*Questions & Answers from 'CatchmentCARE Week – Virtual Event: 18th -20th March 2021*


## Day 1 Webinar 2 - Sustainable Management of Point & Diffuse Source Pollution

**Question 1** What work has there been on identifying heat customers in the "real world"?

**Answer** I am not really sure what is meant by this? The biggest use of energy in NI is heat so there are many customers.

**Question 2** How long post-harvest does it take for the willow to re-grow?? Is the soil left bare for long post-harvest?

**Answer** Depending on the time of year of harvest and warmth, the willows could be back budding within the month easily. There will often be other plants growing on the soil (depending on the age and maturity of the plantation) so it is unlikely to be bare and if so, not for long.

**Question 3** Can the willow be used for other purposes as well as biofuel??

**Answer** Yes, there are many different uses for willows however as far as any larger scale economy goes, biomass combustion is currently the largest use. There are medicinal potentials from the bark other than the well-known salicylic acid and any number of niche uses. Link 1.

**Question 4** Has any wildlife surveys been done in the willow planted areas? Or any soil studies done to see impacts of willow on soil??

**Answer** Yes, many biodiversity studies have been conducted on the benefits of willow in this regard.

Kris Verheyen a,*, Maud Buggenhout a, Pieter Vangansbeke a,b, Anke De Dobbelaere c, Pieter Verdonckt c, Dries Bonte. Potential of Short Rotation Coppice plantations to reinforce functional biodiversity in agricultural landscapes. Biomass and bioenergy67(2014) 435 442

Ode to Energy Crops. Biologist, Volume 53, Number 1, Feb 2006

RUFUS SAGE, MARK CUNNINGHAM1 & NIGEL BOATMAN. Birds in willow short-rotation coppice compared to other arable crops in central England and a review of bird census data from energy crops in the UK. Ibis (2006), 148, 184–197

Willow has been found to increase the biodiversity of an area over previous land uses, including sheep grazed pastures and arable crops where a low biodiversity predominates. Ecological studies of the large areas of SRC willow planted in Yorkshire for the ARBRE project clearly demonstrated that willow plantations never displace species from an area and that the overall biodiversity, including ground vegetation, birds, butterflies and invertebrates, is improved (Rich and Sage, 2001). ***Mammals***: A minimum of 10 species have been observed in SRWC, including the Brown Hare, Stoat, Mice, Vole, Shrew, Fox and Rabbit. These include important food resources for larger carnivores.***Flora:*** 151 species of plant have been recorded growing in SRWC at sites across in England. These provide, both directly and indirectly, food for butterflies and many other insects and their predators. This diversity of ground flora is also important in regulating weed control by providing competition for resources and preventing domination of individual plant species. Floral diversity also increases the habitat complexity which will encourage a wider diversity of beneficial predatory invertebrates important for controlling pest species.***Birds:*** Due to the structural complexity of willow and the difference in morphology of the many varieties, at least 32 bird species have been recorded in SRWC. Arboreal species such as Tits and Warblers, 'skulking' species such as Wren and Robin, and migrant species also utilise the willow coppice. In west Wales, preliminary results from a study (by Llysdinam's Wales Biomass Centre and IGER) using mist nets to evaluate the avian biodiversity of SRC recorded 14 species of birds within the cropped areas of first year SRC; and avifauna flocks of reed buntings (Emberiza schoeniclus) and finches were also observed.***Invertebrates:*** At least three times the number of plant-eating species spends part of their life cycle in the canopy of SRWC compared to conventionally grown barley and wheat (Sage & Tucker, 1998). Over 135 invertebrate species have been found in the canopies of willow, and almost as many ground dwelling and subterranean species have also been recorded. Between 70-80% of all of these species were found to be non-pest species and many of which were beneficial to the crop by predating on pests and therefore acting as a natural control.Preliminary results from Welsh upland studies of SRC willow have been encouraging and support the more general findings presented above. Evidence for upland Wales agrees with the lowland conclusions that the beneficial impacts of planting SRC willow greatly outweigh any negative ones and that these benefits can be enhanced through careful plantation design and sensitive management practices.

*References. Lowthe-Thomas SC. Ground cover management for short rotation willow coppice in the uplands of mid-Wales. PhD Thesis. Cardiff: University of Wales (Cardiff University); 2003.*
*Rich TJ, Sage RB, Moore N, Robertson P, Aegerger J, Bishop J. ARBRE monitoring – ecology of short rotation coppice plantations. ETSU B/U1/00627/REP, DTI/Pub URN/ 01/768; 2001.*

*Sage R, Tucker K. Integrated crop management of SRC plantations to maximise crop value, wildlife benefits and other added value opportunities. ETSU B/W2/00400/REP; 1998.*

**Question 5** Is the willow research at a stage where it can be used to influence DAERA Agri policy post the current CAP

**Answer** I would think so but so far apparently not.

**Question 6** Do you see the greatest use of willow going forward in and around small WWTW or is there a role to play in the wider environment as part of traditional buffer strips? Are there any the biodiversity implications for riparian species?

**Answer** I think both and I believe the biodiversity implications are beneficial as …… many biodiversity studies have been conducted on the benefits of willow in this regard.

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**Question 7** Can willow be used as a natural de-wormer??

**Answer** Very possibly, it seems to have so many uses and can give rise to so many interesting chemical compounds – see attachment 95

**Question 8** Can the willow be used for animal feed/medicinal plants for livestock?

**Answer** Yes – work along these lines is ongoing also – see attachment 50

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**Question 9** Are there testing done for bacteria and fungus that solubilise phosperous to make it available in the soil (as Christine Jones/David Johnson/Elaine Ingham recommend)?

**Answer** Answer to come

**Question 10** Can growing mixed species swards and nitrogen fixing clovers for example have an impact on P requirements??

**Answer** Answer to come

**Question 11** Are there organic farmers in the catchment and what organic or non-synthetic sources do they use for P?

**Answer** Answer to come

**Question 12** How long would it take for an Index 4 soil to reduce to Index 2?

**Answer** Answer to come

**Question 13** What are the differences between the Morgan and Olsen P tests?

**Answer** Answer to come

**Question 14** How does N influence P ?? What P sources do organic growers use?

**Answer** Answer to come

**Question 15** What have been the biggest challenges of the project to date?

**Answer** The biggest challenge to date has probably been securing land for growing willow. To date we have two sites (Liscooley in the Finn Catchment, and Cavanagrow in the Blackwater Catchment) up and running, but we are still trying to secure a third site. This process has not been helped by the Covid 19 pandemic, especially as potential landowners are somewhat nervous about meeting new people.

Another challenge relates to soluble reactive phosphorus (SRP) sampling using the auto-samplers being very much dependant on the weather. Rainfall has the potential to increase diffuse sources of P entering a water-body, with this in turn likely to interfere with the SRP results associated with the WWTWs discharge. Therefore, taking samples during or just after rainfall events has to be avoided and sampling should only be conducted after several days of dry weather, which in Ireland is sometimes restrictive.

**Question 16** How do you find using the BenthoTorch?

**Answer** The BenthoTorch is useful as it provides a quick in situ reading of the green algae, cyno-bacteria and diatom concentrations occurring on the tested substrates at the upstream and downstream locations. The data is geo-referenced (GIS coordinates) so you are able to pin-point the location of where and when the data was collected. However, the BenthoToch does not provide species level data and so collected data is not useable with, for example, generating Trophic Diatom Index (TDI) scores.

**Question 17** Are you looking at diatom species assemblages upstream and downstream of your sites? They may reflect differing communities based on the SRP readings you're getting?

**Answer** We are using a BenthoTorch to give an indication of algal communities occurring upstream and downstream of the discharge locations. The BenthoTorch uses the emitted fluorescence of algae to calculate the concentration (µg chl-a/cm²) of green algae, cyno-bacteria and diatoms occurring on the tested substrate. In terms of species assemblages, it does not go beyond differentiating between green algae, cyno-bacteria and diatoms. While we are aware of biotic methods such as the Trophic Diatom Index (TDI) that do utilise diatoms identified to species level to monitor water quality, this has not been employed in our study and to date we are solely relying on the use of the BenthoTorch to assess differences between upstream and downstream.

**Question 18** Are direct discharges of waste water direct into river systems not in breach of EU directives??

**Answer** The EU Urban Waste Water Treatment Directive concerns the collection, treatment and discharge of waste water, while a primary objective of the Water Framework Directive is for all EU water-bodies to achieve at least "good" status, with both of these directives aimed at protecting water bodies from pollution threats.

In general, although there may be some exceptions/exemptions to this, waste-waters are not directly discharged into river systems, and pass through some form of Waste Water Treatment Works (WWTWs) system, or septic tank system before being discharged into, for example a near-by stream. These WWTWs may consist of a primary, secondary or tertiary treatment method prior to the waste-water being discharged to the stream, and these systems are licenced and certified by the EPA in Ireland, and NIEA in Northern Ireland. Many small-scale WWTWs through-out Ireland and Northern Ireland have primary and secondary treatments employed, and while this removes solid objects, organic matter and some dissolved nutrients from entering the stream, it still allows for up to 50 % of phosphorus to pass through the system. It is this phosphorus entering the stream via WWTWs discharge pipes that has the potential to result in eutrophication, and as such is the target of our project.

**Question 19** **Can anaerobic digestion or even humanure composting be used as well?? Or even reed bed systems??**

**Answer** WWTWs may employ primary, secondary or tertiary treatment methods prior to the waste-water being discharged to near-by streams. The aim of primary treatment is to remove large solid objects through either flotation, settling or screening, while allowing smaller objects to either settle out by gravity or be removed by clarifiers. The collected "sludge" is then transported off-site for further treatment. It is possible for the sewage sludge that builds up to be exported off site and used to feed off site anaerobic digesters.

There are several methods for removing phosphorus (and other nutrients) from waste-waters at the secondary and tertiary stages. These include physico-chemical methods such as dosing with iron or aluminium salts, or biological methods such as Enhanced Biological Phosphorus Removal (EBPR) that utilise Accumulibacter bacteria, that accumulate P as a "luxury" energy reserve. In general however, both these methods have limitations that restrict their use for small-scale WWTWs systems, e.g. chemical storage costs or the requirement for operator supervision, although the principle of EBPR is

employed in small-scale WWTWs that use "package plants" and conventional activated sludge (CAS) systems to treat waste. Again, this sludge that builds up in these package plants may be collected and exported off site and either mined for phosphorus (if viable) or used to feed an anaerobic digester, although part of it is also used to re-seed the activated sludge process.

In terms of using human manure for composting, the EPA in Ireland provide guidelines for farmers who want to spread sludge from their own septic tanks or WWTWs systems on their own land, that include restrictions on the types of food crops for which spreading is allowed (i.e. not allowed on food crops). There are also EU guidelines which must followed such as the "The Waste Management (Use of Sewage Sludge in Agriculture) Regulations, 1998" (S.I. 148/1998). See:

https://www.epa.ie/pubs/advice/water/wastewater/How%20to%20safely%20spread%20sludge%20from%20your%20septic%20tank.pdf

Reed bed systems have been successfully employed in the treatment of waste-water especially as part of Integrated Constructed Wetland (ICW) systems. These ICWs make use of the natural processes associated with wetland vegetation, soils and their related microbial assemblages to contribute to the treatment of waste-water and have been used through-out Ireland (over 140 in operation) and the UK (over 900) for treating farmyard run-off, domestic waste-water effluent, industrial effluent from mining and food processing plants, and for treating landfill leachate. These ICWs have the potential to be low-cost sustainable systems that are aesthetically pleasing and beneficial for wildlife, although their ability to store and retain nutrients such as phosphorus over the long-term is questionable. However this may be improved through the addition of a harvestable crop (e.g. Willow) in conjunction with the ICW as demonstrated in "Zero-discharge wetland systems".