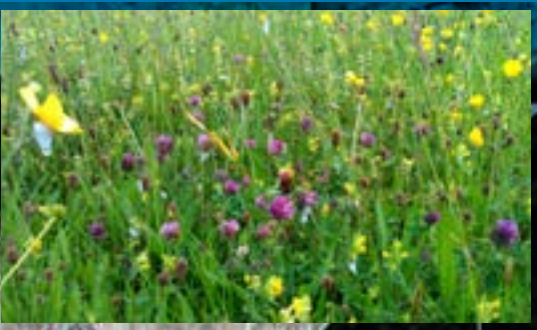
Issue 4: Winter 2016

Online Edition: ISSN 2009-8928 Print Edition: ISSN 2009-891X

Catchments Newsletter

Integrated Catchment Management: sharing science and stories



CATCHMENT CITIZEN SCIENCE AND BIODIVERSITY

what local communities are doing....

Inside this issue

CONTENTS

Inside this issue

Editorial

"When we try to pick out anything by itself, we find it hitched to everything else in the Universe"
John Muir (Environmentalist who helped establish National Parks in the USA)

The readers of this Newsletter are largely scientists and engineers involved with the development and protection of natural resources, although we hope that with time there will be a broader ranging readership. Most of us are specialists, such as myself, and I am most comfortable in my own discipline – hydrogeology. And, of course, over the years I have tried to promote the value and role of that discipline and the functional area I worked in (my silo!), often without listening to, realising or attempting to take account of the work and roles of other disciplines and functional areas to any great degree. The Victorian novelist George Eliot/Mary Ann Evans is supposed to have said "It is never too late to be what you might have been". Apart from the fact that, in my case, it is, an element of the role of the EPA Catchments Unit is to help develop a shared vision of a more holistic and integrated environment, link up and make the boundaries of the silos more permeable, adopt a collaborative culture and a systems thinking approach, which means understanding the system by examining the linkages and interactions between the elements that compose the system (in our case catchments).

Imagine how a householder in a local community 'sees' the surrounding landscape; in simple technical language, it would be a mosaic of topographical, physical, ecological, cultural and infrastructural features and functions, probably with no significant mental boundaries between them, particularly between those that are considered 'natural'. Water would be just one element in this mental model of an area. Therefore, the main themes for this Issue – citizen science and biodiversity – are designed to foster 'thinking outside the box', and to encourage the relevant disciplines, work units, organisations, communities and individuals, who may have different but related responsibilities and values, to appreciate the varied roles of and linkages with these different areas. In the process, we can ensure a more integrated approach to environmental management, multiple benefits and effective utilisation of Ireland's natural capital.

Voluntary citizen scientists are playing an increasingly important role in environmental appreciation, communication, understanding and management in enabling local communities and individual citizens to assist professional scientists and public bodies by contributing relevant environmental data and, in the long run, by influencing public policy on environmental issues. Also, citizen science can be fun!

To illustrate the value of citizen science and local community engagement, we have a series of articles. Dean Eaton (page 4) outlines the partnership between Shankill Tidy towns, Kilcross residents, and Dún Laoghaire Rathdown County Council on their 'Apple Tree and Bees' project; the facility to enable the public to record 'obstacles' in rivers using an App thereby enabling them to be mapped (page 6) has been brought to Ireland by Siobhan Atkinson and the UCD Reconnect Project; there is no better example than in the article by Martin Ryan, Willie Bryan and Alan Walsh on mapping mayflies and stoneflies in the Pil river (page 7). The critical role of local champions, in this case Enda Fields, is illustrated by Bernie O'Flaherty in her article (page 9) on successful community work undertaken in the Emyvale area, County Monaghan. Fran Igoe then highlights the work done by local anglers in Lough Derg (page 12). Ray Flynn, Caitlin Buick and Francis Macklin show the benefits of the liaison between scientists and the Sixmilewater Rivers Trust in an interesting article on local river water quality (page 14). And we follow on with the article by Tom McLoughlin (page 16) who describes a successful community campaign on Achill Island to, as he says, 'counteract the scourge of terrestrial invasive species like Gunnera and Japanese knotweed which is causing havoc with ecosystem biodiversity in places like Achill Island'. As species such as Himalayan balsam (Impatiens glandulifera) and Japanese knotweed (Fallopia japonica) also pose threats to water quality in that they leave river banks vulnerable to erosion in winter, certain terrestrial invasive species are also a Water Framework Directive implementation and catchment management issue, which we need to deal with soon rather than let the problem get worse. Other catchments that want to respond to the threat of alien invasive species can follow the example of Kilkenny's community campaign to eradicate invasive species (page 17).

Perhaps my favourite article is the one by Aila Carty, Caolan Harrington, Rory Harrington and Janet Laffey (page 19), with its mixture of philosophy, principles and practical implementation of environmental management. 'Integrating environmental objectives with agricultural ones is fundamental to productive land use, both in the short- and long-term' according to Chris Stoate (page 22); I recommend following Chris's work in Loddington on the Allerton Project blog http://allertonresearch.blogspot.co.uk.

Wayne Trodd and Ciara Maxwell (page 23) outline what biodiversity is, the threats to it in Ireland and make the link with land-use, climate change and public involvement. John Finn and colleagues continue the theme of farming, biodiversity and water quality, in particular outlining the importance that the role high nature value farmland can play (page 25). Our bees are critical to both biodiversity and agricultural production in Ireland, and it is good to see the progress outlined by Una Fitzpatrick (page 26) on protecting pollinators; progress that must continue. Sorcha Ní Longphuirt shows the benefits of river nutrient reductions between 1990 and 2013 on estuaries and coastal waters (page 28). The concept of 'adopting an integrated approach involving both habitat and predator management in a context that requires cooperation with landowners and therefore requires an understanding of the landscape (catchment) in terms of both ecological setting and farming activities' is the basis for a Game and Wildlife Trust project in the Hampshire Avon valley – Waders for Life – a component of which (detection of lapwing predators in the Avon catchment) is described by Sinéad Barrett on page 30. And, climate change is a critical part of the biodiversity, water quality and flood mitigation story. Margaret Desmond, in her article on page 32, says that 'after years of denial, procrastination and inaction, the time has arrived to get real about the impacts of a changing climate on Ireland's environment, society and economy', and she draws attention to the Local Authority Adaptation Strategy Development Guidelines.

How can we pull it all together and connect up the various strands and components in a sensible framework as a means of achieving improved understanding, synergies and multiple benefits? On page 33, the catchment services concept is proposed as an overarching framework that includes all the services in a catchment – ecosystem, geosystem and human/social system services – with the aim of encouraging relevant disciplines, work units and organisations to understand and take account of the linkages, and to work together to benefit both water and biodiversity, and potentially enabling sustainable and climate resilient agricultural practices and infrastructural development. Alec Rolston and colleagues in Dundalk IT are undertaking a research project (page 36) to identify the mechanisms for the feasible delivery of this catchment services concept in Ireland.

And finally, one of the most important catchment services is drinking water for local communities – on page 39 we have an article from the National Federation of Group Water Schemes on a pilot that encouraged people in areas where the groundwater contributed to their local drinking water to check and maintain their septic tanks.

So, the range and content of the articles in this Newsletter will, I hope, have modified our 'mental models' of the multitude of related and connected components of catchments somewhat; they have broadened mine! Articles for future issues would be welcome as a means of continuing this, keeping in mind how wide-ranging the articles may be.

"When the wind of change blows, some people build walls, others build mills" Chinese proverb

Donal Daly, EPA Catchments Unit

EDITORIAL

Dun Laoghaire Biodiversity in Action

National Apple Collection

On a clear, cold February morning, several members of Dún Laoghaire-Rathdown County Council staff and the Shankill Tidy Towns Committee visited University College Dublin (UCD) with a very important mission, to learn about and take action to help safeguard the 'National Apple Collection'.

KEVIN KENNY GRAFTS AN APPLE TREE

NATIONAL APPLE TREE COLLECTION AT UCD

Such an opportunity would not have been possible if not for the determination of the original curator Dr Keith Lamb, who in the 1940's identified the need to protect our natural heritage and set about scouring the four provinces for native Irish apple trees to add to an embryonic 'National Collection'. Nor would it have been possible if it had not been for the tenacity of Professor Michael Hennerty to continue that work and who oversaw the phoenix-like rise of the 'National Collection' after an incident with a bulldozer in 1970 (more on that later). Thankfully the collection is now thriving due to the on-going management by Kevin Kenny, a Senior Technical Officer with UCD, his staff and the good will of the College.

Kevin Kenny provided a most informative tour of the collection, regaling several interesting stories concerning the history of the collection and the good fortune discovering and propagating some of the varieties. One such variety the Ballyvaughan Seedling, discovered on a small farm in Co. Clare, was in particularly poor health. A grand total of five spindly cuttings were secured from the last remaining tree. Of the five cuttings taken and grafted onto rootstocks, only one took, which proved particularly fortunate as the parent tree perished the following year. Thankfully the Ballyvaughan Seedling is growing well amongst many other rare native species from every county in Ireland.

Kevin also pointed out the benefits of growing Irish varieties, which have greater resistance to diseases due to their acclimatisation to the warm and damp Irish weather conditions and therefore require less chemical use than foreign imports. Particularly pertinent considering the All-Ireland Pollinator Plan which was launched recently and seeks (amongst other things) to encourage less chemical use in an effort to safeguard Ireland's pollinators.

So what about the 1970 bulldozer incident? I guess it's fair to say that we're lucky to have a 'National Collection' at all, after the collection, originally housed in the Albert College, now DCU (Dublin City University), Glasnevin, became the victim of an overzealous worker with a bulldozer! The whole collection was utterly destroyed in a single weekend.

Fortunately the majority of the Irish varieties were held by the Brogdale Horticultural Trust in Kent, which houses over 4000 fruit trees from around the world and who were only too happy re-supply the Irish varieties. It still took many years of badgering from Professor Michael Hennerty to convince the Department of Agriculture to allow the varieties to be imported and only then under strict condition that the trees would be grown in isolation under the care of Kevin Kenny for two years to ensure they were disease free.

The 'bulldozer incident' highlighted the importance of safeguarding the 'National Collection' and provided the determination for Dún Laoghaire-Rathdown County Council working in partnership with Shankill Tidy Towns to create its own mini collection. With the assistance of Kevin Kenny, cuttings were taken from 30 of the 70 cultivars making up the National Collection and grafted onto (M26) semi dwarfing rootstocks. These trees are now being grown under glass in the Shanganagh Parks Depot to give the grafts the best possible chance of taking.

The total cost of this Biodiversity in Action project was €600, thanks largely to the time given freely by volunteers from Shankill Tidy Towns, Dún Laoghaire-Rathdown County Council staff and Kevin Kenny of UCD. Volunteers will be sought to assist with the planting of the new orchard in Shanganagh Park to coincide with National Tree Week 2017, after which the future of our National Apple Collection will be a little more secure.

- Apple Trees and Local Bees

Bee Friendly Kilcross

In response to the decline in bee and hoverfly populations, the All-Ireland Pollinator Plan was produced by a collaboration of interested parties and headed by Úna FitzPatrick of the Biodiversity Data Centre and Jane Stout of Trinity College, Dublin (see article on P. 26/27). Launched in September 2015, the Plan was a call to action, encouraging a wide range of sectors to do their bit to make Ireland a more pollinator friendly place.

BEE POLLINATING A FLOWER (PHOTO: PADDY MORRIS)

Heeding the call to action were the residents of Kilcross, a small estate in Sandyford, Dublin, thanks largely to the passion and dedication of local resident Marese Hegarty and an army of willing helpers from the local Estate Management Forum. With a small amount of funding (€1000) from Dún Laoghaire-Rathdown County Council via their Biodiversity in Action Programme, Marese and friends developed a plan that would see them become one of the first pollinator friendly estates in Ireland, and unexpectedly achieve so much more...

Their approach aimed to make taking action as simple and easy as possible, whilst also getting the best value for money. To this end the group linked up with The Royal Horticultural Society's Garden School based in Marlay Park, who run a social enterprise project offering free horticulture courses to the unemployed and adults with learning difficulties. The Garden Club provided Kilcross Estate with 100's of bee friendly plants, grown by members of the Gardening School in exchange for a small donation which would be used to secure more places on future courses.

A series of child friendly and adult orientated workshops were held at the local community centre. Participants then joined the organisers to plant 100's of bee friendly plants along the borders of the estate. Some plants were also given to local residents to 'brighten up their gardens', thereby offering more nectar sources for the pollinators. Due to popular demand a garden club was established through which pollinator friendly gardening advice was given.

Other Estate Management and Resident Groups learnt about the efforts of Kilcross and wanted to know more. Kilcross were happy to offer places at their workshops as they saw this as an ideal opportunity to spread the message further. Now there are several pollinator friendly estates springing up throughout the Dún Laoghaire-Rathdown area, a new embryonic gardening club meet regularly at the community centre, there are many more pollinator aware children and adults championing the pollinators cause and of course many more happy hoverflies and bees.

It's amazing what can be achieved by a small amount of funding and the passion to turn a vision into reality.

Dean Eaton, Acting Environmental Awareness Officer, Dun Laoghaire Rathdown County Council

Reconnect Project – Engaging citizen science to help map river obstacles

Reconnect is an EPA-funded project being undertaken by a team of researchers from University College Dublin. Its aim is to assess the extent and impact of flow barriers or obstacles on freshwater biology, hydromorphology and connectivity in Ireland. A key task is to develop a systematic methodology for mapping the location of barriers or obstacles in Ireland's rivers.

REMEMBER : SAFETY FIRST! ALWAYS TAKE CARE WHEN NEAR THE WATER. SEE WWW.IWS.IE FOR GUIDES TO STAYING SAFE.

SURVEY OF A BRIDGE APRON ON THE RIVER DODDER

A river obstacle is a physical structure, either natural or manmade, located within a river channel. Man-made obstacles include dams, bridge aprons, weirs, sluices and culverts. These have the potential to prevent or delay the up- or downstream movement of fish, invertebrates and river material including sediment. Natural obstacles such as waterfalls, log-jams and fallen trees can also limit the movement of fish and invertebrates, so knowing their locations relative to man-made obstacles is important.

The impact of a range of barriers on the physical habitat of rivers and aquatic organisms such as fish and invertebrates will be assessed as part of the project. This information will be used to produce a validated multi-criteria decision-support tool for prioritising the selection of barriers for modification or removal.

River obstacles and citizen science via a mobile app

Mapping the locations of river obstacles is not a simple task. Ireland has a vast river network (74,000 km) and it is suspected that there are hundreds of barriers in most major river catchments. For instance, a field study of the Nore catchment identified 508 potential obstacles and, of these, 497 were man-made structures (Gargan et al., 2011). The Reconnect project employs "citizen science" techniques to help identify and record these river obstacles and has linked up with the UK River Obstacles project (http://www.river-obstacles.org.uk) to use their mobile phone app to allow anyone near a river to record the location and type of manmade and natural obstacles they see. We encourage all citizens who access rivers (e.g. anglers, canoeists, walkers) or have an interest in the health of Ireland's rivers to download the app and use it to record any river obstacles or barriers that they may encounter.

The app is free to download and easy to use. One simply takes a photograph of the obstacle and notes some details. The app uses the GPS facility built into a smartphone to map the location. In remote locations where a signal may not be strong enough to use the app, the UK River Obstacles team have developed facilities for information to be captured locally and then entered via the website or by the mobile app at a later time. For example, it is possible to upload a photograph directly from the picture album in a smartphone and manually enter the location of the obstacle when a stronger signal is available.

All data collected by the app are stored on a secure central database. The records are verified by members of the Reconnect team. The information will be used to help build a geo-referenced data layer of river obstacles in Ireland and will have many uses into the future. It will initially help identify river obstacles for further assessment. The information will also have many other uses, for example a canoeing or kayaking club may use the data to identify potential hazards along a river while planning a trip.

The river obstacles app can be downloaded for free from Google Play and the iTunes App Store. Links to the app can also be found on the River Obstacles website (www.river-obstacles.org.uk/) and the Reconnect Facebook page.

To find out more about the project please visit our website (www.ucd.ie/reconnect), like us on Facebook (www.facebook.com/ReconnectRivers/), or follow us on Twitter (@Reconnect_News).

Siobhan Atkinson, UCD Reconnect Project

What fly is that?

This is a question that has puzzled anglers from all around the world and one that ensures the constant pitting of wits between nature and those who fly fish. The ability to identify which flies are attracting trout and the ability to then recreate them can allow the angler to win that very battle of wits between man and nature, even if it is just once in a while.

Two such anglers are Martin Ryan and Willie Bryan, both are members of 'Clonmel and District Salmon and Trout Anglers Association' and 'Cashel, Golden, Tipperary Anglers Association'. Between them they have over ninety years' experience fishing the rivers streams and lakes of Waterford, Tipperary and the great lakes of the west of Ireland. They have gained a vast knowledge of river flies through years of experience and from numerous angling publications, books and magazines.

While many trout anglers are capable of identifying some of the insects which live in the rivers and stream in which they fish, most do so from a historic or anecdotal basis rather than from a scientific one. As fly-tiers, anglers often design flies and imitate natural patterns to represent certain flies, sometimes without knowing whether these flies are even present in our rivers, streams or lakes. Selecting a fly based on the knowledge that the very species is living in our waters makes for more precise preparation and this can give the angler a sporting advantage.

But these tiny insects are more than just the subject of fly fishing folklore, they are a vital link in the chain of life within our freshwater ecosystems. Furthermore, the range and abundance of flies present are clear indicators of the health of any river, stream or lake.

Over the years Martin and Willie developed a keen interest in the identification of river flies and together decided to take this interest a step further by undertaking a study of water habitats in Waterford City and County and to record the range and numbers of flies they found. They called this project 'The Waterford Ephemeroptera (Mayfly) and Plecoptera (Stonefly) Recording Scheme' or WEPRS and it ran from January to September 2010. The scheme received the support of the National Biodiversity Data Centre in Waterford; Mary Kelly-Quinn of UCD; and Craig Macadam of the British Ephemeroptera Recording Scheme. Funding was secured from the Heritage Council through Bernadette Guest, Heritage Officer, Waterford City and County Council, and this covered the cost of sampling equipment and travel expenses.

SAMPLES OF STONEFLIES

MARTIN AND WILLIE EXAMINING A KICK SAMPLE

- Total number of sites visited during the survey = 82
- Number of insects collected = Over 22,000, from which approx. 3,500 were retained for positive identification.
- Samples were collected from sites at altitudes ranging from sea level to 502 metres above sea level.
- Total mileage accrued from January – September 2010 = 12,000 miles.

The methods used to collect samples of immature Mayfly and Stonefly nymphs for the survey are those approved by the EPA and the British Ephemeroptera Recording Scheme. Standard kick sampling techniques were used to collect the nymph samples for the survey. This involves the use of a 1mm mesh net placed downstream of the chosen sample area while the substrata immediately upstream are agitated to dislodge any species present. The insects collected are then placed into a sorting tray for examination and separation into the different family groups. A selection of the samples collected by Martin and Willie were placed into an alcohol solution for transportation to the laboratory at the National Biodiversity Data Centre for closer examination and identification. The vast majority of samples gathered were released back to the waters they were collected from, thus ensuring minimal disruption to the natural habitat.

In addition to kick sampling, stone washing was used to dislodge the stone clinging nymphs for collection and examination. The collection of adult flies of Ephemeroptra and Plecoptera was carried out using a sweep net of 1 mm mesh. The net when drawn through bankside vegetation dislodges the winged insects into the net. When identification was made at waterside the species were recorded and the insects then released, in instances where closer examination and identification was required the sample was placed into a plastic container for transportation to the lab. On most of the waters surveyed, at least three sites were sampled and where possible a distance of five kilometres was spaced between each site.

Results from the WEPRS 2010 were compared to existing publications for verification and to assess the true value of the study. Comparisons on the mayfly species encountered was made with the findings of 'The Distribution of the Ephemeroptra in Ireland' by Mary Kelly-Quinn and John J. Bracken (2000) and the 'Mayflies of County Waterford' by Michael O'Meara (2008).

The WEPRS identified 22 species of Ephemeroptra (mayflies), this number includes 6 previously unrecorded species for Waterford. In addition, 12 species of Plecoptera (stoneflies) were recorded.

NEWS AND ARTICLES

MARTIN AND WILLIE DISCUSSING RIVER FLIES WITH DR FRAN IGOE

MARTIN AND WILLIE AT AN ANGLER'S HUT

It is important to note that Martin and Willie had no scientific background when they set out on this study. What they did have was a knowledge of their local waters from an angler's perspective and this proved invaluable to them. By carrying out this study of river flies the two anglers not only discovered the variety of species living in their local waters but also gained a greater understanding of the importance of these insects to the very survival of trout and salmon in our waters.

Perhaps it is the Latin terminology used by scientists to name these flies, such as Brachyptera risi (February Red) that deters more anglers from taking a closer look at the range of insects living in their rivers. Perhaps most anglers are content to rely on the knowledge of others and anecdotal evidence to determine their choice of fly. Martin and Willie list the benefits to anglers of having a greater understanding of the different species of flies in our waters as follows:

- "You become a more informed angler, able to make a better choice of fly and more skilled at tying flies as a result of the knowledge gained."
- "You become more aware of the importance of these insects to the overall health of the river, stream or lake."
- "You can create a benchmark which will indicate any future improvements or deterioration in water quality of the waters you fish."
- "If there are young members of a club or group who have an interest in science and biodiversity, this type of study caters for such interests and can provide opportunities for a career arising out of a hobby."

Since completing the report on Waterford's Mayflies and Stoneflies in 2010, Willie Bryan has completed a certificate in Biological Identification and Recording at UCD. Willie and Martin see both a challenge and opportunity for angling clubs to take on similar studies in their waters and to be more aware of the significance these insects have for the survival of salmon and trout in our waters.

Both Martin and Willie recently attended a 'Waters and Communities' public meeting at Kildalton College, Piltown, Co. Kilkenny to discuss local opportunities and issues relating to the Pil River and the River Suir. After the meeting the pair got chatting with Dr Fran Igoe about river flies and put forward a proposal to undertake a similar study along the Pil River, this study would prove valuable as the ecological status of Pil River has not yet been assigned. This will be of benefit to the local communities who wish to gain a better understanding of the life in and along their local river. At that meeting Martin and Willie also met with a group from the 'Friends of St Johns River' in Waterford City and agreed to carry out an up-to-date study of the river flies in that river for comparison to their WEPRS 2010 study. The two anglers are willing to offer similar support and advice to any angling club or group wishing to take on such an interesting and rewarding project.

As to the original question "What fly is that?" - we may not know the answer, but we now know who to ask - Martin Ryan and Willie Bryan.

'I would like to congratulate Martin and Willie on the important contribution they are making to recording and monitoring of fly life in our rivers. They have acquired an expert knowledge of mayfly and stonefly identification and clearly illustrate the enormous potential contribution that citizen science can make. Many mayfly and stonefly species are under threat and we need up-to-date information on their distribution. This is a challenge with 74,000 km of river channel in Ireland, most of which is small headwater streams which are especially important from a biodiversity perspective. We need more citizen scientists like Martin and Willie to engage in recording and tracking changes in fly life in their local rivers and streams.' - Mary Kelly- Quinn, Associate Professor, School of Biology & Environmental Science, UCD.

Martin Ryan, Willie Bryan (Anglers and Fly Experts) and Alan Walsh, Local Authority Waters and Communities Office

List of waters surveyed under the scheme:

Rivers and Streams

- R. Suir
- R. Blackwater
- R. Colligan
- R. Tay
- R. Mahon
- R. Clodiagh
- R. Finnisk
- R. Tar
- R. Bride
- Araglin R.
- Couse R.
- Glasha R.
- Nire R.
- Dawn R.
- Glenakeefe R.
- Owenashad R.
- Glenshelane R.
- R. Anne
- Prison Stream
- St. Johns R.
- Coumduane Stream

Loughs

- Coumshingaun Lough
- Spilleog Loughs
- Coumduala Lough

Reservoirs

- Carigavantry Reservoir
- Belle Lake Reservoir

What does citizen science, a local water champion and Lipton tea bags have in common?

This is the story of Enda Fields and his lifelong interest in his local water environment. Enda has a long lasting interest and connection with Emy Lough, Co. Monaghan, a local fishery and a Water Framework Directive designated lake within the Ulster Blackwater catchment. He is currently the Youth Development Officer with Emy and District Anglers and also Treasurer of Emyvale Tidy Towns Committee.

LITTER DECOMPOSITION MONITORING APPARATUS COMPLETE WITH TEA BAGS. PHOTO INCLUDES ENDA FIELDS TO THE RIGHT.

The work Enda and the local communities in Monaghan have been involved in ranges from local stream clean ups to an international Citizen Science project (involving Lipton Nylon Tea Bags). It is hoped that learning about these initiatives may inspire communities in other areas with an interest in managing their local water environment.

Citizen Science Project

Enda's most recent undertaking is the international Netlake Citizen Science Project, comparing water temperature, water colour, litter decomposition rates and microplastics in 25 lakes across Europe during 2016. The project is led by the Royal Netherlands Academy of Arts and Science, with Dundalk Institute of Technology, Freshwater Studies Centre as the lead Irish partner.

Following training in Czech Republic earlier this year, Enda is now confidently undertaking lake monitoring using the following measurement techniques:

- Lake Colour – colour measured using Forel-Ule scale and a mobile phone app 'Eye on Water'.
- Water Transparency using a Secchi disk.
- Lake weed analysis of the Common Reed.
- Lake Temperature using ibuttons.
- Litter Decomposition rates, using 48 Lipton Nylon Tea Bags.
- Microplastics (using nylon stockings).

This project is in its early stages of water monitoring and tea bags are due to be lifted from Emy Lough later this month (August), dried and weighed. For further information, see www.nioo.knaw.nl/Netlake-Citizen-Science

Enda's interest in angling began at Emy Lough, in the early 1980's - he remembers when the lake and feeder stream had excellent stocks of wild brown trout. However, drainage on the Mountain Water millrace, alterations to a weir and pollution of the river (especially nutrients) all contributed to the demise of this wild trout fishery. To try and change this, Emy and District Angling Club decided to partner with Inland Fisheries Ireland (IFI) in 2008 on a joint management arrangement for Emy Lough. A car park and jetty was built in 2009 and since then the lake is stocked annually with rainbow or brown trout. The club's membership of 70 adults and 10 youths and the many visiting anglers can now enjoy fly fishing on the lake. Emy Lough is a modified lake, with an outflow controlled by a manual sluice gate and fed by a mill race from the Mountain Water river. The lake historically supported the local flax milling industry throughout the last century.

EMY LAKE CROSS BORDER YOUNG ANGLERS WORKSHOP GROUPS.

River Restoration Works

Enda initiated some river restoration works in the overgrown mill race in 2010 to support the recruitment of wild brown trout into the lake. The first step involved a river clean up as part of An Taisce's National Spring Clean. Emyvale Tidy Towns volunteers, which included some young anglers, removed blockages, excess vegetation and rubbish from the stream.

Two years later, the Emy & District Anglers applied to the national Environment Fund to improve fish spawning beds. They received €750 and purchased 8 tonnes of special gravels from the Cooley Mountains and with assistance from Inland Fisheries Ireland and the support of local volunteers they carried out the instream improvement works.

Enda coordinated a StreamScapes Water Awareness workshop in 2015. Earlier this year, he attended the Public Participation Network funding workshop and successfully applied for €500 on behalf of the Angling Club from the Local Authority Community Fund. Community groups should get in touch with their local Public Participation Workshop and avail of these funding workshops.

It's now recognised that more restoration work is needed to further improve the main river channel and make the local fishery self-sustaining. With this in mind, the angling club joined the newly formed River Blackwater Catchment Trust in 2014 to support the focus on the wider river catchment management.

Supporting Youth Angling Projects

As Youth Development Officer with Emy and District Angling Club, Enda has organised workshops for young anglers through the Trout Angler Federation of Ireland (TAFI).

The club has also participated in the Monaghan PEACE lll Project, assisted by TAFI and IFI, linking young anglers from across the border in fishing workshops, learning boating skills, fly casting and care for the natural environment. Following the StreamScapes Water Awareness workshop, and with the support of Monaghan County Council, Enda has taken young anglers to a trout hatchery in Northern Ireland. The World Youth Angling Championship was held at Emy Lough in 2013, attracting visitors from South Africa, France, America, Poland, Spain, Czech Republic, Scotland. Again this event was supported by IFI, TAFI and 'The Gathering'.

Further community projects

A 4km walkway amenity, funded through LEADER and the local Donagh Development Association has been developed around Emy Lough and this is very popular both with walkers and runners.

A partnership is forming between Emyvale Tidy Towns, the Development Association and the Angling Club to help further improve local waters for amenity purposes and to enhance and link with wildlife habitats. For many years Emy Lough has also provided the local area with a drinking water source. This is managed by the Glaslough/ Tyholland Group Water Scheme and there is growing interest in reducing nutrient inputs to the lake, thereby improving the water quality.

Looking after our rivers and lakes and giving nature a hand can reap multiple benefits for local communities. It's all about people with ideas, developing small projects and looking for opportunities to build local partnerships between communities and public bodies.

The Local Authority Waters and Communities Office

As Ireland enters the planning stage of the second cycle River Basin Management Plan, the newly

LAKE CLEAN UP BY LOCAL COMMUNITY VOLUNTEERS.

formed Local Authority Waters and Communities Office has two key focus areas:

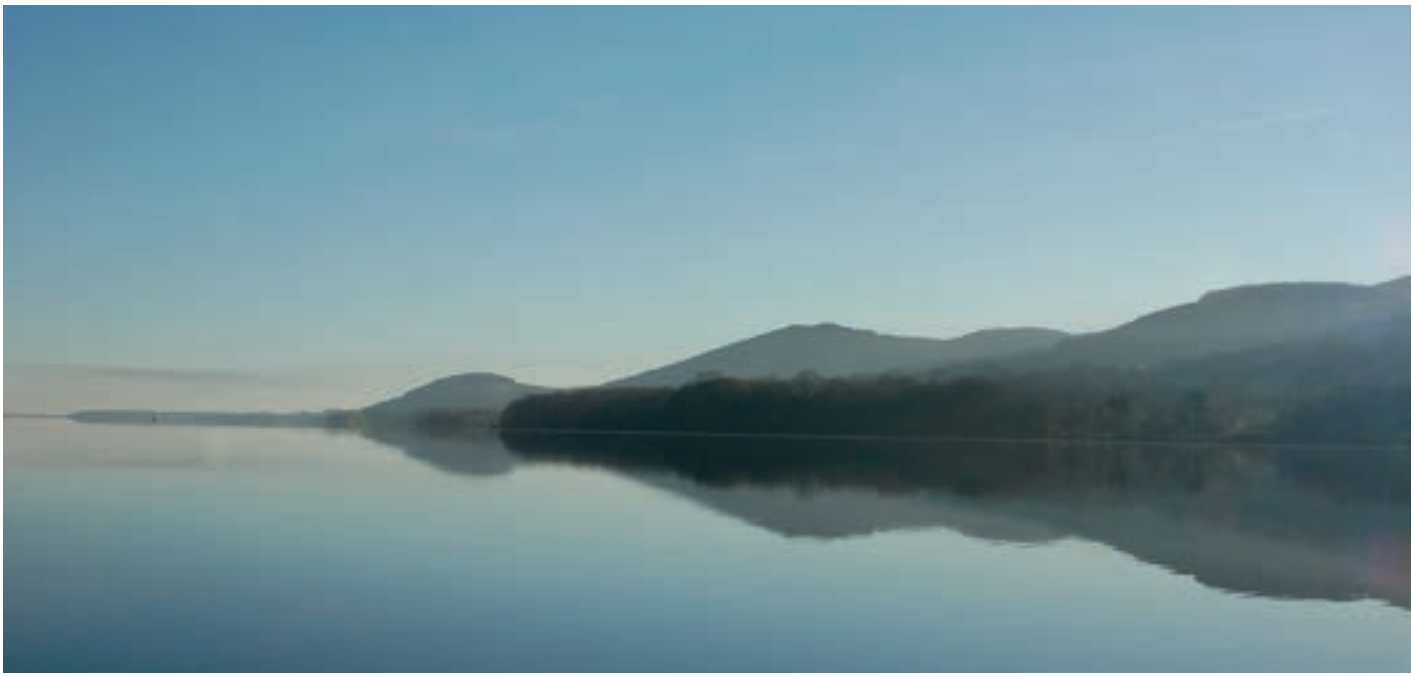
- To support local authorities in coordination of implementation of River Basin Management Plans and
- Mobilising community involvement in water quality management.

Throughout the entire country there are many excellent examples of individuals and community groups working on water management projects and many other community development initiatives with a focus on water quality.

Through this new office resources will be directed towards water quality education and awareness raising. The appointment of 12 Community Water Officers has now taken place and these will be working to actively engage with local communities and offer assistance with project start ups. It is hoped that more local water champions like Enda Fields can be identified and the lessons and experiences gained from their great work can be shared with other individuals or groups with an interest in improving their local water environment.

Bernie O'Flaherty, Local Authority Waters and Communities Office

TYPICAL BLOCKAGE OF RUBBISH AND DEBRIS IN EMY LOUGH MILLRACE



OUT ON LOUGH DERG (PHOTO: MICK GOUGH)

The Lough Derg Native Fish Biodiversity Project: unlocking our hidden underwater biodiversity through a locally led large scale citizen science project

Ireland's freshwater fish fauna represent some the most unique aspects of our native biodiversity. Unlike some of our other "native species" there is no issue with regard to how they arrived to Ireland towards the end of the last Ice Age some 20,000 years ago. It is even possible that some fish species may have survived the last cold period nearby in glacial refugia further south. Either way once the ice retreated, anadromous or sea run populations of salmonid species such as Brown trout, Atlantic salmon and their distant cousins Arctic char colonised Ireland, in waves, from different areas of Europe; lineages which are still represented in many populations in Ireland today. In addition, further genetic differentiation occurred as salmonids generally head home to their natal streams - so over time genetic traits that conferred a survival advantage to specific populations became fixed.

Today the genetic biodiversity of Irish native salmonids is high and some forms are even unique to Ireland. It was in this context and amid concern for Lough Derg as a fishery and its declining trout population that the Lough Derg Native Fish Biodiversity Project was initiated.

The project commenced in 2006, and has been a collaboration between Lough Derg Angling Federation and its constituent 13 local angling clubs, the Irish Char Conservation Group, Inland Fisheries Ireland Limerick (formerly Southern Regional Fisheries Board), ESB, Lough Derg Sub Aqua Club, Lough Derg Science Group, Queens University, University of Waterloo, Canada and North Tipperary County Council. The project was originally coordinated by the Shannon Regional Fisheries Board and subsequently managed by the Irish Char Conservation Group.

Community Citizen Science

The project is a great example of a large scale community led project involving citizen science in an effort to get quality information that can be used to support good planning and management. In addition the information is interesting in its own right and shines an extra light on what is part of our unique natural and cultural heritage.

The project was initiated by the anglers, who wanted to find out more about the fish in the lough, and they had a number of specific queries. For example anglers wanted to know if the different "types" of trout that they had been catching, which looked different from each other, meant anything from a taxonomic point of view. In other words are there different species of trout in the lough?

Lough Derg species of trout, whitefish and pollan

Could it be possible that there might even be different species of trout within the lake like the trout in Lough Melvin, which has three distinct species? A number of other issues arose, such as do the Gillaroo trout still exist in the lake? The Gillaroo is an unusual species of trout which has deep red spots. They feed primarily on snails and other invertebrates with hard shells, giving their stomachs the appearance of a gizzard. They are only known from a few other lakes in Ireland. It is documented that back in the 1700s, the Bishop of Killaloe dined on the gizzard of the Gillaroo trout, and that it was one of his favourite dishes.

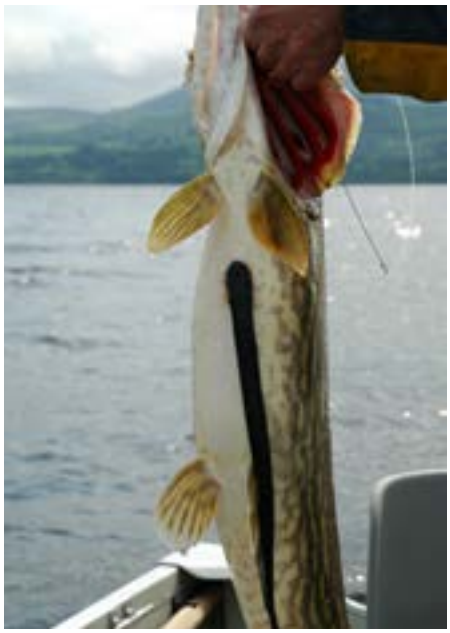
Another form of trout known as the Croneen trout, which spawns in the Camcor and Little

PHENOTYPICALLY DIFFERENT TROUT - ARE THEY REALLY DIFFERENT, AND IS THIS DIFFERENCE SIGNIFICANT?

Brosna Rivers, was thought to feed in Lough Derg, with these adults then migrating back up the Shannon to these rivers in a catchment area around Birr, Co. Offally. The Croneen is an unusual trout in that it looks and behaves like a sea trout but never goes to sea.

Other questions that the anglers and other stakeholders wanted answers to included did the unique Irish whitefish (probably an endemic species to this country) known as the freshwater pollan still occur within the lake? The lough once supported a commercial fishery for this species but they had not been recorded for a number of years. Anglers also wanted to know more about a landlocked form of parasitic lamprey that attached itself to trout. What species was it, and was it damaging the trout fishery?

Collecting and surveying



PIKE WITH LAMPREY ATTACHED CAUGHT BY AN ANGLER ON LOUGH DERG (PHOTO: HERMAN MOLENAA)

The anglers were given specific tasks to do. These included the collection of fish tissue for genetic analysis, the taking of fish scales for aging purposes, photographs for morphometric and meristic analysis and collection of macroinvertebrate and plankton samples to be processed for stable isotope analysis. Notices were put in the local press and signage placed around the lake and in local shops to encourage

MOUNTSHANNON ANGLERS HEAD OUT ON SAMPLING EXPEDITION

visiting anglers and non-club affiliated anglers to participate. The anglers also carried out additional fish surveys which allowed a comparison between current fish stocks with historic figures available prior to the construction of Ardnacrusha Dam at the outflow of Lough Derg. Funding was accessed through a range of sources.

IFI and ESB collected juvenile fish samples from all of the streams flowing in to the lough where the trout spawn, in addition to the Camcor and Little Brosna Rivers where the Croneen trout spawn. The Lough Derg Subaqua Club divers took benthic samples and Lough Derg Science Group also took plankton samples and provided identification of macroinvertebrate samples. The project recorded the first record of the invasive crustacean species Gammarus tigrinus which was found in large densities at depth within the lough (perch have been feeding heavily on them!). The EPA funded the trout genetics element of the programme. The University of Waterloo carried out the stable isotope analysis. Funding was acquired for a number of project actions including the placement of a fish counter on the Nenagh River. This is the 1st and only fish counter counting migrating freshwater trout in Ireland.

A massive effort was undertaken by all involved. 1969 lake trout samples were recorded. The fish survey found that:

- Pollan exist within the Lough, albeit a very small population – only 1.5% compared to 1920 figures.
- Regrettably, no record of Gillaroo trout has been established and it appears that this trout "species" is extinct within the lough.

GILLAROO TROUT, WHICH APPEARS TO BE EXTINCT IN LOUGH DERG

- The lamprey that are feeding on trout are in fact juvenile sea lamprey which are feeding off fish opportunistically as they migrate downstream to the sea.

The project established that the juvenile sea lamprey also attack other fish species including roach and bream. It is likely that these lamprey are the progeny of a few adult lamprey that had escaped through the Dam at Ardnacrusha. Subsequent work using eDNA (analysis carried out by UCD) collected by the project, established the presence of sea lamprey in a number of tributaries flowing into Lough Derg, suggesting that these may be the location of the sea lamprey spawning grounds. This is a significant result as heretofore it was unknown where they might spawn and the data tallies with anecdotal information collected by the project.

The trout genetics are currently being reported on and form a significant body of work which will be published in the scientific literature and will change how the management of the lake trout is conducted in the catchment. Initial results do suggest that the trout within Lough Derg are genetically diverse and require appropriate management strategies to reflect this fact.

The project is ongoing and information generated to date is the result of the participation of many individuals and organisations (both state and nongovernmental), in the spirit of collaboration and genuine interest in the conservation of the native fish biodiversity in the lough.

Fran Igoe, voluntary scientific advisor to the Lough Derg Native Fish Biodiversity Project for almost 10 years.

LAMPREY AND ITS HOST LOUGH DERG TROUT. NOTE SCAR ON TROUT WHERE LAMPREY HAD BEEN FEEDING (PHOTO: KEVIN GRIMES)

Catchments, water quality and community science– A tale from Co. Antrim

Any programme of sustainable development needs to consider not only environmental and economic factors, but also social issues. Case studies, too numerous to mention, show that if the wants and needs of communities are not taken into account, sustainable development projects ultimately fail. Summer 2015 provided researchers from the School of Planning, Architecture and Civil Engineering at Queen's University Belfast (QUB) with an opportunity to assist members of a local community in southern Co. Antrim in a catchment characterisation programme.

At the same time the programme gave researchers the opportunity to study nutrient transport in a relatively unfamiliar geological setting for Irish Hydrology.

Basalt, although well known to all geologists, is a relatively unusual rock type across most of Ireland. That is except in the northeast where Tertiary basaltic lava flows underlie nearly all of Co. Antrim, along with smaller proportions of the surrounding counties. Although considered an important aquifer in Northern Ireland, looking at hydrographs of rivers draining Antrim's basaltic catchments would suggest otherwise. Flows typically rise and fall very rapidly following rainfall, in a manner more akin to catchments underlain by poorly productive bedrock (Figure 1). Despite these potentially stressful ecological conditions, many of the catchments in western part of Antrim, draining into Lough Neagh, host unusual aquatic species, including trout subspecies not found elsewhere. At the same time diverse anthropogenic activities, coupled with a flashy hydrological regime make aquatic ecosystems in the area vulnerable to pollution, as reflected by regular fish kills.

Understanding the impact of land use on water quality forms a core element of catchment management. Although higher blanket bog -covered areas of the Antrim Plateau experience limited pollution pressure, human activity proves considerably more intense in lower lying areas (Figure 2). Extensive pasture and associated drainage of wet soils, coupled with widespread intensive livestock rearing units, form a significant suite of potentially polluting agricultural activities, while other pressures on water quality can include (on-site and centralised) sewage disposal, urbanisation, landfills and manufacturing industry.

Concerns about how these diverse activities impact aquatic life in the Sixmilewater River in southwestern Co. Antrim prompted the Sixmilewater River Trust to start a community science initiative to monitor variations in biota throughout the river's catchment. Following discussion with personnel from QUB, the initiative expanded in summer 2015 to examine influences on river water quality, while at the same time allowing trust members to build up further expertise and understanding of how land use can affect pollutant levels.

Community science initiatives can have a range of benefits, including generating community support

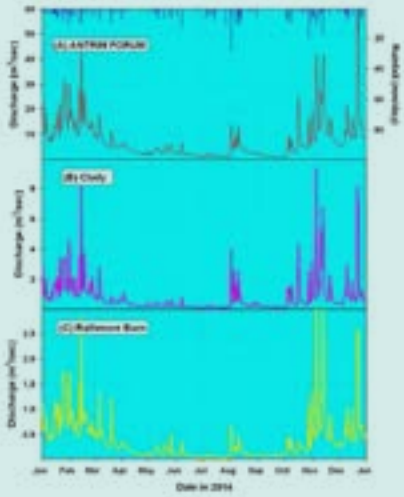


FIGURE 1: RAINFALL-RUNOFF RESPONSES FOR THE SIXMILEWATER RIVER, AND SELECTED TRIBUTARIES. DATA SOURCE: NATIONAL RIVER FLOW ARCHIVE (UK)

FIGURE 2: (A) GEOLOGICAL MAP OF SIXMILEWATER CATCHMENT. (B) LAND USE IN THE SIXMILEWATER CATCHMENT, CO. ANTRIM.

for conservation, providing local knowledge to researchers and offering additional human resources to assist in data acquisition. Although this latter point requires an upfront commitment in training and oversight, when completed successfully, it provides a means of collecting more extensive datasets than could be done by researchers alone.

In the case of the Sixmilewater study, Queen's University Belfast researchers and Sixmilewater River Trust members focused on routine collection of water temperature and specific electrical conductivity (SEC) measurements from across the catchment between June 2015 and August 2015. These measurements permitted comparison of basic water quality parameters with ecological status, and were complemented by continuous temperature/specific electrical conductivity monitoring of stream water quality at four target locations, whose locations were informed by initial catchment-wide specific electrical conductivity surveys. Two supplemental rounds of catchment-wide sampling, completed in July 2015 and August 2015 allowed comparison of field water quality parameters with the results of laboratory-based analyses, the cost of which was covered jointly by the Antrim & District Angling Club and Ballynure Angling Club - both of whom are part of the Sixmilewater River Trust.

Seven rounds of regular Temperature/specific electrical conductivity measurements, made at 38 monitoring points across the 278km^2 catchment during the eight week period, revealed specific electrical conductivity to vary from just under 55mS/cm to just over 200mS/cm. Critically, results proved broadly consistent between points during measurement rounds, with those sub catchments that scored highest in terms of ecological health having the lowest specific electrical conductivity. Conversely, sub catchments displaying chronic water quality problems had the highest specific electrical conductivity (Figure 3).

Investigation of results provided by data loggers during July 2015 revealed a gradual increase in specific electrical conductivity, corresponding to a decline in river discharge; this was interspersed with sharp declines (and recoveries) in specific electrical conductivity following periods of intense rainfall. Similar responses were observed in flashy catchments elsewhere during the recently completed EPA-sponsored STRIVE-Pathways research.

Comparison of the results of specific electrical conductivity measurements with those of laboratory analyses revealed an excellent correlation with chloride concentrations (Figure 4), while relationships with nitrate and orthophosphate levels proved less significant.

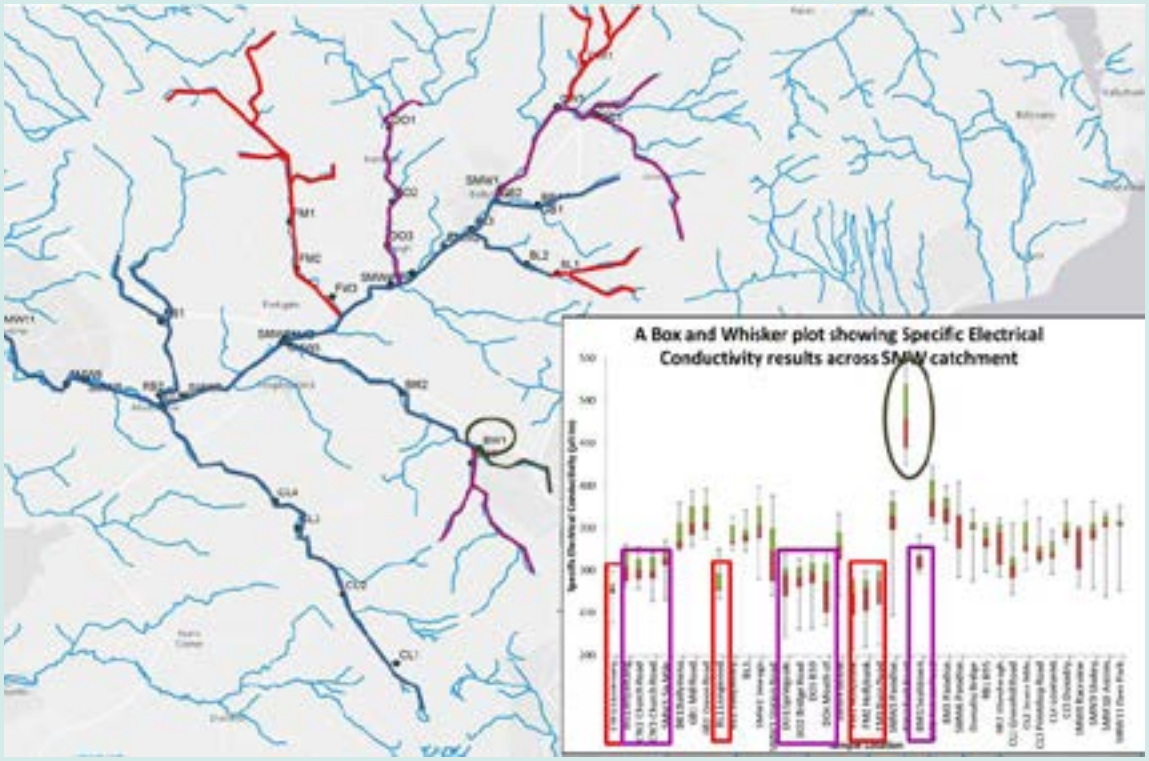


FIGURE 3: MAP OF THE SIXMILEWATER CATCHMENT SUMMARISING STREAM ECOLOGICAL STATUS, RANGING FROM RED, SHOWING HIGH STATUS STREAMS TO DARK BROWN (UPSTREAM OF BM-1), INDICATING POOR STATUS. THE FIGURE INSET HIGHLIGHTS THE RELATIONSHIP BETWEEN SEC AND STATUS. (RED AND PURPLE –GOOD TO HIGH STATUS, UNBOXED-MODERATE AND DARK BROWN-POOR STATUS).

Overall, mapping the results of the aqueous nutrient analyses across the catchment revealed nitrate levels to be generally low and range between 0.4mg/l-N and 3.0mg/l-N (median 1.76 mg/l-N). By contrast phosphate levels were consistently above the 35mg/l ecological threshold, even in headwaters, where native crayfish occur. Elsewhere lab analyses showed phosphate levels could exceed 10 times the threshold, while concentrations above 190mg/l were noted in samples collected from a semi-urbanised sub catchment displaying consistently poor ecological health.

Chronically high aqueous phosphate levels across the Sixmilewater Catchment point to sustained widespread nutrient sources that impact water quality. This in turn suggests a limited capacity of catchment subsurface materials to attenuate phosphate. In contrast, lower than anticipated nitrate levels suggest reactive processes contribute to denitrification. Examination of TOC analyses from across the catchment, generated by the Geological Service of Northern Ireland (GSNI) Tellus project, shows organic carbon in non-peat soil samples, collected from across the catchment, to typically range between 12% and 25% (Paul Wilson, GSNI personal communication). At the same time although iron levels in soils were also very high, water quality data suggest their role in restricting aqueous P mobility is limited.

Potential aqueous N and P sources across the catchment are manifold. These include on-site wastewater treatment systems. Although Northern Ireland has an extensive rural sewerage network, which discharges to centralised sewage treatment plants, coverage is not comprehensive. Across the Sixmilewater Catchment 3,715 properties were not served by the network and mainly dispose of waste water using smaller on-site wastewater treatment systems. Of these 1,096 are located within 50m of surface drainage. Despite these figures, there appears to be little correlation between higher status streams and on-site wastewater treatment systems occurrence/density, suggesting that their cumulative impact on catchment water quality is limited.

Overall, study results have demonstrated the benefits that can arise from community science initiatives. Since the completion of this phase of the project, the Sixmilewater Trust is now examining the possibility of longer term water quality monitoring, with a view to better understanding the impact of runoff events on aquatic health, and their association with frequent fish kills across the catchment. At the same time QUB personnel and members of neighbouring trusts are currently investigating the possibility of adopting similar approaches to cross-community science initiatives in North Belfast to rehabilitate industrially contaminated streams. We will be sure to keep readers updated of any future progress on this topic.

Raymond Flynn (School of Planning, Architecture and Civil Engineering, Queen's University Belfast), Caitlin Buick and Francis Mackin (RPS Consultants, Boucher Road, Belfast)

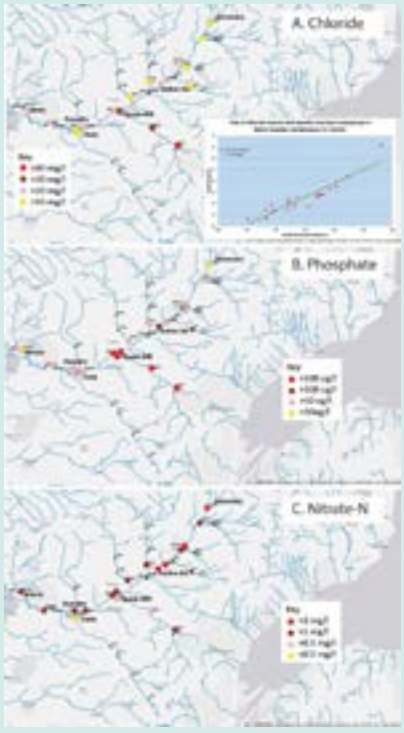


FIGURE 4: MAPS SHOWING VARIATION IN CHLORIDE, PHOSPHATE AND NITRATE ACROSS THE SIXMILEWATER CATCHMENT, CO. ANTRIM. SAMPLES COLLECTED 19-20 AUGUST 2015.

Campaign to Control/Eradicate Invasive Species in Upper Achill, Co Mayo – an update on the pilot project

Invasive alien terrestrial species are a major environmental problem and are causing environmental harm in different parts of Ireland. They are taking over vast areas of agricultural land and excluding native species. Invasive species are one of the biggest threats to biodiversity worldwide.

Public meetings were held in 2015, in Upper Achill to discuss the growing problem with invasive species like Gunnera (Gunnera tinctoria - Giant or Wild rhubarb) and to a lesser extent Japanese knotweed (Fallopia japonica) and their possible control.

It was also agreed that Rhododendron is a huge problem in the area but was not the focus of this pilot project.

It was agreed that the best way to eradicate/ control the problem of Gunnera and Japanese knotweed was to use a knapsack sprayer and spray these plants. All landowners in Upper Achill were encouraged to spray their own land as it was very important that all land where Gunnera was growing was sprayed to ensure that it would not be a source of cross contamination and spread to other fields in future years.

A Facebook page was setup to highlight and to raise awareness of this problem. The local media also published several articles highlighting the problem with Gunnera in the Upper Achill area.

SUMMER 2015 - SPRAYING THE GUNNERA BEGINS

Biology of Wild Rhubarb (Gunnera)

Gunnera was most likely introduced into Achill over 100 years ago as an ornamental plant and then spread as an invasive species. This probably happened because of climate change as Gunnera requires high rainfall and mild temperatures to grow. Gunnera is native to countries like Chile where there is a similar climate to the West of Ireland. It grows on peaty soils (not on bogs), river banks, gravelly road sides and on cliffs. It also thrives where the land is not grazed or where it is un-used.

Gunnera has spread rapidly in Upper Achill owing to emigration (demographics) and the closure of houses which is nothing new to Upper Achill. It is estimated that there are over 170 acres of land under Gunnera on the island of Achill (UCD studies). Its ability to grow on marginal soils is attributed to the fact that the Gunnera plant can 'fix' its own nitrogen from the atmosphere (air contains 78% nitrogen gas by volume) which in turn gives it a lush green appearance in the spring and the ability to outcompete other plants like grasses.

Progress to date:

Consent was sought and received from most of the landowners in the Upper Achill area to gain entry to their land for spraying purposes. A small number of landowners have sprayed their own land since the start of the campaign. However, more landowners are being encouraged to spray their land.

Approximately 5-6 acres of land infected/overgrown with Gunnera has been treated in the Sraheens area over the past Summer. There was a good response to the herbicide application (see photo). Japanese knotweed was also sprayed in the Sraheens area during the Summer and the results look promising.

The Gunnera plants (over 2m in height) were so dominant in the fields in Sraheens that it was nearly impossible to enter some parcels of land for spraying purposes. Those plants that were sprayed in July 2015 did not produce any large fruiting heads compared to the fields which were not sprayed. It will be fascinating to see the difference between these fields in 2016 and in subsequent years.

This is a long term (5-10 year) project where annual monitoring for any re-growth of Gunnera is essential. Undoubtedly respraying will be required since each plant can produce over 250,000 (yes ¼ of a million) seeds per plant and consequently there are probably millions of seeds in the soil seed bank.

SUMMER 2016 – PROGRESS BEING MADE IN REDUCING THE NUMBERS OF GUNNERA

Challenges ahead

Good progress was made during 2015. Much was learned about the best time of the year to spray, the best herbicide and the optimum concentration of herbicide to use. It is hoped that further progress on the control of the Gunnera and Japanese knotweed in the Sraheens/Kildownet area will be achieved during 2016.

In conclusion, I believe that this campaign can work and hopefully it can be used as a template for other parts of Achill Island and other areas of the country where Gunnera and Japanese knotweed are problematic. However, it would be appropriate if volunteer campaigns like this one (it could be argued that they are acting in the national interest) received more State support in order to counteract the scourge of terrestrial invasive species like Gunnera and Japanese knotweed which are causing havoc with ecosystem biodiversity in places like Achill island.

Mar a deartear as Gaeilge: 'Tus maith leath na hoibre'.

For more information please check out our Facebook page: http://bit.ly/achillinvasives

Tom McLoughlin, EPA

Community response arrests the spread of Invasive Species in Kilkenny

The spread of the Invasive species Himalayan Balsam has been the target of a community intervention along the River Nore in the Kilkenny City area and its tributary the River Bregagh. Himalayan Balsam is one of Ireland's most invasive plant species and is considered to be a threat to wildlife ecology along rivers especially their riparian areas, and so is an issue that should be addressed under the Water Framework Directive.

KEEP KILKENNY BEAUTIFUL VOLUNTEERS

SOME OF THE VOLUNTEERS WHO HELPED REPEL THE INVASIVE SPECIES: BRIAN GILLIGAN, TIDY TOWNS, PAT BOYD, KEEP KILKENNY BEAUTIFUL BIODIIVERSITY GROUP AND MARTIN GREENAN, KILKENNY ANGLERS.

Removing Himalayan balsam is not straightforward and requires a lot of man power, community and river stakeholder intervention. The Tidy Towns Committee, Keep Kilkenny Beautiful and its Biodiversity Committee first targeted Himalayan balsam which had become rampant on the River Bregagh, which is a tributary of the River Nore flowing through Kilkenny City in 2015 .

The River Bregagh is a tributary of the River Nore which rises to the south west of Kilkenny and meanders through the greater southern and western environs of the old city and flows under city walls and Abbeys where it joins the River Nore.

Community volunteers cleared the upper part of the affected areas in the months of June and July in 2015 and 2016 and concentrated on preventing any re-emergence in this area for the remainder of the year. Progress on the first year of the River Bregagh Himalayan balsam campaign would have been greater but for an outbreak of Giant hogweed on the River Nore to which a number of the Bregagh volunteers responded.

VOLUNTEERS WALLED IN ON THE RIVER BREGAGH

A response to combat the Giant hogweed's threat to public health and the rivers ecology was directed by the local National Parks and Wildlife Officer, and included individuals from the Tidy Towns biodiversity group, the Local Sub Aqua Club, the Kilkenny Anglers and the Local Canoeing Club. The result of this intervention was that 70 or so Giant hogweed plants were treated and their seed heads removed preventing them from going to ground and germinating. The same Giant hogweed response team have been proactive again this year and it is hoped that one invasive species epidemic has been averted and is under control.

In May of this year 2016 the River Bregagh Himalayan balsam campaign resumed and the stakeholder groups that so successfully responded to the previous years outbreak of Giant hogweed spearheaded the completion of the removal of all stands of the invasive species from the River Bregagh tributary. The important participation of the rivers amenity stakeholders in this difficult access phase of treatment also released experienced volunteers to participate in the removal of Himalayan balsam downstream of the River Bregagh confluence.

The Tidy Towns, River Nore Himalayan balsam removal campaign began in May on the popular Lacken and Canal walk areas of the river downstream of the River Bregagh and a strong community response has seen large areas of infestation being cleared and indigenous habitat being restored.

Earlier removal of invasive species on the River Bregagh has already resulted in a return of nesting ducks and foraging swans to the restored grass leavey island and riverbank habitat and a return of a pair of squawking water hens to what had previously become an impenetrable forest of Balsam.

The intervention and participation of Tidy Towns cross community volunteers and river amenity stakeholders in biodiversity advocacy projects is heralding a new dawn in river conservation on the River Nore and its tributaries in Kilkenny. The group have been in contact and were recently visited by Fran Igoe, the WFD Southern Regional Coordinator from the Local Authorities Waters and Communities Office who offered advice and support for the work.

Pat Boyd, Keep Kilkenny Beautiful

HIMALAYAN BALSAM INVADES - NOT MUCH ROOM LEFT FOR OTHER SPECIES!

RIVER USERS ACCESSING INHOSPITABLE AREAS

Ecosystem hydrology: utilizing the functional ecology of forests and wetlands

Acknowledging the benefits of multiple land use

Recently published findings in the UN Food and Agriculture Organization's (FAO) 'State of the World's Forests' report, suggest that fostering co-operation between a country's agriculture and forestry sectors improves food security and reduces deforestation. The report emphasised that such collaboration between these sectors reduces environmental damage and enhances social and economic outcomes - as similarly noted by Ramsar, the international organisation that promotes the values of wetlands.

Understanding the roles that forests and wetlands play in nutrient dynamics and hydrology of catchments yields insights into their capacities to intercept, recycle and retain nutrients, as well as delivering other social, economic and environmental benefits. Such roles may be purposefully reinstated where lost, and even redesigned to encompass a range of specific environmental tasks, including those related to water and land in catchment management.

This first of three articles for the 'Catchment Newsletter' outlines a range of enterprises undertaken during more than three decades for reinstating some of the country's functional ecology which has been diminished over millennia. Working for VESI Environmental Ltd, the authors have helped pioneer many of the innovative concepts applied and have been involved in work at more than 150 sites throughout the country. The present article focuses on the background and the general principles applied. The remaining two describe their application in individual case studies, and will appear in future issues of the Newsletter.

The consequences of lost habitats

Although generally known, it is also unfortunately little appreciated that Ireland has almost entirely lost the two once most widespread habitats-types that had come to dominate the country after the last glacial period some 12,000 years ago. These were, on the one hand, forests dominated by pine, birch and aspen on the more free-draining upland soils, grading to oak, ash and elm on the mesic more nutrient rich soils at lower elevations. On the other hand, a wide variety of wetland categories of lakes, shallow ponds and marshes existed wherever water gathered. So great has this loss been, that there are hardly any traces left today of their once widespread existence. Consequently the key roles that forests and wetlands once played in the country's nutrient dynamics and hydrology have been extensively reduced.

Comprehensive and insightful studies over many decades, such as by Bormann, Likens and their associates at Yale and Cornell Universities, USA, working at the US Forest Service catchments at Hubbard Brook, New Hampshire, have demonstrated that forest habitats would have reduced nutrient loss and beneficially influenced hydrological dynamics – a range of dynamic capacities that land and water management can only dream of aspiring to achieve under current practices. Tree canopy-interception, deep-rooting of trees and forest canopy transpiration, respond commensurably to precipitation. In the case of wetlands, impeding the flow of surface-waters and the absorption of its vectored constituents - wherever water slows on its journey to the sea. These key ecosystem functions are now sorely absent over most of the Irish countryside with profound and compounded negative impact on the country generally.

The original vegetation succession of these lost habitats, which would have continued over millennia, was of course influenced by the ecologically early arrival of humans and their use of fire - opening the forest canopy, releasing vegetation-stored nutrients and consequently increasing the flow of nutrients to downstream shallow lakes and marshes. The combined effects of repeated fire and the subsequent nutrient loss would have had profound direct and indirect ecological consequences in impoverishing upland soils and increasing the nutrient status of receiving shallow lakes and marshes. With the arrival of agriculture during the Neolithic era, these new anthropocentric dynamics were further augmented as even more forest was cleared, resulting finally in the development of moor-type peatland in areas of base-poor soils with relatively higher precipitation such as is evident at the Ceide Fields in north county Mayo. In shallow lakes, a common feature of the saucer-shaped topography of the country, released in-flowing nutrients probably initiated or at least, speeded up the development of raised bogs.

The need to understand

Understanding is central to human endeavour. Grasping how nutrients are utilised and recycled in an ecosystem improves comprehension of their community species' evolution and biology, and their ecological dynamics, and also allows assessments to be made regarding their sustainable management. Knowing how forests, woods, marshes and associated wetlands function, provides a basis for their effective reanimation. Such ecological reanimation, can incrementally lead to better appreciation of how they function and of the associated ecosystem services that they provide.

Ecological reanimation versus restoration

- Ecological reanimation focuses on facilitating bio-geo-chemical processes delivering self-managing and self-facilitating systems sustainably minimizing leakiness and entropy.
- Ecological restoration focuses on facilitating the recovery of lost biological assemblages within recent evolutionary time lines.

In recent years these ecosystem based benefits have become more recognised at the fore of efforts for sustainable social and economic development. Their scope was quantified in the World Millennium Goals/Declaration 2002. These goals are a blueprint, agreed upon by nearly all countries and leading development institutions, towards helping the global community understand the close relationship existing between the Planet, nature and humans' own long-term wellbeing.

Knowing how catchment management benefits from forests and flow-intercepting marsh-type wetlands, points to how they might also be reanimated and properly used for managing various known polluted water sources. This reanimated capacity of marsh-type wetlands has special relevance as it includes their capacity to effectively treat municipal waste waters, road drainage, agricultural and food processing waste waters, landfill leachate and mine drainage etc. Forest development on the other hand may be structured to enhance water retention, aid in recharging aquifers and neutralise acid through-fall. This 'philosophy of understanding through doing' reflects the rhetorical question posed by the Chinese Tang Dynasty poet-philosopher Han Yu:

"Does the bowl in the garden mock nature, when night after night green frogs gather to prove it's a pool? Who says you can't make a pond out of a bowl?"

THIS INTEGRATED CONSTRUCTED WETLAND (ICW) TREATS ALL THE WASTE AND DRAINAGE WATERS FROM THE DUNHILL COMMUNITY, EDUCATION AND ENTERPRISE CENTRE'S ECOPARK, AND ADJACENT GAA SPORTS CENTRE. IT IS LOCATED 1 KM SE OF DUNHILL VILLAGE, CO. WATERFORD. ALL STORM WATER RUNOFF FROM ROOFS AND PAVED AREAS ARE INITIALLY ATTENUATED WITHIN A CENTRALLY LOCATED POND WITHIN THE ICW COMPLEX, WHICH PERIODICALLY DISCHARGES TO THE ADJACENT LAST WETLAND AREA. THE CENTRE'S SEWAGE/WASTEWATER FROM A DIVERSITY OF FOOD, INDUSTRIAL AND ADMINISTRATIVE ENTERPRISES ENTER A SEPTIC TANK WHICH THEN DISCHARGES ITS FLOW THROUGH A SERIES OF FOUR INTERCONNECTED SEPARATE WETLAND AREAS.

The initial priming factors in almost any land and water endeavor

Recognising the complexities of each site and its innate characteristics, and innovatively using them resourcefully, are key to successfully implementing land and water management. This includes its soil base and water supply. With its repeated layers of disturbance, Ireland's ecology and landscape are particularly challenging. This is especially so where understanding, conserving or restoring its natural capital and heritage are concerned. Attempting to introduce innovative change to current land and water management practices is difficult. It is also paradoxical, since probably no other country in Europe has seen its original ecological base more eroded, torched, drained, grazed, ploughed and manured. Consequently the country has retained little of its once wider functional ecosystems and associated biodiversity. Most of this loss has resulted from often assumed economic necessity. It has also been at times exploitative, an example being the loss of oak forests in the 1500's. These sustained impacts have led to the field patterns and dispersed farms and dwellings generally seen as the 'natural' present day postcard-image of the countryside. Afforestation, peat harvesting and other initiatives, have suggested that the land might be used differently. Yet land use change remains a common challenge for many, including national institutions and governance, with politics interfering to a dominating degree.

This is particularly evident as rural Ireland strives to adapt to urban development, transport-infrastructure, wind turbines, electricity distribution, industry and rural dwellings. Only when economic and social arguments are coherently presented on a site-by-site basis does change seem to become acceptable. Different approaches to land usage have always been challenged, especially if seen as threatening existing economic and cultural interests. Thus any 'new idea' needs to be honed and tested within the ambit of social, economic and environmental management, with the frequently quoted axiom of "thinking globally and acting locally" having special relevance and application. Clearly experience and diversity of connected relevant competences are also required. New initiatives call for and benefit from a step-by-step approach, and ongoing reflection on the work in progress.

Innovation

Over the past 33 years, more than 100 functional wetlands, 18km of re-profiled riparian corridors and 25 novel forests have been developed or progressed by those at VESI, with State and private partnerships. A broad range of purpose has driven this work, in particular the need to address challenges relating to nutrient and water management, including flood attenuation and ecological reanimation. These endeavours have led to the development of the 'Integrated Constructed Wetlands' (ICWs) concept that is successfully applied and cost effective in the treatment of a wide range of polluted water sources. In addition, the development of alternative forest design and practice, including riparian and forest corridors, enhances nutrient management and water quality. Underlying all these initiatives has been the awareness that air, land and water are inextricably linked through bio-geo-chemical processes, and that water management is fundamentally a land use issue.

By grasping how a forest or a wetland functions, one can reanimate them and address the salient aspects of each site's specific needs. One such example is the ICW treating combined municipal waste water at Castle Leslie, Glaslough, Co. Monaghan shown in the photograph.

CASTLE LESLIE INTEGRATED CONSTRUCTED WETLAND

THIS INTEGRATED CONSTRUCTED WETLAND (ICW) TREATS ALL WASTE AND STORM WATER FLOWS FROM DUNHILL VILLAGE, CO. WATERFORD. STORM WATER IS TREATED SEPARATELY IN A SERIES OF FOUR LINEAR PONDS BEFORE DISCHARGING TO THE ADJACENT RE-PROFILED DUNHILL-ANNESTOWN STREAM. THE VILLAGE SEWAGE/WASTEWATER ENTERS A SEPTIC TANK AND IS PROGRESSIVELY TREATED THROUGH A SERIES OF FIVE WETLAND AREAS. THE FIRST OF WHICH IS DIVIDED INTO TWO SEGMENTS TO FACILITATE ODOUR CONTROL AND SEDIMENT MANAGEMENT. IT WAS RE-CONSTRUCTED IN 2012 AND HAS A NUMBER OF UNIQUE EDUCATIONAL AND AMENITY FACILITIES.

Influences of each specific water-source

Each rivulet, stream and tributary influences the receiving water into which it flows, whether river, marsh, lake or inshore water. Each source differs in terms of its flow, velocity and vectored contents, including nutrients and suspended material, as well as its conductivity status. Furthermore these may differ from season to season.

Each water source is influenced by the initial interactive surface through and upon which it falls, including atmosphere, vegetation and soil/geology. Effective forest and wetland reanimation design should address this elementary fact in ways that optimise water quality and flow. By explicitly integrating all source-water with each site's location, soil, landscape setting and potential ecological-biodiversity, a sustained suite of benefits and synergies as exemplified by Integrated Constructed Wetlands can be achieved.

Establishment of forest

Trees, woods and forests have special merit for catchment management in providing capacities for capturing, recycling and retaining essential nutrients and carbon. Tree canopies intercept, absorb and transpire water. Their roots increase water infiltration to the ground and reduce overland flow. Together these have greater effect than the grasslands that dominate the land cover of the Country. Novel alternatives to conventional forest establishment have shown that a forest's capacity for water retention can be additionally enhanced, thus achieving little or no surface discharge. This is of special relevance in the management of canopy-induced acidification and water quality during timber harvesting. Through the novel use of excavated borrow-pits, and the accompanying mound-planting of trees, effective alternatives to conventional ploughing and ripping in the establishment of forest may be achieved. The use of such integrated depressions is better at retaining surface water within the forested area, with tree stability enhanced by mounding. The establishment of forest corridors can provide shelter and access throughout farms, and is another approach that could better help protect receiving waters. These are especially effective when positioned across sloping ground with mounding, and sumps to further intercept surface water flow.

Key Message: Site-specific assessment and integrated design can benefit catchments

The work presented recounts the importance of site-specific assessment and the roles of integrated design that can benefit catchment management. Its importance and relevance are supported by the United Nations Environment Programme's Convention on Biological Diversity 'Ecosystem Approach' and its 12 principles. In addition there is a need to avoid formulaic 'tick-the-box' approaches to design and implementation, just as there is an ever-present danger that where formulaic solutions are the norm, opportunities to deliver on multiple benefits - often only specific to a site - are missed.

Summary points

The implementation of forest and wetland functional ecosystem reanimation for catchment management requires:

- Accepting the inextricable linkage between social, economic and environmental needs in land and water management.
- Social-economic gains need not necessarily be tempered by ecological failure (loss of biodiversity, anthropogenic induced climate change, loss of ecosystem services/buffering etc.). There are opportunities for enhanced sustainable developments through integration and collaboration.
- Water management is largely a land use issue as it needs sufficient space to sustainably facilitate treatment and attenuate flow.
- An optimal approach to land and water resources is required rather than one that strives for the maximisation of a single outcome.

"Nature never did betray the heart that loved her." (William Wordsworth, 1770-1850)

Aila Carty, Caolan Harrington, Rory Harrington and Janet Laffey - VESI Environmental Ltd. Little Island, Cork & Dunhill, Co. Waterford

www.vesienviro.com

Sustainable Intensification - Integral Integration

Sustainability is generally regarded as meeting our needs today without compromising those of future generations. We are all becoming increasingly comfortable with the idea that a range of environmental factors underpin our ability to produce food, clean water and, to an increasing extent, fuel. Look no further than the recent flurry of activity around soil health on farming-related social media as evidence of this. Integrating environmental objectives with agricultural ones is fundamental to productive land use, both in the short- and long-term.

There are two further ways in which integration is key to our productive management of the land. The first is a response to the polarisation of farming systems. While this may have delivered economic efficiencies in the short term, there is an increasing realisation of the benefits associated with the integration of food production systems, not least in terms of waste management, weed and disease control, and security of feed supply. The second relates to knowledge exchange. A long history of one-directional knowledge transfer, from scientists to farmers, is gradually giving way to a more enlightened approach, in which the skills and knowledge of the most pioneering farmers are recognised as having equal, or more, relevance to the current challenges associated with food production. Put the best scientists and the most forward-thinking farmers together and we have real dynamism that can help us to achieve sustainable intensification.

'Intensification' now is not measured in tonnes of fertiliser or litres of diesel or plant protection products, but through the knowledge and technology that are developed and applied to improve the efficiency with which those resources are used. As well as ensuring economic and environmental benefits arising from improved resource use efficiency, this approach harnesses natural processes for nutrient cycling and control of pests, weeds and diseases. Integration of environmental and production objectives, arable and livestock systems, and scientific and farmer knowledge, is integral to the activities on the SIP study farms. Together, our farms provide a platform on which science can be applied in a practical setting, and a focus for discussion with visiting farmers and advisors.

The Allerton Project at Loddington has been integrating its environmental research with its farm business objectives since its start in 1992. As our contribution to the Sustainable Intensification Platform (SIP), we are conducting research into various cover crop mixtures, as well as crop establishment methods with differing levels of soil disturbance. Both areas of research have potential for improving soil function, with associated benefits to crop performance and water-related objectives.

Our other area of research is on optimising the use of grass fields for sheep production, through better understanding of the role of sward minerals in those fields. This is highly relevant to the integration of farming systems. As well as improving the live-weight gain of lambs, grass leys within an arable rotation help to reduce parasite burdens in sheep, and grassweed populations in the subsequent arable crops.

IN-FIELD WATER RETENTION MEASURES AND MONITORING EQUIPMENT

The Allerton Project works with a wide range of research partners, with NIAB TAG (National Institute of Agricultural Botany/The Arable Group) and the University of Nottingham being our key partners on the SIP. We also work closely with retailers and a range of agricultural supply companies. But, most importantly, we work with farmers and their advisors. Last year, more than 2,000 agricultural professionals from across the country visited us at Loddington, providing numerous opportunities for two-way exchanges of information and ideas.

There is similar activity in the local area around Loddington, with a range of initiatives providing mechanisms through which researchers and farmers can exchange information and ideas, and develop plans for research. These specific opportunities for practical approaches to mutually beneficial collaboration between farmers, form part of our contribution to the SIP landscape scale work. Collaboration between local farms can have social as well as economic and environmental benefits. As one local farmer put it to me recently, 'It makes life worth living'.

So integration is integral to all we are doing. Coming from a flour milling family, adopting a career in agrienvironmental research, and running a small farm business with my wife, integration has personal resonance too! But that is something that everyone with whom we are trying to engage should be able to say.

Chris Stoate, Head of Research at the Allerton Project for the Game and Wildlife Conservation Trust at Loddington, Leicestershire, England.

You can find Chris's blog at http://allertonresearch.blogspot.ie/ This article originally appeared in SIPSCENE - The newsletter of the Sustainable Intensification Platform. http://www.siplatform.org.uk/sites/default/files/newsletter_pdf/SIPSCENE_3rd_Edition_final.pdf

Twitter: @SIPResearch

Biodiversity – the variety of life

The terms 'nature' and 'biodiversity' are interchangeable. Human beings are an intrinsic part of biodiversity and interact with it on a daily basis. Our activities change and shape the landscape in which we live and the consequent environmental and land use changes can have wide ranging influences on biodiversity.

What is Biodiversity?

The Convention on Biological Diversity (www.cbd.int) defines 'biological diversity' or biodiversity as the variability among living organisms from all sources including, among other things, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. The Oxford English Dictionary offers a simpler definition: 'The variety of plant and animal life in the world or in a particular habitat, a high level of which is usually considered to be important and desirable.' In short, biodiversity is the variety of life on earth. Biodiversity is under considerable threat however, both globally and in Ireland.

What are the key pressures?

The key pressures on Ireland's habitats and species include direct habitat damage from peat cutting, wetland drainage/reclamation, over/under-grazing, water pollution, unsustainable exploitation (e.g. overfishing), invasive alien species and recreational pressures. Climate change is also likely to have some effect on Irish species and habitats. Human population growth is an example of an indirect pressure, the effects of which are exacerbated by limited public awareness of the economic value of biodiversity and its benefits to society.

Protecting Biodiversity and Ecosystem Services

So why protect biodiversity? There is now an increased understanding that aside from the obvious environmental benefits of protecting biodiversity there are considerable economic benefits too. Biodiversity underpins our economy, health and well-being by providing us with clean air, water, food, materials, medicines and healthy functioning ecosystems amongst other things. This stock of 'natural capital' provides us with important 'ecosystem services'. 'The Economic and Social Aspects of Biodiversity - Benefits and Costs of Biodiversity in Ireland', a study commissioned by the Dept. Environment, Heritage and Local Government in 2008, offered a preliminary and conservative estimate that biodiversity contributes at least €2.6 billion to the Irish economy annually through the goods and services it provides. It is, therefore, vital that we protect biodiversity, not only for the sake of protecting nature, but also for our own sustainability.

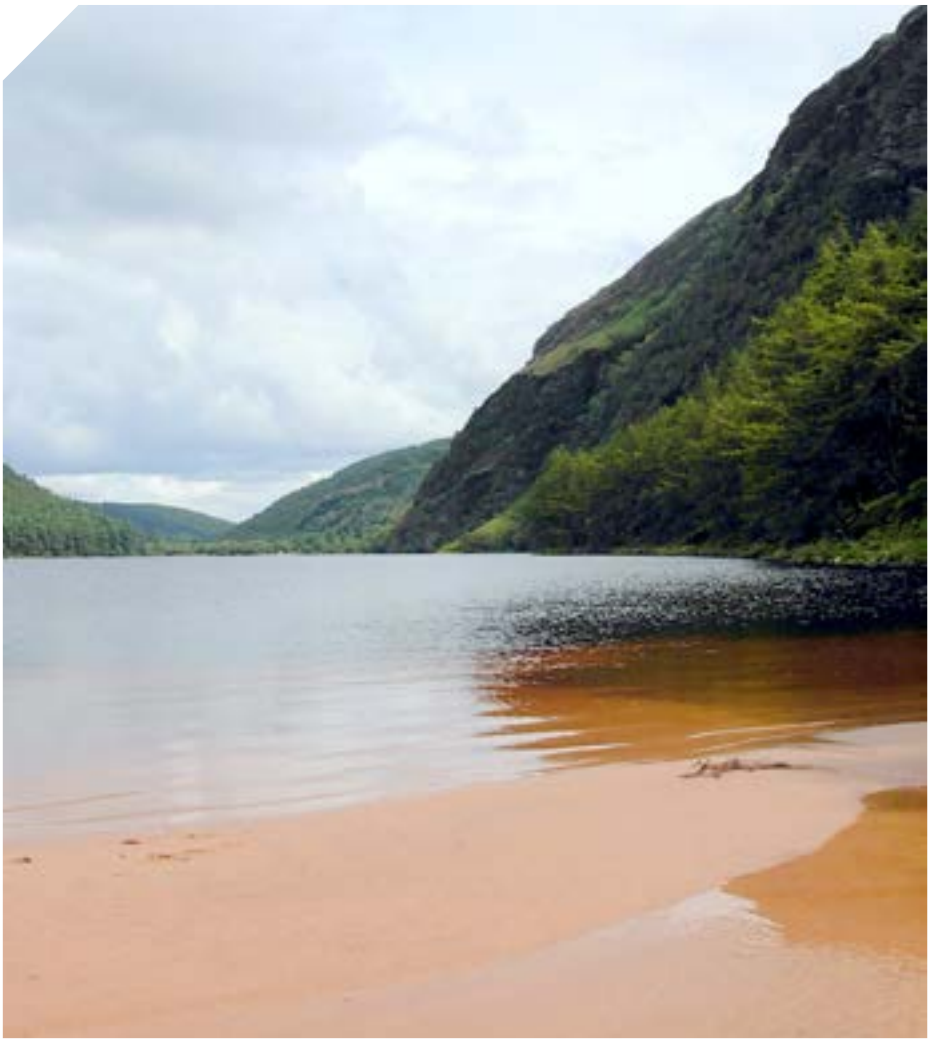
Ireland also has international and legal obligations to protect biodiversity and is committed under the Convention on Biological Diversity to halt biodiversity decline by 2020. Protection of biodiversity within and outside of protected areas is important and requires greater integration of biodiversity concerns in policy development and implementation at all levels. Ireland's second National Biodiversity Plan (2011-2016) includes a programme of measures aimed at meeting Ireland's biodiversity obligations. The plan outlines Ireland's vision for biodiversity as follows: 'That biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally.'

Natura 2000 Network

Biodiversity is protected at a European level by the Habitats and Birds directives. These directives have resulted in the creation of a comprehensive network of sites for habitat and species protection called the Natura 2000 network. Details of Ireland's protected sites can be found on the National Parks and Wildlife Service website (www.npws.ie/protected-sites). The network consists of Special Areas of Conservation (SACs) as designated under the Habitats Directive and Special Protection Areas (SPAs) as designated under the Birds Directive. There are currently 430 SACs and 154 SPAs which are afforded legal protection in Ireland.

How are we doing?

Ireland supports a relatively low diversity of flora and fauna compared to mainland Europe. Nevertheless, our aquatic systems and wetlands support internationally significant populations of birds, fish and invertebrates. 41% of our



UPPER LAKE, GLENDALOUGH, CO. WICKLOW. PART OF WICKLOW MOUNTAINS SAC (PHOTO: WAYNE TRODD).

KESTREL (FALCO TINNUNCULUS), WIDESPREAD THROUGHOUT IRELAND (PHOTO: WAYNE TRODD)

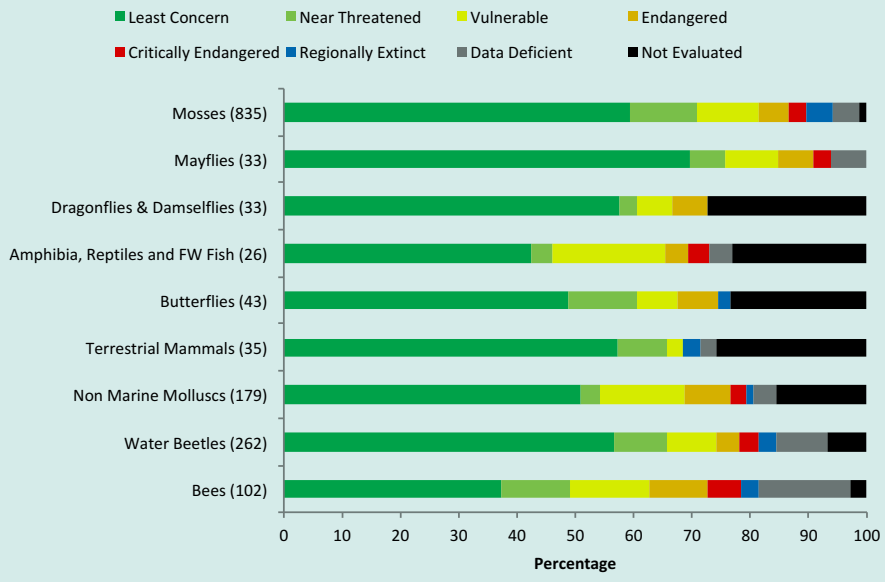
habitats are currently assessed as being of bad conservation status, 50% are inadequate and 9% are favourable. The habitats of most pressing concern in Ireland are those that have reduced range and/or area, notably raised bogs and species rich grasslands.

Many of our species are reported as having a stable trend but a number of key or iconic species are declining. Current assessments of our species show that 52% are assessed as being of favourable conservation status, 20% inadequate, 12% bad and 16% are of unknown status. One of the species of greatest concern is the pollution sensitive freshwater pearl mussel as only a few healthy populations exist.

Over the last 40 years the breeding ranges of 47% of Ireland's bird species have contracted, whereas 18% have expanded to new areas. Two groups of concern that have been highlighted are breeding waders and upland birds.

Red List Species - protecting species most at risk

Red Lists are assessments of species using the International Union for the Conservation of Nature (IUCN) categories and criteria. They identify species in most need of conservation interventions. The National Parks and Wildlife Service and Northern Ireland Environment Agency co-ordinate Ireland's Red Lists (http://www.npws.ie/red-lists). Current assessments of Irish species are outlined below.



CONSERVATION STATUS OF IRELAND'S RED LIST SPECIES (SOURCE: NATIONAL PARKS AND WILDLIFE SERVICE; NUMBER OF SPECIES ASSESSED IN BRACKETS)

A new Red List for Irish macro-moths has recently been published, which categorises 43 species (8% of the Irish list) as being threatened to some degree (i.e., vulnerable, endangered or critically endangered).

Challenges

The current pressures on biodiversity need to be monitored and managed. There is a pressing need to build on current work and put in place robust baseline biodiversity monitoring systems and comprehensive ecosystem services mapping.

Land use changes and the planned intensification of agriculture may lead to further habitat loss if plans are not implemented in a sustainable way. The impacts of climate change and the continuing threat of invasive alien species are areas that also need to be constantly monitored and guarded against where possible.

Most importantly, on-going efforts to increase public awareness of biodiversity must be continued and augmented. Public awareness and appreciation of biodiversity and its intrinsic link to everyday life is vital if measures to protect our environment are to succeed.

The subject matter of this article will be dealt with in more detail in the upcoming EPA State of the Environment 2016 Report.

Wayne Trodd, Ecological Monitoring and Assessment Unit, EPA and Ciara Maxwell, Inspector, Office of Environmental Enforcement, EPA

References

Bullock, C., Kretsch, C., & Candon, E. (2008). The Economic and Social Aspects of Biodiversity - Benefits and Costs of Biodiversity in Ireland. Dept. Environment, Heritage and Local Government.

INFLOWING STREAM AT LOUGH DOO, CO. MAYO. PART OF MWEELREA/SHEEFFRY/ERRIFF COMPLEX SAC (PHOTO: WAYNE TRODD).

High Nature Value farmland: co-delivery of farmland biodiversity and water quality

We introduce High Nature Value farmland and its positive contribution to multiple environmental dimensions. Environmental supports could more deliberately target measures to maintain and enhance the joint delivery of multiple environmental benefits, and increase the cost-effectiveness of such funding. We provide an example of the overlap of HNV farmland areas with High Status Water Bodies.

What is High Nature Value farmland and why is it important?

High Nature Value (HNV) farmland has been defined as "those areas in Europe where agriculture is a major (usually the dominant) land use and where agriculture sustains or is associated with either a high species and habitat diversity, or the presence of species of European conservation concern, or both". Maintaining both the nature value of this farmland and the livelihoods of farmers in these areas is a key policy challenge in the years ahead. The European Commission includes HNV farming and forestry systems as one of the seven headline indicators of environmental impact. Member States are required to identify areas with High Nature Value farming practices, to support and maintain High Nature Value farming through Rural Development Programmes (especially agri-environment schemes), and monitor changes to High Nature Value farmland area over time.

The IDEAL-HNV project

The IDEAL-HNV project (Identification of the Distribution and Extent of Agricultural Land of High Nature Value in Ireland) developed methods to improve prediction of the likely national distribution of High Nature Value farmland, using the following indicators:

- Semi-natural land cover classes
- Stocking density from
- % hedgerow cover from
- Length of river and stream
- Soil diversity calculated

Data were modelled at the tetrad scale (2km x 2km), and presented here at the scale of Electoral Divisions. The resulting map (from Matin et al., accepted) indicates the likely occurrence and distribution of High Nature Value farmland in each Electoral Division, based on a scale ranging from very low (blue colour) to intermediate (yellow) to very high (green) (Fig. 1a). To our knowledge, this is the first Irish national-scale map that has used objective agri-environmental criteria to predict the likely distribution of High Nature Value farmland. This provides a reference point for the future monitoring of the distribution of High Nature Value farmland in Ireland (see www.high-nature-value-farmland.ie).

STREAM (WITH HABITAT FOR FRESHWATER PEARL MUSSEL) FLOWING THROUGH FARMLAND IN CO. KERRY.

To compare the coincidence of HNVf areas with the distribution of Good Status Water Bodies in Ireland, areas with high and very high HNVf likelihood were merged to give one polygon (Fig. 1b). This polygon was overlaid on the River Waterbodies Ecological Status layer from the EPA (Fig. 1c). On the intersecting area (Fig. 1d), over half (53%) of the Good Status Water Bodies in Ireland (EPA, 2007-2009 data) occur in areas with high likelihood of being HNV. The most recent data (2010-2012) shows that of the assessed river lengths, 63% of the good status river waterbodies and 79% of the high status river waterbodies occurred in areas with high HNVf potential (intersecting area in Fig. 1d) (Moran and Sullivan, unpublished).

High Nature Value farming systems are now well recognised not just for their biodiversity, but also for their provision of environmental public goods including clean air, clean water, carbon storage, aesthetic landscapes and vibrant rural communities. Here, we show that High Nature Value farmland is also associated with areas of high water quality. Given the high environmental quality of High Nature Value farmland, there is considerable opportunity for the design of environmental supports in these areas to not just maintain and improve biodiversity, but also water quality, carbon sequestration and other environmental dimensions. Importantly, the design of environmental supports to explicitly address and jointly enhance multiple environmental dimensions 'environmental bundles' can increase their cost-effectiveness. Environmental monitoring of High Nature Value farmland can also better measure and demonstrate the co-benefits, and investigate the effectiveness of the delivery of joint benefits.

Acknowledgements

IDEAL-HNV was funded by the Stimulus Research Fund (award 11/S/108) of DAFM through the National Development Plan.

J.A. Finn[1], C. A. Sullivan[2], S. Matin[3], S. Green[3] & J. Moran[2]

1. Teagasc, Environment Research Centre, Johnstown Castle, Wexford, Ireland
2. Centre for Environmental Research Innovation and Sustainability, IT Sligo, Ash Lane, Sligo
3. Department of AgriFood Business and Spatial Analysis, Teagasc, Ashtown, Dublin, Ireland

References

Matin, S., Sullivan, C.A., Ó hUallacháin, D., Meredith, D., Moran J., Finn, J.A. and Green, S. 'Map of High Nature Value farmland in the Republic of Ireland.' Journal of Maps (accepted).

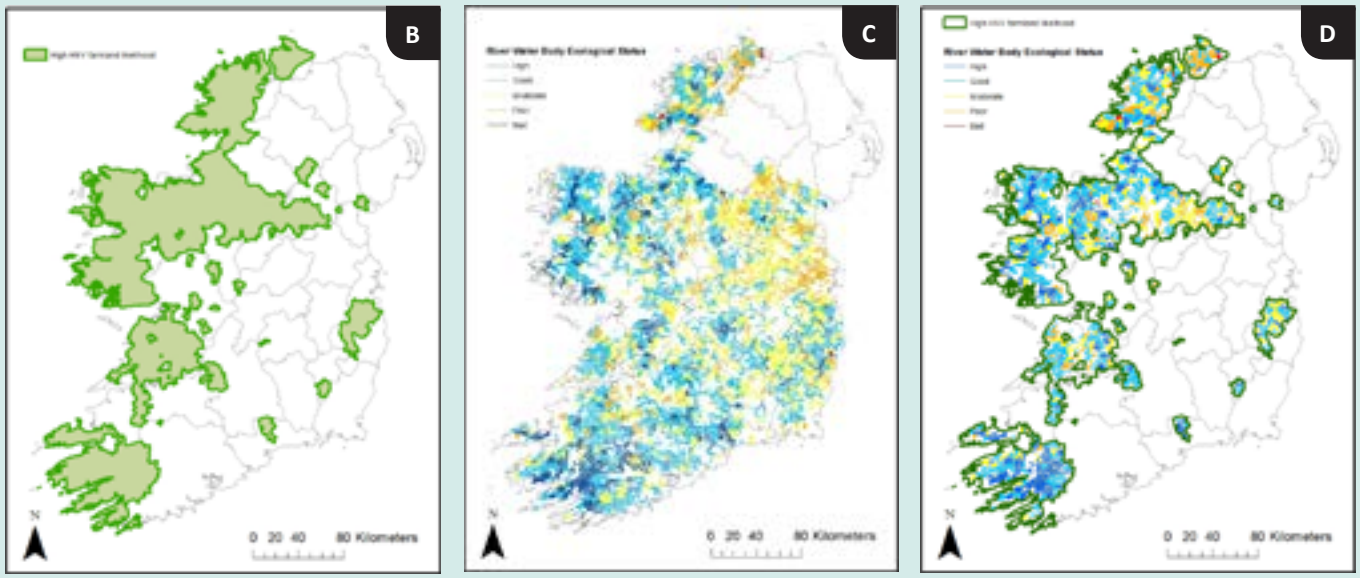


FIGURE 1: OVERLAP OF HIGH NATURE VALUE FARMLAND AND AREAS OF HIGH WATER QUALITY. A) LIKELY OCCURRENCE AND DISTRIBUTION OF HNV FARMLAND IN EACH ELECTORAL DIVISION, BASED ON A SCALE RANGING FROM LOW (BLUE COLOUR) TO INTERMEDIATE (YELLOW) TO HIGH (GREEN). B) AREAS WITH HIGH LIKELIHOOD OF CONTAINING HNV FARMLAND C) RIVER WATER BODIES AND AN ASSESSMENT OF THEIR ECOLOGICAL QUALITY D) OVERLAP OF PREDICTED HNV FARMLAND AND RIVER WATER BODIES.

Ireland is buzzing as 68 organisations come together to save our Bees

All-Ireland Pollinator Plan 2015-2020

Irish farmers growing strawberries, tomatoes, apples or oilseed rape know how important pollinators are. Without them they see greatly reduced yields. The annual value of pollinators for human food crops has been estimated at €153 billion worldwide, and at least €53 million in the Republic of Ireland. The free service they provide is worth over £7 million per year for apples in Northern Ireland and €3.9 million for oilseed rape in the Republic of Ireland.

If pollinators died off, it would be impossible to grow your own fruits and vegetables. Peas, beans, courgette, pumpkin, currants, raspberries and many others all need to be pollinated. It's not just crops; about three-quarters of our wild plants also require insect pollinators. Without pollinators the Irish landscape would be a very different and much less beautiful place.

Bees are our main pollinators. This is because they are entirely dependent on plants for their food.

The young are fed exclusively on pollen, and the adults rely on nectar as an energy source. Whilst feeding on flowers, bees transfer pollen between flowers and so act as pollinators.

In Ireland, we have 98 different bee species. This includes the domesticated honeybee; 20 different species of bumblebee; and 77 different species of solitary bee. Research tells us that to maintain pollination you need healthy honeybees in combination with a diversity and abundance of

LONG GRASS FOR POLLINATORS (PHOTO: CHERRY TOWNSEND)

wild bees. In the UK it has been shown that if all honeybee hives were used for crop pollination, they could only provide about one third of the service required by crops. The rest is provided free of charge by wild pollinators.

Without pollinators we won't starve, but it would be much more difficult to have a healthy balanced diet rich in fruits and vegetables. Bees need the same things we all do - somewhere safe to live and enough food to feed themselves and their families. Unfortunately, we're not providing that anymore in Ireland, yet we still expect them to carry out pollination when we need it.

We know bees are declining. One third of our 97 wild species are threatened with extinction in Ireland. We know it's because we've drastically reduced the areas where they can nest and the amount of food our landscape provides for them. We've also inadvertently introduced pests and diseases that negatively impact their health, and we subject them to levels of pesticides that make it difficult for them to complete their life cycles.

If you're a pollinator, finding enough food is the biggest challenge you face. Declines in wildflowers are subjecting our pollinators to starvation. If we want pollinators to be available to pollinate our crops and wild plants for future generations we need to manage the landscape in a more sustainable way and create a joined-up network of diverse and flower-rich habitats as well as reducing our use of chemical insecticides. This doesn't just mean in the countryside, but in our towns and villages as well.

By taking small actions to provide bees with food and shelter across the landscape we can tackle the problem, but it requires all of us to help - from farmers to local councils, to schools, gardeners and businesses. We can stand back and watch the problem happen, or we can try to do something. The All-Ireland Pollinator Plan is about coming together to try and create an Ireland where pollinators can survive. It's a shared plan of action. By working together, we can collectively take steps to reverse pollinator losses and help restore populations to healthy levels.

In publishing the Plan, Ireland became one of the first countries in Europe to develop a strategy to address pollinator decline and protect pollination services. The Plan was developed by a 15 member steering group and identifies 81 actions across five objectives. Sixty-eight governmental and non-governmental organisations came together to support the Plan when it was launched in September 2015. Since then, that number has increased. Responsibility for delivering the 81 actions has been shared out between the supporting organisations, who include: Department of Agriculture, Food & the Marine, Teagasc, Bord Bia, Northern Ireland Environment Agency, Heritage Council, Fáilte Ireland, Federation of Irish Beekeepers' Associations, Iarnrod Eireann, National Trust, Tidy Towns, Ulster Farmers' Union and Waterways Ireland.

The main objective of the Plan is to start making Ireland more pollinator friendly by taking actions on farmland, public land and private land. It's about moving away from the 'lawn and lollipop' approach of short grass and occasional trees in many of our public parks. It's about allowing wildflowers to grow along transport routes to create pollinator highways across Ireland. It's about farmers allowing hedgerows to flower in spring, Tidy Towns groups considering pollinator friendly planting and making our gardens and schools pit-stops for busy bees. It is not about allowing all land to 'go wild' but rather taking small actions, where appropriate, to achieve a more sustainable balance.

Pollinator friendly guidelines are currently being developed for all sectors. These clearly outline lots of actions that can be taken to help implement the Pollinator Plan. Guidelines for local communities (e.g. Tidy Towns) and gardeners are already available on the website, with others to be added over the coming months (farmers, local councils, businesses). The Pollinator Plan is not just about protecting bees. It's about protecting the livelihoods of farmers and growers who rely on their free pollinator service, and protecting our own ability to go into a supermarket and buy Irish fruit and vegetables at an affordable price. It's about protecting the wild plants who depend on insect pollination. Those wild plants provide fruits, seeds and shelter for our birds and mammals, and habitats that enhance many other animal populations. In coming together to take action to protect pollinators, we not only make crop production more sustainable, but we help protect the general health of our environment.

http://www.biodiversityireland.ie/pollinator-plan

Una Fitzpatrick, National Biodiversity Data Centre

PERENNIAL PLANT – LAVENDAR
(PHOTO: ANDREA MCDONAGH)

RED-TAILED BUMBLEBEE AND COMMON CARDER BEE (PHOTO: JOHN BREEN)

The impact of nutrient reduction measures on the health of Irish estuarine systems

Nutrient over-enrichment in estuaries and coasts due to human activity is a widely recognised global phenomenon. These ecosystems can respond to this disturbance through enhanced growth of phytoplankton and opportunistic seaweeds, resulting in the formation of algal blooms. Some phytoplankton bloom species can produce toxins and be harmful to plants and animals while opportunistic macroalgal blooms (such as sea lettuce) can be unsightly and produce odour problems as they decay which may impact on tourism and local communities. In Ireland, high phytoplankton biomass and increased frequency of bloom events, due to nutrient enrichment, have contributed to estuarine waters being classed eutrophic or potentially eutrophic. At present, 36 % of Irish transitional and 67 % of coastal waters monitored by the Environmental Protection Agency (Water Quality report 2012) are considered 'healthy' (good or high status) leaving a large proportion of areas requiring improvement.

A REPRESENTATION OF (FROM TOP TO BOTTOM) THE IMPROVEMENT IN EUTROPHICATION STATUS, THE REDUCTION IN MEASURED RIVERINE N AND P INPUTS BETWEEN 1990 AND 2011, AND THE MAIN (NATIONAL) DRIVERS OF NUTRIENT REDUCTIONS IN THE BLACKWATER ESTUARINE SYSTEM IN SOUTHERN IRELAND. THE BLACKWATER CATCHMENT IS AN EXAMPLE OF A LARGELY AGRICULTURAL SYSTEM WHICH HAS SHOWN A DIRECT IMPROVEMENT IN ESTUARINE WATER QUALITY AS A RESULT OF NATIONAL MEASURES TO REDUCE NUTRIENT LOADS. WHILE PHOSPHORUS LOADS TO THE SYSTEM BEGAN TO DECREASE FROM THE LATE 1990'S WITH THE INTRODUCTION OF THE PHOSPHORUS REGULATIONS, NITROGEN LOADS ONLY SHOWED A DECREASE FROM 2008 AND ARE PROBABLY RELATED MORE TO THE GOOD AGRICULTURAL PRACTISES REGULATIONS WHICH INTRODUCED CLOSED WINTER FERTILISER SPREADING PERIODS AND IMPROVED FARMYARD PRACTICES.

THE TOP SECTION OF THE GRAPHIC DETAILS THE COMBINED SOURCES OF NUTRIENT LOADS TO 17 IRISH CATCHMENTS IDENTIFIED THROUGH LOAD APPORTIONMENT MODELLING, THE MEASURED REDUCTION IN RIVERINE INPUTS AND THE CORRESPONDING CHANGES TO ESTUARINE PARAMETERS BETWEEN 2000 AND 2013. THE BOTTOM TABLE IDENTIFIES THE CHANGES WHICH HAVE OCCURRED IN EACH INDIVIDUAL ESTUARINE AND COASTAL SYSTEM AND THE CORRESPONDING DRIVER OF NUTRIENT CHANGE. INFO-GRAPHIC PRODUCED BY DARREN FORDE.

OPPORTUNISTIC GREEN SEAWEED ON REDBARN BEACH, CO. CORK, JULY 2016. PHOTO: ROBERT WILKES.

The amount of nutrients entering estuaries and coasts is dependent on the nutrient source which can either be diffuse (e.g. run-off from agriculture, forestry etc) or point (e.g. waste water treatment plants, industrial sources). In Ireland today the amount of nitrogen and phosphorus from each source will vary considerably in each catchment. For example, while phosphorus will originate largely from agricultural sources in some catchments, phosphorus largely emanates from waste water treatment plants in catchments which have large cities or towns.

In Ireland, blanket mitigation measures have been applied to reduce nutrient losses from agriculture, domestic and industrial sources. These measures stem from a number of European Directives, and National Regulations which have been implemented in recent years. The EPA has been monitoring estuaries and coasts for the last 30 years allowing us to identify whether measures have improved water quality since their implementation.

The main objective of this research project was to trace the historic nitrogen and phosphorus flows from their source to the coastal zone to determine the effectiveness of recent mitigation measures. The study focused on 17 Irish catchments and looked at how nutrient loads have changed from 2000 to 2013, how this has impacted river nutrient delivery to the estuary, and how the estuary itself has responded in terms of nutrient concentrations and phytoplankton biomass.

Load Apportionment Modelling indicated that in most systems the greatest overall contributor to nutrient loads are diffuse sources. However, reductions in both diffuse and point sources have resulted in considerable reductions in phosphorus loads to coastal systems, highlighting the effectiveness of measures which have been applied. Reductions in nitrogen loads have been more modest and are largely related to agricultural improvements. In each catchment the type of land use (agriculture, forestry etc) and the proximity of large towns to the estuary or coast greatly influenced the effectiveness of measures. The greater decrease in phosphorus inputs meant that ratios of nitrogen to phosphorus increased in some estuaries. This indicated an imbalance in nutrient reduction which, while improving estuarine ecosystem health, may cause problems downstream in the outer coastal zone.

Phosphorus inputs, measured on each river just before it enters the estuary, showed a significant reduction in 15 cases, but only 4 rivers showed a concurrent reduction in nitrogen. Significant parallel improvements in estuarine water quality were evident in only 8 of the downstream systems, highlighting that the response of estuaries to nutrient load reductions can be complex.

This response is often determined by nutrient cycling processes within the estuary itself and factors such as light and residence time which can 'dampen' the impacts of nutrient enrichment or reduction. In some systems light availability may be low due to large amount of suspended material in the water (e.g. sediment, organic material). This will reduce the growth of the phytoplankton when nutrients increase. In these types of systems blooms will be less frequent or dampened as conditions are not be optimal for growth. This occurs for example in the Upper Slaney Estuary which has high nutrient concentrations but does not have phytoplankton blooms. Some Irish estuaries have short residence times as river flow rates can be high or the nutrients and phytoplankton will be flushed out with each tidal cycle. In these cases phytoplankton do not have time to bloom before they are flushed out to sea. Often in these types of systems we may see green opportunistic seaweed blooms, for example in the Tolka Estuary in Dublin.

The complexity of estuarine systems and how this impacts their response to nutrient increases or reductions dictates that a portfolio of separate, but complimentary, management approaches may be required to address eutrophication in each estuary. In addition the influence of measures, cycling and physical controls will evolve through the estuarine continuum from fresh to marine water, highlighting the need to consider the impact of measures on each river-estuarine system in the context of these control shifts.

The results of the study will inform decision makers on the effectiveness of measures to date and the possible response of systems to future controls in the light of targets set out under the Water Framework Directive.

Sorcha Ní Longphuirt, EPA Cork

Read more in EPA Research Report 184: Assessing Recent Trends in Nutrient Inputs to Estuarine Waters and Their Ecological Effect http://bit.ly/eparesearch184

Detection of the Lapwing Predators in the River Avon Catchment

The River Avon catchment, located in Hampshire in the south of England, is considered to have one of the highest levels of biodiversity in lowland Britain. As well as 205 km of river being designated as Sites of Special Scientific Interest, the catchment also contains two Areas of Outstanding Natural Beauty, two Environmentally Sensitive Areas, nine Special Areas of Conservation and six National Nature Reserves.

Linear Feature	Number of tunnels	Number of detections	Proportion of tunnel sites where predator detected	Standard Error
bridge	11	4	0.36	0.15
fence/hedge	3	1	0.33	0.27
gate	7	1	0.14	0.13
fence/water channel	15	2	0.13	0.09
non-linear feature	29	2	0.07	0.05
Fence	46	3	0.07	0.04
Water channel	48	3	0.06	0.03
hedge	8	0	0.00	0.00
stile	3	0	0.00	0.00
Dry Ditch	7	0	0.00	0.00
water channel/ non linear	6	0	0.00	0.00
water channel/ hedge	1	0	0.00	0.00
bridge/gate	1	0	0.00	0.00
stile/water channel	1	0	0.00	0.00
bridge/dry ditch	1	0	0.00	0.00
water related features	83	9	0.11	0.03
non-water realated features	104	7	0.07	0.02

TABLE 1 LINEAR FEATURES ASSOCIATED WITH THE TRACKING TUNNELS AND CORRESPONDING DETECTIONS.

GWCT MINK RAFT: USED FOR CAPTURING THE FOOTPRINTS OF WILD ANIMALS (MOSTLY MINK) USING A MIXTURE OF CLAY AND SAND

TRACKING TUNNEL: USED FOR CAPTURING THE FOOTPRINTS OF WILD ANIMALS USING INK. PLACED IN TERRESTRIAL LOCATIONS SUCH AS ALONG HEDGEROWS.

One species found within the Hampshire Avon catchment is the lapwing wader species (Vanellus vanellus); a bird that has suffered significant declines recently both in the UK and in Ireland and is now a Red List species. With the intensification of agriculture comes a loss in the foraging and breeding habitat of the lapwing and a greater susceptibility to both avian and mammalian predators. The dense, tall homogenous swards that form with intensification reduce both anti-predator alertness and nest crypsis (camouflage in order to avoid detection). Since 2003 farmers have been encouraged to join the Higher Level Stewardship (HLS) scheme, and uptake by farmers within the Avon Valley has been high. A considerable investment in habitat restoration has taken place over the last 20 years, but to date there has been no reversal of the downward decline in wader numbers.

The Game and Wildlife Conservation Trust (GWCT) is currently undertaking a project – Waders for Real – which aims to reverse the decline of breeding waders such as the lapwing in the Avon Valley. The Game and Wildlife Conservation Trust is adopting an integrated approach involving both habitat and predator management in a context that requires co-operation with landowners and therefore requires an understanding of the landscape (catchment) in terms of both ecological setting and farming activities. As part of this, I undertook an MSc ecology research project as a component of the Ecology and Environmental Management course, University of York, in the summer of 2015. The project's aim was to detect and monitor the mammalian predators of the lapwing, in an effort to learn more about the mammals contributing to its decline within the catchment. With this knowledge, predator control can be planned to combat the decline of the lapwing species.

Detection surveys allow us to gain vital information on predators which is required in the conservation of their prey species. However the data gained from these detection methods may give incorrect inferences into the species if it is assumed to be absent when a detection method has failed to detect it, as is seen in many studies. Therefore occupancy modelling must be used, whereby imperfect detection of the species is assumed and hence the detection probability of a species is incorporated into the analysis. A comparison of naïve (assume detection probability is 1) and modelled (assume imperfect detection) estimates of occupancy and detection probability were examined in order to ascertain

CAMERA TRAP: USED FOR CAPTURING PICTURES OF WILD ANIMALS BASED ON A TRIGGER OR INFRARED SENSOR.

the importance of occupancy modelling. Once the detection probability was calculated, an examination into how this probability could be increased in the future was undertaken.

Mink rafts and tracking tunnels were positioned by Game and Wildlife Conservation Trust within four sites in the Hampshire Avon catchment, and camera traps were positioned within two of these sites. A total of 12 cameras were placed over one month with the aim of maximising the chance of recording predators, e.g. at linear features. The cameras were moved to a new location on-site every two weeks. The pictures obtained from the camera traps were viewed and processed using the Aardwolf software. A total of 21 mink rafts were deployed approximately every 1 km along the Avon River and its main water channels. They were checked on a weekly basis for tracks. A total of 187 tracking tunnels were placed along a 150m grid line, along linear features where possible in order to maximise chances of detecting small mammalian predators. Environmental conditions for each tunnel were recorded (Table 1). Within this project, my role included undertaking the weekly check of all tracking tunnels, as well as analysing the data collected from the three detection methods.

Key Findings

Over the course of the summer one mink, one stoat, two polecats, 12 weasels, seven hedgehogs and six unidentified mustelid tracks (stoat, polecat or mink) were recorded via the tracking tunnels. Small mammals including mice, voles, water shrew and rats, birds and amphibians/reptiles were also recorded. Six mink tracks were found on mink rafts. Two stoats and two mink were detected using the camera traps.

No detection method was consistently the best across all predator species. Tracking tunnels were found to be the best at detecting the smaller species, such as weasels and hedgehogs. Mink rafts only detected mink, and camera traps only detected mink and stoats. Occupancy modelling was undertaken using the Presence software package. Occupancy and detection rates for all three detection methods were low for all predator species. When comparing the naïve estimates and the modelled estimates it was clear that the naïve estimates underestimated occupancy and overestimated detection probability in relation to modelled estimates.

An investigation into whether the environmental factors played a part in the success of detection of the tracking tunnels was undertaken. Bridges had the highest proportion of detections and fences/hedges had the second highest. However it is important to note the low number of tunnels and the high standard error associated with fences/hedges.

Discussion of Findings

This project reiterates the fact that when detection probability is assumed to be one, the occupancy is underestimated and the detection probability is overestimated. This highlights the importance of using occupancy modelling in detection surveys in order to gain accurate information on the presence of a species.

Although this study did not record many detections, some trends were noted when analysing the environmental factors associated with the tunnels that detected the predator species, although more detections would be necessary to test these statistically. Bridges were associated with most detections and there were more water related detections that non-water related detections. It is interesting to record more detections along the water channels than not, as there was only one (semi) aquatic species – mink – investigated in this study.

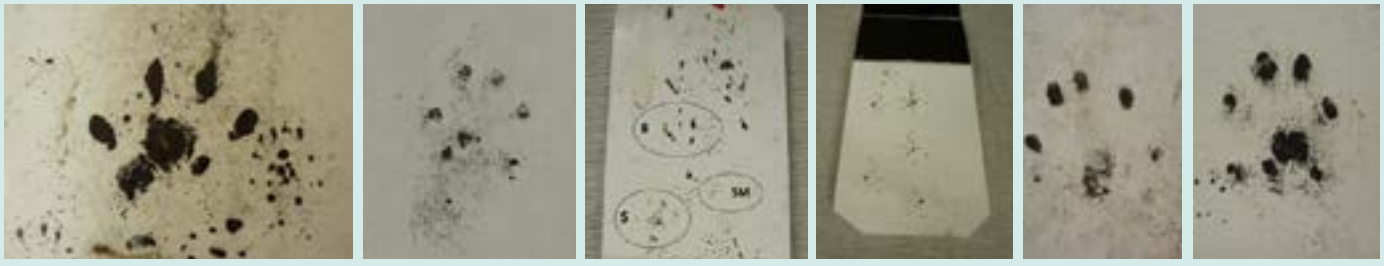
The detection probabilities were found to be consistently low in this study. The methods used need to be examined to allow for an analysis into how they could be increased in the future. It is recommended that where there are low detection probabilities, as is the case in this study, more repeat surveys would be beneficial. Further recommendations to increase detection probability in future years include beginning checks earlier in the year, baited detectors and placing detectors in favourable environmental conditions. It is hoped that more accurate information will become available to allow for successful predator control.

Monitoring predator species is vital in understanding the spatial and temporal dynamics of the species before using predator control. It is suggested that with more accurate information becoming available with the aforementioned recommendations in place, successful predator control can be undertaken within the Hampshire Avon catchment. This may include non-lethal control in the case of protected species (like the hedgehogs and polecats) such as protective cages around nests, conditioned taste aversion and fencing off of habitat patches. It may also include lethal control for predators such as the invasive mink species. It is hoped that, with a combination of this predator control and a farmer-led habitat management initiative, the lapwing will increase in abundance within the Hampshire Avon catchment.

Information on the Waders for Real project is available at http://www.gwct.org.uk/research/species/birds/lapwing-and-other-waders/waders-for-real/

Acknowledgement: Many thanks to Dr Jonathan Reynolds and the Predator Control Team at GWCT, Fordingbridge, for advice and assistance with this project.

Sinéad Barrett, RPS Consultants (Project undertaken as part of the MSc placement with the GWCT)



A) HEDGEHOG; B) WEASEL; C) STOAT (S), BIRD (B) AND SMALL MAMMAL (SM); D) AMPHIBIAN; E) MINK; F) POLECAT. A SELECTION OF INK TRACKS FOUND IN THE TRACKING TUNNELS.

Time to get real about addressing climate change impacts

After years of denial, procrastination and inaction, the time has arrived to get real about the impacts of a changing climate on Ireland's environment, society and economy.

The effects of extreme events, such as storms and flooding and slow onset changes such as temperature rise, changes in precipitation regimes and sea level rise, will have a transformative effect on people's lives, wellbeing, communities and businesses. It is now timely to plan to protect ourselves from the changes that are already upon us and those that are projected to arrive. This makes more social and economic sense in the long run rather than taking the more costly approach of cleaning up after events year in and year out.

This means, taking stock of what is happening to our climate, understanding how it is impacting on our natural and managed systems and preparing in an informed way for future climate risk at the appropriate administrative level.

Our local authorities have a key role to play in the development of strategies and plans to protect our communities, businesses and citizens from the effects of a changing climate. They in turn must be supported by central government, research, data and information providers to deliver evidence based decision making.

Ireland's changing climate

Changes in Ireland's climate are in-line with global trends. Observations outlined in The Status of Ireland's Climate, 2012, confirm that:

- Temperatures have increased by about 0.8°C over the period 1900-2012; an average of about 0.07°C per decade;
- Average annual national rainfall has increased by approximately 60 mm or 5% in the period 1981 to 2010, compared to the 30-year period 1961 to 1990.
- Mean annual sea surface temperature, as measured at Malin Head, Co. Donegal, is now more than 1.0°C higher than the long-term average calculated for the period 1961–1990.
- Analysis of long-term river flows from over 40 measurement sites around the country shows a tendency for increasing annual mean flows.

A recent EPA report (Nolan, 2015) employed the method of Regional Climate Modelling to assess the impacts of a warming climate on the mid-21st-century climate of Ireland. The report states that:

- Mean annual temperatures will increase by 1–1.6°C;
- Heavy rainfall events will increase in winter and autumn;
- Storms affecting Ireland will decrease in frequency, but increase in intensity, with increased risk of damage.

Such climate change will have diverse and wide ranging impacts on Ireland's managed and natural ecosystems, water resources, agriculture and food security, human health, and coastal infrastructures and zones. In fact, all sections of our society and economy will be impacted by a changing climate to varying degrees, depending on sensitivities and vulnerabilities. This could include direct impacts on, for example, water resources and quality or indirectly through impacts on business supply chains, human migration patterns and global food security.

How to act to protect ourselves?

The consequences of a changed climate will be felt most acutely by local environments, businesses and communities. The first line of defence in planning for this new environmental regime lies with the local authority sector. As the sector working closest to the ground, the local authority is best positioned to plan in a strategic way for changes within their communities. In the wake of extreme events authorities and agencies have to date largely been able to simply clean up, rebuild and return the affected area to some semblance of normality. But this will become increasingly difficult in future. The risk is that the costs of simply reacting to the impacts of climate change will spiral as extreme events become more severe, and the period of time between events will also shorten, diminishing the economic, physical and psychological capacity of affected communities to recover between shocks.

Reducing the impacts of climate change through mitigation action is the most immediate policy response. However, many impacts of climate change are 'locked-in' for decades to come (Intergovernmental Panel on Climate Change (IPCC), 2013). Due to the slow response time (inertia) of the climate system these changes are projected to continue and increase over the coming decades. Even if GHG emissions were stopped right now, some changes, such as sea-level rise, are projected to continue up to and beyond the end of this century. This means that we need to understand, manage and adapt to the risks posed by a changing climate.

Fortunately, there are a number of tried and tested approaches that will guide us on how to plan in a considered and coherent way for climate change. This will allow us to adapt our towns and cities, and the support systems they rely on, to the future impacts that climate change will bring.

The Local Authority Adaptation Strategy Development Guidelines and Climate Ireland

In May 2016, EPA research published Guidelines to make it easier for local authorities to plan for the inevitable consequences of climate change. The Local Authority Adaptation Strategy Development Guidelines (Gray, 2016) aim to support local authorities in the development of a local climate change adaptation strategy. This in turn, will support the implementation of the National Adaptation Framework, and associated international commitments.

The Guidelines were prepared by scientists at University College Cork's Environmental Research Institute. The guidance, which is based on international best practice, the EU Adaptation Guidelines and extensive stakeholder engagement, can be used by a local authority to assess the adaptation fitness and coherence of its spatial plans and the other plans and policies under its remit. The guidelines follow a stepwise process to adaptation planning and subscribe to an adaptive risk management approach. They can be used in conjunction with the EPA funded climate information portal Climate Ireland - http://www.climateireland.ie/climateinfo/about.html

These guidelines represent a first but important step for local authorities in planning for climate change. They will be supported by ongoing research, training and capacity building. They can be downloaded online: http://bit.ly/laclimate

Margaret Desmond, Senior Research Fellow, UCC/EPA

References

Dwyer, N. 2012. The Status of Ireland's Climate, 2012. EPA Report No. 26. EPA: Wexford

Gray, 2016. Local Authority Adaptation Strategy Development Guidelines. EPA Report No. 164. EPA: Wexford.

IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker,T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Nolan, P. 2016. Ensemble of regional climate model projections for Ireland. EPA Research Report No. 159. EPA: Wexford.

The Catchment Services Concept
A means of connecting and progressing Water Framework Directive and biodiversity requirements in the context of 'Sustainable Intensification' of agriculture, and climate change

Achieving successful management of our water and biodiversity resources in the context of both the Food Harvest 2020 strategy and climate change is a major challenge for Irish society and the public servants who have responsibilities in these areas.

ECOSYSTEM SERVICES PROVIDED BY THE RIVER, TREES AND FIELD OF BARLEY

Meeting the challenge will benefit from a holistic, integrated approach by considering related elements of water management, biodiversity management, land-use management and climate adaptation/mitigation together to their mutual benefit. Currently there is a danger that siloed organisational structures founded on either disciplines, specific regulations and/or narrowly based processes and objectives with inadequate linkages and integration, could hamper progress. This paper proposes the catchment services concept as an overarching framework that includes all the services in a catchment – ecosystem, geosystem and human/social system services – with the aim of encouraging relevant disciplines, work units and organisations to understand and take account of the linkages, and to work together to benefit both water and biodiversity, and potentially enabling sustainable and climate resilient agricultural practices.

The philosophy underlying this article are that: i) in the Irish landscape, climate, farming, habitats and water are inter-related and inter connected; ii) each have requirements that, in certain circumstances, are conflicting; iii) we need a means of maintaining agricultural production, while boosting climate resilience, protecting wildlife and ensuring satisfactory water quality; iv) we are unlikely to achieve this unless we adopt a holistic, integrated approach.

Catchments

The river catchment is proposed as the land based unit for water management and for most components of aquatic and terrestrial biodiversity management. Catchments are coherent topographically-based features, defined by the natural hydrology and hydrogeology, with water in continuous connection over ground and underground from the highest areas along the topographic divide to the lowest areas alongside rivers.

Therefore, catchments link aquatic biodiversity, aquatic ecology and water status. In the process, they connect the ecologically-driven Water Framework Directive (WFD) with the EU Biodiversity Strategy to 2020.

Agriculture is the dominant land-use in most catchments; water links farming to the requirements of both the WFD and the Biodiversity Strategy. While it can be argued that terrestrial wildlife is not linked directly to water in catchments, several species are associated with water and all are associated with geographical areas, even if the boundaries are not defined by topography.

GEOSYSTEM SERVICE PROVIDED BY SUBSOIL (GLACIAL TILL) WHICH ATTENUATES POLLUTANTS AND HELPS PROTECT THE UNDERLYING GROUNDWATER FROM POLLUTION

Integrated Catchment Management (ICM)

The ICM approach (Daly, 2013) is supported by the Department of Environment, Community & Local Government (DEHLG, 2015) as the means of ensuring the good ecological health of water in Ireland. ICM involves a series of interconnected steps: i) building partnerships; ii) creating and communicating a vision of ICM; iii) characterising the physical and ecological components; iv) identifying and evaluating possible management strategies; v) designing an implementation programme; and vi) implementing the programme and making adjustments, if necessary. It takes account of and connects all the services in the catchment – ecosystem, geosystem and human-social. It requires partnership with local communities and citizen engagement.

Looking to the future, planning for how to manage carbon emissions while maintaining the catchment services so that they can support local livelihoods and ecosystems will be vital. Adapting to climate changes already 'locked in' due to historical emissions will also be key, and highlighting adaptation measures at catchment or subcatchment scale could help people see the tangible benefits locally.

For instance, measures such as in-field water ponds could help reduce peak flows from floods, while maintaining farmer's access to water, reducing runoff of nutrients, and enhancing local biodiversity.

Catchment Services

Catchment services comprise two components of natural capital – ecosystem and geosystem services – and the social and economic services provided by people living in the catchment.

Ecosystem services

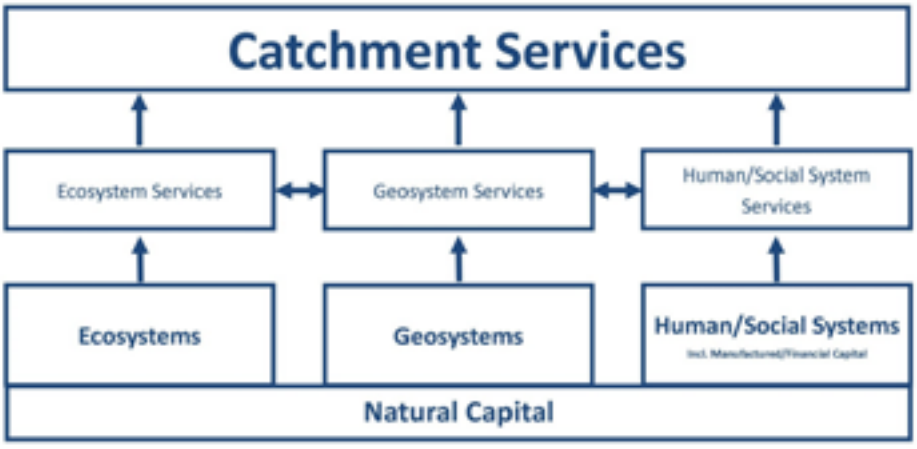
The crops; livestock; terrestrial and aquatic flora and fauna; pollination; riparian zones for water purification; soil ecosystems for attenuating pollutants and increasing crop production; cultural values attached to wildlife; etc.

Geosystem services

The landscape geomorphology; bedrock and gravel; groundwater for drinking water and geothermal energy; soils and subsoils as chemical and physical attenuating media for pollutants; hydrometeorology (rainfall, evapotranspiration, wind); geological heritage sites; minerals; oil/gas; caves; cultural values associated with landscape features; etc.

Human-social system services

Housing; farming both intensive and extensive; mining; quarrying; wind farms; water abstraction facilities; roads; landfills; industries; cultural values associated with historical features and buildings such as ring forts, castles and holy wells; water mills; pathways along streams and canals; and other recreational facilities; etc.



AN ILLUSTRATION OF HOW NATURAL CAPITAL, CONSISTING OF ECOSYSTEM AND GEOSYSTEM SERVICES, LINKS WITH HUMAN/SOCIAL SYSTEM SERVICES TO GIVE THE HOLISTIC CATCHMENT SERVICES.

There are overlaps between the three systems because natural and cultural landscapes are on a spectrum and not in separate silos.

The value of using these three subdivisions of services within the concept of catchment management is as follows:

- It helps ensure that all relevant services are considered in an integrated manner, thereby assisting in achieving sustainability.
- The conceptual framework encourages linkages between water management, biodiversity objectives, climate change mitigation and adaptation, land-use planning and the ICM approach. Currently, there is a tendency to treat biodiversity and water quality objectives separately, for instance in agri-environment schemes. While many measures designed for biodiversity also assist in achieving water quality objectives (including drinking water safety) and vice versa, the co-benefits are not achieved because the measures are not usually considered collectively (e.g., planting crop cover for bird species can have dual/multiple benefits provided the crop is planted in the vicinity of a stream). This situation is exacerbated by the fact that different Departments and public bodies have separate responsibilities for biodiversity, water quality, planning, flood protection and drinking water provision.
- The catchment services concept links natural capital with human/social capital and therefore builds on the intellectual, promotional and educational opportunities provided by the natural capital concept.
- Consideration of all three types of services is necessary in preparing River Basin Management Plans as part of the implementation of the WFD.
- It may help provide additional reasons for encouraging certain types of ecological restoration, for instance, restoration of riparian zones which have the multiple benefits of increasing biodiversity and climate resilience, improving water quality, flood alleviation and adding to the aesthetic beauty of river flood plains.
- From the perspective of local communities, it is comprehensive and includes the complete mosaic of physical, ecological, cultural and infrastructural features and functions, thereby giving a sense of comfort that no one sector is dominating and that the needs of local communities are taken into account.

EPA Catchments Approach

As part of the EPA role in WFD implementation, the EPA approach involves characterising ~600 subcatchments, which vary in size from 70-200 km^2, with the assistance of local authorities and other public bodies – the greater the assistance provided, the greater the value of the work. This scale is considered to be appropriate to the level of information available and suitable for community engagement.

The services are included and can be recorded in a subcatchment reporting template, even those not

HUMAN-SOCIAL SYSTEM SERVICES PROVIDED BY OLD MILL ON THE CAMLIN RIVER, CLOONDARA, COUNTY LONGFORD PHOTO:WAYNE TRODD

directly relevant to the WFD. Pressures on water and aquatic ecosystems are determined and, in the case of diffuse pollution sources, likely critical source areas are located. Potential management strategies and mitigation measures are evaluated. A regional assessment is enabled by aggregating the subcatchment reports into 46 water management units – these are the national hydrometric areas, e.g. Suir and Brosna catchments. These will be the basis for the national River Basin Management Plan that is due for finalisation in December 2017. This catchment work will provide the building blocks for successful water, biodiversity and land-use management in the future and the results will be made available online to all.

As national climate mitigation and adaptation strategies are published over the coming years, actions at local catchment and subcatchment scale could be planned and recorded to show the value of this work to local communities.

Conclusions

Even with an abundance of expertise in the areas of water, climate change, biodiversity and farming, an absence of joined-up thinking can lead to poor decision making; the common platform provided by the catchment services concept would mitigate this.

Acknowledgment

This article is a slightly amended version of a paper that was published in the Teagasc National Biodiversity Conference 2015 "Farmland Conservation with 2020 Vision". The Proceedings are available at: www.teagasc.ie/publications/view_publication.aspx?PublicationID=3742

Donal Daly & Paddy Morris, EPA Catchments Unit

References

Daly, D. 2013. A healthy catchment initiative for Ireland – Making Integrated Catchment Management Happen. Proceedings of IAH Conf. "Groundwater and Catchment Management", Tullamore.. Available at: http://www.iah-ireland.org/current/pastevents.htm

DECLG, 2015. Significant water management issues: public consultation document. Department of Environment, Community and Local Government. Available at: www.environ.ie/en/Environment/Water/WaterQuality/News/MainBody,41920,en.htm

Developing the concept of catchment services for progress towards integrated water management in Ireland

In the previous article, Donal Daly introduced the concept of catchment services (the benefits received by ecosystems and humans from resources and processes which are supplied by catchments: Wagener et al., 2008). As part of their 2015 Water Research Call, the EPA funded the 'Extra TIMe' Project which aims to identify the mechanisms for the feasible delivery of the catchment services concept in Ireland. Extra TIMe builds on the outputs of the Towards Integrated Water Management (TIMe) Project undertaken in 2015 by the Centre for Freshwater and Environmental Studies at Dundalk Institute of Technology.

The Extra TIMe Project runs from March 2016 to March 2017 and consists of five key components:

- Identifying national and international programmes which implement the catchment services concept;
- Identifying key components of the catchment services concept in Ireland (including benefits and disbenefits of the concept) and how these may change in the future under different climatic, legislative and social/demographic scenarios;
- Identifying the implications of implementing the catchment services concept on governance frameworks and regulations;
- Identifying the implications for community engagement and catchment management in Ireland (thereby linking in with the second cycle of River Basin Management Planning);
- Identifying the feasibility of implementing the catchment services approach in Ireland.

Understanding Catchment Services and their sensitivity to change

The catchment services concept encompasses both biotic and abiotic services whilst incorporating the contribution and importance of communities and cultural services into the benefits that catchments provide. Understanding how these benefits change in a non-stationary world is important for the delivery of Integrated Catchment Management (ICM) and incorporating catchment-level thinking in Ireland. With catchment-based initiatives in the UK estimated to cost over £100 billion over the next 15 years (Indepen, 2014), the necessity to ensure understanding and recognition of the importance of catchment-based thinking and catchment services in Ireland is paramount to ensure cost-effectiveness of actions and engagement with, and ownership of, catchment-based actions by local communities.

Catchment services and the concept's key components (ecosystem, geosystem and human/social system services) are likely to be affected by drivers of future change such as climatic, legislative or social (demographic) change. Understanding how the fundamental services provided by catchments may be affected by change is essential for both undertaking ICM-focussed initiatives, and communicating the catchment services concept. Importantly, consideration of both the services (benefits) and the disservices (negative impacts) which catchments provide to ecosystems and humans is required to understand how catchment services may develop and change with time. Examples of catchment services and disservices are shown in Table 1.

An operational framework for climate adaptation services presented by Lavorel et al. (2014) has been adapted by the Extra TIMe Project in order to assess the influence of multi-factorial scenarios (climatic, legislative and social) on the fundamental services provided by catchments

	Service	Disservice
Ecosystems	• Provision of fuel, food, water, timber. • Regulation of floods, climate, water quality. • Spiritual, recreational and aesthetic benefits. • Nutrient cycling, soil formation.	• Over-abstraction of water table levels impacting on the ecology of groundwater-dependent wetlands. • Non-native (invasive) species outcompeting native species leading to a reduction in native biodiversity. • Offensive smelling decomposing organic matter.
Geosystems	• Filtration of contaminated water. • Provision of geothermal energy. • Geodiversity relating to geological heritage sites.	• Damage caused by earthquakes. • Water quality deterioration following landslides or bog bursts. • Delivery of contaminants from groundwaters to surface waters.
Human/Social Systems	• Provision of drinking water. • Provision of water for agriculture. • Provision of water for energy. • Recreational areas.	• Flooding. • Drought. • Low flow periods limiting hydroelectric power production. • Urbanisation of land resulting in reduced biodiversity.

TABLE 1: EXAMPLES OF SERVICES (BENEFITS) AND DISSERVICES (NEGATIVE IMPACTS) PROVIDED BY CATCHMENTS.

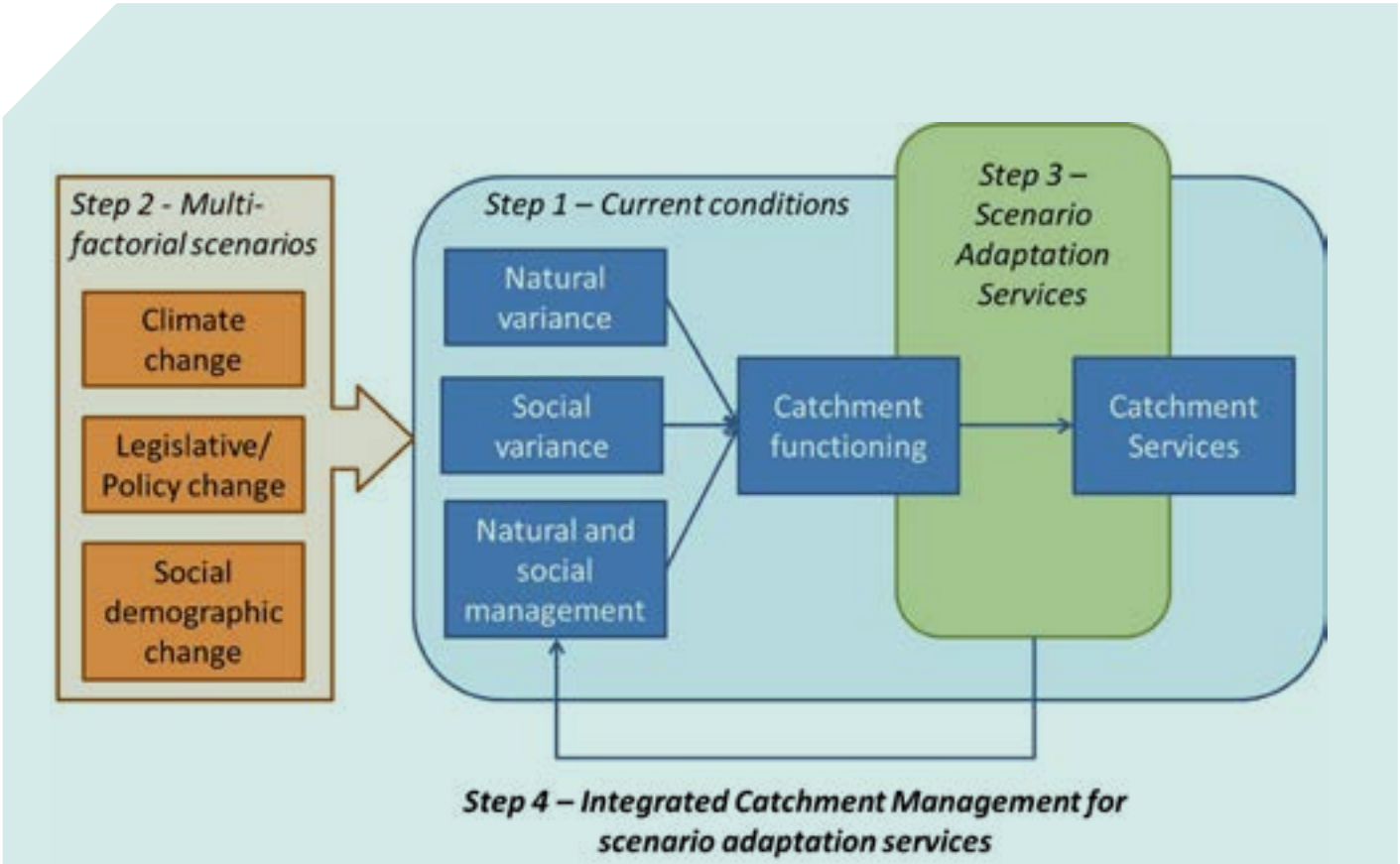


FIGURE 1: THE OPERATIONAL FRAMEWORK BEING IMPLEMENTED BY THE EXTRA TIME PROJECT FOR THE IDENTIFICATION AND QUANTIFICATION OF SCENARIO ADAPTATION SERVICES (ADAPTED FROM LAVOREL ET AL., 2014).

(Figure 1). While the Extra TIMe Project is currently applying this framework at the theoretical level, the intention is for this framework to be applicable at both the individual catchment and subcatchment scale. The framework identifies four steps necessary to assess how catchment services may be impacted by change and how adaptation can be identified and quantified:

- Step 1 requires an understanding of current conditions within a catchment (including natural and social variance, e.g. ecological condition of water bodies, and population trends respectively) and the current management actions being undertaken within the catchment.
- Step 2 requires assessing the multifactorial scenarios (e.g. climate change, legislative and policy change, and social demographic change) likely to be acting as drivers of environmental and social change in the catchment into the future.
- Step 3 involves identifying the mechanisms to which nature and society may adapt to these changes in catchment services.
- The implementation of the mechanisms identified in Step 3 form the crux of the adaptive ICM process (Step 4) that is required to manage catchments in Ireland into the future to ensure the impacts of changes to fundamental catchment services on natural and social systems are minimised.

Catchment services can also be influenced by environmental stressors and pressures acting within a catchment. These environmental stressors and pressures can themselves be impacted by drivers of change such as climate change. By implementing the operational framework shown in Figure 1, it has been possible to qualitatively assess the sensitivity of key catchment services to environmental drivers and future climate change scenarios (Figure 2). Subsequently, it is possible to identify those catchment services that may be most greatly impacted by climatic change and environmental drivers into the future. This can assist the development of ICM actions aiming to mitigate against such change or aiming to increase environmental and social resilience to change. For example, Figure 2b shows that of the services evaluated, cultural ecosystem services[2] are typically less sensitive to climatic change and environmental drivers than provisioning services[3]. For geosystem services: water purification, nutrient attenuation, soil productivity, erosion and sedimentation and surface water-groundwater connectivity have provisionally been identified as those services most sensitive to climatic change and environmental stressors (Figure 2c).

Legislative and policy change (such as the implementation of Food Wise 2025 in Ireland) and social demographic change (for example, population increases and urban land use), will also affect catchment services in a variety of ways. In the coming months, the Extra TIMe Project will proceed in identifying such affects and their implications for governance and communication frameworks in Ireland.

Communicating the concept of catchment services

Given the complex nature of catchment services, in order to be able to instil catchment-level thinking across multiple social levels (governing agencies through to local communities), the methods used to communicate the catchment services concept will be critical in developing buy-in and engagement for future management and interactions.

Indepen (2014) identify four pre-conditions

FIGURE 2: PRELIMINARY RESULTS IDENTIFYING THE SENSITIVITY OF SELECTED CATCHMENT SERVICES AND DISSERVICES (A), ECOSYSTEM SERVICES (B) AND GEOSYSTEM SERVICES (C) TO CLIMATIC CHANGE AND KEY ENVIRONMENTAL STRESSORS

for the wider deployment of catchment based approaches in the UK which are applicable to delivering the catchment services concept in Ireland. Stakeholders and society need to:

- Recognise the importance to the economy and society of protecting and improving the environment and the crucial services it provides;
- Ensure that policy and decision making at all levels acknowledge the value of the environment and the services it provides;
- Seek to manage the environment in a way that is integrated across policy and economic sectors;
- Seek out the most efficient options and tradeoffs so that decisions are affordable to tax- and bill-payers.

Comprehension of what a catchment is, what Integrated Catchment Management entails, and a level of understanding that a catchment has the potential to act as a service provider for economic, social and environmental benefits is required to achieve acceptance of the catchment services concept. Subsequently, a community engagement framework is necessary to begin the process of instilling catchment and catchment services level thinking.

The developmental process for this engagement framework by the Extra TIMe Project will explore the following questions:

- Is it necessary for communities (government agencies and local communities) to fully understand the catchment services concept in order to achieve significant management objectives for Integrated Catchment Managment in Ireland?
- Is the promotion of Integrated Catchment Managment as the national water resources management process enough to raise awareness of the catchment services concept and to achieve key management goals and objectives?
- What are the advantages of instilling catchment-scale, and catchment services thinking across governing agencies and local communities, and are there disbenefits associated with promoting this concept?
- Should any engagement framework focus primarily on wider-level engagement issues in local water resources management, underpinned by the promotion of catchment services and catchment-scale thinking?
- What are the consequences for failing to instil catchment services and catchment scale thinking amongst communities (governing agencies and local communities)?

Conclusions

Outputs from the Extra TIMe Project will assist in understanding the susceptibility of catchment services to future change and the subsequent implications on governance and community engagement frameworks. Understanding and recognising the importance of catchment-based thinking and catchment services is paramount to ensure cost-effectiveness of ICM actions and engagement with, and ownership of, catchment-based actions by local communities.

In order to improve both societal and environmental resilience to drivers of change, greater community-level engagement in local water management issues is required to embed catchment-scale thinking. This would create greater focus on the services provided by catchments and how these may change in the future in response to the drivers of environmental and social change.

By identifying the mechanisms required for the successful delivery of the catchment services concept in Ireland, the Extra TIMe Project aims to continue progress towards integrated water management in Ireland.

Alec Rolston, Centre for Freshwater and Environmental Studies, Dundalk Institute of Technology.

Email: alec.rolston@dkit.ie
Twitter: @Water_DundalkIT

References

Indepen (2014). Discussion paper on the potential for catchment services in England: Wessex Water, Severn Trent Water and South West Water. Indepen Ltd., London.

Lavorel, S., Collof, M.J., McIntyre, S., Doherty, M.D., Murphy, H.T., Metcalfe, D.J., Dunlop, M., Williams, R.J., Wise, R.M. and Williams, K.J. (2014). Ecological mechanisms underpinning climate adaptation services. Global Change Biology DOI: 10.1111/gcb.12689.

MEA (2005). Millennium Ecosystem Assessment Ecosystem and human well-being: Wetlands and water synthesis. World Resources Institute, Washington D.C.

Wagener, T., Sivapalan, M. and McGlynn, B. (2008). Catchment classification and services – Towards a new paradigm for catchment hydrology driven by societal needs. Encyclopedia of Hydrological Sciences DOI: 10.1002/0470848944.hsa320.

[1] Lavorel et al. (2014, p.2) defined climate adaptation services as "the benefits to people from increased social ability to respond to change, provided by the capacity of ecosystems to moderate and adapt to climate change and variability".

[2] Cultural ecosystem services have been defined as the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences (MEA, 2005).

[3] Provisioning services are the products obtained from ecosystems, including food, fibre, genetic resources, biochemical, natural medicines, pharmaceuticals and fresh water (MEA, 2005).

National Federation of Group Water Schemes - Septic Tank Systems Pilot Project

The National Federation of Group Water Scheme who are the representative organisation for community-owned rural Group Water Schemes in Ireland have recently completed an on-site wastewater treatment systems pilot project on two Louth Group Water Schemes.

DOOR TO DOOR SURVEY, TULLYALLEN GROUP WATER SCHEME

MEETING BETWEEN NFGWS AND EPA TO DISCUSS THE SELECTION CRITERIA FOR ROLLING OUT THE PILOT PROJECT

During the first year of the EPA's National Inspection Plan, most failures were due to poor management, including lack of desludging - the pilot on Sheepgrange and Tullyallen Group Water Schemes in Louth aimed to address this.

The success of the Louth pilots that addressed the management of septic tank systems in group water schemes has prompted the Environmental Protection Agency to provide funding in August 2016 towards a more ambitious and longer term initiative that will see the National Federation and individual group schemes play an active role in building awareness and co-ordinating community action on this issue.

Septic Tank Desludging - Pilot

Focusing on the zone of contribution to the boreholes supplying drinking water to both schemes and armed with information supplied by the EPA as well as zone of contribution maps, National Federation of Group Water Scheme staff joined with local group water scheme members in canvassing houses within their respective zones of contribution. The householders completed a doorstep survey to determine their knowledge about their on-site wastewater treatment systems and the regularity of desludging.

The survey also asked if they would be interested in their local Group Water Scheme co-ordinating desludging of their septic tank on a tri-annual and ongoing basis ... at a reduced 'bundled' rate to be negotiated with a competent contractor. While not everyone was at home during this canvass, those that were – with just one exception – answered in the affirmative. For the handful of farmer members on both schemes, who are entitled to empty their own tanks, the canvass was used to emphasise the importance of not landspreading such waste within the zone of contribution. Again, the farmers responded positively. Although only households within the Zone of Contribution were canvassed, the offer of group water scheme coordinated desludging was extended to all households on the scheme. While take-up was understandably limited in the wider scheme, most houses within the zone of contribution did sign up.

Next steps: rolling out the programme...

Apart from identifying its successes, the final report from the pilot also identified difficulties that had arisen, most especially the fact that there were significant time lapses between various phases of the project, from delivering letters in advance of the canvass through to the actual desludging of tanks. The fact that the National Federation of Group Water Scheme staff involved could only give so much time to the project meant that the momentum was lost at several stages of the pilot. In recognition of this fact and to build on the success of the pilot, the EPA grant includes funding towards the Federation's co-ordination and management of the extended roll-out of this initiative.

National Federation of Group Water Scheme Development Officers Jean Rosney and Joe Gallagher were appointed as Project Co-ordinators with a start date for the project of the 1st of August 2016 and a Steering Group was set up to oversee the project with the first meeting held in late August.

With assistance from the Environmental Protection Agency and the Geological Survey of Ireland, the screening criteria will be agreed and four Group Water Schemes will be selected for the initial role out of the project. These Schemes will have already completed the Zone of Contribution for their water source, will be within a high risk area and will need to comply with other selection criteria. It is also intended to include a combination of both surface and groundwater sourced Schemes in this selection.

The Project Co-ordinators will further develop the programme delivery model by building on the experience gained through the pilot programme with particular regard to the conclusions and recommendations of the review report. They will also be generating water awareness through the local schools within selected areas, identifying and sourcing additional possible sources of funding and support to assist with the ongoing implementation of the programme, developing a national mapping strategy and identifying further Group Water Schemes for ongoing implementation of the project.

Jean Rosney, National Federation of Group Water Schemes

http://www.nfgws.ie/

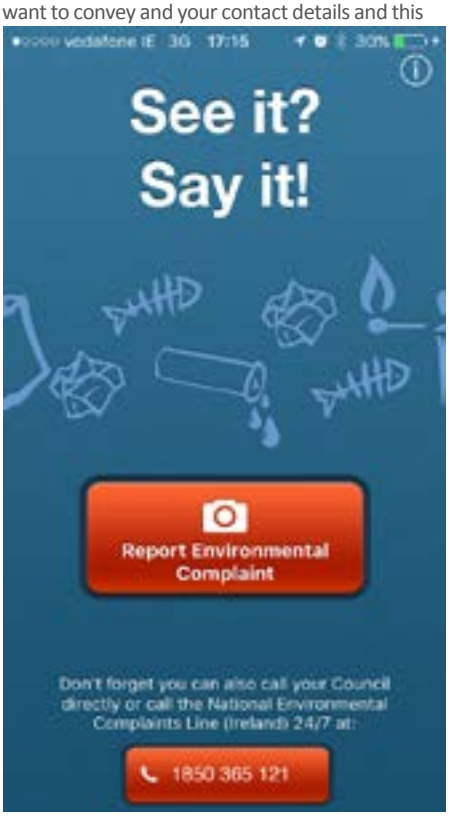
Resources

Citizen Science - what can you do?

Report environmental pollution

The EPA has developed an iPhone and Android App, called See it? Say It! to help people to report environmental pollution in their town and village.

This App makes it easy for people to report a pollution incident the moment they see it. Using the App you can take a photograph of a pollution incident, add a summary description of what you want to convey and your contact details and this



SCREENSHOT FROM SEE IT? SAY IT! APP

will automatically be sent to the relevant local authority for follow up (the app will add GPS location coordinates).

This App complements the 24 hour nationwide environmental complaints phone line - 1850 365 121. You can report issues such as backyard burning, fly tipping, water pollution, odours and littering by using the new App, or by phoning the complaints line. http://bit.ly/reportanincident

Record Biodiversity - National Biodiversity Data Centre

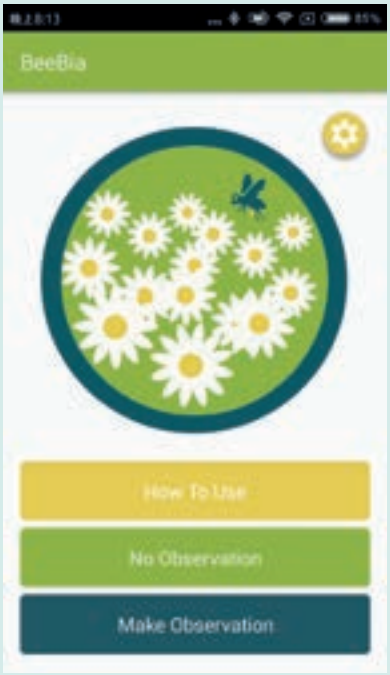
The National Biodiversity Data Centre provides access to all validated biodiversity data through Biodiversity Maps, the on-line biodiversity data portal. The Data Centre also provides an on-line system for recorders to submit and manage their species observations. These records, when validated, are added to the national biodiversity database and can be accessed through Biodiversity Maps.

SCREENSHOT FROM BIODIVERSITY APP

The Data Centre also supports a number of recording initiatives and monitoring schemes, details of which can be accessed here: http://bit.ly/recordbiodiversity

Support pollinators with the BeeBia app

A smartphone App has been developed that allows the capture of a series of photos of flowers to help support research into pollinators like bees. BeeBia is a collaboration between Trinity College Dublin, University College Dublin and Dublin Bay Biosphere. The App prompts for a suite of 10 photos that must be taken within close proximity of each other. Each is taken about 10 meters or steps from the previous one. This App is free of charge. It is currently available on Android only. It is planned to develop an iOS version later this year. http://beebia.org/



POLLINATOR CONSERVATION RESEARCH - THE BEEBIA APP

Help with Bird Surveys: BirdWatch Ireland

BirdWatch Ireland is the largest independent conservation organisation in Ireland, and they have a huge range of surveys that you can help out with. Much of their work depends on volunteers and on our branches who are actively involved in survey, education and awareness-raising initiatives and are most familiar with local conservation issues. http://bit.ly/recordbirds

Coastwatch - Coast Survey and Litter App Testers

Coastwatch promote Informed public participation in protection and management of the coastal zone, and they are currently looking for beta testers for a new app to record litter around the coasts of Ireland. http://bit.ly/coastwatchlitter

Their next Coastwatch Survey will take place from Sept 15th to Oct 15th 2016. The survey is designed to give an overview of the state of the coast. It involves volunteers from all walks of life checking their chosen 500m stretch of coast (survey unit) once around low tide, and jotting observations down on the survey questionnaire while on the shore. This citizen science work can be augmented with water tests. Data is then collected and pooled to provide a snapshot of state in areas surveyed at that time. http://bit.ly/coastwatchsurvey

OFFICE OF PUBLIC WORKS DRAINAGE MAPPING TOOL

Office of Public Works Drainage Mapping Tool

This useful mapping tool provides information on different drainage schemes throughout the country including spatial information on areas that benefit from these schemes (i.e. benefitting lands associated with arterial drainage schemes). http://bit.ly/opwdrainage

Modeling the pathways and attenuation of nutrients from domestic wastewater treatment systems (DWTS) at a catchment scale

- Mass balance based model to determine annual nutrient loading from DWTS to rivers.
- Model splits the transport of nutrients to the river into three distinct pathways.
- Transport and attenuation of nutrients determined by local subsoil permeability.
- Model incorporated into a broader source load apportionment catchment model.
- Relative risk of nutrient pollution from DWTS in a catchment can be identified.

http://bit.ly/septicpathways

Natura 2000 conservation: how can social-science research enhance conservation outcomes?

Governance of biodiversity is closely linked to social and economic processes and human behaviour, appreciation of which can enhance conservation outcomes. This study reviewed findings on the social aspects of Natura 2000, identifying research gaps and recommendations for improving the network's implementation across the EU. The researchers say limited stakeholder participation, negative perceptions of the network and a lack of consideration of the local context hinder the network's effectiveness. They recommend increasing public awareness and compensating private landowners. http://bit.ly/n2000conservation

Urban gardens provide many ecosystem services to Barcelona residents

BARCELONA'S GREEN INFRASTRUCTURE AND BIODIVERSITY PLAN 2020

Urban gardeners in Barcelona, Spain, identified 20 ecosystem service benefits, from pollination to environmental learning, in a recent study. Cultural ecosystem services — mainly related to the opportunity for residents to interact with nature — were the most common and highly valued of the ecosystem services identified. http://bit.ly/urbangardenecosystems

EPA Research

EPA Research Report 175: AgImpact Project – Identifying Approaches to Improving Knowledge Exchange (KE) in the Irish AgriFood Sector using Expert Opinion

There is significant pressure to develop knowledge exchange (KE) processes that will facilitate the application of existing and new knowledge in order to deliver increased agricultural production efficiency and profitability while protecting natural capital including water. The growth in the agri-food industry, as envisioned in Food Wise 2025 and Northern Ireland's Going for Growth strategic plan, must be achieved within the context of the targets established within European Union environmental directives, such as the Nitrates (91/676/EEC) and Water Framework Directives (2000/60/EC). The project workshop participants identified that the increased complexity of the agri-food system, with multiple economic, environmental and social policy objectives in addition to a broader range of stakeholders, requires on-going innovation to ensure a Knowledge Exchange framework that reflects this. It was agreed that at policy level there was a need for a common vision for how sustainable intensification of agriculture could be achieved within the constraints of current environmental regulation. The key recommendation from this project is the need to change from the traditional top-down linear knowledge transfer model of Knowledge Exchange to a more balanced system that integrates both a bottom up and a top down approach. A suggested approach to achieving this integration was the establishment of a grant scheme that could be used to initiate a catchment competition. This scheme would focus on providing community stakeholders with funding and resources to integrate a bottom up approach to Knowledge Exchange into existing top-down structures within their catchment. http://bit.ly/eparesearch175

The Wheel launch new Sustainable Community Funding and Governance Handbooks

The Environmental Protection Agency (EPA) has partnered with The Wheel to produce the Sustainable Communities guidebooks series, providing up to date advice on funding and governance for community-led groups throughout Ireland. Chock full of ideas and resources, both handbooks' tips and tools can be tailored to fit your needs and guide you towards sustainability. You can download these at http://bit.ly/communitiesbooklets

EPA Research 169: HYDROFOR: Assessment of the Impacts of Forest Operations on the Ecological Quality of Water

The EPA has published the results of the HYDROFOR research project which is an EPA and DAFM-supported multi-sector cooperative project to investigate the impacts of forestry operations on Ireland's aquatic ecology . A multidisciplinary group of researchers at University College Dublin (UCD), University College Cork (UCC) and the National University of Ireland, Galway (NUIG) investigated the relationships between conifer forests, forestry operations, and surface water quality and ecology in Irish rivers and lakes. HYDROFOR addressed several key information needs by investigating pollutant inputs from forest operations through the entire forest cycle. The key drivers of the episodic acidity were shown to be organic acidity together with base cation dilution. Higher losses of organic acidity from forests planted on peat were highlighted as a concern. Elevated sediment and phosphorus release to water courses was detected during felling, windrowing and replanting. A small number of potential mitigation measures (aquatic buffer zones and sediment traps) to address these problems were investigated in this study and the research evidence highlighted their ability to reduce some pollutant inputs. http://bit.ly/eparesearch169

EVENTS

Irish Forum on Natural Capital - Making Nature Count, October 4th

Irish National Hydrology Conference, November 15th

The 17th National Hydrology Conference will be held on Tuesday 15th November 2016 at the Hodson Bay Hotel, Athlone. This event is Ireland's leading Conference devoted to Hydrology providing a unique forum for attendees to share policy developments, research results, and practical solutions to engineering hydrology issues. http://bit.ly/hydro2016

Science Week, November 13th - 20th

Science Week is an annual national celebration of the life-changing and fascinating world of science. The week-long festival highlights how science, technology and engineering are fundamental to everyday life. The 2015 Science Foundation Ireland - Science in Ireland Barometer found that 70% of the Irish public believe science is too specialised for them to understand. With you and your organisation, Science Week wants to turn that around. Help connect people to how science underpins all of our lives from cooking, to farming, from technology to health. Get involved in Science Week - http://bit.ly/scienceweek2016

SCIENCE WEEK
Supported by Science Foundation Ireland
13-20 NOVEMBER 2016
#scienceweek #sciencerising

Cavan Monaghan Science Festival 2016

Cavan and Monaghan County Councils are joining forces during Science Week from 13-20 November 2016 and hosting a range of events during the Cavan Monaghan Science Festival 2016.

During this Science Festival both the Cavan and Monaghan Environment Section staff intend to roll out **CSI Water**. This presentation will demonstrate how our Environment Section staff undertakes their enforcement work, laboratory work, sampling and biological monitoring. These presentations will be hosted in some of the branch libraries daily across both Cavan and Monaghan during this Science Week Festival and we hope to reach an audience of over 1000 primary school students and their teachers.

Family days will be held on the Saturday and Sunday of our Science Festival in Cavan and Monaghan where we hope to have a number of events including the **Rivers on the Move** exhibition from the Ballinderry Rivers Trust.

The objectives of the festival are to increase the awareness and visibility of science in our society, promote the importance of science for economic growth, to promote STEM (Science, Technology, Engineering and Maths) at a local/regional level and to show that STEM is fun, educational and social.

From a water and catchment perspective there will be lots of relevant events going on so keep an eye on both the Cavan County Council and Monaghan County Council websites for more information. If you require any more details please e-mail environ@cavancoco.ie

Communicating Change: Methods of Promoting Sustainability, 10am -2pm, December 7th

This workshop aims to highlight communication methods that can be used across a number of sectors, and takes place in the Simon Perry Building, Trinity College Dublin. It will show which communication methods can help promote sustainability in transport, consumer goods and energy. Three EPA-funded projects, on eco-labelling, shedding cars and encouraging community transitions, will all speak. You can register online at http://bit.ly/sustainabilityworkshopdec7

CAN YOU CONTRIBUTE TO THE NEXT ISSUE?

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.

epaCatchments

Healthy • Resilient • Productive

Valued water resources supporting vibrant communities

For further information

www.catchments.ie

EPA Catchments
McCumiskey House, Clonskeagh, Dublin 14

053 916 0600

hello@catchments.ie

@EPACatchments

YouTube.com/EPAIreland

SlideShare.net/EPAIreland

Pinterest.com/EPAIreland