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Catchments Newsletter

Integrated Catchment Management: sharing science and stories

Inside this issue

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Editorial

In the EPA's most recent water quality indicators report, which looked at data up to the end of 2017, we have unfortunately seen a continued decline in water quality, and an increase in nutrients being released to waters. We are also losing our highest quality sites, our pristine water quality sites, across Ireland.

Water quality issues can be very localised, with huge differences between different catchments. Over the last few years, the EPA has focused on making sure that we understand what is happening to water quality locally – where the issues are, what are the likely significant pressures causing these issues, and what can be done to fix them. You can see some of the work being done by the EPA Catchments Unit to help target the right measure in the right place on pages 37 and 38.

Working with local communities and landowners will be the key to any improvements. This issue of the Catchments Newsletter focuses on agriculture. There are challenges, but also opportunities. The EPA has been working as a partner with the agricultural community on schemes like the pilot farm hazardous waste collection scheme, and the IFA Smart Farming Initiative (see page 36). We are working with multiple partners on the Blue Dots Catchments programme (page 23) which aims to protect and restore our pristine and high status waters in Ireland.

We have articles on Farming for Nature and two of the new European Innovation Partnerships (EIPs) working directly with farmers – the Mulkear EIP and the Pearl Mussel Project EIP. These EIPs are implementing innovative ways to make sure that farmers are paid for the environmental public goods they produce, with locally adapted results-based payments. There are now 23 EIPs working across Ireland – you can see details of all these EIPs on page 42.

Coillte is one of the largest landowners in the country, and their recently lunched not-for-profit Coillte Nature subsidiary, which will focus on carbon sequestration, species diversity, biodiversity, and development of recreational forests, is a really exciting development (see page 19).

We also have two stories from further afield – Ken Taylor from New Zealand's Our Land and Water National Science Challenge gives us his perspective. Ken recently visited Ireland, and in his words:

'farmers in both our countries want to do the right thing by the environment, but they need a clear understanding of what the right thing is, and that includes the evidence base that supports action on the ground'.

The EPA Research programme has multiple projects helping with this evidence base – you can read about two of these which are working on nutrient critical source areas, national benchmarks for nutrient use and legacy phosphorus issues on pages 39-41.

The EPA is also working with the National Biodiversity Data Centre and is funding citizen science projects on dragonflies and damselflies and monitoring coastal biodiversity. You can read about how the EPA is supporting citizen science, and a LAWPRO-led project that is helping anglers monitor border lakes, on pages 14-18.

This is the second issue of the Catchments Newsletter to focus on agriculture. Our issue in March 2016 also had an agricultural focus and looked at the potential of locally led agri-environment schemes, the example of Burren LIFE project, and even had the BT Young Scientist's from Cork who had an award-wining project on the 'Plight of the Pearls' on the cover.

Three years later, locally-led schemes are in place across Ireland, the Burren's model of results-based payment is part of several of the new EIPs, and the Pearl Mussel Project is working to save this species from extinction in eight priority catchments across Ireland. Rivers Trusts are growing (see page 9) and local communities have clear guidance on how they can get funding under LEADER for projects related to water and biodiversity (see page 6).

'water is a heritage which must be protected, defended and treated as such' – preamble to the Water Framework Directive

You can see how local communities across Ireland got involved with this year's Heritage Week and Water Heritage Day on 25 August 2019, with stories, songs, crafts and sports helping them connect with their local waters (page 4). This partnership between LAWPRO and the Heritage Council is another great example of how by working together, we can achieve more.

As we approach the end of 2019 it is important to acknowledge the huge work that has been done in developing and beginning to implement the 2nd Cycle River Basin Management Plan. The LA Waters Programme has a team of people working on community engagement and local catchment assessments; the new sustainability advisors are now in place working with farmers to implement local measures; public bodies are engaged and are working collaboratively together on water issues; and the National Water Forum is now in place to make sure all stakeholders have a voice on future plans for our water.

The process of planning for the 3rd cycle of the Water Framework Directive, which will run from 2022 to 2027, has now begun. The EPA will publish the next Water Quality In Ireland report, which looks at data from 2016-2018, in late 2019. In December 2019, an overview of the Significant Water Management Issues in Ireland (SWMI) will be published by the Department of Housing, Planning and Local Government. A public consultation on SWMI will run until June 2020 and the outcomes of this will be used to inform a draft River Basin Management Plan for 2022-2027, which will be published in December 2020. There will be a further public consultation period on the draft plan until June 2021, and then the final River Basin Management Plan for 2022-2027 will be published in December 2021. Throughout this process, the Catchments Newsletter will continue to share science and stories about what is being done - and how much more work there is to do.

Jenny Deakin, EPA Catchment Science and Management Unit

Heritage Week – celebrating water and our connections to it.

Heritage Week took place this year from 17-25 August. The theme this year was 'Pastimes |Past Times'. Events took place all around the country, culminating in Water Heritage Day on Sunday 25 August.

As an island nation, our history and our heritage have been shaped by the sea and the great Irish rivers, lakes and wetlands. Stories, songs and poems passed down through generations have preserved deep-rooted traditions and connections with water.

Cities, towns and villages developed along our coast because of access to the sea, deep water ports and river estuaries for trade and transport. Fishing has supported rural communities and ensured a steady supply of fish for table and market. In fact, as a nation we owe a great deal to our natural waters and the myriad of wildlife they support.

This year's Heritage Week theme Pastimes | Past Times was an opportunity to recall great stories, songs, crafts, sports and other activities associated with your local river, lake, canal or coast.

www.heritageweek.ie

Kilkenny: Eanna Ní Lamhna and the local community in Graiguenamanagh taking a walk on the wild side.

Leitrim: Wild Child Day on the Bonet River, Dromahair.

Waterford: Dungarvan Harbour - connecting a community with their catchment with a guided nature walk along the Cunnigar sand spit, a natural feature that extends from An Rinn out into Dungarvan Harbour.

Waterford: Paddy Dwan, naturalist and photographer, leads a walk on becoming a wild life detective in the unique Anne Valley constructed wetlands and explains the importance of wetlands for our water and wildlife.

Kilkenny City: Pat Boyd and Pat Durkin lead a walk and talk on the wildlife living in and along the River Nore and the ongoing invasive species project.

Kerry: Kilmoyley Tidy Towns' Love our Waters Weekend.

Kildare: discovering Rathangan's water and wildlife on a visit to the River Slate and the Grand Canal organised by LAWPRO, Rathangan Tidy Towns and Wild Kildare.

Sligo: Seán Hickey reads some of his poetry and Michael Bell of Sligo's Birdwatch Ireland branch talks about birds on a stroll beside the Garavogue River.

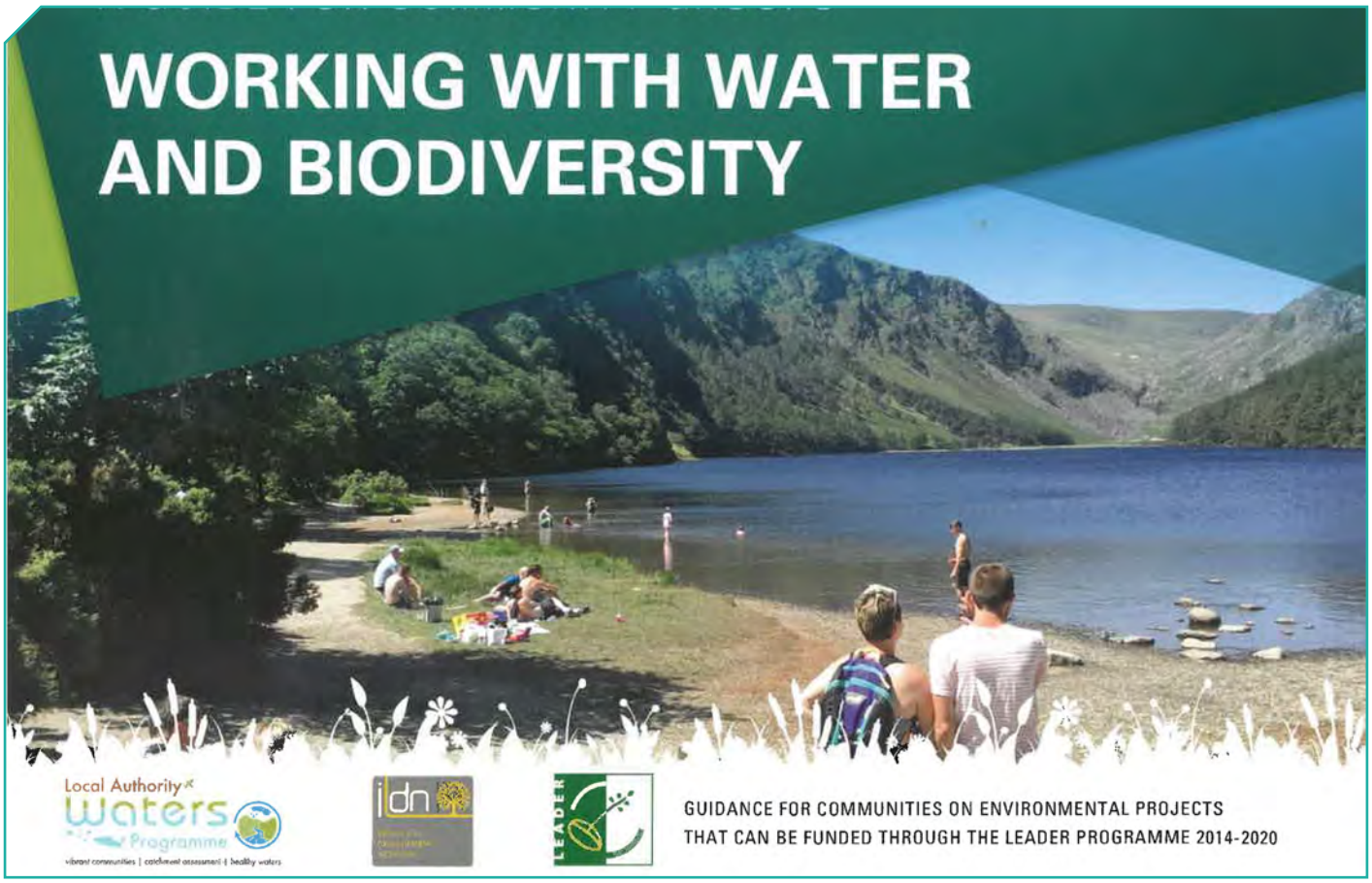
Wexford: visit to Woodland for Water river banks in association with Seal Rescue Ireland and the local community.

Monaghan: electrofishing the Mountain Water.

Galway: Milltown celebrating the River Clare on Water Heritage Day.

Galway: Corrib Beo organise a magical Water Heritage Day visit to Inchigoill Island and it's 11th century Romanesque church.

Clare: fieldtrip to the Shannon Wetlands Project.



The cover of the new Water and Biodiversity booklet, featuring Upper Glendalough lake on the hottest day of 2018. Photo: Fran Igoe.

LEADER - Working with water and biodiversity: a guide for community groups

The Local Authority Waters Programme has written guidance for communities on environmental projects that can be funded through the LEADER programme 2014-2020.

This booklet has a full guide for anyone who is thinking of applying for LEADER funding for water or biodiversity projects.

It includes examples and ideas for potential projects:

Think projects...	...think river catchments
• Planting of native wildflowers and vegetation in a habitat restoration project • Silt trapping or 'Slow the flow' Natural Water Retention Measures, such as the addition of large woody debris to drains • Rain gardens and Sustainable Urban Drainage Schemes (SuDS) • Innovating monitoring techniques • Rainwater harvesting on roof of buildings and use of recycled water • Coastal or lake nature safari and stewardship project by local anglers and recreational water users	• Fish passage projects • Tree planting and riparian biodiversity work • Citizen science led by anglers • Bespoke breeding boxes for birds and mammals • Wetlands to promote wildlife and reduce pollution and flooding • Removal of invasive species and biosecurity planning • Putting a plan together: feasibility studies and planning involving the catchment community • Outdoor biodiversity classroom

WATERS AND COMMUNITIES NEWS

Protecting and enhancing water quality in a community can have many benefits for people living locally: we all want to have good water. All our waterways are important, and work can be on everything from a small drain or stream to larger waterways such as rivers, lakes and coastal waters.

Ireland has some of the best waters in Europe, including High Status waters which are especially important for species like Atlantic salmon and Freshwater Pearl Mussels. Lots of our wildlife is now threatened with extinction and needs active support from communities all around Ireland. This booklet is an excellent guide to what your community can do.

Wildflowers for nature: wildflower meadows are beautiful and can help bees and other pollinators thrive.

LEADER: enabling community-led rural development

Since its launch in 1991, LEADER has provided rural communities across the European Union with the resources to enable local partners to actively engage and direct the local development of their area, through community-led local development. In Ireland, under the LEADER Programme for 2014-2020, a budget of €250 million in grant aid is being provided to support rural communities and local businesses.

The LEADER Programme is administered at a local level by 29 Local Action Groups (LAGs) who operate on administrative or county boundaries and are made up of local representatives from the community, public and private sector.

Each Local Action Groups is responsible for selecting and awarding LEADER funding to projects within their geographical area. A project must be aligned with the priorities of the Local Development Strategy (LDS). The LDS is a 5-year plan that was developed by the Local Action Groups, in conjunction with the rural community, to support the sustainable development of the area.

Grants are provided under the following themes and sub-themes:

- Economic Development, Enterprise Development and Job Creation
  - Rural tourism; Enterprise development; Rural towns; Broadband
- Social Inclusion
  - Basic services targeted at hard to reach communities; Rural youth
- Rural Environment
  - Protection and sustainable use of water resources; Protection and improvement of biodiversity; Development of renewable energy

All of the LEADER themes have some relevance to water. Different types of projects can be grant aided. These include:

- Training projects – up to 100% of a project can be grant funded
- Analysis and development – up to 90% of a project can be grant funded
- Capital projects – up to 50% grant aid for private project promoters, and up to 75% grant aid for community project promoters

In early 2018, the Local Authority Waters Programme (LAWPRO) met with the Department of Community and Rural Development to discuss how communities could better access LEADER funding for environmental projects. This followed an analysis by LAWPRO, based on discussions with community groups and potential applicants, the National Rural Network, LEADER company staff and CEOs on barriers limiting community take-up under the rural theme. The need for planning permissions and other associated requirements to be in place prior to the awarding of capital projects in environmentally sensitive areas was highlighted as a key blockage. This made projects in these areas more expensive and less attractive for groups to champion. To address this, LEADER rules have been changed so that permissions, Environmental Impact Statements, and Appropriate Assessments for projects under the Rural Environment theme can now be funded under LEADER.

Putting up nest boxes for the Dipper, a charismatic river bird and an indicator of clean water.

Learn more:

Hard copies of *Working with water and biodiversity: a guide for community groups* are available from the Local Authority Waters Programme – email info@lawaters.ie or contact your local Community Water Officer.

Building bridges: all photos accompanying this article are from a recent fact-finding trip to the UK to view the work of Rivers Trusts. Our Irish delegation included representatives of An Forám Uisce, EPA, LAWPRO and The Rivers Trust.

The growth of The Rivers Trust movement on the island of Ireland

Mark Horton from The Rivers Trust tells us how there are now ten rivers trusts in the Republic of Ireland, and a further seven in Northern Ireland, covering almost a quarter of the land on the island of Ireland.

Rivers trusts are community-led charities started by local people to care for their local rivers. They concentrate on delivering practical improvements for their rivers, get involved in education, flora, fauna, fisheries, biodiversity, habitat, access, pollution and any other issues that impact their river catchment, such as climate change, acid rain, litter and underlying social problems leading to environmental decline.

Over the past 12 months The Rivers Trust family in Ireland has grown from strength to strength. There are now 10 trusts stretching from northwest Donegal to southeast Wexford. There are a further seven rivers trusts in Northern Ireland, two of which in the Erne and the Blackwater (Ulster) river catchments are cross-border rivers trusts, bringing the total number of rivers trusts on the island of Ireland to 17. As catchment-based organisations they collectively cover an area equivalent to about a quarter of the landmass of the island of Ireland and cover thousands of kilometres of rivers and streams.

The most recent trust to form is the East Wicklow Rivers Trust. Its area of interest stretches from Bray in the north to Arklow in the south and encompassing a diverse range of river types and habitats. The Trust had its official launch on 8 May on the banks of the Vartry River where guests not only got to hear about the Trust's plans, but got to get their hands wet, with Professor Ken Whelan leading a freshwater mini-beast hunt and introducing everyone to the wonders of the world beneath the ripples of the river.

Although almost all the Irish rivers trusts have formed over the last few years, they are already undertaking projects tackling a wide range of catchment issues. In County Donegal, Inishowen Rivers Trust is leading on a pilot project of national significance. Following the devastating flooding in August 2017, the Trust has been working with the local community to identify opportunities for implementing natural flood management measures that could help slow the flow of water from the land, retain water where it is useful in the landscape and provide added benefits for wildlife and people. This work is being undertaken with help from Professor Mary Bourke, Trinity College Dublin, who is carrying out a study into possible options for implementing natural water retention measures in the area. The study is titled 'Natural Water Retention Measures in Inishowen – Community Engagement and Development of Strategic Plan' and is funded through a grant from the Office of Public Works.

Maigue Rivers Trust have been working with their local community to help tackle the scourge of Giant Hogweed, an invasive plant from the western Caucasus region of Eurasia. The plant outcompetes native riverbank flora, creating a monoculture that dies back during winter leaving riverbanks bare and prone to erosion. In the summer the sap from the plant can cause sever blistering of the skin posing a threat to human health. The Trust has worked closely with the Ballyhoura Development CLG using funding from Local Agenda 21, the Heritage Council and the Salmon Conservation Fund to train up members of a Rural Social Scheme in invasive plant identification and control and in the safe use of pesticides. Giant Hogweed along a 12km stretch of the banks of the River Loobagh from Ballingaddy to the confluence with the Maigue has been treated each year since spring 2016 and already there has been a significant decrease in the amount of Giant Hogweed in the catchment.

In County Mayo, the River Moy Trust has secured funding to work with the farming community to look at reducing livestock access the river. It is working one-to-one with landowners to identify areas where livestock exclusion fencing can be erected to protect the riverbanks from erosion and where cattle-operated pasture pumps can be installed to offer alternative drinking water sources, providing benefit to both the river and the landowner.

Other rivers trusts are currently running or planning to deliver training programmes for the public to engage people in citizen science and hands on river conservation work. Education projects in schools focusing attention on our precious freshwater environment and its wildlife are also top of the agenda for trusts up and down the country.

These are just a few examples of some of the great work river trusts are doing in Ireland.

Mark Horton – All-Ireland Director, The Rivers Trust and Chief Executive, Ballinderry Rivers Trust

Learn more:

The establishment and work of rivers trusts in Ireland is supported by Mark Horton the All-Ireland Director of The Rivers Trust and the Chief Executive of Ballinderry Rivers Trust in Northern Ireland. Mark works very closely with the Local Authority Waters Programme whose team of 12 Community Water Officers and over 30 Catchment Scientists are liaising with rivers trusts and like-minded groups to increase capacity, knowledge sharing and collaboration opportunities on water quality improvement projects and community engagement.

You can contact Mark Horton on 00 44 7572 287509 or email
mark@theriverstrust.org
www.theriverstrust.org

Rivers Trusts in Ireland, June 2019.

A booklet is only a first step: getting your feet wet is the best way to let our wild places and wildlife inspire wonder.

StreamScapes: 30 years of working with communities

streamscapes
the waters & the wilds

Mark Boyden from StreamScapes tells us about how over the last three decades StreamScapes has inspired local communities around Ireland and published localised booklets to help them understand the wonders of their local waters and wildlife.

It's now thirty years since a small, voluntary think-tank assembled in the late 1980's to consider how to respond to a collapse in water quality, after reading "Fish Kill" headlines on a regular basis.

Admittedly, we were Salmon aficionados, not necessarily anglers but all in love with the redeeming potential of the lore surrounding bradán feasa, keenly aware of salmon being dependent upon a wide suite of similarly pollution-intolerant species, and of how this entire ecosystem was inextricably linked with the highest water quality.

We founded Coomhola Salmon Trust and put in motion actions which would lead to the establishment of the StreamScapes Aquatic & Biodiversity Community Engagement Initiative. One important measure that arose out of these deliberations was the creation of easy-to-understand introductory publications which would address water-related issues; the water cycle itself, pollution, food webs, water quality assessment, and other similar issues.

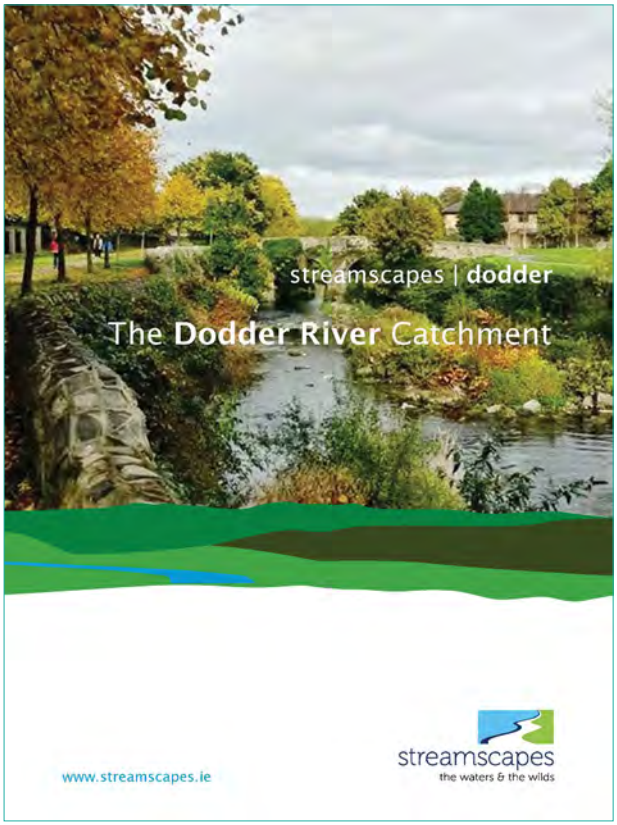
During the 1990's we conceived and published 'StreamScapes Basic' (intended for primary schools) and 'StreamScapes Advanced' (for secondary schools and lay adult community groups), together with their accompanying and dedicated 'Teacher's Guides'. With time, and field experience of community engagement, we saw that the localisation of environmental education greatly enhanced its effectiveness. In more recent years we took the generic material and repackaged it in a local context by;

1. having an iconic local image as the front cover;
2. featuring a local catchment map as booklet centre-fold;
3. describing the habitats and species, from source to sea, in the catchment in question (using Fossitt classification), and;
4. providing further catchment-related information, relevant local contact details as well as local sponsors' logos.

In retrospect it seems like such a simple and resource-efficient action, to take generic information and localise it, but to date we're not aware of this technique being utilised elsewhere.

With StreamScapes projects we ideally target direct project participation of a small critical mass of local population (generally circa 5%), however, to build project capacity, a widely-distributed booklet can reach a much greater number of people and assist in creating great local currency of water quality and biodiversity issues. Despite the growth of social media and web-based learning, there is still a place for an attractive colour booklet on a kitchen table!

The EPA, various Departments, State Agencies, and numerous Local Authorities have supported these publications which have reached thousands of households.



Streamscapes Dodder – which includes some amazing photos of local wildlife, information about the built heritage of the river, memories, stories and even a poem about the river, all provided by the local community. This publication was supported by Dublin City Council, South Dublin City Council, Dun Laoghaire-Rathdown County Council, The LA Waters Programme, and the EPA.

World Water Day 2019 saw the launch of the latest iteration, 'StreamScapes Dodder', which has added to a stable of StreamScapes books which cover catchments across Ireland north and south including the Erne, Ulster Blackwater, Slieve Gullion, the Burren, South East Galway, the Feale, Laune, Lee, Poulnasherry Bay, the Ilen, Loobagh, and the Catchments of Bantry Bay.

Learn more:

StreamScapes booklets can all be downloaded at http://streamscapes.ie/research/ and further information is available from Mark Boyden at streamscapes@eircom.net or on 027 50453.

EPA Research Report No. 155 - Public Engagement in Integrated Catchment Management: StreamScapes Recommendations can be downloaded using this link: www.bit.ly/streamscapesresearch

Citizen Science: how you can help monitor and understand your local environment

The EPA is working on citizen science in partnership with the National Biodiversity Data Centre, An Taisce and others. Citizens have been participating in and contributing to scientific research for years. The widespread use of smartphones means that scientific data can now be very easily shared and mapped. We need your help monitoring Dragonflies and Damselflies and recording what your see on the coastline near you when you Explore Your Shore.

Citizen Science is research carried out by members of the public who volunteer to collect scientific data. This research often focuses on monitoring biodiversity, invasive species and climate.

Although citizen science is a relatively new term, citizens have been participating in and contributing to scientific research for many years. The widespread use of smartphones means that scientific data can now be very easily shared and mapped, resulting in a rapid increase in the number and type of citizen science research projects. A number of organisations and projects have been established to help the coordination and communication of citizen science across Europe.

Carrying out citizen science offers many benefits for both citizens and scientists. Citizens working together can collect much more scientific data than scientists working alone. Participating in citizen science can increase public engagement with and understanding of important environmental issues. Citizen science can encourage people of all ages to get out into nature and can contribute to an increased sense of community.

The EPA is now funding several ongoing citizen science projects, with topics including water, air, radiation and biodiversity. These are run in partnership with other organisations, and include:

The GLOBE Programme

The Global Learning and Observations to Benefit the Environment (GLOBE) Programme is an international science and education programme that provides school students with the opportunity to participate in data collection and to contribute meaningfully to our understanding of the earth system and global environment.

GLOBE was re-launched in Ireland in 2017 and this two-year pilot programme is managed by An Taisce in partnership with the EPA. Participating schools learn about air quality and the weather by making scientific measurements and using their data to carry out research.

Learn more:

www.globe.gov/web/ireland/home

EPA/European Environment Agency Air Quality Project

Beginning in 2019, a joint European citizen science project will be carried out between many of the European EPA's and the European Environment Agency (EEA). This project will focus on the measurement of nitrogen dioxide concentrations in the air resulting from car use. More information will be available on the EPA website as this project develops.

Learn more:

You can learn more about other national citizen science initiatives and EPA supported initiatives at www.epacitizenscience.ie

Downy Emerald. Photo: Donna Rainey ©.

Four-spotted Chaser. Photo: Rachel McKenna ©.

Dragonfly Ireland 2019 - 2024 citizen science survey seeking volunteers

Dragonfly Ireland 2019-2024

Dragonflies and damselflies are beautiful creatures. Their presence near freshwater can provide a useful indicator of water quality. Dave Wall, Citizen Science Officer with the National Biodiversity Data Centre, tells us how your help is needed to monitor and map these creatures between now and 2024...

Dragonflies and damselflies are charismatic insects, easily recognised by their large size and dazzling body colours. This makes them a good target for biological recording. They spend most of their lives as aquatic nymphs, so their presence at freshwater sites can provide a useful indicator of water quality. Some species also have specific habitat and climate requirements which make them potential bio-indicators for habitat quality and climate change.

To say that dragonflies and damselflies have a long history would be something of an understatement. The earliest dragonfly ancestors pre-date the dinosaurs and are found in European Upper Carboniferous rocks, dating back 350 million years. These ancestors of dragonflies and damselflies included the largest winged insects that ever lived, with a two-and-a-half-foot wingspan. Modern dragonflies and damselflies appeared on the scene around 250 million years ago.

Historically known as 'Devil's Darning Needles', they were associated with evil in many European cultures, but we now know that they are in fact harmless to humans. They are however a very effective predator on other flying insects, with a 95% success rate in hunting. They feed on a range of species including midges, mosquitos, flies, wasps, butterflies, and other dragonflies and damselflies.

Dragonflies vs Damselflies

While the two groups superficially look similar, there are a number of pointers that may be used to tell dragonflies and damselflies apart.

Dragonflies are larger and more robust looking, and their bodies have a shorter, stockier appearance. Damselflies have longer, slender looking bodies.

The eyes of dragonflies are large and close together, making up much of the head of the animal. Damselflies' eyes are widely separated.

In dragonflies the hind wings are usually shorter and broader than the forewings, they are strong fliers and can be found well away from water. Damselfly wings are roughly of equal size, they are weaker flyers and tend to stay close to water.

When resting, dragonflies hold their wings spread out to the side or slightly forwards. Damselflies rest with their wings partially or fully folded backwards along the body.

Dragonfly and damselfly life cycle

The life cycle of dragonflies and damselflies consists of three distinct stages. The eggs are tiny (<0.75mm) and are laid on the stems or leaves of aquatic plants, or into water or wet mud. The eggs hatch in 2-5 weeks, however, eggs laid in autumn may enter a period of suspended development and will hatch the following spring. Dragonfly larvae are larger and more robust than damselfly larvae. As in the adults, the eyes of damselfly larvae are set far apart. Larval development typically lasts one or two years but can take up to 5 years for some species. Larvae feed on freshwater macro-invertebrates and even small fish.

Newly emerged adult dragonflies and damselflies are termed 'tenerals'. These are very delicate and should not be handled. They show little body colouration and have a distinct sheen to the wing membranes. The body colours become more vivid with

Large Red Damselfly. Photo: Gerry Fitzmaurice © .

time. Adults live for between 2 weeks and 4 months, depending on species. When adults reach sexual maturity, they return to water to mate and lay. In poor weather and low temperatures, dragonflies and damselflies cannot fly and will rest in ground vegetation, trees, and shrubs. Dragonflies and damselflies are predated upon by birds, spiders, frogs, newts, other dragonflies and even carnivorous plants.

Threats to Dragonflies and Damselflies

Globally, at least one in ten dragonfly and damselfly species are threatened with extinction. In the last assessment of the conservation status of the 24 species resident in Ireland, four species were assessed as threatened and one as near threatened. The remaining species were assessed as least concern. However, it is almost 20 years since the last major survey of dragonflies and damselflies in Ireland and new data is required for a fresh assessment of their conservation status. The main conservation threats facing Irish dragonflies and damselflies are habitat loss and water pollution. Three of the threatened species, Northern Emerald, Downy Emerald and Irish Damselfly are found in low nutrient status wetlands and the change brought about by enrichment of these habitats is considered their primary conservation threat.

Dragonfly Ireland 2019 – 2024

Dragonfly Ireland 2019 – 2024 is an all-Ireland survey of dragonflies and damselflies, and their habitats. The survey is coordinated by the National Biodiversity Data Centre in the Republic of Ireland and by the Centre for Environmental Data and Recording in Northern Ireland. Dragonfly Ireland 2019-2024 is funded by the Environmental Protection Agency as part of a citizen science project focusing on aquatic species and their potential as bio-indicators. The goals of Dragonfly Ireland include:

- Collecting verified dragonfly and damselfly records, contributing to a 2024 Dragonfly Atlas.
- Exploring the use of dragonflies and damselflies as bio-indicators of freshwater habitat quality.
- Engaging with the public to increase awareness of water quality and climate change.
- Developing and supporting a network of trained and experienced dragonfly recorders in Ireland.

Dragonfly Ireland will also generate important information on some of Ireland's small water bodies. Despite the widespread nature of small water bodies in the Irish landscape, they are a poorly understood habitat, and little is known about their ecological value. Collecting data on habitats and the associated dragonfly and damselfly fauna will help to fill this knowledge gap.

How to get involved

The project offers three levels of participation to volunteers.

- **Dragonfly Spotter** encourages the submission of casual sightings of any Dragonfly or Damselfly species.
- **Dragonfly Recorder** asks volunteers to conduct timed surveys of a freshwater site, record all dragonfly and damselfly species present, estimate their numbers, and assess their habitat. Two surveys must be completed, one in May/June and the second between July and September.
- **Dragonfly Monitor** asks volunteers to conduct a minimum of four surveys at their local site, and to repeat site surveys annually.

Learn more:

If you would like to participate in Dragonfly Ireland 2019 – 2024, further information is available at:

www.biodiversityireland.ie/record-biodiversity/dragonfly-ireland-2019-2024/

Sightings of Dragonflies and Damselflies in Northern Ireland can be submitted at: www2.habitas.org.uk/records/dragonflies

Explore your shore: volunteer to explore Irish coastal biodiversity

Explore Your Shore!

Dave Wall from the National Biodiversity Data Centre tells us how you can help map our marine biodiversity with the newly launched Explore Your Shore, and how this EPA-funded project is partnering with other organisations around Ireland's coasts...

The National Biodiversity Data Centre has launched a new marine citizen science project called Explore Your Shore! The project focuses on recording intertidal and coastal marine plant and animal species, and building a network of active marine biodiversity recorders in Ireland. The records obtained will improve our knowledge of marine species distributions around the Irish coast.

The life aquatic: a Common Hermit Crab and a Snakelocks Anemone. © Dave Wall.

Explore Your Shore! is calling on members of the public to get involved by submitting their records of intertidal and coastal animals and plants via ExploreYourShore.ie. The project is also asking the public to survey specific habitats and species using a suite of online surveys.

As part of the project, a number of survey and identification workshops will be held across Ireland. The records collected will be used to map the current distribution of intertidal and coastal species in Ireland.

Explore Your Shore! will assess the use of marine plants and animals as indicators of water and habitat quality, and to monitor the impacts of climate change. The project will also seek to map the distribution of invasive marine species such as wireweed, slipper limpet and Chinese mitten crab.

At a stakeholder workshop held on Bull Island in June 2019 to mark the launch of the project, Dave Wall, Citizen Science Officer with the National Biodiversity Data Centre said:

"Our shorelines are inhabited by a diverse range of marine plant and animal species that are readily identified by the public. The presence of particular species on a given stretch of shoreline can provide an indication as to the water quality and habitat quality at that location."

The National Biodiversity Data Centre's Director, Dr Liam Lysaght, added:

"Despite being an island nation, the importance of Ireland's intertidal biodiversity has not received the attention it deserves. This initiative aims to get people more engaged in discovering Ireland's shoreline and the wonderful biodiversity it contains."

Compass Jellyfish and Bladder Wreck seaweed. © Dave Wall.

Explore Your Shore! offers a suite of surveys to enable the public to get involved in marine citizen science data recording. The project aims to inspire people to get out and about on our coastline and to explore and discover the rich diversity of life on our shores. Participants will be able to map and explore their records via the National Biodiversity Data Centre's Citizen Science Portal, as well as benefitting from the physical and mental wellbeing obtained by spending time by the sea.

The project is also partnering with a number of existing coastal biodiversity recording schemes such as Seasearch Ireland diving surveys, Coastwatch eco-audit surveys and Purse Search Ireland which records shark, skate and ray egg cases. In addition to two existing surveys focusing on casual record collection and beach biodiversity, two more Explore Your Shore! surveys will focus on rocky shore biodiversity and photo-recording intertidal species.

Learn more:

If you would like to participate in Explore Your Shore! further information, survey forms and other resources are available at www.ExploreYourShore.ie

The National Biodiversity Data Centre App is available to download for iPhone or Android via their website www.biodiversityireland.ie

Explore Your Shore! is possible thanks to funding provided by the Environmental Protection Agency to promote citizen science and awareness of water quality in Irish freshwater and coastal aquatic habitats.

Anglers in border region scale up lake monitoring

The Local Authority Waters Programme is helping anglers in the border region monitor their lakes using innovative citizen science techniques. Three Community Water Officers tell us how the project is progressing...

Jimmy McVeigh, Community Water Officer, working with local citizen scientists to monitor a lake.

During the draft River Basin Management Plan consultation in 2018, anglers in the border region expressed a desire for more monitoring on their lakes. After researching the potential for LAWPRO funding for a Citizen Science monitoring project, the Border Community Water Officer team approached the Environmental Protection Agency, Local Authorities, Northern Ireland Environment Agency and IFI about a potential project. Once the agencies were on board the team applied for funding from LAWPRO which was awarded.

As the project was due to take place in different lakes along the border region the team wished a systematic methodology for data collection. Jimmy McVeigh explored the options and with the LAWPRO Technical lead Michael Pollard devised a GIS enabled app using Survey 123 ARCGIS. Working with Ray Smith of the EPA, Jimmy developed an online data entry system that would record site specific data directly onto the volunteers mobile or tablet. This provides a central database for all the data that can then be shared throughout the partnership.

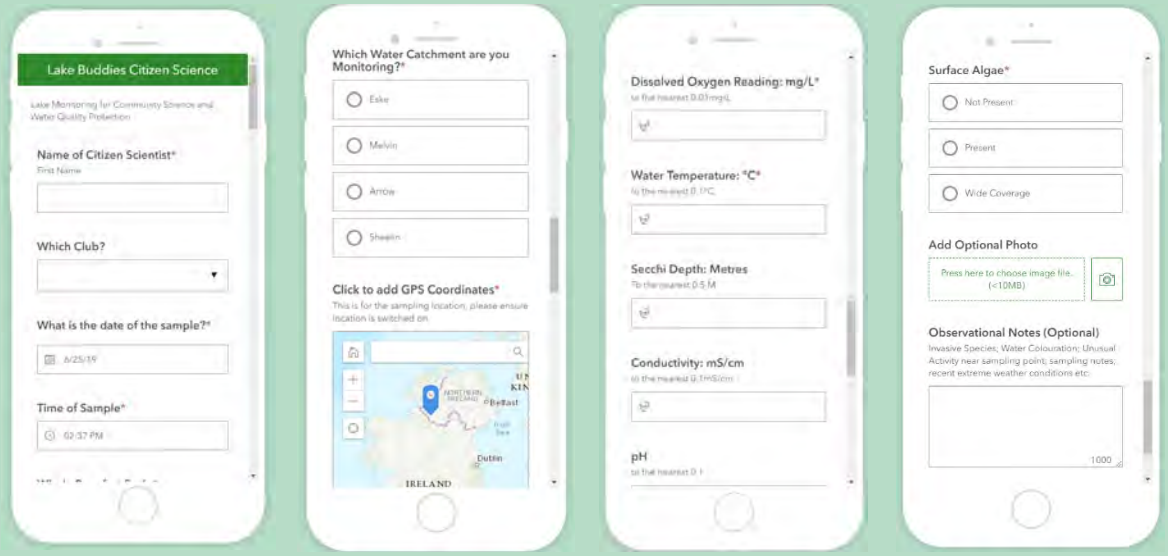
Participants use meters and visual observations to collect data on the following parameters:

- Wind Speed
- Presence of Algae
- Dissolved Oxygen (mg/l)
- pH
- Electrical Conductivity
- Temperature
- Observations at Sample Location

Karen Kennedy organised a training day for volunteers at Rossinver Community Centre, County Leitrim, in May 2019. Topics included the science behind Lake Monitoring (delivered by Ray Smith of the EPA); Biosecurity (Ruairí Ó Conchúir, LAWPRO), Citizen Science in Northern Ireland (Lisa Maddox NIEA). Jimmy then demonstrated how to take a record using the app, and Patsy Ryan and Vicky Veerkamp, border catchment scientists demonstrated how to use the equipment in the local Ballagh River.

We are very pleased to say we have our first records submitted and we hope this pilot project will lead to greater stewardship of our waterways and helps further our understanding of lakes in the region. We would like to thank the anglers, volunteers, agency staff and LAWPRO colleagues for their contributions.

Jimmy McVeigh, Karen Kennedy and Gretta McCarron, Community Water Officers, Local Authority Waters Programme



Survey 123 app for Lake Monitoring Citizen Science.

Dawn over the Dublin Mountains.

Coillte Nature to focus on carbon sequestration, species diversity, biodiversity, and development of recreational forests

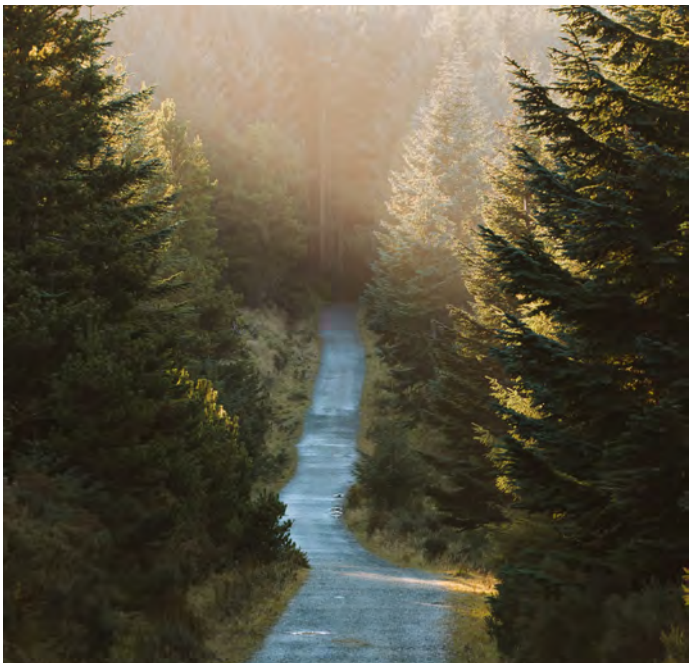
Deborah Meghan, Coillte's Director of Stewardship, Risk & Advocacy, tells us about a new not-for-profit entity, Coillte Nature, which will focus on multiple benefits for the environment, and recreational forests.

Coillte Nature will target the delivery of new woodlands facilitating species diversity, biodiversity and carbon sequestration as part of the Government's National Forestry Programme. The establishment of Coillte Nature will also see the conversion of certain commercial Coillte forests to recreational forests.

Coillte has always approached its 30-year role as manager of Ireland's forestry assets in an environmentally sustainable manner. Protecting the environment will continue to be an intrinsic part of Coillte's sustainable forest management, as part of its normal commercial forest operations.

With the establishment of Coillte Nature, the company is seeking to advance its sustainability agenda by undertaking large discrete projects with a separate non-commercial focus. These projects are intended to increase the national forest estate but with a strong emphasis on carbon sequestration, species diversification, biodiversity and the development of outdoor recreation and tourism amenities.

Coillte Nature will collaborate with other organisations through joint ventures, etc., in implementing forestry and recreation projects. An inaugural project of Coillte Nature is the Dublin Mountains Conversion plan, to gradually, over the next 30 to 40 years convert commercial forests of the Dublin Mountains to native and mixed woodlands. For over ten years Coillte has worked with the National Parks and Wildlife Service, Dublin City Council, Dún Laoghaire Rathdown County Council, South Dublin County Council and representatives of outdoor recreation groups to promote recreation in the Dublin uplands through the Dublin Mountains Partnership. During this time Coillte has seen visitor numbers climb to over 600,000 per year, making these forests some of the most visited outdoor attractions in the region.



Coillte forests in the Dublin Mountains have good connections to the capital, and there are more than 600,000 visits per year to them.

Due to their proximity to the city, nine Coillte forests account for the vast majority of visits to the Dublin Uplands (Ticknock, Barnaslignan, Carrigolligan, Kilmashogue, Ballyedmonduff, Massey's Wood, Hell Fire, Cruagh and Tibradden). These forests are currently managed on Coillte's forest planning systems as commercial forests, however given their exceptionally high usage and Coillte's positive experience with the Dublin Mountains Partnership, Coillte has taken the decision to convert them to forests with the primary purpose of recreation and biodiversity within Coillte Nature.

Coillte forests in The Dublin Mountains are used for activities like horse riding, hiking, mountain biking and even ziplining.

Conversion from commercial forests to recreational forests will involve a mixture of continuous cover forestry (CCF) and removal of commercial species and replacement with non-commercial native tree species.

Coillte have launched a consultation portal seeking views from key stakeholders, the general public and any other interested parties. The consultation portal can be found at www.coillte.citzenspace.com and we welcome all feedback.

Deborah Meghan, Director of Stewardship, Risk & Advocacy, Coillte

Farming for Nature: improving the natural health of our countryside

The Farming for Nature initiative seeks to acknowledge and support those farmers who farm, or wish to farm, in a way that will improve the natural health of our countryside.

Farming for Nature is an independent, not-for-profit initiative which aims to support High Nature Value (HNV) farming in Ireland. It was established in 2018. Much of the impetus for Farming for Nature came from our experience of working with farmers in the Burren region, western Ireland. This convinced us of the enthusiasm of many farmers to look after their heritage if given the right financial incentives, technical support and encouragement - the pocket, head and heart as we say.

During this time, we also witnessed the power of partnership in achieving what are, ultimately, common goals – indeed we are delighted to welcome many of these partners – agricultural and environmental – in supporting this initiative. The Farming for Nature project started with a national award.

The main purpose of this award was to unearth and to share the stories of farmers across Ireland who are making a positive difference to nature on their farms and in their communities. We want to show that farmers are a part of nature and not apart from it, and we want to use these positive testimonies to encourage others to follow suit. We want to show that farming for nature can also be agriculturally, economically and socially progressive.

Storytelling alone won't solve all of our challenges. So we are currently looking at developing our resources, our outreach and expanding our network. We hope to use our website and other media to promote and share some of the exciting emerging initiatives and technical innovations taking place in this field in Ireland today, for example our locally-led European Innovation Partnerships and our Results-based Agri-environmental programmes.

There is widespread awareness of the environmental damage that can be caused by the wrong type of farming. We hear about it all the time. There isn't as much discussion of those that are doing a great job farming for nature, about the positive stories, meaning we don't have many good role models. This negative narrative can alienate farmers from nature, making them feel apart from it rather than part of it. Encouraging farmers to feel that they are part of the solution, not just the problem, is the first step in a long

journey which will require a lot of financial and technical support, new partnerships and new visions. The work of Farming for Nature can hopefully be the start.

Learn more:

www.farmingfornature.ie

Farming for Nature farm walks: The BRIDE Project, Cork

BRIDE Project

The BRIDE Project (Biodiversity Regeneration In a Dairying Environment) is an innovative agri-environment project based in the River Bride catchment of north-east County Cork and west Waterford, Ireland. The project is co-funded by the European Union and the Department of Agriculture, Food and the Marine through the European Innovation Partnership (EIP) funding initiative and the project will operate through the period 2018-2023. The Project aims to design and implement a results-based approach to conserve, enhance and restore habitats in lowland intensive farmland.

An innovative feature of the BRIDE Project is the landscape-scale approach to biodiversity whereby groups of farmers in a given area will be encouraged to implement a range of habitat improvement measures. This combined, community-based effort is an entirely new approach to environmental management compared to the randomised process of selection in previous agri-environment schemes. Another innovative aspect is the use of a results-based payment scheme where farmers will have each habitat on their farm assessed and scored, with higher quality habitats gaining higher payments.

Donal Sheehan explains his 2 metre field margins during the Farming for nature farm walk.

In May 2019 there was a great turnout of over forty people at their Farming for Nature farm walk where participants were given an update on the project to date and habitat management measures were explained:

- Treelines
- Ponds
- Field Margins
- Multi-species Grassland
- Bird & Bat Boxes
- Rodenticide alternatives

The BRIDE Project's bird, bat and owl boxes.

A picture speaks a thousand words – and seeing the BRIDE Project measures in a farming environment not only demonstrates the practical side of the measures but immerses you into what can be achieved on your farm as a whole when biodiversity is improved.

Sometimes, simple measures are best: an exposed vertical bank made by simply using a shovel has made an ideal solitary bee habitat.

Learn more:

www.thebrideproject.ie

Farming for Nature farm walks: McCall's Farm, Calverstown, County Kildare

On a beautiful June afternoon, Kim McCall led 50 people around his family's 214-acre farm situated near the small village of Calverstown in South Kildare. The day was organised through the Farming for Nature initiative. Kim explained how they farm the land to promote biological activity in their soils and interaction between plants, soils and animals.

The tour included an overview of old permanent pasture and the use of a variety of grasses and wild flowers including clovers, plantain, dandelions, daisies and yarrow amongst others. He explained that you need to understand the land to manage it properly for nature. For example, in the wet grasslands his Aubrac pedigree cattle and Rouge de l'Ouest ewes graze between September to the end of April but are excluded in the summer time. This allows the flowering habitat to re-seed naturally and flourish. As he says the grazing cow is the management tool for promoting the natural habitat.

To promote soil fertility, they use biochar to spread on the soil which prevents the leeching of nutrients. They make biochar on the farm by burning scrap wood from trees in a flame cap kiln.

Forestry covers 30 acres of the farm with a mixture of softwood and hardwood tress including sitka spruce, birch, chestnut, alder, oak and beech. Even in the vegetable garden some of the vegetables are left to produce flowers for pollinators and other insects. Pollinators are well catered for on this farm!

The day was finished off with tea and cake and was a wonderful opportunity to sit in their lovely garden and watch the bees hard at work. It was a great demonstration of how a farm can be productive and provide a sustainable income for a family while giving back to nature. Fuel for thought and action!

Paddy Morris and Marie Archbold, Catchment Science and Management Unit, EPA

Learn more:

www.farmingfornature.ie/nominees/kim-and-mirielle-mccall/

Walking through woodlands on McCall's farm.

The bee hotel on the castle.

The Blue Dot Catchments Programme

Cormac Mc Conigley, the newly appointed Blue Dot Scientist with the Local Authority Waters Programme, tells us about the first 6 months of the Blue Dot Catchments Programme, which aims to protect and restore high status waters in Ireland.

Across Europe, the protection of high status sites has not been highlighted as a key issue, and no known effective programmes of measures have been implemented elsewhere specifically for the protection or restoration of high ecological status water bodies. Ireland, still retains many of these sites, a total of 17.6% according to the latest RBMP (Government of Ireland, 2018). Comparable proportions in Europe are only found in Alpine areas (Austria: 20%) and Nordic countries (Sweden: 12%, Finland 16%). Neighbouring countries and many central European countries have few left: UK: 3%, Germany: 0.1% and Poland 0.5% (www.eea.europa.eu).

As such, Ireland has recognised the need to be a European leader in the development of protection and restoration measures focussed on high status waters, and has firmly indicated in the 2nd cycle RBMP the prioritisation of high status waters.

The second-cycle River Basin Management Plan (RBMP) was published by the Minister for Housing, Planning and Local Government in April 2018. Ireland undertook a comprehensive re-characterisation of its waters as part of its preparations. The Plan set a high status environmental objective for 319 river water bodies, 37 lakes, 12 transitional water bodies and 16 coastal water bodies. 63% of these water bodies are currently achieving their high status environmental objective, with 33% confirmed through characterisation as being At Risk, while 4% require further assessment or monitoring to assess their risk profile. The long-term trend of decline in the number of high-status river sites was confirmed as continuing.

The EPA produces national water quality reports every three years and these have defined a trend in loss of pristine and high status sites. High status sites have declined from 31.5% (1987-1990) to 17.6% (2013-2015) an almost 50% loss (Fanning et al., 2017).

Particularly concerning is the decrease in the numbers of sites that were considered of the highest status, which score a Q5. In the 1980s, Q5 sites made up 13.4% of all monitored sites; now only a small minority of the monitored sites are at Q5 (0.7%). The decline in the status of these sites must be halted, and then reversed if we are to achieve our WFD objectives.

The RBMP 2018-2021, sets out the targets and measures Ireland will implement to achieve the objectives of the WFD. One of the key measures to address the decline in high status waterbodies is the setting up of the Blue Dot Catchments Programme and associated Steering Group to specifically target the maintenance and restoration of high status waterbodies. The Programme is directed by a Blue Dot National Steering Group which had its inaugural meeting in January 2019. The Steering Group is chaired by John Breen, Director of Services for Water, Environment, Fire and Library Services in Kerry County Council and is made up of representatives from many of the organisations with an interest in high status waterbodies.

Blue Dot Working Group
Local Authority Waters Programme
Department of Housing, Planning and Local Government
Kerry County Council
Wicklow County Council
Donegal County Council
Mayo County Council
Coillte
Department of Agriculture, Food and the Marine – Agriculture & Forest Service
Environmental Protection Agency
Irish Water
National Parks and Wildlife Service
Office of Public Works

The Steering Group met three times between January and May 2019. The first 2 meetings were focused on assisting with the DHPLG bid for a LIFE Integrated Project "*Waters of LIFE*". The third meeting included a half day field trip to the Owenriff Priority Area for Action which includes high status objective water bodies, followed by a meeting to present proposals for key targets for inclusion in a draft Blue Dot Catchments Programme work programme for discussion and input from the group.

Waters of LIFE Integrated Project

The LIFE Integrated Project (IP) "*Waters of LIFE*" aims to support the implementation of measures to protect and enhance high status waters and thus support the work of the Blue Dot Catchments Programme. The project, if successful, will act as a catchment-scale demonstration project to test and validate the effectiveness of implementing locally-tailored 'best practice' measures across a range of land uses typically seen in the catchments of high-status waters. The project will trial and validate the implementation of measures at the catchment scale across a number of pilot catchments with the view to building national capacity, optimising approaches for the targeting of measures in critical areas of the catchment, assessing the effectiveness of the approaches and using the learnings from the project to inform and support ongoing work across all high status catchments. If successful the project will have a budget of approximately €20 million, with over half coming from organisations in Ireland that are beneficiaries. The LIFE bid was successfully submitted in March and is being reviewed by the European Commission.

Blue Dot Fieldtrip

Since the submission of the LIFE IP bid the working group has continued to advance the drafting of the Blue Dot Catchments Programme. In May a fieldtrip was undertaken to the Owenriff Priority Area for Action in County Galway, where the Steering Group had the opportunity to experience first-hand some of the issues that impact high status waterbodies and to discuss potential solutions. The group visited a wastewater treatment plant; a high status lake; an area of old forestry plantations and a river site that is hydromorphologically impacted. At each location a discussion was led by a member of LAWPRO, Irish Water, NPWS, EPA, Coillte or the Forest Service. The fieldtrip successfully allowed the group to deepen their understanding of the issues that affect high status waterbodies and provided an opportunity for learning between members.

Blue Dot Work Programme

Following the fieldtrip, the working group met to define a draft work programme. A proposal outlining key targets the draft work programme should prioritise was prepared by reviewing key literature and documents relating to high status waters, in particular the EPA STRIVE funded project 2010-W-DS-3 which delivered a discussion document titled *Management Strategies for the Protection of High Status Water Bodies* (Ní Chatháin *et al.*, 2012).

The most commonly recommended priorities from the review were:

- To work with communities promoting and supporting the establishment of community led catchment initiatives in Blue Dot catchments.
- Planning/Licensing control and assessment of cumulative impacts.
- Influencing national schemes and programmes (e.g. DWWTS grant scheme; Native Woodlands Scheme; Agri-environmental schemes etc.).
- Improving the exchange of information within and across public authorities and Government Departments, to monitor activities on an ongoing basis in Blue Dot catchments.
- Identify areas for further research related to the protection and restoration of Blue Dot catchments.

There was broad agreement that these 5 priorities would serve as an suitable starting point for the work programme. In the coming months, the work programme will be drafted and presented for review to the Steering Group and other bodies for feedback. The Programme is also being highlighted at Regional Operational Committee and Management Committee meetings under the Local Authority governance structures for implementation of the WFD. LAWPRO have also formed an internal Blue Dot working group comprised of staff across the programme, with a view to supporting the role of the Blue Dot Scientist and developing guidance on local catchment assessments in high status objective water bodies.

Cormac McConigley, Blue Dot Scientist, Local Authorities Water Programme, and Bernadette White, Catchment Manager – Western Region, & Blue Dot Catchments Programme Manager, Local Authorities Water Programme

The Freshwater Pearl Mussel Project European Innovation Project (EIP): how farming for nature can help save an endangered species from extinction

Derek Mcloughlin and Patrick Cushell tell us about the Pearl Mussel Project, which is working in eight Irish catchments to benefit the endangered Freshwater Pearl Mussel. It is based on the innovative use of locally adapted results-based agri-environment payments to reward farmers for good ecological land management.

The Freshwater Pearl Mussel – a globally endangered species

The freshwater pearl mussel is a globally endangered species. Ireland has over a third of the EU population, of which 80% occur along the western seaboard in the top eight catchments. These catchments support a high proportion of semi-natural habitats and retain a relatively intact hydrological system with extensive wetlands (blanket bog and associated seepage areas in particular). They are amongst Ireland's least modified river catchments. Each of the catchments has a lake on the system, which acts as a buffer for nutrients, sediment and flow. Despite their relatively intact nature, all of these catchments are undergoing a slow population decline.

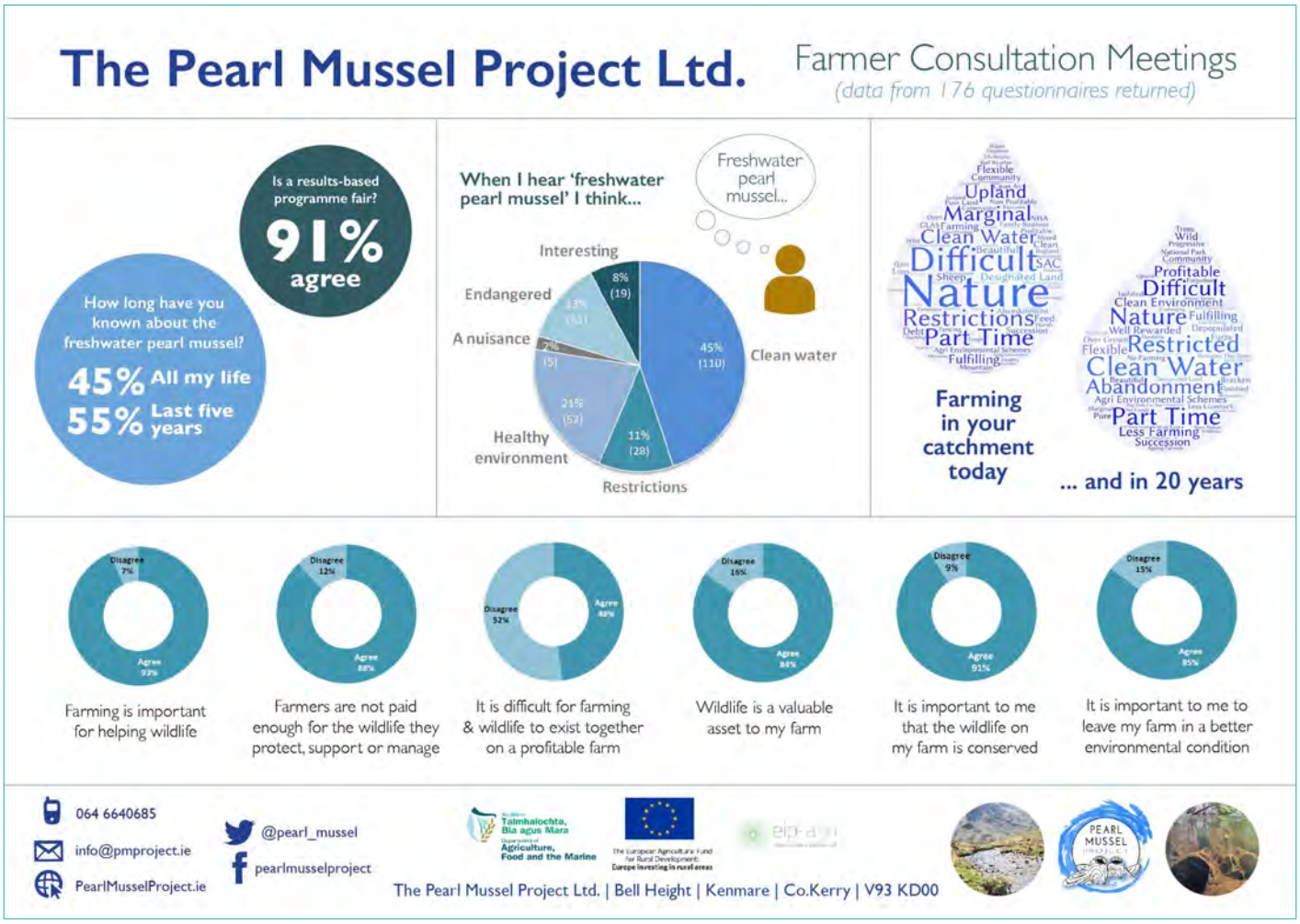
The main reason for this decline is the low survival of juvenile mussels, which are extremely sensitive to changes in environmental conditions. This is leading to an ageing population. Juveniles depend on a clean, well oxygenated gravel river bed, with little silt, or algal growth, and moderate flows.

Activities that cause changes in river flow, increased levels of silt, and increased levels of nutrients, can contribute to the decline. In addition to drainage and changes to river channel morphology, increased intensification of land use in the catchments threaten future survival of freshwater pearl mussel.

Agri-environment schemes and the results-based approach

As almost two-thirds of the land area of Ireland is in agricultural use, this industry has a considerable influence on the quality of our freshwater and terrestrial habitats. Significant resources have been spent in recent decades on national agri-environmental schemes aimed at agricultural pressures on biodiversity loss and water quality.

The Freshwater Pearl Mussel. Photo: Pearl Mussel Project.



The Pearl Mussel Project - what was said at consultation meetings held with farmers.

PMP farmer Denis Sheehan, Caragh catchment, County Kerry.

The traditional agri-environment schemes (such as REPS and GLAS) are generally measures- or actions-based. This typically means a farmer will be required to carry out a range of actions or follow a management prescription on their farm in order to receive their payment. The payment remains the same for all farmers, regardless of the level of success of the respective action. Indications suggest that agri-environmental schemes to date have not achieved the desired results with continued declines in biodiversity and water quality being reported throughout Ireland.

A Pearl Mussel Project advisor on a training day in Kerry.

In results-based agri-environment schemes, a farmers' payment is linked to the nature quality of their farm. The higher the nature value, the higher the farmers payment. Should this nature value increase over time this is reflected in an increased payment to the farmer. Farmers understand this and it provides an opportunity and strong incentive to manage their land to a higher environmental standard. The benefits of adopting the results-based approach include:

- incentivises farmer to achieve better environmental outcomes
- provides increased flexibility to farmer in choosing means by which they deliver environmental benefits
- represents better value for money for the tax payer as payments are only made on the verifiable delivery of environmental goods and services
- increased likelihood of achieving environmental targets.

The Pearl Mussel Programme

The Pearl Mussel Project is a voluntary 5-year results-based European Innovation Partnership (EIP) programme that seeks to improve the quality of watercourses to benefit the endangered freshwater pearl mussel. It is locally adapted and focuses on the top eight freshwater pearl mussel catchments in Ireland, in counties Donegal, Mayo, Galway, Kerry and Cork. The Programme, which has a budget of €10 million is funded by Department of Agriculture, Food and the Marine as an EIP, is being run by the Pearl Mussel Project Team.

Peatland, grassland, and woodland habitats are used as result indicators. The higher the quality of these habitats, the higher the payment farmers receive. Habitat quality is assessed at the plot (field) level using a scorecard for each habitat. The score cards award marks for various aspects of the habitat which reflect quality such as; plant species present, vegetation structure, wetness, exposed soil, and damaging activities. Habitats achieve a final score on a scale of 0 (low) to 10 (high). Better quality habitats will obtain higher scores and result in higher payments.

Those farmers whose land floods along freshwater pearl mussel habitat are eligible for a Floodplain Payment that also relates to the habitat quality of the plot that floods. This is to acknowledge the important function floodplains play in freshwater pearl mussel rivers.

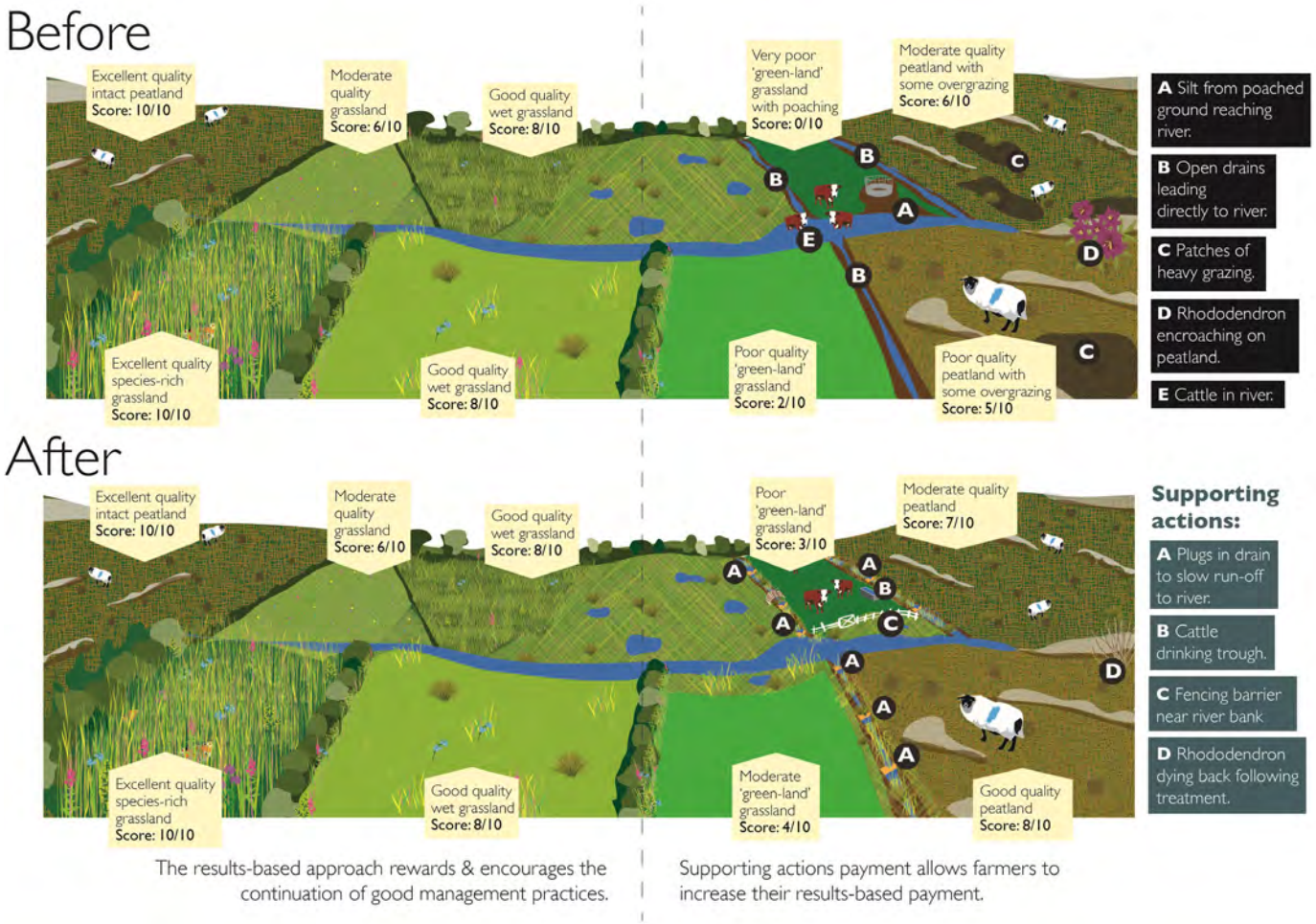
The condition of watercourses on the farm also influences the final payment through a 'whole-farm score'. Farms with evidence of damage to watercourses will have their overall results-based payment reduced by a factor of up to 70% depending on severity. This will present a major incentive for farmers to address these issues in order to receive the full potential payment in future years.

In order to facilitate improvement of scores, each participating farmer has a budget of up to €1,200 per year with which they can implement supporting actions. These may include measures such as fencing of water courses, provision of water troughs, and conversion to lighter breeds of cattle.

This approach has the effect of creating a market for nature, and provides an opportunity and incentive for farmers to manage their farm habitats to produce higher-quality biodiversity to ultimately benefit freshwater pearl mussel. Decisions for farming practices rest with the farmer, who decides to continue current practices or increase their nature value score. They now have the opportunity to be rewarded for the environmental services provided by their farm.

The key message with the approach of the PMP is that we focus on the result of the farming practices, rather than the prescription of how these practices should be carried out.

This model has been adapted from results-based programmes developed for other ecological targets including the Burren Programme, EU RBAPS pilot project, and the Hen Harrier Project EIP.



Multiple benefits; carbon sequestration, flooding, biodiversity

Although the overarching aim of the PMP is to assist in providing the near-pristine conditions for freshwater pearl mussel, farmers that achieve high scores in these catchments provide a host of environmental services including carbon sequestration, flood management, and greater biodiversity.

A nose pump, which can be used by cows and means they do not need to access the river for water. Photos shows Lawerence Joyce, PMP, Padraig Cronin, KerryLIFE, Vincent O'Malley, PMP.

Conclusion

Farmers in some of the most ecologically sensitive areas of Ireland have for many years received payments that only reflect their agricultural output often at the expense of complex ecosystems and globally rare species such as the freshwater pearl mussel. Their interface with environmental authorities has often been by way of penalties and prohibition, without clear communication as to the reasons for such enforcement. A farmer in one of the catchments observed:

''we are only ever told what we can't do. Nobody has ever actually told us how to manage our land for a higher nature value''.

Using a results-based approach, the PMP has developed a programme tailored to the top eight catchments and to the way they are farmed. It is a farmer-led approach with financial incentives for higher scores, and strong support from specially trained advisors and the Pearl Mussel Project team.

Derek McLoughlin and Patrick Cushell, Pearl Mussel Project EIP

About the Pearl Mussel Project

The Pearl Mussel Project team comprise ecologists, agricultural scientists and advisors, and are based in Kenmare, Co. Kerry and Westport, Co. Mayo. The project steering group include members from EPA, LAWPRO, NPWS, DAFM, Agriculture Consultants Association, Galway-Mayo Institute of Technology, Teagasc, Forest Service and the KerryLIFE project.

Learn more:

www.pearlmusselproject.ie

Bundorragha River, County Mayo – one of the eight Pearl Mussel Project catchments.

The Mulkear River. Photo: Ruairí Ó Conchúir.

The Mulkear European Innovation Project (EIP)

The Mulkear EIP offers a new approach to address water quality concerns by developing catchment sensitive farming practices. It is working with local farmers, in a catchment which is At Risk, by supporting them to stay farming while bringing about catchment scale improvements in water quality.

The Mulkear catchment covers and area of approximately 650km² across Limerick and Tipperary and forms part of the Lower Shannon SAC. The Mulkear EIP came about after 2 years hard work by local farmers and support bodies, including the Local Authority Waters Programme (LAWPRO), to secure funding for a local, farmer led, agri-environmental project.

The Mulkear EIP will run for 5 years with a budget of €1.2 million and will work with a minimum of 60 farmers. It will focus on the implementation of a locally-led collaborative partnership, with farmers centrally involved in the co-design of an innovative suite of measures to address the water quality concerns as identified in local catchment assessments. The key objectives are to:

(i) build capacity within the farming community to identify and mitigate agricultural impacts on water quality through practical on-farm measures and shared learning in catchment sensitive farming discussion groups;

Farm demonstration event with Mulkear farmers in May 2019. Photo: Ruairí Ó Conchúir.

(ii) deliver a collaborative partnership model to enable EIP partners, including LAWPRO, the Agricultural Sustainability Support and Advisory Programme (ASSAP), the local dairy coops, and the two local authorities, amongst many others, to collectively identify key water quality concerns in the catchment;

(iii) collate data generated from local catchment assessments to mitigate the risk from the major sources and pathways identified while simultaneously developing baseline data for monitoring purposes;

(iv) deliver a highly innovative collaborative approach to catchment sensitive farming with local farmers inputting into the co-design and development of appropriate mitigation measures;

(v) celebrate the Mulkear via a community based outreach programme based on improving local water quality, biodiversity and riparian management.

The project will work throughout the Mulkear Catchment, in both upland and lowland farming systems, to address concerns by promoting a catchment sensitive farming approach. It will focus on the 9 subcatchments which are classified as being At Risk of not meeting the WFD objective in the Mulkear. In so doing it will develop a model of collaborative working to collectively identify these key water quality concerns and deliver a tailored Catchment Sensitive Farming training programme within a network of discussion groups / knowledge transfer groups to inform and empower farmers to address local farming related impacts on water quality. It will develop the collaborative partnership approach further through the Mulkear EIP Operational Group (OG) Delivery Groups, farm demo events and community outreach activities.

Positive impacts, expected results and practical recommendations

It is expected that the Mulkear EIP will deliver a broad range of positive impacts and that the results generated will help inform sustainable farming practices at a catchment scale. The results will help inform practical water quality improvements and environmental practices and policies, by providing:

(i) A pilot catchment for the delivery of a catchment sensitive farming approach to improve water quality in recommended areas for action under the River Basin Management Plan.

(ii) A pilot catchment for the implementation of a locally-led collaborative approach to achieving reductions in nutrient levels and improvements in ecological status.

(iii) Evidence that farmers can play a positive role in supporting healthy water bodies and ecosystems while undertaking smart farming measures in an upland and lowland context.

(iv) A tested and proven suite of on-farm measures that help mitigate agriculture impacts on water quality, riparian zones and instream habitats in dairy, beef and mixed farming context.

(v) A focus on getting targeted measures (the right measure in the right place) where they will have greatest effect in the Mulkear Catchment.

(vi) Develop catchment sensitive farming discussion groups to provide local farmers with enhanced skills and an improved understanding and appreciation of the source-pathway-receptor model and water quality and environmental issues associated with their farming operations and how these issues can be addressed in the context of a locally led scheme.

(vii) Establish a costed, tested and collaborative approach to catchment sensitive farming that can be developed further and be implemented elsewhere to improve water quality.

Mulkear Farmer Paddy O'Dwyer. Photo: Ruairí Ó Conchúir.

The Mulkear EIP will be a key pilot in the implementation of the River Basin Management Plan. It will strengthen local level delivery of Ireland's obligations under the Water Framework Directive and will pilot the new approach to River Basin Management Planning for the 2018 – 2021 WDF cycle. It will deliver a collaborative partnership model to enable project partners to collectively identify key water quality concerns within the Priority Areas for Action in the Mulkear Catchment as outlined in the River Basin Management Plan for Ireland (2018-2021).

This new approach includes the development of a much-strengthened evidence base to understand the full range of pressures affecting water quality and the development of a programme of measures, as included in the Mulkear EIP project, needed to deliver water quality improvements. The project will take a proactive approach to cooperative engagement to addressing water quality in the Mulkear Catchment. The Mulkear catchment is therefore an excellent example of an area requiring innovative solutions to enable farming to continue without further water quality impacts and general environmental degradation.

Ruairí Ó Conchúir, Project Manager, Mulkear European Innovation Partnership

Learn more:

www.mulkeareip.com

A gudgeon.

IRD Duhallow, Cork: farmers day on the river - goujon or a gudgeon?

Farmers participating in the RaptorLIFE project attended a river education event held by IRD Duhallow, where they got to try their hand at fly casting, as well as meeting some of the inhabitants of their local river.

Only the size of a chicken goujon, this Gudgeon (Gobio gobio), a widely unknown species of fish, is in fact quite a large example of its kind. Gudgeon are not frequently recorded in Ireland and are often over looked as part of our freshwater fish communities. This individual of the species was recorded during a river education event held on the Allow River by IRD Duhallow as part of the RaptorLIFE project. Gudgeon forage on sandy and gravelly substrates in both fast and flow moving streams using the barbels on either corner of their mouths to detect their prey. They feed on a variety of invertebrates and have been known to graze on filamentous algae in Ireland. The species is not fished commercially or for sport in Ireland, however in Victorian and Edwardian times it was fashionable to fish for and fry Gudgeon in breadcrumbs in the famous dish "Gudgeon Tansy". Indeed the word goujon is derived from the French name for the fish.

A non-native species, Gudgeon is thought to have been introduced to Ireland sometime after the 12th Century however no documentary evidence of exactly when exists. Indeed much of what we know about Gudgeon in Ireland was derived from research conducted on fish caught in the Allow and Blackwater catchments in 1971, however the species has gone largely undetected in the Allow since then. One of a number of species recorded on the day, this specimen of Gudgeon brought unexpected excitement to the event because the distribution of the species in Ireland is so poorly documented. Other species recorded on the day included Atlantic Salmon, Brown Trout, Brook Lamprey and the critically endangered European Eel.

The river education event was held by IRD Duhallow for farmers participating in the RaptorLIFE project. These landowners on the Araglin and Blackwater rivers, voluntarily fenced their sections of the river in order to exclude livestock, with the aim to improve water quality, restore riparian vegetation and stabilise rapidly eroding river banks. Attending farmers had the opportunity to try their hand at casting and angling, but all were absorbed by the wealth of information being given by Andrew Gillespie of Inland Fisheries Ireland on the invertebrates, salmonids and LIFE in the river. It is hoped that through learning and knowledge exchange that farmers will build a greater appreciation for river environments, taking ownership of river protection in their local area, and encouraging others to do likewise. Inland Fisheries Ireland conducted electrofishing and Duhallow Angling Centre of Excellence assisted on the day.

IRD Duhallow RaptorLIFE have fenced off nearly 29km of river in the upper reaches of the Blackwater Special Area for Conservation. Fencing river margins allows the banks to revegetate, thus stabilising areas that are rapidly eroding, further reducing siltation of the river substrate. This in turn will help provide clean gravels for spawning salmonids and brook lamprey, improve Freshwater Pearl Mussel habitat and that of critical growing stage of its juveniles known as glochidia. This fenced area in itself becomes a new habitat of biodiversity. Many of these farmers were provided with alternative drinking sources for their stock to restrict them from entering the river, this improves the water quality, eliminating the risk of eutrophication and algae on the riverbed, this too being detrimental to the spawning gravels of salmonids, Brook lamprey and the habitat of the Freshwater pearl mussel and its juveniles.

Learn more:

www.duhallowlife.com

Wai Ora, Whenua Ora, Tangata Ora - Healthy Water, Healthy Land, Healthy People.

Our Land and Water - innovation and science to underpin new mitigation measures in New Zealand

Enhancing the production and productivity of New Zealand's primary sector, while maintaining and improving the quality of the country's land and water for future generations. Ken Taylor tells us about the mission of the Our Land and Water National Science Challenge.

New Zealand's National Science Challenges emerged from The Great New Zealand Science Project, which in 2012 invited New Zealanders to talk about the biggest science related issues for them. The project resulted in 11 Challenges, set up by the Ministry of Business, Innovation and Employment in early 2016. They are designed to ensure that science investment focuses on areas that matter most to New Zealanders.

Our Land and Water Director Ken Taylor says the Challenges are essentially vehicles to fund and promote collaboration between scientists, researchers, Māori, industry and stakeholders involved in these critical areas.

The Our Land and Water Challenge has a daunting task: to investigate and deliver solutions to help preserve the most fundamental treasures of our country - land, water and associated ecosystems - while still producing economic value from those treasures. Ken believes that currently, New Zealand is operating far below its potential in the economic and environmental spheres. "The current state of many of New Zealand's soils and freshwater bodies is poor and as a nation we capture and share only a small fraction of what our high-quality products are sold for overseas."

Obviously, agriculture and food production are very important to New Zealand and while most New Zealanders value primary production, many consider their environmental impacts to be unacceptable. Ken believes the essence of the Challenge is to shift the way we view land and water. "It's about changing the conversation from farming versus the environment to farming and the environment and finding ways or ideas that create sustainable outcomes", he says.

Land suitability is a big part of that sustainability equation. "Land suitability is about fitting the activity to the land rather than manipulating the land to fit a predetermined use", says Ken. "The goal is to adapt the use to the land, not the land to the use."

"Rather than science taking place in isolation across many research institutions and universities, it's much better, and more productive in terms of outcomes, if we work collaboratively".

Building enduring partnerships with Māori so they can play a more active role in the sustainable management and economic

development of land and water is a key part of the Challenge.

The Māori title of Our Land and Water is "Toitu te Whenua, Toiora te Wai" which means "Let the permanence of land remain intact–let water abound". This is an adaption of the Māori proverb, "toitū te whenua, whatungarongaro te tangata" – land is permanent, while people come and go.

"The Māori world view is a holistic approach that seeks to understand the total system, not just parts of it", says Ken. "We are all part of a very big interconnected system – soil, water, plants, animals, and most importantly, people, all interacting in complicated ways. We want to understand how all of these bits work together, not just the science stuff but, critically, how and why people operate in particular ways and respond to various opportunities and barriers."

Those opportunities and barriers include the adoption of new technology. As Ken notes, the average time it takes for new technology to be fully adopted in New Zealand and Australia is 16 years. "Intergenerational change is too slow", he says. "We need intragenerational action. Part of the current lag is because transition pathways are not clear or compelling enough. One of our main aims is to encourage new ways of working and incentivise transition so we can at least halve that adoption time."

"If you assume the land use is right then the next thing is targeting interventions or mitigation. Roughly 80 per cent of farming's impact on the environment comes from 20 per cent of the farm so let's focus on that 20 per cent and target the critical source areas. This is not only more cost effective but is likely to deliver the best results".

Water-use and quality is a hot topic for Kiwis and investigating the way contaminants move through the environment and impact on water quality is another area of interest for the Challenge. There's been lots of work done on this in New Zealand, but not so much in an integrated or collaborative way. For example, as factors that impact water quality, nutrients (e.g. nitrogen, phosphates) bacteria (e.g. E.coli) and sediment need to be considered together. It's clear that Our Land and Water has a very wide scope and understanding farming systems and the way farmers think and act is a key factor, which Ken is keen to stress.

Toitū te whenua, whatungarongaro te tangata - land is permanent, while people come and go.

"We are committed to working with stakeholders and building partnerships with industry groups (e.g. DairyNZ). But one of most important groups is farmers. Many of the potential benefits can't be realised without behavioural change and science won't have all the answers so farmers are hugely important. Only through working together will we create a New Zealand environment we can all be proud of."

Ken Taylor, Director, Our Land and Water, New Zealand

This article was reprinted with Ken Taylors' permission. The original article can be viewed at www.fonterra.com/nz/en/our-stories/articles/using-collaborative-science-to-unlock-our-potential.html

Our land and water has developed decision making tools to help farmers.

5 minutes with Ken Taylor, Director, Our Land and Water, New Zealand

You recently visited Ireland to present at the EPA Water Conference and learn about what Ireland is doing. What did you think?

If there's one message I came away from Ireland with its this: farmers in both our countries want to do the right thing by the environment, but they need a clear understanding of what the right thing is, and that includes the evidence base that supports action on the ground. I was really impressed with the Local Authority Waters Programme approach, in terms of its philosophy, focus and structure. Early days I know, but it's a great platform from which to get stuff done.

Ken's presentation to the EPA Water Conference is available at www.catchments.ie/epa-national-water-event-2019-presentations/

How did Our Land and Water start and why?

Our Land and Water is one of 11 National Science Challenges that are tackling the biggest issues facing New Zealand that need science to help fix them. We channel government funding into ambitious, 'mission-led' science programmes that aim to transform New Zealand for the better. Our Land and Water is one of the largest National Science Challenges, funded by the Ministry of Business Innovation and Employment for up to $96.9 million over 8 years.

The National Science Challenges are a new way of doing science for New Zealand. Our research is done collaboratively among science providers like Crown Research Institutes (CRIs) and universities and we bring a range of scientific disciplines into each programme. We involve stakeholders in our research to make sure it's relevant to industry and communities and to speed up adoption of change.

Our Land and Water's official objective, set by the government, is to enhance the production and productivity of New Zealand's primary sector, while maintaining and improving the quality of the country's land and water for future generations.

As Director, what does your role entail?

Ultimately, I'm responsible for making sure our research is bringing us towards achieving our mission. That means making sure our science produces useful outputs, has impact and is accessible. It's also really important for me to be connected to the social and political context we're working within. I keep closely in touch with what's happening in Wellington and the current and potential new policy that's relevant to achieving our mission.

I work with the science community and manage our many relationships – Our Land and Water has 16 partner research institutions, including all seven Crown Research Institutes and most of New Zealand's universities. Across our programme of research, there are about 160 scientists and over 100 collaborating institutions, businesses, regional councils, industry bodies and other stakeholders.

We are also building strong relationships with Māori communities and agribusinesses because we recognise their perspectives have much to offer the country.

NZ earns approximately $37 billion from primary sector exports, but these same products are sold in international markets for an estimated $250 billion.

What major projects have you been working on over the past 12 months and what are some of your recent major achievements?

The biggest project for me over the past 12 months has been helping the team develop our science strategy for the next 5 years. This was a huge undertaking that required talking to lots of people to make sure our science programme has taken the pulse of industry, farmers, our communities, environmental groups, councils, the scientists and regulators.

One of our biggest projects so far has been the development of the 'land use suitability' concept and finding ways of making it work. Land use suitability is a way of planning land use that expands upon

the traditional assessment of land capability, to include a much more detailed understanding of how and where land naturally reduces agricultural contaminants, the resilience of downstream water bodies and the impacts on the goals our communities have set for our fresh water. Eventually this research will produce tools that make the consequences of different land use decisions clear and predictable.

Our goal for these tools is to give land owners confidence to diversify their land use, giving them greater resilience to changes in regulatory limits, weather and markets and improve productivity, profitability and environmental outcomes.

What are the predominant trends regarding farming inputs, as social licence becomes more of a hot button issue in our primary sector?

In New Zealand, we've had a tradition of focusing on outputs rather than inputs – managing for effects rather than restricting activities. There's no doubt that in some quarters there is an increasing call to control inputs directly.

My view is that continuing to manage for effects is the best approach, because it allows farmers the flexibility to make the best adjustments or changes for them and their own circumstances and land. However, that requires a good understanding of the relationship between land-use activities and environmental effects and access to management tools that allow land managers to see that connection. The rapidly growing field of agriculture technology and precision agriculture will help here, as will the tools our researchers are developing.

Social licence to operate will only be restored when communities see a clear demonstration that things are getting better in the environment. Trust comes with seeing the evidence with your own eyes. We are starting to see some encouraging results. Phosphorus trends are improving, and our research shows this is largely to do with on-farm mitigation strategies working.

How does Our Land and Water work with New Zealand farmers?

If you want buy-in and rapid uptake, you have to work closely with the people making the change on the ground.

One of our major research programmes, Next Generation Systems, has worked closely with innovative farmers to identify potential land use mixes and new systems of primary production and helping them de-risk, trial and evaluate their transformation.

Later this year, new research will look at innovative farms that are responding to niche market opportunities or creating a diversity of enterprises, while matching their practices closely to the fine-scale attributes of the land.

Another research programme, Storying Kaitiakitanga, has interviewed people in Māori agribusiness about Māori food production practices that employ the principles of kaitiakitanga, which includes values of guardianship and responsibility. One of the things we think will really help us as a country are the ways Māori look at farming and the environment as part of the same system. This joined-up thinking is validated in Western science as an ecosystem approach. If we're going to achieve our mission we have to think in terms of systems beyond farming.

"Naku te rourou nau te rourou ka ora ai te iwi" – " With your basket and my basket the people will live".

What can farmers do to help your cause?

Our Land and Water has a goal to transform New Zealand's farmland into more diversified mosaics of land use – because an individual farm may be made up of parcels of land that are suitable for different uses. Our land-use suitability tools aren't yet complete but on the Our Land and Water website farmers can find our research-backed suggestions, resources and sources of funding (under Get Involved, see What You Can Do On the Farm) and some existing tools (under Resources, see Toolboxes).

We now have the science to demonstrate the positive impact precision agriculture can have. Our research has shown that using variable rate irrigation on farms with variable soil types can cut the amount of nitrogen and phosphate being lost by 70–80%. We also know a lot more about critical source areas – low-lying land such as gullies and swales where run-off accumulates – and our research has shown the importance (and cost-effectiveness) of targeting interventions and additional mitigations to these small areas.

In many areas we will go a long way towards meeting environmental bottom lines by implementing precision technology and better managing critical source areas. In other areas, land-use change may be necessary to meet future regulatory limits and the demands of our markets.

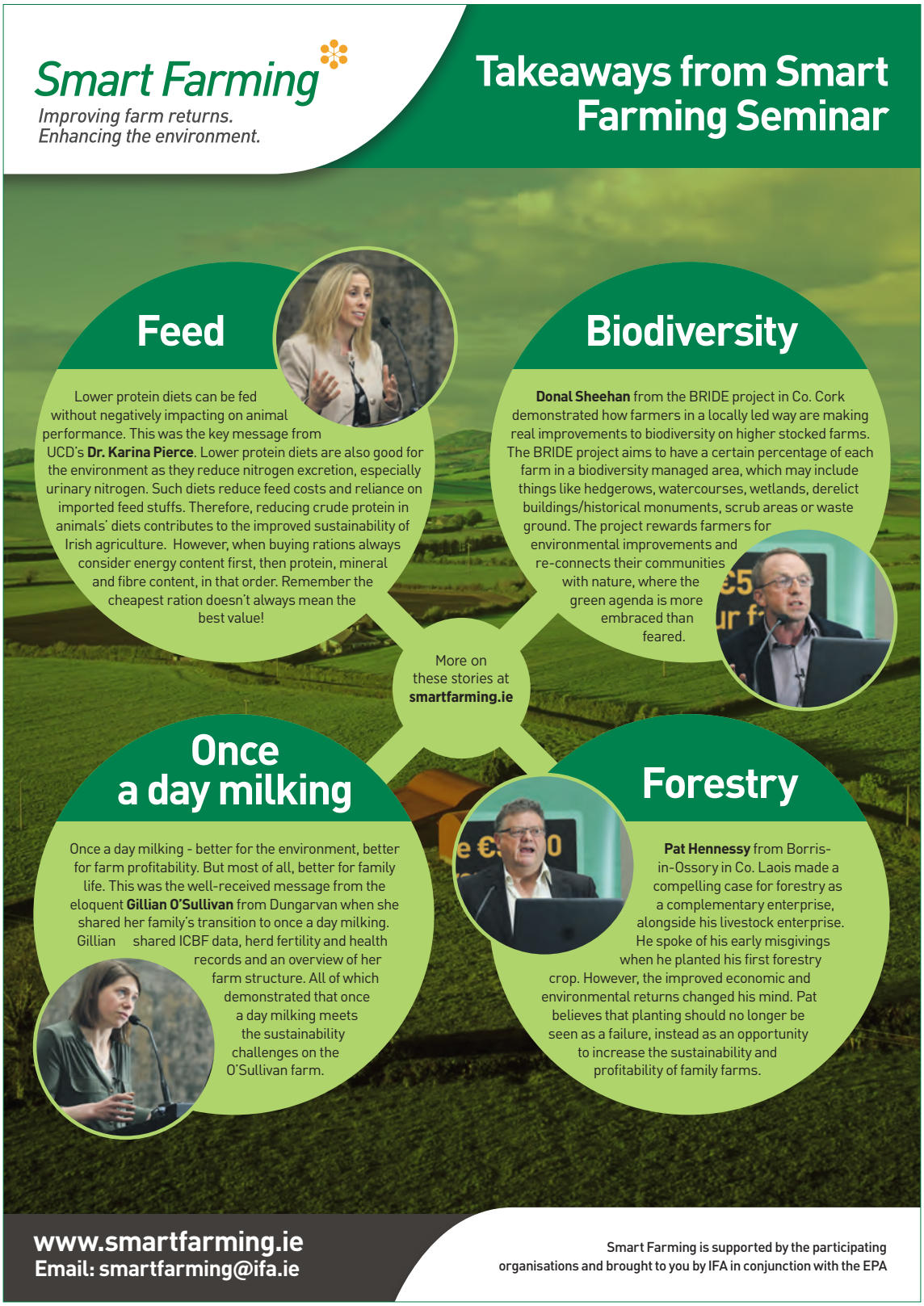
This article was reprinted with Ken Taylors' permission. The original article can be viewed at www.farmlands.co.nz/ NewsAndEvents/ News/5-minutes-with-Ken-Taylor/

Learn more:

Visit the Our Land and Water website at www.ourlandandwater.nz

Smart Farming: Spring Seminar

This year's IFA Smart Farming seminar took place on 30 April 2019. The Smart Farming Programme is supported by the EPA, and focuses on ways to improve farm returns and enhance the rural environment.



Agriculture: getting the right measure in the right place

A key change in catchment science and management in recent years has been the move from national, one size fits all measures to more localised action. It is all about the right measure in the right place. Here, Eva Mockler explains how simple maps can highlight the importance of understanding where potential measures can be placed for maximum positive impact.

A proportion of nitrogen and phosphorus applied on agricultural land is lost to surface waters in overland runoff or leaching. These diffuse nutrient losses from do not occur uniformly in the landscape but from 'hot spots', or critical source areas. These are areas where the source of nutrients has a pathway through the landscape to a water body. For phosphorus, this pathway can be poorly drained steep slopes, whereas for nitrogen well drained soils over a permeable aquifer is a major pathway.

Working together to achieve more

Where agriculture is a significant pressure, the Local Authorities Waters Programme are working with the Agricultural Sustainability Support and Advice Programme (ASSAP) who are providing farmers with a free and confidential advisory service to help improve water quality. ASSAP has 30 farm advisors, 10 of which are funded by the Department of Agriculture, Food and Marine, 10 by the Department of Housing, Planning and Local Government, and 10 by private dairy co-ops. EPA scientists aim to provide these teams with the evidence needed to target their work to get the best environmental outcomes.

Targeting measures to reduce nutrient and sediment losses from agriculture

The map opposite highlights the types of agricultural measures that are needed in water bodies across Ireland:

- Measures for phosphorus and sediment (blue)
- Measures for nitrogen (orange)
- A mix of targeted measures for phosphorus, sediment and nitrogen (striped)

The blue areas highlight where excess phosphorus and sediment loss from poorly draining soils may be impacting on the water quality in rivers and lakes. Targeting measures that break the pathway between farm runoff and the receiving waters are most likely to be effective in these areas. This assessment was based on 2nd Cycle Water Framework Directive characterisation, which used monitoring data from 2010-2015, and will be updated to reflect the outcomes of 3rd cycle characterisation when completed.

The orange areas of the map highlight where excess nitrogen losses can occur through freely draining soils. This nitrogen then infiltrates into groundwater before being discharged into river systems and onwards to estuaries and coastal waters. This can impact on water quality in estuaries, and sometimes on drinking water quality. This assessment was based on water bodies where agriculture is a significant pressure, characterisation of the transitional and coastal water bodies, chemistry data and the outputs of the EPA Catchments Unit's nutrient model (i.e. the Pollutant Impact Potential (PIP) maps).

Although getting the right agricultural measure in the right place requires working at a farm scale, this national overview map can facilitate discussions around the continued move from one size fits all measures to more localised action.

Targeting smart buffer zones, not strips

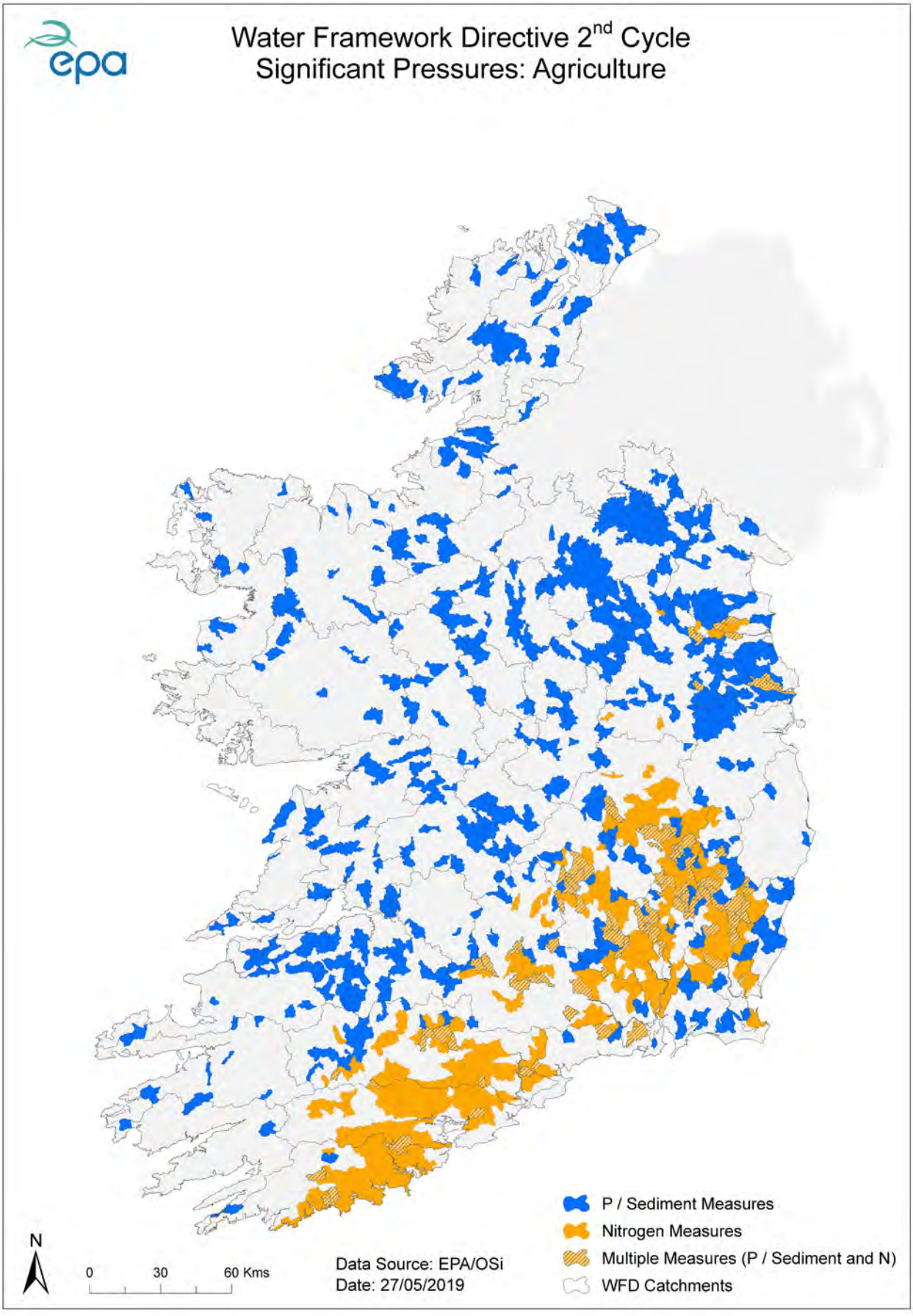
Another useful map is the national PIP-P (Pollutant Impact Potential for Phosphorus) map which is used to focus catchment scientists to areas where agricultural sources of nutrients might be causing water quality impacts. This is currently being further developed through the DiffuseTools Project to greatly improve the mapping of Critical Source Areas (CSAs) and the ability to pick out the areas of farms where buffers will be most effective. These areas are typically not strips of land, as runoff does not tend to move in uniform sheets across fields. Instead, as rainfall runs off from fields many flow paths converge to a few delivery points where the bulk of water and any sediment or nutrients that it may carry are delivered to water courses. And so, for the purpose of reducing sediment and nutrient losses to surface water, targeted zones that intercept the flow paths are preferable to buffer strips of uniform width. The DiffuseTools Project is producing national maps of CSAs that will support the identification of these targeted buffers zones. The development of these new tools will be covered in a future issue of the Catchments Newsletter.

Eva Mockler, Catchment Science and Management Unit, EPA

Learn more:

Significant Pressures: Agriculture www.catchments.ie/significant-pressures-agriculture

DiffuseTools: www.cwrr.ucd.ie/diffusetools-project/



Areas for targeting agricultural measures for phosphorus and sediment (blue), nitrogen (orange) and phosphorus, sediment and nitrogen (striped).

AgriBenchmark – Establishing national benchmarks of nutrient use on Irish farms to improve sustainable management

To achieve sustainable agriculture which reduces agricultural pollution and improves farm profitability (a win-win), Irish farms need to reduce nutrient surpluses and increase nutrient use efficiencies. To achieve this, the UCD project AgriBenchmark developed nationally representative benchmarks of these key performance indicators for nitrogen (N) and phosphorus (P), to set targets and motivate improvements.

Calculating nutrient use and benchmarks

Using data from 1446 nationally representative Teagasc National Farm Survey farms from 2008-2015, farm-gate nutrient balances (kg/ha) were calculated by subtracting exports (in milk, livestock and crops) from imports (in fertiliser, feed and livestock). Nutrient use efficiencies (%) were also calculated by dividing nutrient exports by imports. Benchmarks were then established for different farm sectors and soil types by ranking farms using quantile regression analysis and percentiles to identify those with the lowest nutrient surplus per production intensity and highest gross margins.

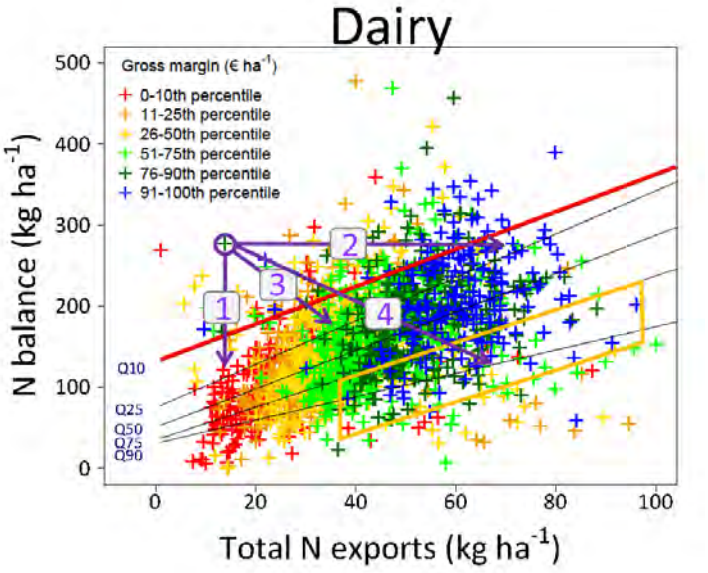


Figure 1: Benchmark farms with the lowest N balances for a given production intensity for dairy farms are below the Q75 line. Optimal benchmark zone farms, which also have the highest gross margins (dark green and blue points), are in the gold box. Points above the Q10 line are the worst 10% performing farms and this could be used to set maximum permitted surpluses. To improve performance by reaching below the nearest black line, a farm must (1) lower its nutrient surplus, (2) increase its exports, or (3) do both (see purple arrows).

Table 1. Average N balances, use efficiencies and farm characteristics of benchmark dairy farms relative to poorer performing groups.

			Optimal benchmark zone	Benchmark		Above average	Below average	Worst	
Performance	N balance	(percentile)	76-100	91-100	76-90	51-75	26-50	11-25	1-10
	Gross margin	(percentile)	76-100	0-100	0-100	0-100	0-100	0-100	0-100
Key performance indicators	N balance	(kg/ha)	122.1	62.5	105.7	135.0	167.2	204.5	271.3
	NUE	(%)	30.7	36.5	27.6	23.4	20.0	17.2	13.8
	Gross margin	(€/ha)	2733.8	1553.4	1815.3	1846.8	1841.9	1879.5	1909.0
	Total N imports	(kg/ha)	178.9	102.4	146.9	176.8	209.3	247.0	314.7
	Total N exports	(kg/ha)	56.8	39.9	41.2	41.8	42.1	42.5	43.4
Farm character-istics	Agricultural area	(ha utilised)	47.2	48.1	48.2	53.3	53.3	53.8	50.4
	Stocking rate	(livestock/ha)	2.2	1.5	1.7	1.8	1.9	2.0	2.1
N imports	Fertiliser	(kg/ha)	135.9	78.3	112.8	136.5	165.5	197.7	251.4
	Concentrates	(kg/ha)	36.1	20.8	29.5	35.4	37.8	41.2	51.9
	Forage crops	(kg/ha)	6.0	2.9	3.7	4.0	5.2	7.3	10.6
	Livestock	(kg/ha)	0.9	0.5	0.9	0.9	0.7	0.8	0.8
N exports	Milk	(kg/ha)	45.1	24.0	30.8	32.7	33.1	33.8	34.8
	Cash crops	(kg/ha)	2.6	9.2	2.2	1.0	0.6	0.1	0.1

Results

Large ranges in nutrient balances for farms of the same production intensity show considerable room for reducing surpluses (Figure 1). National agricultural intensification policies, which aim to increase total exports, are likely to increase nutrient surpluses, nutrient use efficiencies and gross margins, but benchmark farms minimise surpluses to relatively low levels (i.e. are more sustainable). Table 1 shows key performance indicators of benchmark dairy farms for N relative to poorer performing percentile groups, which can be used to set targets. Optimal benchmark dairy farms tend to have higher total exports (from higher milk yields), lower total imports (chemical fertiliser and feed), a smaller land area, and higher stocking densities.

Ian Thomas, Paul Murphy and Edel Kelly (UCD), Cathal Buckley, Emma Dillon and John Lynch (Teagasc)

Learn more:

www.agribenchmark.ucd.ie

Final report available to download at:
www.epa.ie/researchandeducation/research/researchpublications/researchreports/research274.html

Legacy phosphorus and the pivotal role of fluvial suspended solids in agricultural catchments

Phosphorus is the main nutrient that causes enrichment of inland rivers and lakes and understanding how it behaves is critical in developing measures to improve water quality. David O'Connell, TCD, tells us about an EPA-funded research project looking at the impacts of legacy phosphorous.

It is estimated that less than 50% of the phosphorus applied to agricultural crops in the form of manure and artificial fertilizer is utilized by the growing harvest crop, with less than 30% of such P input subsequently converted into food for human consumption. So where is the rest of this phosphorus ending up if not in the crops? The answer lies in the fact that a significant proportion of the phosphorus applied to crops accumulates in rivers, streams, lakes and groundwaters largely in different particulate mineral and/or organic forms. Such accumulated phosphorus species are termed 'legacy phosphorus' which may leach back out into the water (in a more biologically available soluble form) for decades thereby impacting on surface and groundwater ecosystems.

This time lag of phosphorus release to surface, groundwater ecosystems means that the expected impact of nutrient abatement measures for the reduction in P loads to downstream aquatic ecosystems may be significantly muted and delayed. Such delays in observable positive impacts from government driven nutrient abatement actions often extend much longer than political terms of office which results in questions on the efficiency and effectiveness of such measures, even though they may be on course for eventual positive outcomes.

Fluvial sediment bound P (which can constitute up to 90% of P from agricultural catchments) plays a role in stream productivity (i.e. macrophyte growth) and degradation of water quality but major knowledge gaps still exist as to the actual bio-availability of such suspended and streambed sediment bound phosphorus. Relatively little attention has been given to the dynamics of different phosphorus species at a molecular level, and their mobilisation from suspended sediments in such aquatic environments.

In this ongoing research study, we are investigating the potential impact of fluvial sediments in agricultural catchment streams on surface water quality. This project represents an international collaboration between Trinity College Dublin (TCD), SLU (Swedish University of Agricultural Sciences) and the Canadian Light Source (CLS) at the University of Saskatchewan (US) in the examination of fluvial sediment bound P composition, spatial and temporal dynamics, reactivity and bioavailability using state of the art monitoring and analysis techniques coupled with catchment scale modelling.

Agricultural catchments in both Ireland and Sweden have been chosen to take account of geological, climatic, agricultural and land-use differences and are being concurrently sampled and monitored using time integrated sediment traps and surface water auto-samplers. Sediment and surface water processing and bioavailability studies are performed in both SLU and TCD whilst the collaboration with Dr. Yongfeng Hu at the Canadian Light Source (synchrotron) in Saskatoon, provides the project partners with exclusive access to the cutting-edge advanced synchrotron radiation facilities for the investigation of temporal and spatial change in the sedimentary molecular level phosphorus forms.

These synchrotron light techniques direct electromagnetic radiation onto a sample which generate diffraction, absorption or fluorescence spectra that can be used to determine the molecular structure of the compounds present. Such synchrotron light techniques are increasingly used for the characterization of environmental samples, although there have only been few applications to mineral transformations in fluvial-dynamic environments such as fluvial sediments.

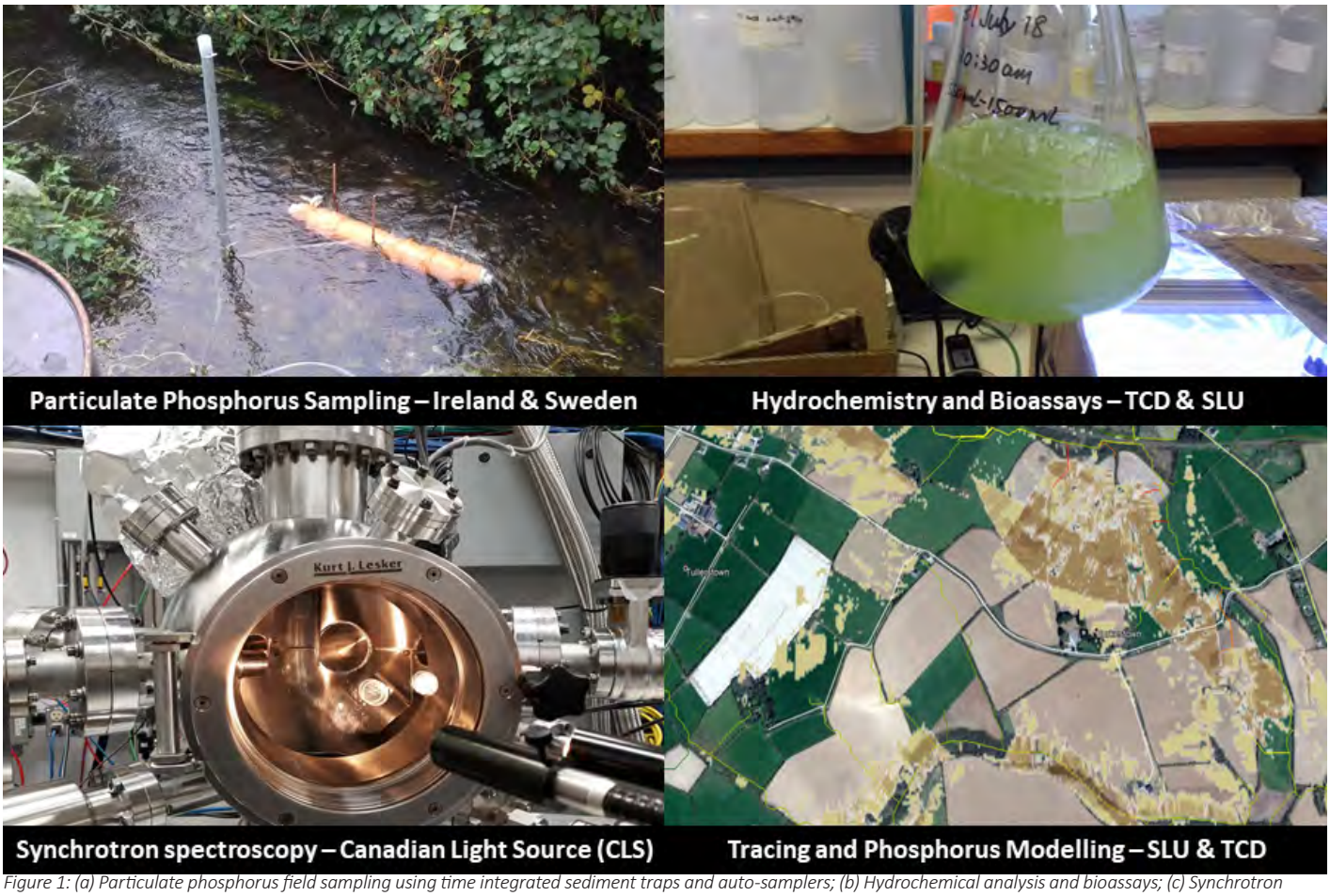


Figure 1: (a) Particulate phosphorus field sampling using time integrated sediment traps and auto-samplers; (b) Hydrochemical analysis and bioassays; (c) Synchrotron analysis of particulates at the Canadian Light Source, Saskatoon, Canada; (d) Sediment s source tracing, susceptibility maps and catchment scale phosphorus modelling.

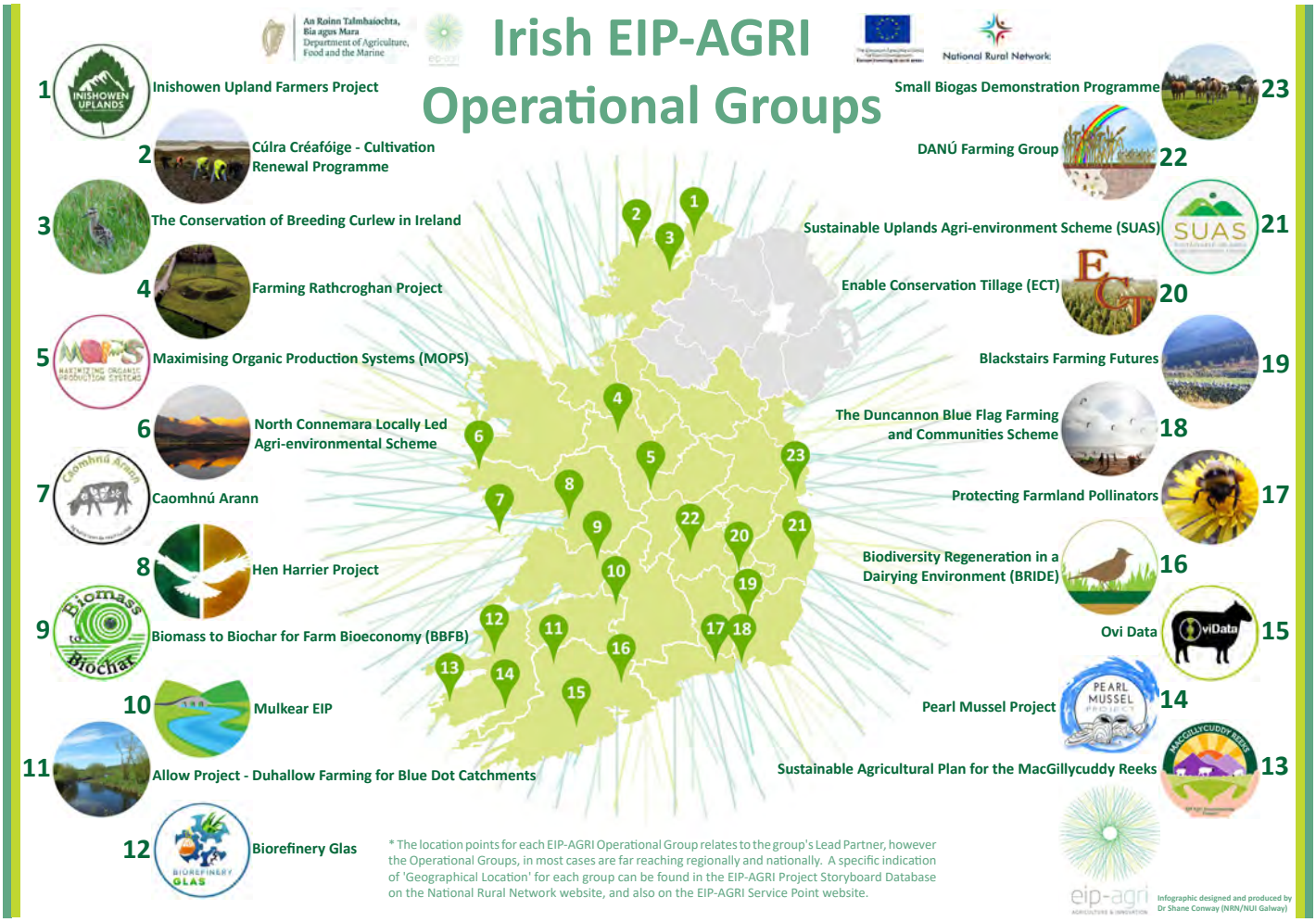
Phosphorus fractionation through chemical extractions have shown seasonal and temporal changes in the proportion of the various phosphorus forms from autumn to winter. Algae bioassays show seasonal change in the bioavailability of fluvial suspended sediment bound P for the Irish catchments while experiments are still in progress for the Swedish catchments. A combined approach using advanced synchrotron (XANES) and 31P NMR spectroscopy at the Canadian Light Source (CLS) and the University of Saskatchewan (US) is being used to examine inorganic and organic P speciation and potential contribution to catchment scale P cycling. Furthermore, radiometric fingerprinting coupled with high-resolution distributed modelling techniques are being used to identify catchment critical source areas from where the fluvial suspended solids are likely to have originated from. Controlled experiments are also being carried out in the TCD laboratories to assess the bioavailability of fluvial sediment bound legacy P fractions using bioreactors.

Current experimental results are being collated to refine and develop further catchment scale models describing the suspended sediment exchanges of phosphorus. These P exchange models should therefore be much better able to simulate the coupling of sediment transport and biogeochemical transformations for agricultural catchments. With such improved models developed by TCD and SLU, various scenarios encompassing different phosphorus catchment management strategies may be predicted and assessed to examine the effect of increasing sedimentary P and bioavailability fluxes on the ecological status of rivers and streams in agricultural catchments.

David O'Connell, Department of Civil, Structural and Environmental Engineering, Trinity College Dublin

ARTICLES

The European Innovation Partnership for Agriculture Productivity and Sustainability (EIP-AGRI)



Infographic: Irish EIP-AGRI Operational Groups

The European Innovation Partnership for Agriculture Productivity and Sustainability (EIP-AGRI) is an exciting and novel approach to research and innovation. EIP-AGRI is one of five European Innovation Partnerships (EIPs) launched to boost the EU's capacity to innovate. EIP-AGRI focuses on agriculture and forestry. Other EIPs target issues related for example to healthy ageing and smart cities.

EIPs are challenge-driven and focus on societal benefits and modernisation. EIPs support cooperation between research and innovation partners to achieve better and faster results compared to existing approaches.

The overall aim of EIP-AGRI relates to the pooling of expertise and resources by bringing together public and private sectors at EU, national and regional levels. EIP-AGRI works to:

- Combine supply and demand side measures
- Focus on forming partnerships, using bottom-up approaches
- Link actors in different types of interactive innovation projects such as Operational Groups (OGs) under Rural Development Programmes (RDPs)

The National Rural Network (NRN) works closely with the Department of Agriculture, Food and the Marine (DAFM) to support and build networks between Ireland's Operational Groups, as well as research and disseminate information on Ireland's EIP-AGRI projects.

Learn more:

www.nationalruralnetwork.ie/eip-agri/

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Do you have a story you would like to tell, or a resource you would like to share?

If you would like to submit an article, please email hello@catchments.ie and let us know. The only rule is you need to avoid acronyms, if at all possible.

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