have been monthly meetings held since April 2018 with up to 40 attendees. A keynote speaker presents at each meeting with topics that are relevant to the Lake, its community and solutions to the current water quality issues. Agencies involved include LAWPRO, Agricultural Sustainability Support and Advisory Programme (ASSAP), LEADER, National Parks and Wildlife Service (NPWS), Inland Fisheries Ireland (IFI), EPA, National Federation of Group Water Schemes (NFGWS), Mayo County Council, Galway and Mayo Institute of Technology (GMIT) Galway and Castlebar and other stakeholders.

The Local Authority Waters Programme catchment assessment team came on board in Summer 2018 and started work immediately on this PAA. The first step in the process was to undertake a desktop assessment which involved gathering the relevant spatial and temporal data available to us from various agencies and public bodies involved in water quality protection. The desktop assessment is a comprehensive study that brings together all available scientific data about the lake and its surrounding surface water catchment, together with its groundwater catchment given the karst nature of this area of County Mayo. It also forms the basis for the development of a work plan for the local catchment assessment of all water bodies influencing the quality of Lough Carra. A catchment drive around the Priority Area for Action helped cement what we learned from our desktop study prior to going out or getting our boots wet in the catchment.



WATERS AND COMMUNITIES NEWS

The next step in the process was to hold a community information meeting which is key in encouraging and strengthening community stakeholder engagement. With an already active community group such as the LCCA, we knew we had lots to learn from the people living and working within the catchment of Lough Carra, and a key aim for the meeting was to learn as much as we could from them and use it to refine our knowledge and workplan.

The community information meeting was held within the Lough Carra catchment at the Carnacon Community Hall. During arrival and set up on the evening of 19 February 2019, it became apparent that we had little control over the things we often take for granted such as electricity. Strong winds earlier in the evening knocked out the power supply in the locality. This did not deter a turnout of some 32 attendees which included locals, representatives from Mayo County Council including their local councillor, the EPA, angler associations, third level institutions and a strong presence from the agricultural sub group and the education sub group of the LCCA. Fortunately, with the help of a local young farmer providing a generator and coupled with the meitheal like response of others whom gathered for the meeting, we managed to deliver an overview of who we were, what we were hoping to do and how we were hoping to work together with the community, without noticeable delay. A short presentation was delivered by our Community Water Officer Mick Kane and lead catchment scientist Ailbhe Douglas. A selection of A0 maps were posted around the hall along with a live sample of aquatic insects from a stream within the catchment.

Good conversations after the presentations helped us build on what we learned from the desktop assessment and influenced our local catchment assessment work plan. The attendees on the night offered us information about the location of karst features in the catchment, which we raised as an issue where there was a lack of mapped detail. We were also advised about the good water quality of the drinking water supply from the Carra Group Water Scheme which abstracts directly from the lake at Castleburke at the northern end of the lake. The community were interested to know what the issues were with the quality of the lake and what can be done to protect the lake into the future.

Comments from the meeting included questions such as:

- What impact does forestry potentially have on lakes?
- There is talk about a lot of focus on inputting rivers. Will LAWPRO be focusing on lake assessment at all and what methodologies would be used?
- People that fish the lake have noticed a deterioration in water quality over the last few years. The change in the marl substrate over time has shown that it has changed from a chalky white appearance to a grey and sticky consistency. If marl acts as a filter for contaminants and pollutants, maybe LAWPRO should assess the composition of the marl?
- Fish stocks have changed dramatically over time. No more dominant shoal of perch like in the past. Even if the Keel river is at good, do we acknowledge that there is an issue with Lough Carra?



Biological demonstration with the pupils of Roxborough National School, June 2019.

Our fieldwork plan was further refined on foot of information provided to us at the community meeting, including details for unmapped small streams which needed to be investigated. Our initial fieldwork commenced in June 2019 and covered the geographical area of the three river waterbodies within the PAA feeding into the lake, and also including its outflow, the Keel river.

Our initial fieldwork took the form of surface water characterisation and biological assessment of aquatic plant and animal communities. Physico-chemical data such as dissolved oxygen concentrations, pH, temperature and conductivity were also recorded. We also gratefully took up the kind offer of a boat trip out on Lough Carra for a day, with a superb guide provided by Chris Huxley. As well as absorbing knowledge imparted from Chris about the lake at various landmarks and strategic locations during the trip, we also recorded physico-chemical data and pressures observations around the lake as we went.

Additional local catchment assessment work was undertaken in September 2019 to build on the earlier round of results and capture any seasonal variation throughout the PAA. Water chemistry analysis was also included on this occasion to assist in refinement of significant issues related to nutrient pressures on the lake (orthophosphate, ammonium). We also undertook catchment walks along strategic sections of streams and rivers feeding into the lake, where information related to specific pressures e.g. domestic waste water, agriculture etc., were noted from the desk study, and required validation and evidence from the fieldwork to confirm if they were impacting.

The Geological Survey of Ireland (GSI) spent several weeks during summer 2019 mapping karst features in the Carra catchment. Both LAWPRO and GSI were carrying out assessments in the catchment simultaneously. An example of both agencies working together was at Roxborough National School where LAWPRO recorded a low dissolved oxygen reading at a study site beside the school and interactions with GSI revealed that their mapping of karst features coincided locally with this low reading. The data from both organisations are helping tell the story of the groundwater and surface water interactions and studying where the pressures are coming from that may be impacting on the lake.

WATERS AND COMMUNITIES NEWS



Ballinrobe River Festival, The Burrows, Ballinrobe 27 July 2019.

Our assessment within the PAA has determined a certain level of impact and this has shown up in a number of forms such as decreased dissolved oxygen saturation in the rivers and streams; abundant to dominant cover of vegetation often rooted in deposits of sedimentation in the channels in historical arterial drainage channels etc. This impact can be attributed to a number of pressures such as physical alteration of the natural morphology of the watercourses through channelization; mobilisation and deposition of sediment from agricultural land drainage works, and livestock access points to waters courses for drinking.

During and following on from local assessment work, the Catchment Assessment Team liaise and work closely with the Agricultural Sustainability Support and Advisory Programme (ASSAP). LAWPRO refer specific agricultural related issues to ASSAP based on significant issues detected during local catchment assessment surveys e.g. sediment. ASSAP provide a free and confidential service to farmers in the PAA and undertake a whole farm assessment focusing on the significant issue identified by LAWPRO.

In parallel with the local catchment assessment work in the PAA, the LCCA decided to apply to LEADER to fund a feasibility study with a view to development of a LIFE application which would focus on nutrient reduction and community awareness within the Lough Carra catchment. Mayo County Council and NPWS came together as co-ordinating beneficiaries for the application. Several other agencies agreed to commit to the LIFE bid as associated beneficiaries and stakeholders including LAWPRO. A Steering Group was formed to help advise and guide on the development of a concept note for submission to the EU LIFE office.

In addition, a strong LCCA education sub group formalised in mid-2019 with IFI, NPWS, LAWPRO, GMIT, LCCA, principals of local schools and community members. To date, all national schools have been visited by IFI delivering their Something Fishy workshop. All national schools have also been given the NFGWS workbook All About Water and the teachers are progressing through the modules with a strong focus on catchment management. The

result of these actions has led to the development of a very strong Catchment Association with community engagement, school projects and funding supports. The model adopted in this project may be transferable to other catchments.

LAWPRO also were heavily involved in Heritage Week which was held from 17-25 August this year and included Water Heritage Day on Sunday 25 August, which is a new initiative as part of Heritage Week. Along with similar numerous water quality awareness events, the Ballinrobe River festival was held on the

banks of the Robe at the Burrows in Ballinrobe town. LAWPRO had a pop-up stand in the Environment Tent alongside IFI and National Parks and Wildlife Services. It was a great family day in the sun and there were great water activities such as stand up paddle boarding in the river.

The UK and Ireland Lakes Conference was held in Westport in mid-October this year. The first day included a day of presentations by many public agencies at Hotel Westport. Both Chris Huxley and Tom Byrne from the association spoke at the event about the Lough Carra Catchment Association to date and progress with the LIFE bid concept note application. The second day began with a trip to the shore of Lough Carra at Church Island. A short video detailing the history and amenity value of the lake was shown, which was written and directed by EPA Biologist Bryan Kennedy. Phillip Doddy also recited a poem inside the church as well as playing a couple of tunes on the violin with reference to the lake. The trip to Lough Carra concluded with an informal information sharing discussion on the shoreline.

Work is ongoing between LAWPRO and ASSAP. ASSAP will continue to work with the farming community. Collaboration will also continue with GSI which will help in the understanding the groundwater and surface water interactions in the catchment. LAWPRO will continue to support the LCCA and providing information back to the community.

Peter Mitchell, Catchment Scientist, LA Waters Programme

Learn More:

www.loughcarra.org

You can watch an EPA-supported video highlighting the unique features and stunning beauty of this marl lake on YouTube

www.bit.ly/epaloughcarravideo

The marl crusts of Lough Carra

The Lough Carra Catchment Association has supported the publication of ‘The Marl Crusts of Lough Cara’ by Philip Doddy. This booklet highlights some of the features that make this lake so unique...

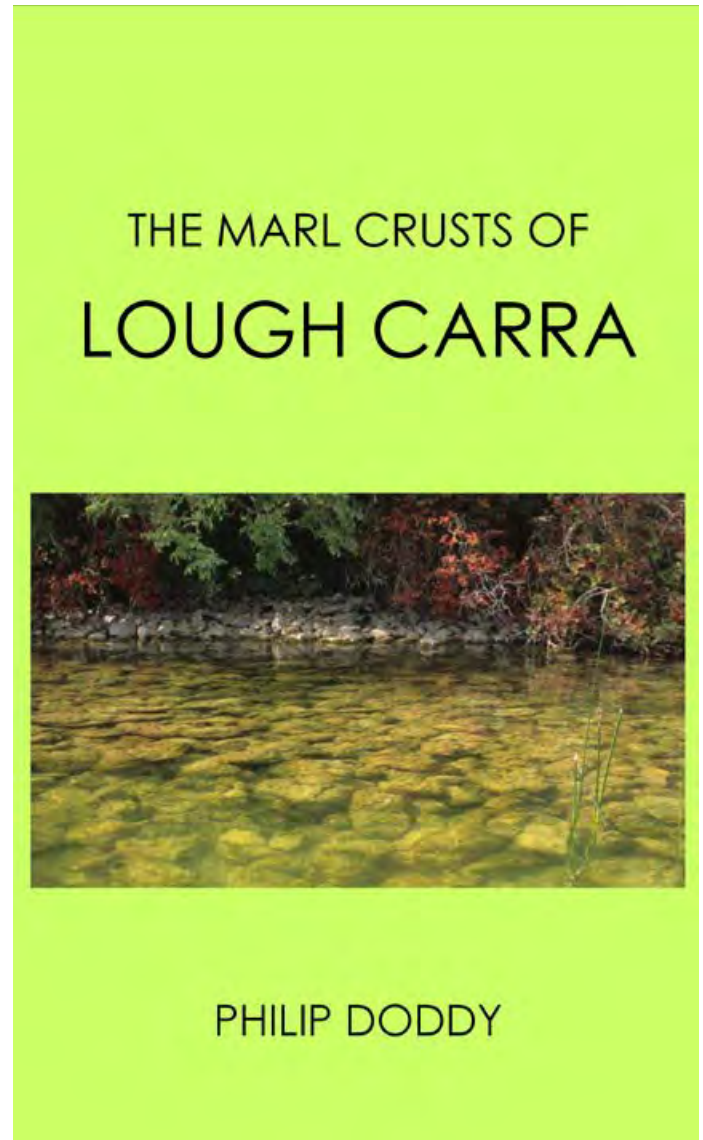
Take a wander along the shore of Lough Carra and you will surely see many things of interest - the beauty of the landscape, a bird dabbling in the water, bright patches of wildflowers, maybe a few sheep quietly grazing in a nearby field. Another thing you might notice is that the rocks along the lakeshore are covered with a curious, whitish, quite slippery layer. This is a marl crust.

What are marl crusts?

If you cut a slice of marl crust and look at it closely, you’ll see a green layer just beneath the surface. Below this will be a soft, whitish, crumbly layer, made up of quite fine grains. A magnified view of the green material shows that it contains many living things – a community of tiny life forms. The majority of these are cyanobacteria – ancient organisms which can grow as filaments, clusters of cells, or interwoven masses, depending on the species. Cyanobacteria have been around for billions of years; indeed some of the earliest traces of life on Earth are micro-fossils of cyanobacteria.

Various algae can also be seen in the living layer of marl crusts, along with microscopic animals such as nematode worms. Bigger animals live in these crusts too. Because thick crusts often have cavities or hollows, animals such as beetles, flatworms, and caddis fly larvae can be found living in them. A water spider will often emerge from a piece of crust if you examine it closely. A particularly rare beetle, called *Ochthebius nilssoni*, has recently been found living in Lough Carra crusts.

As well as these living creatures, marl crusts contain a lot of small grains of calcium carbonate (the main mineral that makes up limestone). In the upper layers of crust, these grains are bound together by many strands of filamentous cyanobacteria. This is why crusts have a firm texture. These grains also form the whitish material towards the base of the crusts. Because cyanobacteria need light, they cannot grow very deep within crusts, and so the lower parts of crusts are more loose and crumbly in texture.



Krustenstein Boulders

Philip Doddy

Learn More:

The marl crusts of Lough Cara is available to download online:

www.lifeonlimestone.weebly.com/marl-crusts-booklet.html

www.loughcarra.org

Doddy, P., Roden, C.M. & Gammell, M.P. (2019) Microbialite crusts in Irish limestone lakes reflect lake nutrient status. *Biology and Environment: Proceedings of the Royal Irish Academy* Vol. 119, No. 1, 1–11.

WATERS AND COMMUNITIES NEWS

Community meeting in Leitrim - climate change and bogland

On Friday 8 November 2019, a community meeting was held in Carrick-on-Shannon, County Leitrim.

Ray Flynn from Queen's University Belfast gave a talk on Making Bog Conservation worth it for your pocket and Community Water Officer Karen Kennedy gave a talk on Bogs - supporting water quality and potential funding opportunities.



Climate talk organisers and guest speakers – Michael Bell, John Brennan, Karen Kennedy, Tommy Early, Ray Flynn.

Climate change and the future financial benefits of Bog land

A public presentation by Karen Kennedy (Community Water Officer) and Dr. Ray Flynn (Queens University Belfast).

Will be held in The Bush Hotel, Carrick-on-Shannon Friday November 8th at 8.30PM sharp following the AGM of the Leitrim Organic Farmers co-Op

All Welcome

Learn more:

See pages 29-33 of this Newsletter where we have articles from the Irish Peatland Conservation Council and researchers from Queen's University Belfast, including Ray Flynn, on Ireland's bogs.



Attendees at the meeting on climate change and the future financial benefits of bogs.

WATERS AND COMMUNITIES NEWS



Royal Canal Clean Up at North Strand.

Dublin Community Clean-Up Day 2019: from our mountains to our coasts

The annual Dublin Community Clean Up Day is going from strength to strength. It is a partnership that now covers more than 180 locations, with over 1500 volunteers taking part in April 2019. Thomas Carolan, Community Water Officer for Dublin, tells us all about it...

On Saturday 27 April 2019, communities from Dublin came together to partake in the biggest clean-up of our streets, rivers, canals and beaches. With over 180 registered locations throughout the county this was a celebration of dedicated volunteers and an

opportunity to showcase the great work being carried out across Dublin and beyond all year long in the protection and improvement of our environment.

This year a steering group with representatives from the Dublin Local Authorities (Dublin City Council, Fingal County Council, Dún Laoghaire-Rathdown County Council and South Dublin County Council), Clean Coasts, National Spring Clean, LAWPRO and established voluntary groups Dublin Clean Canals & Dodder Action collaborated to build and further develop the success of action days in 2018 and bring about Dublin Community Clean-up Day 2019. This involved volunteers, agencies and communities working together and making a concerted effort to tackle litter and environmental degradation.



Friends of the Camac and Clondalkin Tidy Towns.

WATERS AND COMMUNITIES NEWS



Dodder Action and Firhouse volunteers on the Dodder.

This more integrated and collaborative approach in 2019 reaped huge dividends with over 1500 volunteers taking part and thousands of bags of waste being collected on the day despite inclement weather conditions. Some groups carried out clean-ups in the following weeks due to high winds giving rise to a further 200 volunteers partaking and another 300 bags of waste collected in the River Dodder Catchment. The relentless positivity of our citizens protecting and enhancing our environs far outshine the burden of littering and fly-tipping by those few individuals who have a blatant disregard for our environment and continue to litter.

Clean-ups took place in our coastal areas, on our rivers, in our villages and neighbourhoods throughout the county. The event provided an opportunity for existing groups to build capacity and entice new members to get involved but it also offered a platform to activate new community clean-ups in several locations.

This inaugural event was a perfect occasion to commend and highlight the vast year-round work being carried out by volunteer groups such as Tidy Towns, residents groups, youth groups and various voluntary organisations from across Dublin. The event also promoted and educated the wider community about social responsibility through visibility and presence in our parks, our streets and our waters. As one resident commented their village

was “awash with pink jackets”, another observed on the “army of yellow vests”, all playing their part with great enthusiasm and dedication.

An enormous thank you to everyone who freely give up their time and to all the agencies who supported & promoted the event, without you this event would not have been possible. A special word of thanks to the Local Authorities who provided the necessary equipment and waste collection.

Clean-ups will take place throughout the year in various locations across the county, so please contact your local community group, Local Authority, Community Water Officer or An Taisce if you would like to get involved and continue to #KeepDublinBeautiful. We of course will endeavour to build upon this year’s success and passion as we look towards next year’s event in 2020.

Thomas Carolan, Dublin Community Water Officer, LA Waters Programme

Learn more:

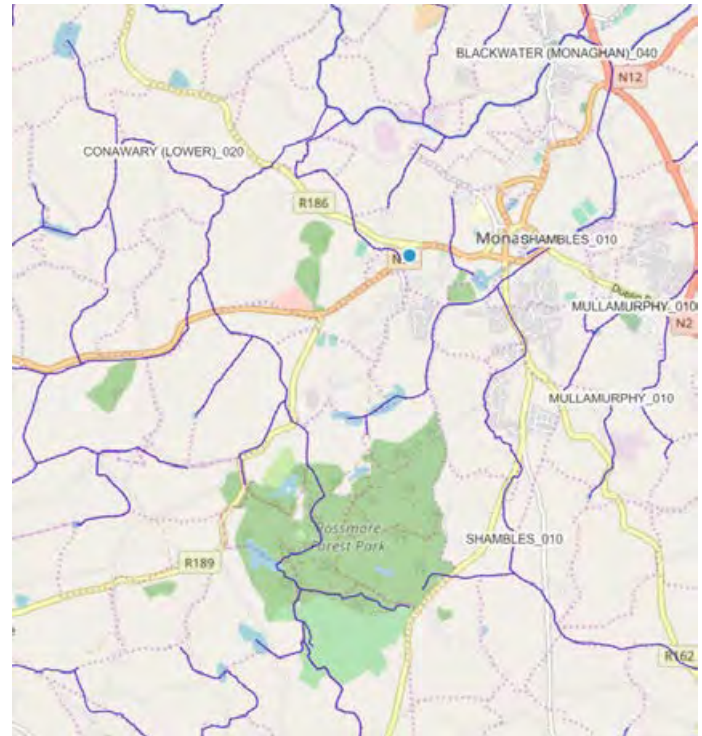
www.dublincommunitycleanupday.ie

Friends of Rossmore Forest Park bash some Himalayan balsam

Bernie O’Hanrahan tells us how the Friends of Rossmore Park in Monaghan are learning how to manage the invasive species in their park, and are working together to identify, remove and manage these species.

The historic Rossmore Forest Park is located just 3 kilometres south of Monaghan town. The park has 6 looped walks among forests and lakes in a drumlin landscape. Recent upgrades include a playground and picnic area, a joint initiative from Coillte & Monaghan County Council. The park is very popular with runners, walkers and families and is home to the Monaghan Park Run, the Haunting of Rossmore Park Halloween event, and various other events from 10k runs to marathons.

Unfortunately, the park has a problem with invasive species including Himalayan balsam, Japanese knotweed and Rhododendron. In recent years the spread of the Himalayan balsam has been observed along pathways and the park streams. The streams form part of the headwaters of the Ulster Blackwater. Concerns regarding Himalayan balsam and bank erosion have also been identified in the cross-border Ulster Blackwater river.



Rossmore Forest Park and waterbodies from www.catchments.ie

According to the National Biodiversity Data Centre, threats from Himalayan balsam, *Impatiens glandulifera*, include competition with native plants & collapsing of river banks. To stem the spread and remove new stands of the Balsam, a call went out through the Friends of Rossmore Facebook page, inviting volunteers to participate in some Himalayan balsam ‘bashing’ on Saturday mornings. It is relatively easy to remove by pulling the entire plant. Dermot McNally of Transition Monaghan also carried the story



Before: Volunteers commence work on large stand of Himalayan Balsam.



After: Job done.

WATERS AND COMMUNITIES NEWS

of Himalayan balsam in the Sustainability Matters column of the Northern Standard.

There is a steady increase in volunteers learning to recognise the plant, to pull the entire plant and to pile in situ. Some great work has been done and park users are adopting parts of the park to look after. We have learned that repeat visits to treated areas are needed to get the best results. So, it's map, remove, monitor and follow up with some aftercare.

Susan and her team of volunteers from the National Learning Network have adopted the Nature Trail as part of their Community Project for the summer months. The ambition of this park users volunteer group for 2019, is to limit the spread, control the lighter

growths and reduce the larger stands of Himalayan balsam. The first flowers only appeared in week 3 of June, so that gave a good head start in 2019 ahead of flowering and seed production this summer. Thanks to all the volunteers to date.

Bernie O'Hanrahan, Friends of Rossmore Park

Learn more:

www.facebook.com/friendsofrossmorepark

www.transitionmonaghan.org



First flower noted 18 June.

Galway Waterways Foundation – celebrating, preserving & enhancing Galway’s rivers & canals



Galway Waterways Foundation was founded in 2017 to raise awareness of the condition of Galway’s waterways, to engage citizens in the restoration of these important resources, to attract funding, and to lobby for attention and improvements of Galway’s rivers and canals.

Few people think of Galway as a canal city and even less as a city of islands. Yet before human intervention Galway was a city of seven rivers and seven islands. In fact, its original Gaelic name was Baile na Sruthán, City of Streams.

No other geographical feature has influenced the history and development of Galway more than its waterways. The original Stone Age and Celtic peoples settled in Galway because of the abundance of salmon, eels, and trout in the rivers. The Anglo-Normans established their outpost in Galway in the 13th century because of the defensive characteristics provided by water on three sides. The strength of the River Corrib was harnessed during the 16th through the 19th centuries by creating canals and channels to drive water wheels that powered 30 businesses from milling to distilling.

Gradually throughout the 20th and into the 21st centuries all this rich history and culture that developed alongside the rivers have been forgotten. Galway’s 13-kilometre, intricate system of rivers

and canals are unloved, poorly managed, and under-developed. The reasons are a lack of public awareness, out-dated 19th century legislation, and a lack of political will to grasp the problems and the opportunities that the waterways represent.

A group of local activists formed the Galway Waterways Foundation in 2017 to raise awareness of the condition of Galway’s waterways, to engage citizens in the restoration of these important resources, to attract funding, and to lobby the politicians and the permanent staff in the Local Authority for attention and improvements. The ambition of the Foundation is to evolve into a fully-fledged Rivers Trust following the model of the successful River Trust model from the U.K.

Progress is slow, but we have been greatly assisted by the Local Authority Waters Programme (LAWPRO) and in particular by Catherine Seale, our Community Water Officer for Galway and South Roscommon who helped us secure some financial support from LAWPRO; and by Mark Horton, All-Ireland Director for the Rivers Trust. We have also made a substantial submission to Galway’s 2020 European Capital of Culture team to make the restoration of our waterways a major component of the Capital of Culture programme.

Phil James, Galway Waterways Foundation

Learn more:

www.galwaywaterways.ie



ARTICLES

Water Quality in Ireland 2013-2018 – water quality is deteriorating

The EPA published the Water Quality in Ireland Report for the period 2013-2018 on 9 December 2019. This assessment of Ireland's water looks at 6 years of data and provides a comprehensive overview of water quality in Ireland. Water quality is getting worse after a period of relative stability and improvement.

The key findings from Water Quality 2013-2018 are:

- Assessment shows only 53% of our surface water bodies have satisfactory water quality
- 92% of groundwater bodies, 80% of coastal waters, 53% of rivers, 50% of lakes and 38% of estuaries were found to be of satisfactory quality.
- Since the last full assessment, river water quality has got worse, with a net decline of 5.5% (128 water bodies) in the status of river water bodies.
- We are continuing to see a loss of the pristine ('best of the best') river water bodies. There are now just 20 pristine river sites down from over 500 sites in the late 1980s.
- The number of seriously polluted river water bodies (the 'worst of the worst') has started to rise - from 6 to 9 - after many years of an improving trend.
- The number of fish kills increased to 40 in 2018 after a historic low of 14 in 2017. It is likely that the hot summer and low flow conditions in 2018 had an impact on this.

Commenting on the assessment, EPA Director Matt Crowe said:

'Ireland has made commitments to protect and improve water quality, under the Water Framework Directive and the National River Basin Management Plan 2018-2021. The aim of European and National Water Policy is to get polluted waters clean again, and ensure clean waters are kept clean.'

'However, the findings of this report indicate that water quality is getting worse after a period of relative stability and improvement. We now have an increase in the number of the most polluted river sites, and the number of rivers in poor ecological health is also increasing. Positive trends reported previously by the EPA have reversed. Not only are we failing to improve overall water quality, we are also failing to prevent further deterioration of our rivers.'

The main significant pressures impacting water quality in Ireland include agriculture, wastewater discharges, impacts to the physical habitat conditions including excess sediment (hydromorphology), and pressures from forestry activities. Of particular concern in the most recent assessment is the increase in nutrients (nitrogen and phosphorus) finding their way into our water bodies. Agriculture and waste water are the main sources of nutrients. Over a quarter

of river sites monitored have increasing nutrient levels and nutrient loads to the marine environment have also increased.

Concluding, Mary Gurrie, Water Programme Manager said:

'The overall increase in nutrient concentrations is a worrying development for our water quality. These excess nutrients come from human activities, predominantly our farms and waste water. We need to address the sources and the pathways by which these nutrients make their way into our rivers and lakes. Good water quality is essential for our health and well-being. The National River Basin Management Plan sets out a programme of measures to protect and improve water quality. It is essential that the measures required are implemented in order to avoid further deterioration and achieve the good water quality which people expect.'

Learn more:

www.catchments.ie/water-quality-in-ireland-2013-2018-released-water-quality-is-deteriorating



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Water Quality in Ireland 2013-2018

Main findings

52.8%
 of surface waters
 are in good or better
 ecological health

364 water bodies
 improved in quality

481 water bodies
 declined in quality

4.4%
 net decline

Rivers

53%
 in good or better
 ecological health

91
 fewer higher status
 river water bodies
 since 2007-09

110
 more poor status
 river water bodies
 since 2007-09

5.5%
 net decline
 since 2010-15

26%
 increasing nutrient
 concentrations

40 fish kills
 in 2018

Lakes

50.5%
 in good or better
 ecological health

28.8%
 increasing total
 phosphorus
 concentrations

Estuaries

38%
 in good or better
 ecological health

Inputs of phosphorus and
 nitrogen from rivers
 increasing since 2012-2014

16%
 increase in
 loads of
 nitrogen

31%
 increase in
 loads of
 phosphorus

Canals

87%
 in good or better
 ecological potential

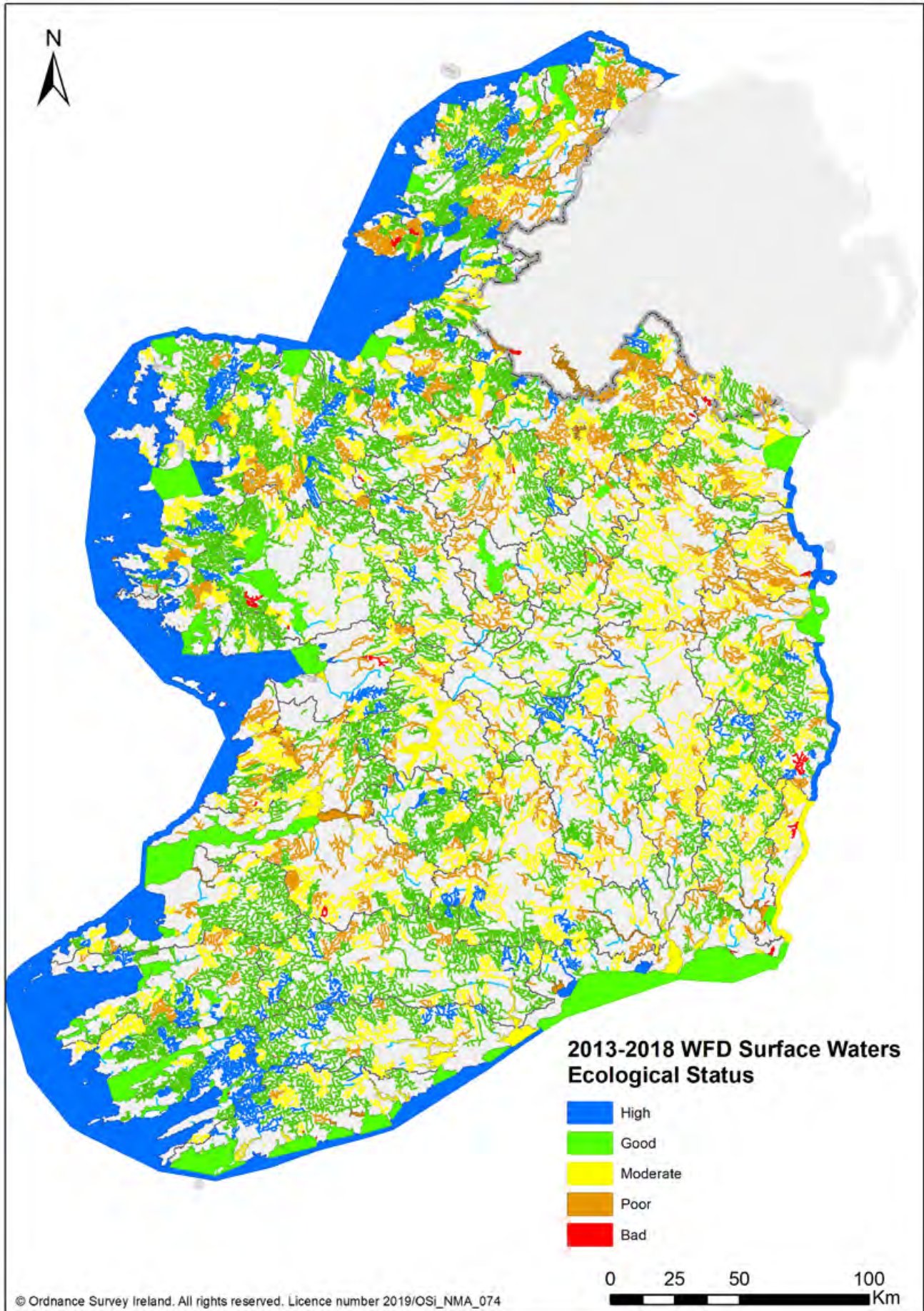
Coastal

80%
 in good or better
 ecological health

92%

of groundwater bodies are in good chemical and quantitative status

ARTICLES



European Environment Agency’s ‘The European environment – state and outlook 2020’ report outlines the scale and urgency of environmental challenges facing us

Europe will not achieve its 2030 goals without urgent action during the next 10 years to address the alarming rate of biodiversity loss, increasing impacts of climate change and the overconsumption of natural resources. The European Environment Agency’s (EEA) latest ‘State of the Environment’ report states that Europe faces environmental challenges of unprecedented scale and urgency.

This is the 6th SOER published by the European Environment Agency (EEA), and this 2020 edition identifies serious gaps between the state of the environment and existing EU near- and long-term policy targets. Citizens’ expectations for living in a healthy environment must be met, and this will require renewed focus on implementation as a cornerstone of EU and national policies.

The message of urgency cannot be overstated. In the last 18 months alone, major global scientific reports from the IPCC, IPBES, IRP and UN Environment (1) have been published, all carrying similar messages: current trajectories are fundamentally unsustainable; these trajectories are interconnected and linked to our main systems of production and consumption; and time is running out to come up with credible responses to bend the trend.

The call for fundamental sustainability transitions in the core systems that shape the European economy and modern social life — especially the energy, mobility, housing and food systems — is not new. Indeed we made such a call in the 2010 and 2015 editions of SOER, and in recent years the EU has embedded this thinking in important policy initiatives such as the circular and bio-economy packages, the climate and energy policies for 2030 and 2050, and its future research and innovation programme. Furthermore, the EU’s sustainable finance initiative is the first of its kind to ask serious questions about the role of the financial system in driving the necessary change.

However, it is one thing to change thinking and another to bring about actual change. The focus now must be on scaling up, speeding up, streamlining and implementing the many solutions and innovations — both technological and social — which already exist, while stimulating additional research and development, catalysing behavioural shifts and, vitally, listening to and engaging with citizens.

We cannot underestimate the social dimension. There are loud and understandable calls for a just transition, in which the potential

losers from the low-carbon economy are given due care and attention. The unequal distribution of costs and benefits arising from systemic changes is now recognised by policymakers, but require solid understanding, citizen engagement and effective responses.

Europe’s environment is at a tipping point. We have a narrow window of opportunity in the next decade to scale up measures to protect nature, lessen the impacts of climate change and radically reduce our consumption of natural resources.

Our assessment shows that incremental changes have resulted in progress in some areas but not nearly enough to meet our long-term goals. We already have the knowledge, technologies and tools we need to make key production and consumption systems such as food, mobility and energy sustainable.

Hans Bruyninckx, EEA Executive Director (extract from EEA SOE 2020 Executive Summary)

Learn more:

www.eea.europa.eu/soer-2020/intro



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An Fóram Uisce – The Water Forum: inspiring, informing, educating and challenging us all to act for clean and healthy waters

Gretta McCarron tells us about The Water Forum, and some new faces who have just joined. The forum represents water stakeholders, with nominees from up to 50 organisations. The work of the members of An Fóram Uisce is focussed on inputting into the review and development of national policies and developing An Fóram's own work programme.

Since its establishment in June 2018, An Fóram Uisce - The Water Forum has been busy developing its own Strategic Plan and contributing to the review and development of policies and programmes pertaining to water services and our water environment.

The 27 Fóram members represent a wide range of stakeholders with an interest in our water services and water resources including Irish Water consumers, rural water, business interests, education, agriculture, fisheries, forestry, trade unions, water sports and activities and environmental organisations. Nominated from up to 50 organisations, the members are led by their Chairperson, Dr Tom Collins and have developed their vision for water quality in Ireland where:

Ireland will have clean and healthy waters, capable of supporting biodiversity and providing the basis for a positive and healthy economic and cultural life.

An Fóram's mission is to ensure that all stakeholders and individuals are regularly reminded of their role in achieving this vision. As An Fóram's membership is reflective of various stakeholders who sometimes hold different perspectives from economic, social and environmental viewpoints, it is important that An Fóram works in a collaborative manner to address on-going challenges in water management in Ireland.

Underpinning this vision is a desire to inspire, inform, educate and challenge stakeholders to realise the goal of clean and healthy waters. The challenges for water services and water quality in Ireland include, but are not limited to increasing demand for water, regional scarcity, poor quality of water bodies, impacts of climate change and preventing deterioration or gaining improvements. To satisfactorily address these challenges will require behavioural change from every individual user as well as effective national policies and strategies to protect water resources.



The work of the members of An Fóram is focussed on inputting into the review and development of national policies by Government Departments, National Agencies and Irish Water and also developing An Fóram's own work programme. The Members actively review various issues and policies arising at national level from their own perspectives and also collectively, endeavouring to reach a consensus on recommendations. All submissions developed by An Fóram are published on our website.

An Fóram's Strategic Plan for 2018-2021 has 7 strategic themes. These themes are focused on adding value to national policy pertaining to the water environment and water services. To develop its understandings and enrich its contributions, An Fóram has commenced a research programme which will assist it to inform and lead the debate on national water policies.

Water conservation and protection is key to delivering on An Fóram's vision. Therefore, an important strategic priority is to lead a programme of public awareness and education on the value of water. By promoting public awareness of and engagement with, the vulnerability of the water resource, An Fóram will support behavioural and attitude change.

In recent months, two new members of staff have been appointed to work with An Fóram's members in the delivery of its work programme. Dr Alec Rolston is tasked with leading the research programme to identify research gaps on key priority thematic areas including drinking water source protection, nutrient pollution, high status water bodies, hydromorphology and invasive species. Alec is also interested in the socio-economic impact of public participation in water management. Alec's research will enable An Fóram to make informed contributions to policy and to lead the debate on improving water quality Ireland. With Alec's support, An Fóram aims to facilitate a dynamic interplay between and within science, policy, programme delivery and water stakeholders across Ireland.

Dr Gretta McCarron is leading the Communications and Education programmes with An Fóram. Many agencies and organisations are currently providing excellent education and awareness

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An Fóram Uisce - The Water Forum

 27 members

including representatives from a wide range of organisations with direct connections to issues relating to water quality and public water consumers

We provide a unifying platform for multiple interests to work together in a collaborative manner



Our purpose is to provide a vehicle for strengthening stakeholder input into decision making regarding water as a national asset



We are the only independent statutory stakeholder body advising on water issues

Our vision is for Ireland to have clean and healthy waters, capable of supporting biodiversity and providing the basis for a positive and healthy economic and cultural life



Our remit includes enhancing public engagement on all matters concerning water and water quality



An Fóram is an independent entity and has the discretion to determine its own work programme

We aim to increase public consciousness of the vulnerability of our water resource and on the interplay between individual behaviour, community, sectoral and societal norms and national policies



We endeavour to inspire, inform, educate and challenge all stakeholders

We are responsible for advising on policy regarding drinking water, lakes, rivers, groundwaters and coastal waters



water resources. An Fóram is keen to assess the public's attitude to our water resource and add value to current community action such as the tidy towns and pride of place initiatives.

The challenges facing Ireland in terms of water and waste water services and also the protection of its water resources are well documented. An Fóram, with its diverse composition, is unique in its capacity to direct the debate, identify decision making priorities, push for more ambitious strategies and empower, individually and collectively, all members of society to act to protect, conserve and value water resources across this island.

At a time when Ireland is awakening to the reality of climate change and the impacts of the neglect of its natural resources, An Fóram's role in advising how these issues might best be addressed has never been more important or relevant. To quote Oscar Wilde, 'We know the cost of everything and the value of nothing'. An Fóram is tasked with reminding us all of the value of our water resources which can no longer be taken for granted.

Since its establishment, An Fóram has been assisted and supported by Sharon Kennedy who has recently left. An Fóram would like to take this opportunity to wish Sharon every success in her new role and to thank her for her dedication and enthusiasm in her work with An Fóram. Sharon has been by Donal Purcell who looks forward to working with An Fóram's Chair, Members and Staff.

Gretta McCarron, Communications and Education Lead, An Fóram Uisce

Learn More:

www.nationalwaterforum.ie

Twitter: [@Forum_Water](https://twitter.com/Forum_Water)

You can contact Gretta at gretta@nationalwaterforum.ie and Alec at alec@nationalwaterforum.ie

programmes for water quality, conservation and habitats across the country. Gretta hopes to collaborate with organisations and agencies to widen the scope and depth of delivery to ensure all individuals, businesses and stakeholders are given the opportunity to value our water resources. Monitoring and evaluation of programmes will be important to measure behavioural change as well as the impacts of community engagement in protecting our



Neil Walker, IBEC; Dennis Drennan, ICMSA; Thomas Cooney, IFA; Suzanne Linnane, Dundalk IT; Derrie Dillon, Macra; Tim Butter, Irish Underwater Council, Tom Collins, (Chair); Thomas Harrington, Maigne Rivers Trust; Dominic Cronin, ICOS; Connie Rochford, Public Water Consumer; David Wright, Community & Voluntary sector; Sinead O'Brien, SWAN; Gerald Quain, Irish Rural Link; Sharon Kennedy, An Fóram Uisce.; Brendan Fitzsimons, Tree Council of Ireland; Tim Fenn, Irish Hotels Federation; Martin McEnroe, Anglers Association; Bernadette Connolly, Cork Environmental Forum; Keith Hyland, Public Water Customer.
Absent from the picture is: Barry Deane, NFGWS; Joe Gallagher, NFGWS; Charles Stanley Smith, An Taisce; Elaine McGoff, An Taisce; Laurie Kearon, Public Water Consumer, Ollan Herr ZWAI and Liam Berney, ICTU.

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Natural Water Retention Measures – implementing the Flood Risk Management Plans

Conor Galvin from the OPW tells us about how Natural Water Retention Measures can deliver multiple environmental benefits for habitats, carbon sequestration, water quality, flood mitigation and public amenity.

Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes¹.

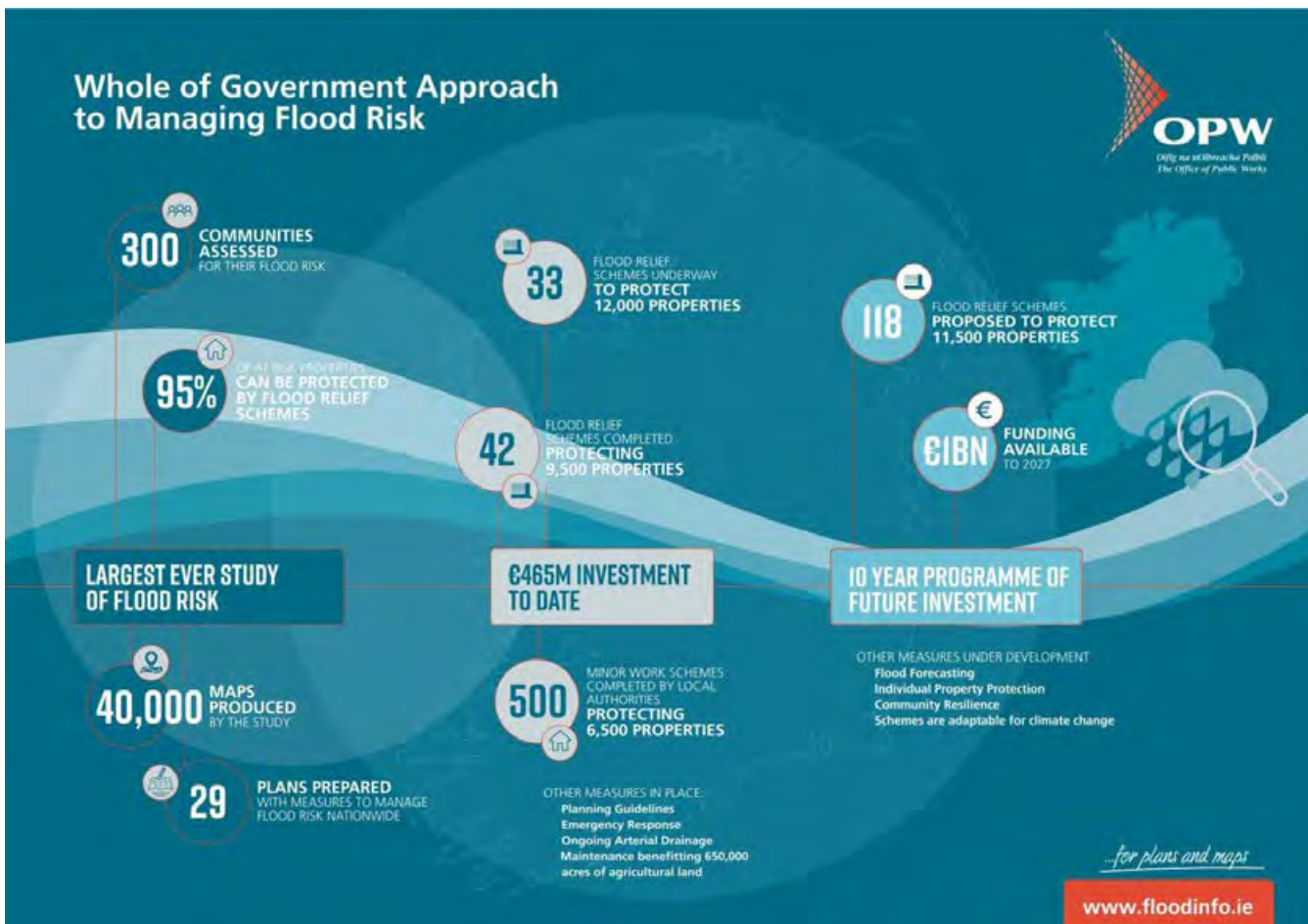
Typical NWRM include riparian woodlands, agricultural and upland drainage modifications, non-floodplain wetlands, instream structures (e.g. large woody debris), and offline storage ponds.

It has been demonstrated that NWRM improve water quality

and can be effective at reducing flooding in small catchments for frequent floods, that is, in catchments less than 10km² and for floods with a one in ten chance of occurring in any given year. NWRM also achieve multiple benefits beyond water quality and flood risk reduction, including habitat creation, climate regulation, and the provision of amenity.

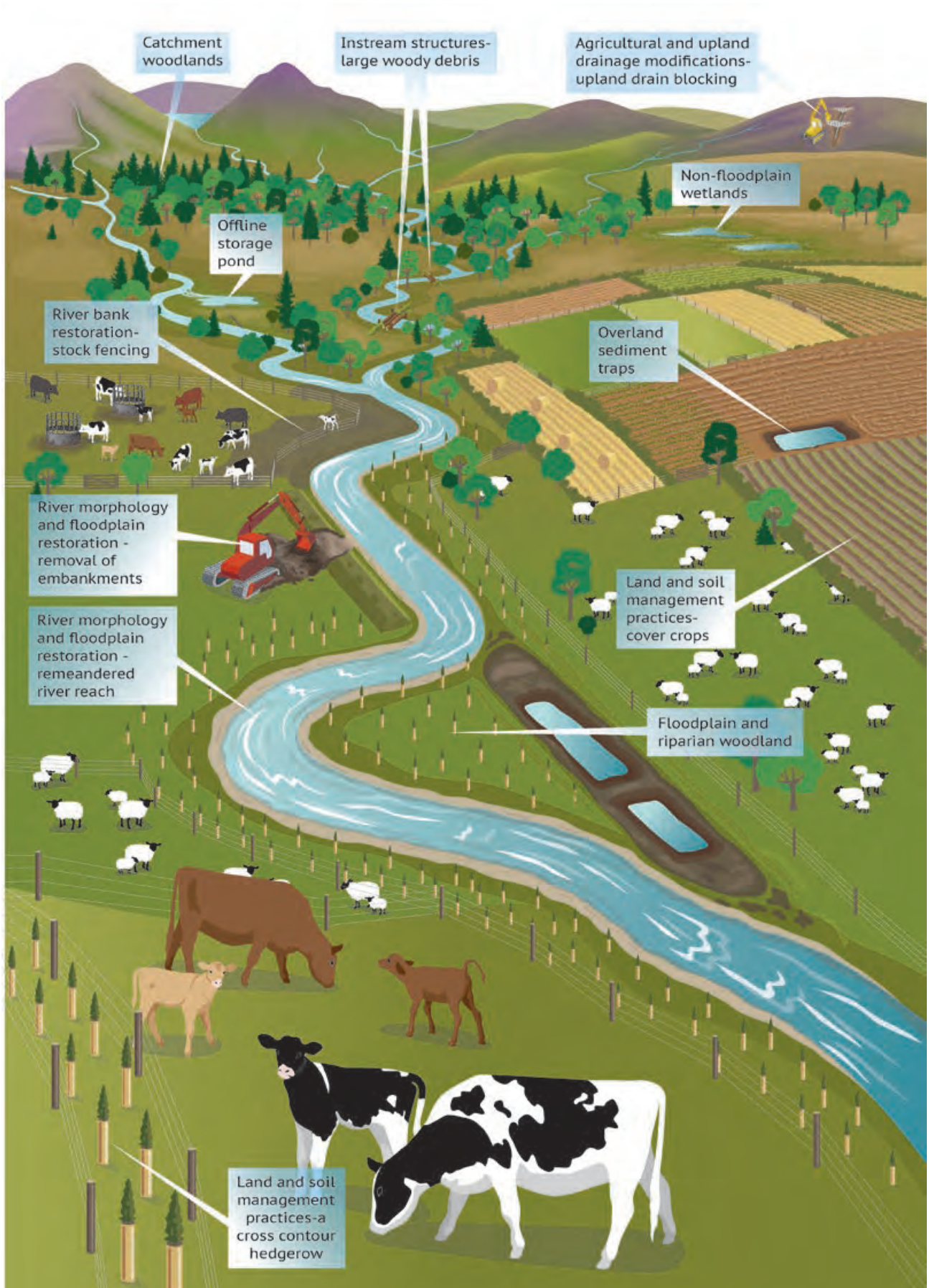
The benefits and appropriate application of NWRM are extensively documented in the Scottish Environment Protection Agency Natural Flood Management Handbook, the Environment Agency (UK) Working with Natural Processes Handbook, and the EU Commissions NWRM web-portal.

As the lead State body for the coordination and implementation of Government policy on the management of flood risk in Ireland the Office of Public Works (OPW) recognise that NWRM has a part to play in managing flood risk. In May 2018 Minister of State with special responsibility for the OPW and Flood Relief, Kevin ‘Boxer’ Moran T.D. published 29 Flood Risk Management Plans to address



¹ EU Commission (2014), Policy document on Natural Water Retention Measures

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Natural Water Retention Measures - taken from the Scottish Environment Protection Agency's Natural Flood Management Handbook.

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flood risk in Ireland. The Government has committed almost €1bn to implement the measures in the plans as part of the National Development Plan 2018-2027. The Plans, which set out the whole of Government approach to managing flood risk, all have a specific measure regarding NWRM as follows:

‘The OPW will work with the Environment Protection Agency, Local Authorities and other agencies during the project-level assessments of physical works and more broadly at a catchment-level to identify any measures, such as natural water retention measures (such as restoration of wetlands and woodlands), that can have benefits for Water Framework Directive, flood risk management and biodiversity objectives.’

The OPW are progressing with three actions to implement this measure; delivering Flood Relief Schemes, the NWRM Working Group, and Research and Pilot Studies.

Flood Relief Schemes

The OPW in partnership with the respective Local Authorities are currently progressing 57 of the 118 Flood Relief Schemes recommended in the Flood Risk Management Plans.

The first in a five-stage process to deliver a flood relief scheme is to carry out scheme development and design, building upon the work already carried out in the National Catchment Flood Risk and Mapping (CFRAM) Programme. During this phase, the scheme designers are required to carry out a NWRM feasibility assessment. This assessment will look at the feasibility of NWRM to form part of the flood relief scheme and also at the potential to achieve co-benefits.

The progression of these flood relief schemes is an opportunity for the implementation of NWRM to complement traditional engineering solutions.

Natural Water Retention Measures Working Group

A NWRM Working Group has been established to advise the Water Framework Directive (WFD) National Technical Implementation Group (NTIG) on proposals for including NWRM as part of a broader suite of mitigation measures that could contribute to the achievement of environmental objectives set out in the second RBMP.

The group has met three times in 2019 and includes a broad range of stakeholders reflecting the wide range of land use types covered by NWRM and also the multiple functions and co-benefits that they can provide.

Natural Water Retention Measures Research and Pilot Studies

The principal NWRM research being undertaken in Ireland is the SLOWWATERS project: A Strategic Look at Natural Water Retention Measures. This four-year research project, which is being carried out under the EPA Research Programme’s Water Research Call 2018, commenced in February 2019 and has a budget of €508,000 jointly funded by the OPW and the EPA.

The research will assess the benefits of NWRM for agricultural catchments in Ireland. The project outputs will provide recommendations for the management of specific catchment types relevant to the Irish environment by quantifying the magnitude of NWRM required to reduce flood peaks. Two demonstration sites in Cork and Wexford will show how to design, build and monitor the performance of NWRM. It is envisaged that the demonstration sites will be visited by numerous stakeholder groups to evaluate the practicalities of uptake of NWRM on Irish farms.

The research is being led by Professor Mary Bourke of Trinity College Dublin and the team includes authors of the Environment Agency (UK) *Working with Natural Processes - Evidence Directory* from Newcastle University and The James Hutton Institute in Scotland as well as participants from University College Cork.

Research is also being carried out to assess the effectiveness and potential for NWRM in forested catchments in Ireland. The OPW through the Irish Research Council Enterprise Partnership Scheme are co-funding a PhD research study, titled *The ecosystem services of Ireland’s forests for flood protection and water quality*. The aim of the project is to test the potential role of specifically-designed NWRM within conifer plantations to attenuate the flux of water, sediment and soluble pollutants to receiving waters and thereby the potential to further reduce the flood risk and environmental impact of forestry operations to sensitive catchments. This research commenced in March 2019 and will use GIS-based mapping techniques, hydrological modelling, and full-scale field demonstration sites.

The OPW have also provided funding to the Inishowen River Trust to assess the feasibility of implementing NWRM in Inishowen. This assessment includes mapping sites with the potential to implement measures such as large woody debris dams, peat drain blockage, and floodplain storage.

Outcomes

Through these three actions the NWRM measure in our Flood Risk Management Plans will provide us with an additional suite of measures to compliment traditional engineering solutions to flood risk management while also achieving multiple benefits in other sectors.

Conor Galvin, Flood Risk Assessment and Management, Office of Public Works

Learn More:

The OPW’s national flood information portal provides location specific access to flood risk and flood management information: www.floodinfo.ie

EU NWRM web-portal: www.nwrm.eu

SEPA Natural Flood Management Handbook: www.sepa.org.uk/media/163560/sepa-natural-flood-management-handbook1.pdf

EA Working with Natural Processes – Evidence Directory: www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk

Inishowen Rivers Trust Slow the Flow event: www.catchments.ie/slow-the-flow-natural-flood-management-in-inishowen/

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Our native White-clawed Crayfish. Photo: D. Gerke/National Biodiversity Data Centre.

Crayfish Plague, a deadly disease that kills every White-clawed Crayfish it infects, is spreading through our catchments

Ireland's native White-clawed Crayfish are now threatened with extinction in eight catchments. In summer 2019, Crayfish Plague was confirmed in the River Nore catchment, at Kilkenny City. It has previously been found in the Barrow and Suir catchments, along with a further five catchments across the country.

Crayfish are freshwater relatives of the marine lobsters which they resemble closely. Species of crayfish can be found in many parts of the world. There are seven European species including the White-clawed Crayfish which is the only species naturally occurring in Ireland

Crayfish plague can wipe out the population of our native White-clawed Crayfish (a protected species) very quickly once a stream or river is contaminated with it. The disease organism is a water-mould and is microscopic and invisible to the naked eye and is only viable in water. Crayfish infected with the disease have a 100% mortality rate.

All water users should take measures to ensure that they do not unknowingly spread the plague to other rivers, lakes and streams. It is transferred by using equipment (angling equipment, water-sampling equipment, boats, wetsuits etc.) in a plague infested area and then moving that equipment to an uninfected area while still wet.

Check, Clean and Dry your equipment

The single most effective action to reduce the spread of the disease is to use the Check, Clean, Dry protocol. This should be done routinely after entering a stream or river. CHECK, CLEAN and allow all equipment to thoroughly DRY-out, then dry for a further 48 hours.

If drying out equipment is not feasible, then equipment should be either:

- a) Power Steam washed at a suitably high temperature (at least above 65 degrees), or
- b) Disinfected using an approved disinfectant such as Milton (follow product label), Virkon Aquatic (3mg/L), Proxitane (30mg/L) or an iodine-based product for 15 minutes

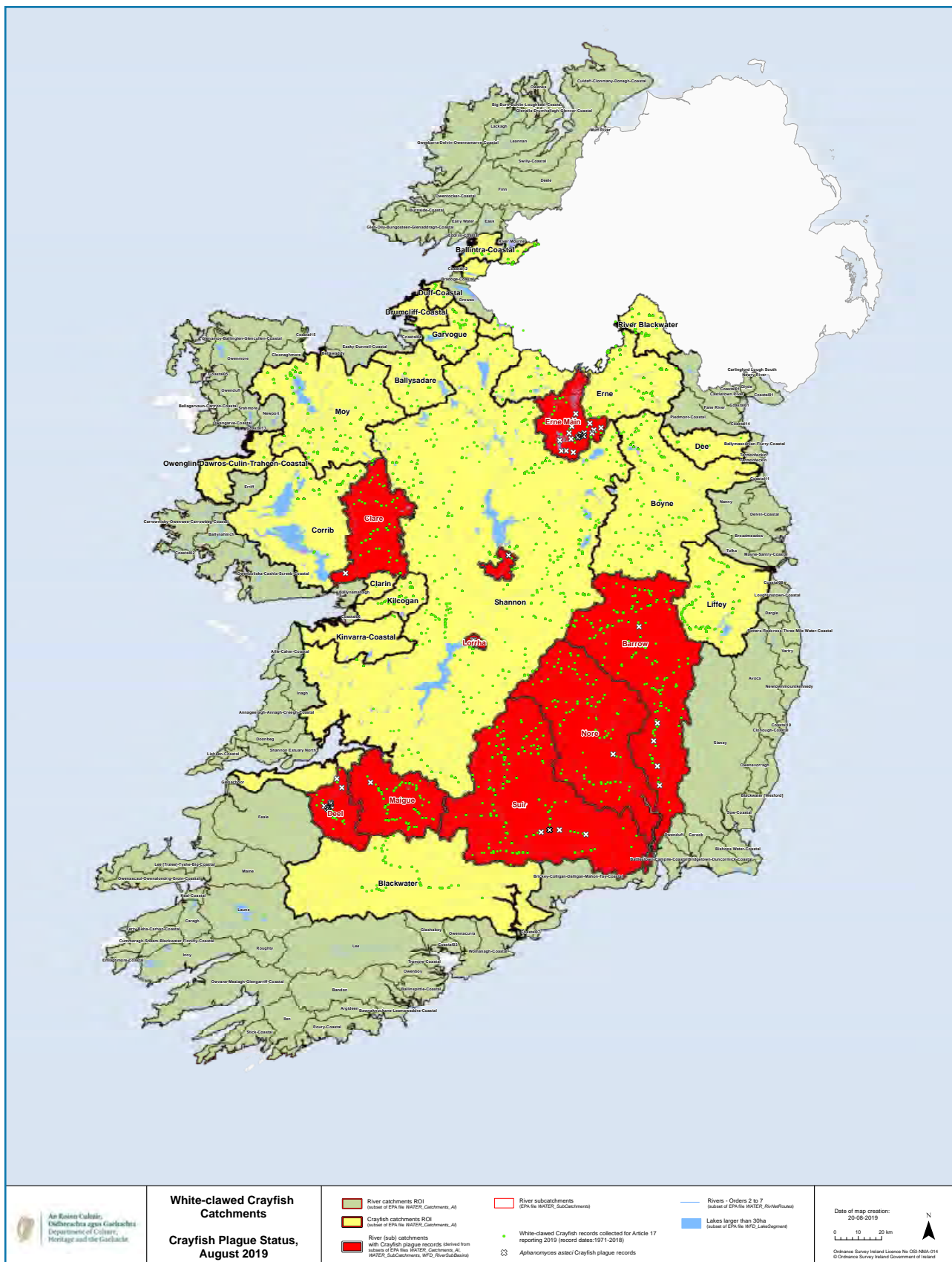
Items difficult to soak can be sprayed or wiped down with disinfectant. Engine coolant water or residual water in boats/kayaks should be drained and where possible flushed out with disinfectant. Please be aware of the locations of the plague and avoid entering water unless necessary. If you do enter water, please ensure that you take the correct action to prevent the spread of the disease.

Learn more:

Further information is available from the National Biodiversity Data Centre www.biodiversityireland.ie/projects/invasive-species/crayfish-plague/

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Crayfish Plague Status, August 2019



Catch Crops – improving soil structure and water infiltration, and reducing nitrate and soil loss



Catch crops are grown between successive cereal crops to help protect the soil and reduce the losses of nutrients and sediments and can provide benefits for biodiversity. Fiona Doolan, one of Teagasc’s ASSAP Advisors, tells us about them.

The weather in Ireland as we all know is quite changeable with dry and sunny weather interchanging with rain and wind and Autumn is a time of year that you really experience the full range of weather conditions we farm under in this country. This unpredictable weather has an impact on every day farming life by disrupting seasonal work. It also can have an impact on the level of nutrient and sediment that leaves the land and gets washed into our streams and rivers.

How can advisors help farmers in these unpredictable weather conditions and help reduce the loss of nutrient and sediment into our streams and rivers? Well one thing being advocated for a long time is the use of Catch/Cover Crops in the post-harvest period, normally grown between successive cereal crops. These short-term crops have 3 distinct advantages when it comes to soil condition and health:

1. Better soil structure and improved compaction resistance
2. Improved water infiltration and reduced soil loss
3. Reduced nitrate loss

While the advantages of cover crops in reducing Nitrogen loss (cover crops can typically catch 60 – 120 kg N/Ha) preventing nitrate leaching to ground waters and improving soil structure, have always been known, it is perhaps the beneficial effect cover crops can have on water infiltration that is most relevant to heavy autumnal rainfall events.



Fallow ground – poor ability to absorb water (poor infiltration).



Tillage Radish helping to improve soil structure and water infiltration.

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A cover crop will help heavy rain to infiltrate the soil, thereby reducing ponding and overland flow of surplus water. They will also provide a cover for the soil in times of high rainfall allowing some protection from erosion by elements.

The ability of all cover crops (Tillage radish, oats, mustard, rape or kale etc) to produce a root mass underground is far greater than fallow land, meaning an improved ability to absorb and retain rainfall. Areas left unsown after harvest are less able to handle large amounts of rainfall leading to greater loss of sediment, and unfortunately bringing one of our most expensive nutrients, Phosphorus, with it. This loss of Phosphorus poses us with two problems – the financial cost of replacing expensive nutrient but also causes a potential problem to the water quality in out streams and rivers.

As with all crops planning is essential in choosing the right crop for your situation. Sowing date is critical however; 'A Day's growth in July is equivalent to a week's growth in August – but a week's growth in August is equivalent to a month's growth in September'. The benefit of that earlier sowing is clearly visible in crops on the ground and what they offer in terms of soil protection.

It is particularly disheartening for any farmer to see the best of his soil washing off his field in torrential rainfall – well established and early sown catch crops can be the glue that holds that soil there while also benefitting biodiversity over the winter months.

Fiona Doolan, Teagasc ASSAP Advisor

Learn more:

www.teagasc.ie/crops/crops/cover-crops



Brassica such as Rape and Kale are popular catch crop choices.

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Launching the Smart Farming Water Guidance – Joe Gallagher, NFGWS, Catherine Seale-Duggan, LAWPRO, and Thomas Cooney, IFA.

Smart Farming – updated water conservation and protection guidance launched

In August 2019, Smart Farming, the resource efficiency programme run by IFA in conjunction with the Environmental Protection Agency, has launched updated water guidance to support farmers work in improving water quality and reducing the risk of penalties.

At the launch of the Smart Farming water guidance, Thomas Cooney, Smart Farming Programme Leader said, “Farmers are the custodians of the rural environment and their increasing participation in the voluntary Smart Farming programme demonstrates their willingness and desire to focus on both improving their farm returns while enhancing the rural environment. I believe this updated water guidance will help farmers achieve these two objectives”.

Mary Frances Rochford, EPA Programme Manager in the EPA’s Office of Environmental Sustainability added, “Clean water is essential to our health and wellbeing and conserving water is essential in the context of our changing climate. We must do more to halt deterioration in water quality so that we protect this most precious public resource. Smart Farming plays an important role in addressing water conservation and water quality in the farming sector. Successful implementation of the measures needs wide and willing take up by the farming community.”

Catherine Seale-Duggan from the Local Authority Waters Programme welcomed the additional information provided on water protection and conservation. She noted that farming is so important for maintaining and improving water quality and she was delighted to see that farmers were being actively supported to achieve water quality improvements on their farms.

On water conservation, it encourages farmers to:

1. Understand current water use, by studying the water bills
2. Locate & fix leaks to save money
3. Reduce use by recycling water

Regarding protecting water quality, the guidance document encourages farmers to:

1. Think about how the farmyard is plumbed to the local stream
2. Take specific actions to reduce risks of water pollution and subsequent penalties
3. Ensure that there is good drinking water quality, by properly constructing wells

Learn more:

www.smartfarming.ie

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WaterMARKE: mitigating agricultural impacts through research and knowledge exchange

The WaterMARKE project will develop operational guidelines for farmers, advisors and policy makers for the successful implementation of water quality risk assessment measures at farm scale and will identify win-win measures where economic and environmental outcomes do not come into conflict, with water quality improved on farms at the lowest cost.

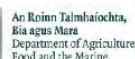
With an increasing global population driving demands for increased food production, agriculture faces the 'Grand Challenge' of sustainably increasing productivity while also continuing to protect the environment. The 'sustainable intensification' of agriculture

offers potential not just to support enhanced farm viability, but to do so in a more holistic way, bringing economic and environmental benefits. However, despite recent policy developments working to protect water quality, surface and ground water quality remains an environmental concern for agriculture. For example, measures have been to optimise the use of nutrients such as phosphorus and nitrogen on farms, reducing the risk of loss of nutrients to water. But while surface water quality had stabilised for a large number of years, it has begun to decline again recently. Therefore, measures are needed to improve water quality where it is unsatisfactory.

The WaterMARKE project emerges in this context in response to the need for evidence-based tools to help ensure that intensification of agriculture is sustainable and protect water quality. It also recognises the complexity of achieving good water quality as part of sustainable agriculture, which is reflected in the project activities and the expertise it brings together.

WaterMARKE

Water - Mitigating Agricultural impacts through Research and Knowledge Exchange



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The project is jointly funded by the Environmental Protection Agency (EPA) Research Programme 2014-2020 and Department of Agriculture, Food and the Marine (DAFM). Working closely with the Agricultural Sustainability Support Advisers (ASSAP) who are providing advice and support to farms in areas where there are water quality issues, the WaterMARKE project team aims to develop tools for water quality risk assessment and appropriate water quality protection measures.

WaterMARKE partners from Teagasc, NUI Galway, UCD, Agricultural Catchments Programme (ACP), Environment Knowledge Transfer, Local Authority Waters Programme (LAWPRO), National Rural Network (NRN), Scottish Rural College and includes biophysical scientists, economists, behavioural psychologists, extension specialists and international law expertise.

The project will develop operational guidelines for farmers, advisors and policy makers for the successful implementation of water quality risk assessment measures at farm scale. An underpinning objective is to identify 'win-win' measures where economic (e.g. farm incomes) and environmental (e.g. improved water quality) outcomes do not come into conflict, with water quality improved on farms at the lowest cost. It will:

- Develop a farm-scale risk assessment to select measures for water quality protection
- Identify barriers to adoption of water quality protection measures
- Using the 'right measure, right place, right time' approach to design a knowledge exchange template for water quality protection measures
- Evaluate options to scale up the implementation of water quality protection measures beyond the pilot case study farms
- At a national scale, the project examines the roles and interactions of all the actors (institutions) involved in the agri-food production value chain, to examine how the information flows and the structure of future programmes could be improved to facilitate further sustainable development and intensification of Irish agriculture

Learn more:

www.teagasc.ie/WaterMARKE

Twitter: [@WaterMARKE](https://twitter.com/WaterMARKE)

The National Federation of Group Water Schemes (NFGWS) – working to make their pumphouses pollinator-friendly

The National Federation of Group Water Schemes (NFGWS) is the representative organisation for community-owned rural water services in Ireland. They've worked with partners to develop pollinator-friendly planting guidelines for their pumphouses all around Ireland.

The NFGWS, in partnership with the National Biodiversity Centre of Ireland, Tipperary County Council and Ashill Group Water Scheme



²The EPA Research Programme is a Government of Ireland initiative funded by the Department of Communications, Climate Action and Environment

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(GWS) are spearheading a new project entitled Pollinator-friendly management of Group Water Scheme sites, which is linked to the All-Ireland Pollinator Plan 2015-2020.

Group Water Schemes, by their nature, are at the centre of rural communities, where these pollinators have the greatest impact. The spread of group schemes across the country means that there could be a pollinator haven in every parish! Group water schemes provide a vital service to rural communities, and with this project, they could also provide a vital service to help save these vital creatures.

Encouraging these pollinators to inhabit the site is very easy and relies on management of the site rather than spending money on landscaping. Plants such as lavender can attract these creatures which are inexpensive – with funding being available under the operational subsidy and from the heritage section of your local authority. This management, besides having a beneficial impact on agriculture and tourism, also has great implications for source protection, flood management and the aesthetics of the GWS site.

John Fogarty, Ashill Group Water scheme has been spearheading this work over the last number of years, cumulating in the creation of a 'Pollinator Haven' around the Ashill GWS source and treatment house. Dr Una Fitzpatrick, National Biodiversity Centre of Ireland, has been working closely with the Ashill GWS on this project. John and Una recently appeared on Ear to the Ground to discuss how pollinators were in decline and measures available to slow

this decline. John, along with the Ashill GWS committee, recently facilitated an open day of the site, where the Tipperary Rural Water Monitoring Committee were invited to see the work that had taken place.

In the time since the opening of the Ashill GWS pollinator garden, 6 groundwater sourced Group Water Schemes in the Tipperary area have begun to plant their own compounds with pollinator friendly plants. In addition to these groundwater sourced schemes, many surface water schemes can see the benefit of implementing these measures around their own sources and treatment plants and are planning to implement this in the next year.

The committee of one of these schemes have involved their local primary school in the project, focusing the minds of the schoolchildren on the importance of pollinators and the importance of good quality water. The NFGWS have also used the initiative as part of our Quality Assurance system, which focuses on a HACCP: Source to Tap method of protecting the water source, as these plants help protect sources from contamination and ties in with the banned use of herbicide around drinking water sources.

Learn more:

www.nfgws.ie

www.pollinators.ie

More flowers + less chemicals = more pollinators

1 Maintain native flowering hedgerows

Hedgerows that are managed to promote mature flowering growth are a vital source of pollen and nectar for pollinators at the beginning of their annual life cycle in spring.

2 Plant pollinator-friendly trees

Planting additional pollinator-friendly trees provides vital sources of food, particularly in spring.

3 Cut the grass less often

Reducing the frequency of mowing allows common wildflowers such as Clovers, Knapweed and Bird's-foot-trefoil to naturally grow amongst the long grass. This is the most cost-effective way to provide food for pollinators and other insects.

4 Eliminate herbicide use

Less herbicide will mean more wildflowers for pollinators to feed on – this is an action you will already be doing!

5 Provide nesting places for wild bees

Wild pollinators need safe places where they can nest and breed in peace.



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Source to Tap - emerging evidence of the scale of the MCPA pesticide problem in cross-border Irish catchments

Source to Tap are monitoring water quality in the River Derg to gauge the impact of grants given to farmers to help them act to reduce the level of pesticides in drinking water. This monitoring will help establish if the financial incentives for farmers provides a more cost-effective way of reducing pesticide concentrations in drinking water than treatment at the works does.



Ensuring the health of our rivers and lakes is not just a priority for the ecosystems they support, but also for the supply of clean drinking water. Under the Drinking Water Directive, the limit for a single pesticide in drinking water is 0.1 µg/L and for the sum of all pesticides is 0.5 µg/L. These limits refer to treated drinking water, with the levels of contaminants reduced during the treatment process. Nonetheless, high pesticide concentrations in raw water are costly to remove and exceedances of the standards in treated water are observed on occasions.

The River Derg flows east from Donegal across the border into Country Tyrone, where it supplies 16 million litres per day to nearly 40,000 people in Northern Ireland. However, concentrations of the pesticide MCPA have been detected up to 4.33 µg/L at the NI Water drinking water abstraction point and up to 8.97 µg/L in River Derg tributaries.

These concentrations were detected by the Agri-Food and Biosciences Institute (AFBI) and Ulster University (UU) as part of the Source to Tap project.



Figure 1: the 24-bottle refrigerated autosampler housed in its kiosk on the banks of the River Derg next to the Derg water treatment works.

Source to Tap is monitoring water quality in the River Derg to assess the impact of a financial incentive scheme for agriculture that aims to improve drinking water quality in the catchment. The

Source to Tap monitoring program is focused on MCPA, which is primarily used in Ireland to reduce the cover of rushes (*Juncus* species) on grazing land. MCPA is preferred over other herbicides as it does not kill grass and can therefore be sprayed, whereas other herbicides such as glyphosate must be wiped, requiring additional equipment.

In order to better understand the sources of MCPA within the tributaries of the River Derg, we conducted a water quality survey across the catchment between April and June 2018. Water samples, taken manually from the river, were collected at 11 locations throughout the catchment every Tuesday for 13 weeks, and analysed in AFBI's laboratories to produce weekly snapshot maps of MCPA concentration. To capture the daily and seasonal variability in MCPA concentrations, we also established a high-resolution bankside sampling system just upstream of the intake for the Derg water treatment works (Figure 1). A 24-bottle refrigerated autosampler was programmed to take a sample once every seven hours, giving us coverage day and night over the course of a week and ensuring that storm events – which are frequently the means by which pollutants are washed off land and into the river – are captured. Once a week, the samples are collected for analysis at AFBI and we now have a full year of high-frequency results between April 2018 and April 2019.

The weekly samples from across the catchment showed that concentrations increased as we moved downstream from the peat-covered and forested areas around the headwaters, through rough grazing land and into the increasingly more intensively farmed land around Castlederg. The average concentration of MCPA in the spatial samples across all tributaries over the 13-week period was 0.14 µg/L. Notably, the tributary with the highest concentration of MCPA (8.97 µg/L) also had the highest average concentration (0.84 µg/L), suggesting that this tributary is frequently having the greatest negative effect on the water quality in terms of pesticide release.

What was more concerning was that the average annual MCPA concentration for the high frequency river water samples, taken just upstream of the NI Water drinking water abstraction point,

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Figure 2 (right): MCPA concentrations (left axis in log-scale; orange circles) and river level (right axis; blue dots) in the River Derg at the bankside monitoring station next to the Derg water treatment works between April 2018 and April 2019. The dotted black line shows the legal limit for MCPA in treated drinking water.

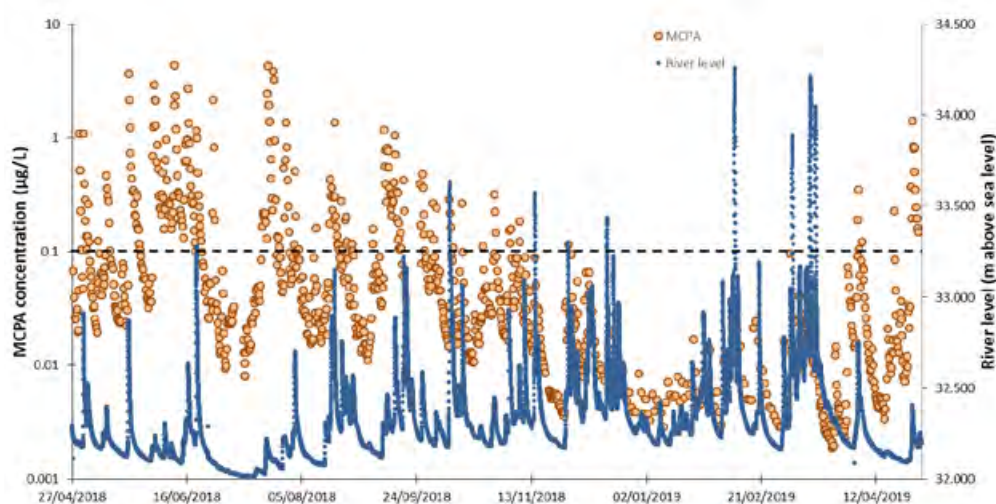


Figure 3 (below): The Source to Tap project has a Land Incentive Scheme with 100% funding for the above measures on farms in the catchment area for the River Derg drinking water treatment works. Farmers can also suggest their own ideas under the Farmer Innovation heading.

Item	Description
Advice and Support	
1.1	REQUIRED: Water Environment Management Plan Development and Delivery (produced by your project officer with your input)
1.2	Rush and/or Peatland Management Plan (where applicable)
Herbicide/Pesticide Control and Rush Management	
2.1	Installation of a pesticide sprayer loading area and wash down area
2.2	Installation of biobed
2.3	Installation of biofilter
2.4	Provision of pesticide storage unit
2.5	Contractor for weed wiping to replace MCPA use
Protection of watercourse from stock & alternative drinking points	
3.1	Stock fencing on watercourses
3.2	Tree Planting next to Watercourses
3.3	Alternative Stock Drinking Points - Water Trough (Including base)
3.4	Alternative Stock Drinking Points - Cattle Operated Pasture Pump (Including base)
Reduction in surface flow across farm	
4.1	Gateway relocation
4.2	Improvement of farm tracks and access routes
4.3	Clean and dirty water separation
4.4	Sedimentation traps and interception ponds
Peatland Management	
5.1	Drain blocking
5.2	Restoration of peat without plant cover - nurse crop
5.3	Restoration of peat without plant cover - brush spreading
Other	
6.1	Farmer Innovation

was 0.15 µg/L. Additionally, over 25% of the samples contained more than 0.1 µg/L of MCPA (Figure 2). This means that both the organisms in the river and the water treatment works' filters are subject to high levels of MCPA for prolonged periods. Data on the toxicity of MCPA to insects, fish and other animals is sparse and mostly inconclusive and therefore such prolonged high concentrations in the river water may contribute to a loss of biodiversity and a reduction in the number of some species. The frequency of high MCPA concentrations in the river water also increases the costs of treating it for drinking.

The majority of the high concentrations occurred in late spring/early summer and late summer/early autumn, which coincides with peak periods for MCPA application. Additionally, MCPA is highly soluble and the majority of high concentrations coincide with storm events when rainfall would have washed pesticides into the river. However, peaks occur that are not associated with rainfall, which could be caused by farming activities such as spraying too close to water courses or accidental spills. Interestingly, MCPA was present in river water over the entire year, albeit at low concentrations over winter, indicating a persistent source to the river system, either from water stored in the soil or from groundwater.

Comparison of our high-resolution data with the statutory monitoring of raw water at the water treatment works highlights that the statutory monitoring, which is taken less frequently, is underestimating the extent of the problem with herbicide contamination. Our monitoring is therefore of benefit to the water companies because it gives them a better idea of the scale of the problem and can help them target resources and measures towards removing pesticides and improving drinking water. AFBI and UU will continue to monitor MCPA concentrations in the River Derg for the next 2 years. The data will be used to determine whether the financial incentive scheme provides a more cost-effective way of reducing pesticide concentrations in drinking water than treatment at the works does.

Phoebe Morton, Source to Tap, AFBI

Learn more:

www.sourcetotap.eu
www.catchments.ie/river-derg-catchment-pilot-cross-border-grant-scheme-in-donegal-and-tyrone-helps-farmers-protect-rivers-and-drinking-water

The Source To Tap project is supported by the European Union's INTERREG VA Programme, managed by the Special EU Programmes Body (SEUPB).

³statutory monitoring of raw water is the regular testing by water companies of water for specific substances as prescribed by law.

Volunteer-led peatland restoration battles climate change and enhances these unique habitats for native wildlife

Catherine O’Connell tells us how volunteers are helping the Irish Peatland Conservation Council restore bogs in Ireland by blocking drains and rewetting these unique habitats– and how these efforts can take decades to see results.



In the lifetime of a peatland, which can exceed 10,000 years, the peatland stores soil carbon in the form of partially decomposed plant remains or peat. High water table levels prevent aerobic decomposition and allow for the accumulation of peat. In terms of greenhouse gas management, the maintenance of large stores of carbon in undisturbed peatlands is a priority. Drainage of peatlands directly contributes to the release of stored carbon from a peatland through the process of decomposition.

Every peatland habitat in Ireland has been affected by drainage for turf cutting, peat harvesting, forestry and reclamation. These man-made impacts have led to the loss of 80% of the habitat and have been responsible for releasing millions of tonnes of greenhouse gases into the atmosphere to fuel global warming. Active management is urgently needed to restore the hydrology and the carbon storage functions of peatlands.

Site restoration is a costly and time-consuming business. It takes decades to reverse the effects of drainage on bog hydrology. Drains inserted in peatlands mostly for peat extraction lower the water table and dry out the surface peat layer (which is 98% water) sufficiently to allow machinery access to extract turf. Once the bog begins to dry, the peat layer oxidises and shrinks creating a slope. Rainfall landing on the bog surface no longer percolates slowly across the site but discharges quickly from the bog. Changes also occur in vegetation composition. The peat forming Sphagnum mosses die back and are replaced by the non-peat forming mosses which can tolerate the shade cast by the luxurious growth of Ling Heather in the drier conditions. Essentially the peat forming function of the peatland is halted. The challenge for peatland managers is to restore this function. Peat formation requires a shallow slope (usually 0.3%), a supply of rainwater and the presence of Sphagnum mosses. The Irish Peatland Conservation Council (IPCC) own and manage a network of five peatlands throughout the country. These include examples of the three main peatland types occurring in Ireland.

Over the years in the role of land managers IPCC have developed skills in drain blocking and habitat restoration. For example, on Lodge Bog in Co. Kildare we have blocked 4km of drains, using Geoflex drain piling made from recycled plastic. The lumbar is purchased in 3m lengths which are driven into bog drains using a mallet. It usually takes 4-6 lengths to block a drain - the sheets interlock with one another in a tongue and groove system. The

positioning of drain blocks is determined by analysing the slope of the drain in a process called levelling. Regarding dam frequency, the rule of thumb is to insert a dam for every 10cm drop in the level of the drain with a minimum of three and maximum of ten dams per 100m length of drain. The objective of damming the drains is to bring the water table on the bog up so that it is within 10cm of the bog surface. Such a height is necessary to allow for subsequent growth of peat forming plants.



Figure 1: A Geoflex plastic dam constructed in a bog. Within hours the water backs up behind the dam. A raised water table on a bog works to maintain the carbon store contained within the peat soil of the bog. Photo: IPCC.

Volunteers are essential to this work as IPCC operate on vegetated sites that cannot accommodate drain blocking machinery. Where a particularly large main drain occurs on the bog it is blocked with a composite dam. This is constructed from two layers of drain piling with a layer of peat infilled between them.

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Drain blocking really works well, and volunteers marvel at how rapidly the water backs up against a newly constructed dam. Rewetting the peat stops the process of decomposition and the release of carbon dioxide. IPCC have found on Lodge Bog that the refilled drains colonise with aquatic Sphagnum mosses within five years - the first positive change in the vegetation and the beginning of restoration to peat forming habitat (see Figures 1 and 2).



Figure 2: Within five years blocked drains revegetate with peat-forming vegetation including Sphagnum moss as seen in this drain on Lodge Bog in Co. Kildare. Photo: IPCC.

However not all Sphagnum species produce peat to the same extent. Bog pool species typically the first to colonise blocked drains have a relatively poor peat-forming capacity.

The hard-oxidised peat of the bog affected years of drainage can be resilient to rewetting and hostile to natural colonisation with Sphagnum mosses. IPCC use another technique to speed up the process of restoration.



Figure 3: Photos showing a successful Sphagnum inoculation site on Girley Bog, Co. Meath. The top photo shows the site just after inoculation when Sphagnum moss fragments were covered with straw in 2015. The bottom photo shows the same area in 2017 with a healthy Sphagnum moss growth. Photos: C. O'Connell.

On areas where the water table is consistently recorded within 10cm of the peat surface, Sphagnum transfer can be undertaken. This restoration technique was developed by Canadian peatland managers and involves collecting Sphagnum moss fragments and inoculating them onto fresh, bare, moist peat. IPCC carried out trials of this method on Lodge Bog between 2009 and 2013 and met with success. Since then we have used the technique on suitable sites in Girley Bog in Co. Meath. Again, volunteers are essential as the Sphagnum transfer method is completed by hand. First drains are blocked to raise the water table to within 10cm of the bog surface. The dry oxidised peat is removed. Fragments of Sphagnum capillifolium are collected from a donor site and spread over the bare peat in a ratio of 1:10. The moss fragments must be covered with straw to help retain moisture on the bare peat surface until they begin to grow. Very positive results are seen on bogs using this method after three years (see Figure 3). Sphagnum capillifolium is a moderately peat-forming moss that can withstand alternating wet and dry conditions which makes it ideal for inoculation.

Table 1: Restoration Timeline for Irish Bogs

Days/Weeks	Improvement of physical conditions
Weeks/Months	Improvement of chemical conditions
Months/Years	Improvement of biological conditions
Years/Decades	Topographical changes

With the increased awareness of climate change, bog restoration is a sensible way to help maintain the carbon store that has been locked in the peat for up to 10,000 years, preventing this from leaking into the atmosphere. While the results of drain blocking may be seen within a matter of days, the restoration of peat formation involving recolonisation with Sphagnum mosses will take decades (see Table 1).

Catherine O'Connell, Irish Peatland Conservation Council

Learn more:

www.ipcc.ie

The IPCC on line Peatland Management Tool Kit provides information on management skills and techniques currently in use in Ireland in the restoration of peatlands - www.ipcc.ie/advice/peatland-management-diy-tool-kit

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Across Ireland blanket bog has been impacted by human activity. The relatively intact bog in the foreground of this picture has become increasingly rare. Of 341 catchment areas, surveyed by QUBBES researchers using remote sensing, only 11, or 3%, showed no sign of human disturbance. On-site investigation of many of these relatively undisturbed areas showed that even these had been affected by burning, drainage and/or overgrazing.

Mending a ragged blanket bog: room for improvement?

Raymond Flynn and Francis Mackin from Queens University Belfast tell us about how their research is helping us understand the relationship between ecology and hydrology in Ireland's blanket bogs, and how their search for intact blanket bogs had startling results...

It will come as no surprise to some readers of the Catchments Newsletter that many of Ireland's wetlands are in a bad way. Mechanised peat harvesting has resulted in the loss of extensive areas of bogland over the last 60 years. So much so that once common habitats, such as the active raised bog (ARB), which supports peat accumulating plant communities, have now become rare, with coverage estimated at less than one percent of its original area. What's more these activities continue, even in many protected areas.

The on-going damage to Irish peatlands has motivated the European Commission to raise the possibility of imposing annual €9,000,000 fines on Ireland to force us to address this issue. The particularly acute situation of raised bogs has prioritised their assessment, done by pulling together botanical and hydrological knowledge accumulated over the past 30 years. This information has allowed National Parks and Wildlife Service (NPWS) to develop a scientific basis for raised bog conservation and restoration programmes for each site in Ireland's network of raised bog special areas of conservation (SAC) and national heritage areas (NHAs). These programmes now form part of Ireland's National Peatland Management Plan.

Progress made by NPWS has been accompanied by a wider recognition of the need for peatland conservation and restoration. On the coattails of the NPWS survey, raised bog conservation and restoration has received further boosts through the EU-funded Living Bog Project, and smaller community-based initiatives, such as those at Abbeyleix, Co. Laois, and Mount Allen, Co. Roscommon. In all cases, scientific knowledge and expertise help identify causes of habitat loss, aiming to reverse year on year trends, and although the situation is far from ideal, there have been some successes, such as Lisnagerragh, Co. Galway where restoration measures have resulted in the area containing ARB more than doubling between surveys completed in 1994 and those carried out in 2012.

But of course, raised bogs form only part of the equation. What about other peatland types? Research into fen ecohydrology has been reasonably detailed, with findings from elsewhere allowing Irish researchers to better understand fen dependence on hydrology. As a result, we have a reasonable understanding of how water supports fen ecosystems.

By contrast, the situation with blanket bogs is not so rosy. Although there is a widespread consensus that water forms a crucial supporting element for blanket bog ecosystems, a review of the scientific literature reveals that almost all hydrological research focuses on sites that have been damaged, often through burning or overgrazing.

The motivation for most blanket bog hydrological research is the development of restoration plans. But to what? In the case of severely damaged areas, where vegetation may be thin to absent, colonising the surface with plant cover is considered a success; but is that really good enough? Shouldn't we be aiming to bring

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back the blanket bog that was there in the first place, and all the benefits/ecosystem services this entails?

One of the aims of the EPA-funded research project Towards the Quantification of Blanket Bog Ecosystem Services (QUBBES), is to better understand the relationship between blanket bog ecology and hydrology in intact blanket bog catchments. To this end, QUBBES researchers undertook a survey of blanket bog catchments, searching for those areas where there was no evidence of physical disturbance, including drainage, peat cutting, burning, overgrazing, forestry or wind turbine developments.

The results proved startling. Of the 341 candidate catchments considered least disturbed, and thus included in the survey, 11 showed no sign of physical disturbance. Even more surprisingly, of the four sites considered most suitable as undamaged sites, all displayed evidence of physical disturbance, including burning, overgrazing and/or drainage, when inspected on the ground.

Findings underscored the need to abandon the idea that large areas of Irish blanket bog remain intact; scientific data clearly suggest otherwise.

Looking at this another way, the results highlight an even greater need to understand ecohydrological processes in these if appropriate restoration targets are to be established. By following this approach, and combining lessons learnt in developing raised bog conservation plans, realistic restoration targets may be established, and scarce resources most effectively applied to maximise benefits to society and the wider environment.

Raymond Flynn and Francis Mackin, School of the Natural and Built Environment, Queen's University Belfast.

Learn more:

www.qub.ac.uk/schools/NBE/Research/ResearchCentres/qubbes/

Ireland's Blanket Bogs – more dynamic than meets the eye

Raymond Flynn and Michael Anderson from Queen's University Belfast's explain how Ireland's blanket bogs are affected by the hydrology of their catchments.

Understanding how water flows through these landscapes will be key to protecting them and restoring them. Instruments measuring rainfall, runoff, evapotranspiration and groundwater levels have been installed at three sites in Antrim, Cavan and Sligo and these data are being complemented by detailed vegetation mapping and water quality monitoring.

Those who pay regular visits to blanket bogs will know how important hydrology can be for getting around. On all-too-frequent rainy days streams can flow with an energy that can pose a risk to the life to those brave (or mad) enough to try and cross them. Yet shortly after rainfall stops, flows can decline quickly and can be low enough to allow people to safely skip across a few hours later, reflecting the speed in which these processes can change. Of course rainfall and runoff are only two of the hydrological processes that affect blanket bogs, albeit those that have received the lion's share of attention from the hydrological community. Other processes, such as groundwater flow through peat, remain somewhat neglected, with many researchers assuming that blanket peat is low permeability mass of saturated organic material that prevents rainfall from infiltrating. Put another way, all the action would appear to occur above ground. However, appearances can be deceptive. Despite their flashy nature, many streams draining blanket bog catchments continue to flow, even during prolonged dry spells, prompting the question "where does this water come from?" Looking at this in more detail suggests that the idea that all stream discharge comes from overland flow, unable to infiltrate through the peat, may be an over simplification and that processes

may be more complex.

Understanding how and why water behaves as it does in blanket bogs has become increasingly relevant in recent years, with the need to better characterise aquatic ecosystem supporting conditions in many of the high status water bodies that blanket peat-covered catchments host. This has become all the more pressing due to widespread deterioration of many with recent upland developments. As most readers of the Catchments Newsletter will be aware, Water Framework Directive legislation requires this deterioration to be restored, even though we may not know how to do so. Better understanding hydrological processes provides an important stepping stone for addressing this issue.

As part of the EPA-funded "Toward the Quantification of Blanket Bog Ecosystem Services (QUBBES)" investigation, researchers at Queen's University Belfast have initiated a series of integrated studies on blanket peat covered catchments to better understand their hydrology. Instrumentation installed at relatively intact sites in counties Antrim, Cavan and Sligo makes regular high-resolution measurements of rainfall, runoff, evapotranspiration and groundwater levels. These measurements have been complemented by vegetation mapping and water quality monitoring with a view to better addressing the controversy around whether blanket bogs act as sponges or not, and to what degree their natural hydrological processes have been altered by human activity. This in turn provides a basis for examining changes in water quality over time frames from individual storm events to longer term trends.

In investigating these issues it has become apparent that contributions to stream flow are more complex than originally assumed. In response, researchers' attention has expanded to consider the role of groundwater flow through peat, and the contribution it makes to runoff. Although a number of publications

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have examined the issue of peat hydraulic conductivity, few have expanded this to consider groundwater flow rates. And besides, consensus on measurement of peat hydraulic conductivity measurement remains inconclusive.



Figure 1: Understanding pathways feeding the streams draining Irish blanket bog catchments remains a poorly understood topic. Rapid rainfall/runoff responses often result in significant differences in discharge over short periods. Discharge during dry weather (above) at approximately 45litres/sec contrasts with that during wetter weather (below) where discharge rose to 1.1m³/sec.

Tracer testing forms an alternative means of investigating blanket bog hydrogeology, without the need to measure either hydraulic conductivity or hydraulic gradient. Measuring the rates of change in concentration of easily detectable tracers, either in single wells, or between wells provides a useful tool to better understand groundwater flow and its variability. Peat is ideally suited to these types of investigations, given the ease with which monitoring wells can be installed. On the other hand perceptions about its very low hydraulic conductivity have meant that the technique has been rarely used in the past. QUBBES researchers examined this issue in more detail.

During spring and summer 2018 researchers installed an array of tracer test wells in blanket peat in the Collin Burn Catchment in the QUBBES Garron Plateau Test Site, Co. Antrim. Initial single well tests revealed tracer levels declining to one tenth of their starting concentration in a matter of hours, suggesting that groundwater flow rates were considerably higher than expected (Calculated values were of the order of 0.1m/day). Similarly flow velocities were observed elsewhere across the site.

The findings from single well dilution tests prompted the researcher team to undertake multiple well tracer testing, where tracer was injected into one well and monitored at observation wells down gradient. Figure 2 provides an example of the type of breakthrough (tracer concentration with time) curve obtained. Results confirmed findings of single well tests, while also indicating a large variety of groundwater flow velocities for groundwater flowing through blanket peat.

Mathematical modelling of breakthrough curves using single velocity and dispersion terms failed to satisfactorily simulate the responses observed in the field. On the other hand the introduction of a second term generated a reasonable fit. But on what physical basis? Coring the peat provided the answer. Samples collected using a 50mm ID Russian Auger revealed 30cm-50cm of relatively undecomposed moss-rich peat, underlying the uppermost 5cm-10cm of highly decomposed peat; the moss-rich overlay more amorphous (highly decomposed) material. Tests in comparable material elsewhere have shown flow rates through the fresher material are considerably higher than those at depth. The widespread occurrence of this deposit at the site suggests that flow below the bog surface can provide an important pathway for delivering groundwater to rivers and streams. This contrasts with the idea that blanket peat is an amorphous low permeability mass.

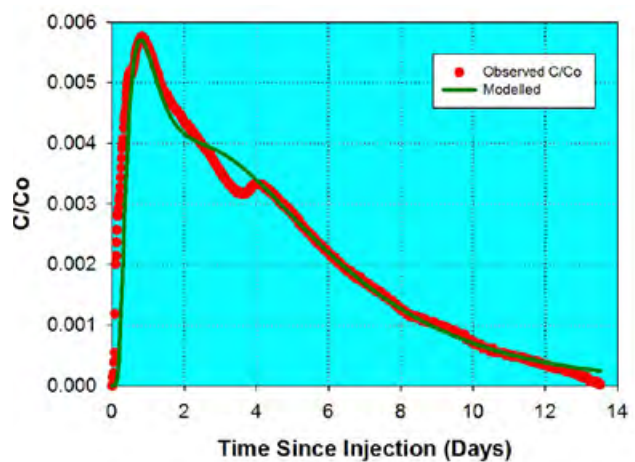


Figure 2: Modelled and observed breakthrough curves generated from a tracer test in blanket peat at the Garron Test Site, Co. Antrim. The curve required two transport terms to generate an adequate model fit.

The results of this study, although brief, have provided a basis for challenging preconceptions about groundwater flow through blanket peat, while further underscoring the importance of subsurface process in delivering water to streams in peat covered catchments. From another perspective the study has emphasised the value of tracer testing in Irish hydrogeological investigations, beyond its conventional application in karst systems. Ongoing work on this topic at Garron aims to integrate these results into numerical models to better understand how blanket bogs function and the ecosystem services they can provide to society.

Raymond Flynn and Michael Anderson, Queen's University Belfast.

Learn more:

www.qub.ac.uk/schools/NBE/Research/ResearchCentres/qubbes/

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Japanese Knotweed, *Fallopia japonica*. Photo: Eithne Davis.

Prevention, control and eradication of invasive species

A diverse array of damaging invasive species are present in Ireland, and are affecting the health of our ecosystems. Improved awareness and participation in biosecurity practices will be key to the future management of invasive species. Neil Coughlan tells us about his work on a four-year EPA funded research project ‘Prevention, Control and Eradication of Invasive Alien Species’

Invasive species are now a common sight across the island of Ireland. From garden escapees to stowaways, to those that have been deliberately released, many invaders have become firmly established and household names. For example, Japanese knotweed, *Fallopia japonica*, with its notorious ability to resist tried-and tested control measures and devalue property, has become an iconic invader. However, although its bad reputation is well earned, many other current and potential invaders are not so well known, despite their negative ecological and economic impacts. These species can outcompete our native flora and fauna, reduce local biodiversity, alter ecosystem functions and services, and diminish the value of our natural capital. Yet, Ireland is not unique in this regard, as the continued spread of invasive species is a global problem.

In 2014, the European Union (EU) enacted the Invasive Alien Species Regulation (1143/2014), which requires Member States

to prevent, control and eradicate damaging invaders. Forty-nine invaders have been formally listed as Species of Union Concern, their control and possible eradication is considered of paramount importance. Nevertheless, although many current and potential invaders have not yet met the collective EU criteria to be included in the list of Species of Union Concern, as a whole, these species are potentially no less damaging.

Iconic invasive species continue to grab both media headlines and emergency ‘war-chest’ funding. However, greater awareness and provisions for managing other lesser known invaders is also needed. Through broadcast and social media, workshops and citizen science initiatives, the Institute of Technology, Sligo has led an outreach programme to increase awareness of the invasive terrestrial plant winter heliotrope, *Petasites fragrans*. This work has greatly improved our understanding of the distribution of winter heliotrope across the island of Ireland and has highlighted the importance of communication and meaningful engagement between the research community, stakeholder groups and the wider public to manage the spread of this invader.

Undoubtedly, prevention remains superior to cure, as management options for effective control and eradication of established invaders is often complex, expensive, resource-intensive, and can be damaging to non-target native species. In many cases, there are simply no means of effective population suppression. For example, the Asian clam, *Corbicula fluminea*, is regarded as a high impact freshwater invader, which can dominate macroinvertebrate communities and physically alter benthic habitats. To date, despite control and eradication attempts worldwide, effective population

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suppression has yet to be developed. Since 2016, however, laboratory-based experiments at Queen's University Belfast have been conducted to examine the susceptibility of Asian clam to thermal shock. The effect of sudden exposure to either extremely cold or hot temperatures to kill clams has been investigated. Although the results are promising, further assessment is still required before these techniques can be applied in-field by designated responsible authorities.



Winter heliotrope, *Petasites fragrans*. Photo: Eithne Davis.



Asian clam, *Corbicula fluminea*. Photo: Professor Joe Caffrey.

Yet, despite the need for improved population control, prevention of further spread is an essential aspect of optimal invader management. To achieve this, biosecurity campaigns such as Check, Clean, Dry in New Zealand and Great Britain, and No Dip No Draw as promoted by the Irish Angling Development Alliance, have meaningfully attempted to prevent invader spread through increased public awareness and the provision of practical decontamination guidance. For example, Check, Clean, Dry promotes the use of systematic checks of equipment such as footwear, clothing, nets, watercraft, trailers and vehicles, which is then followed by the removal of any material through cleaning procedures. Following physical decontamination, extended drying times are recommended as a best-practice protocol.

Recently, innovative research led by Queen's University Belfast has sought to address knowledge gaps and deficiencies in relation to various spread-prevention techniques. In particular,

the susceptibility of a variety of damaging aquatic plants and invertebrates to applications of aquatic disinfectants, steam, and hot-water treatments has been examined. In general, the assessment of aquatic disinfectant has provided mixed results. For example, submergence within disinfect solutions did not deliver complete mortality of aquatic plants or most macroinvertebrates, but did effectively kill some high impact species, such as killer shrimp *Dikerogammarus villosus* (not yet known to be present in Ireland), and bloody-red mysid shrimp, *Hemimysis anomala*. Nevertheless, aquatic disinfectants remain essential for the spread-prevention of damaging pathogenic invaders, such as the salmon fluke, *Gyrodactylus salaris*, and their role within the biosecurity 'tool-box' is crucial. Due to the serious risks posed by invasive pathogens to our native freshwater fauna, including catastrophic damage to a number of our protected indigenous species, such as the white-clawed crayfish, *Austropotamobius pallipes*, a campaign to encourage all water users to Check Clean Dry and/ or Disinfect is being promoted across the island of Ireland. On the other hand, thermal treatments such as steam and hot-water applications have been shown to be highly effective at causing invader mortality for almost all species examined. Going forward, however, prior to recommendation in any Best Practice Guideline, further consideration will need to be given to the practical, user- and environmentally-friendly application of these biosecurity techniques.

Despite the pressing need for further research, spread-prevention of invaders can be greatly assisted by all stakeholder groups, who should seek to increase awareness of invader spread-prevention amongst their members, staff and general public. Practical decontamination of equipment can help limit the spread of invaders, particularly those that are visually difficult to detect, and prevent ecologically damaging and economically costly invasions. Although there is scope to greatly improve biosecurity techniques, even simple steps, such as Check, Clean, Dry, Disinfect can be implemented by every individual to prevent further invader spread.

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Learn more:

www.biodiversityireland.ie

The National Biodiversity Data Centre have excellent advice and you can report a sighting of invasive species on their website



For further information



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