Postgraduate Seminar 2016

Department of
Agriculture, Environment
and Rural Affairs
www.daera-ni.gov.uk

21st September 2016
Greenmount Conference Centre
CAFRE - Antrim

Postgraduate Seminar 2016

09.30	Registration: tea/coffee.
09.50	**Chairman's introduction** Dr. Alistair Carson, Head of DAERA Science, Evidence & Innovation Policy Division.
10.00	**Guest speaker** Professor Elaine Watson, Chief Executive Officer of Agri-Food and Biosciences Institute.
	Year 3 Student Presentations:
10.30	**Emma Baxter:** The epidemiology of *Hymenoscyphus fraxineus*, the cause of ash dieback, in Northern Ireland.
10.45	**Natalie Brush:** An investigation into the extent of pleurisy in pigs in Northern Ireland and the associated management and disease risk factors.
11.00	**Display of 2nd Year Student Posters & tea/coffee break**
	Year 3 Student Presentations (continued):
11.30	**Aimee-louise Craig:** Optimising pig performance through improved lactation sow nutrition and management at weaning.
11.45	**Ryan Devaney:** Identification and quantification of endemic avian viruses causing poultry production problems via next-generation sequencing and quantitative polymerase chain reaction.
12.00	**Joanne Lemon:** Improved cattle performance: assessment of new vaccine technologies to address production losses associated with bovine respiratory syncytial virus.
12.15	**Maria O'Kane:** Nutritional aspects of cows' milk produced in Northern Ireland.
12.30	**Siobhán Porter:** Hedgerow cutting regimes and breeding birds' success.

Postgraduate Seminar

12.45	**Mark Little (AgriSearch):** The effects of management strategy on performance and immune function of dairy cows during the transition and early lactation period.
13.00	**Chairman's Closing remarks** - award of prizes for best 3rd year talk and 2nd year poster.
13.10	**Buffet Lunch**
13.45	**First Year Induction (in Fulton Room 1)** Induction - information for 12 new students commencing their research in October 2016 and their supervisors.
13.45	**Second Year Students Progress Meeting with Science Advisory Branch (in Fulton Room 2)** Current second year students meeting with Dr. Paul Devine & Dr. Patrick Murphy.

For further information on the DAERA Postgraduate Studentships visit the DAERA website at: www.daera-ni.gov.uk/articles/postgraduate-study

Postgraduate Seminar

The epidemiology of *Hymenoscyphus fraxineus*, the cause of ash dieback, in Northern Ireland.

Emma Baxter

School of Biological Sciences, Queen's University of Belfast.

Supervisors: Prof. Alistair McCracken, QUB, Dr. Louise Cooke, QUB, Dr. Colin Fleming, AFBI and Prof. Ian Montgomery, QUB.

Ash dieback affects common ash *(Fraxinus excelsior)*, causing dieback of leaves, shoots and branches, and eventually tree death. It has spread across Europe since the early 1990s. This disease was first reported in Northern Ireland by DARD on 16 November 2012. The causal fungus was first identified in 2006 as *Chalara fraxinea* and its perfect stage, *Hymenoscyphus pseudoalbidus*, in 2011. In 2014 the fungus was reclassified as *Hymenoscyphus fraxineus*.

Ash is a common native tree species in Northern Ireland and is of ecological and commercial importance. From routine plant health inspection, it is evident that the majority of outbreaks are on young, imported trees. A case study has shown that there is evidence of the pathogen cycling within the plantation and spreading to neighbouring hedgerows. Infected trees from the site were dissected and the pathogen movement within the tree described. Unexpectedly, incubation of roots from trees that had basal lesions frequently resulted in development of apothecia. This may provide clues as to how the pathogen was introduced into Northern Ireland.

H. fraxineus has two mating types and relies on sexual reproduction for ascospore production and spread. Over 115 *H. fraxineus* DNA samples have been subjected to both microsatellite analysis and mating type analysis. Results have shown that both mating types are present in Northern Ireland and in some cases occur together at the same site. The microsatellite results are currently being analysed. This analysis may provide evidence to indicate how the pathogen was introduced to Northern Ireland and its pattern of spread within the country. Such information on the pathogen's population structure will provide vital information on where to target disease control measures.

If *H. fraxineus* becomes established, it has the potential to change the face of our landscape, impacting on the environment, biodiversity and economy.

Postgraduate Seminar

An investigation into the extent of pleurisy in pigs in Northern Ireland and the associated management and disease risk factors.

Natalie Brush

School of Medicine, Dentistry and Biomedical Sciences, Queens University Belfast.

Supervisors: Dr. John McKillen, AFBI and Dr. Ultan Power, QUB.

Respiratory diseases are the most common and expensive diseases that affect pigs reared under confined and intensive conditions worldwide. Pleurisy, an inflammatory lung disease, is associated with economic losses due to reduced feed efficiency, increased mortality and growth retardation. Pleurisy also has an adverse effect on animal health and welfare. Evidence from abattoirs across Northern Ireland indicates that pleurisy is prevalent within the pig production industry; however there is currently limited information on the disease in Northern Ireland.

Main research aims:

(a) Determine the prevalence of pleurisy in Northern Ireland pig herds;

(b) Identify the microorganisms involved and assess the farm management and disease-related risk factors for pleurisy; and

(c) Determine the economic impact of pleurisy in pigs in Northern Ireland.

Results to date have determined the prevalence of pleurisy in NI pigs to be 9.91% in animals and 73.60% in pig herds. Correlations between pleurisy lesions and pleuropneumonia, pericarditis, lung abscess and enzootic-pneumonia lesions have been observed at slaughter. A serological survey involving 1400 pigs and 175 pig herds, found antibodies against porcine reproductive and respiratory syndrome virus (PRRSV) in 41.46% pigs from 48% of herds and antibodies against influenza virus A in 22.08% pigs from 48.57% herds. Sub typing of influenza samples determined H1N1 to be the predominant subtype circulating. PRRSV isolates were found in post-mortem samples from pigs. Nucleotide homology between sequences ranged from 88.1%-100%. In comparison with the Porcilis vaccine strain, nucleotide homology ranged from 89.4%-93.8%. Phylogenetic analysis confirmed all NI isolates belonged to the European genotype. The estimated economic cost of pleurisy in NI stands at approximately £3.75 per pig.

It is intended that the outcomes from this project will be used to inform and influence management decisions to reduce the risk of disease development in pig farms across Northern Ireland.

Year Three

Postgraduate Seminar

Optimising pig performance through improved lactation sow nutrition and management at weaning.

Aimee-louise Craig

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Elizabeth Magowan, AFBI and Dr. Niamh O'Connell, QUB.

Although the EU sow herd is now highly prolific, commercially the wean weight of piglets has been compromised. This trial investigated the impact of tailored lactation diets to support a target wean weight of piglets reared in large litters. Five treatments were offered to sows (n=113) from day 108 of gestation to weaning in a 2x2+1 factorial design. A single phase feeding regime (Diet 1: 14.4MJ DE, 1.25% Lysine) was compared to a two phase feeding regime (Diet 1 to day 14 of lactation, followed by Diet 2 (15MJ DE and 1.4%lysine) from day 15 to 28). A standard lysine:valine ratio (0.79) and a high lysine:valine ratio (1.2) were also compared. A control diet containing 13.5MJ DE and 1.0% lysine was included.

Average litter size was 12.8 pigs. Average feed intake for sows was 7.6kg/d. All experimental diets significantly (P<0.001) improved piglet daily gain from birth to weaning compared to the control. This led to an improved weaning weight of 448g (P<0.001) per piglet, and increased (P=0.006) total litter weight weaned (110.3kg) compared to control (102.2kg). Two phase feeding improved piglet daily gain (P=0.009) and weaning weight (P=0.007). Lysine:valine ratio had no consistent effect.

In this study, when sows had an average daily intake of 111.1MJ DE and 31.4g lysine they achieved an average litter weaning weight of 110.6kg and individual piglet weaning weight of 8.6kg. Therefore, piglets in large litters can obtain high weaning weights when the sows are offered lactation diets high in energy and lysine.

Postgraduate Seminar

Identification and quantification of endemic avian viruses causing poultry production problems via next-generation sequencing and quantitative polymerase chain reaction.

Ryan Devaney

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Victoria Smyth, AFBI and Dr. Caroline Meharg, QUB.

Runting-stunting syndrome (RSS) is a production disease affecting broiler chickens and is considered to be multi-factorial. Factors influencing the disease include age, feed quality, immune status, and viral infection arising from a community of viruses (virome). The symptoms associated with RSS range from decreased body weight, a poor feed conversion ratio (FCR), enteric problems such as diarrhoea, lesions within the intestinal tract of the birds and, in severe cases, mortality.

This project has established a virological profile associated with RSS using next-generation sequencing (NGS) which has been used to compare data between affected flocks and unaffected flocks. Preliminary sequencing results from two to three week old affected and unaffected broiler chickens identified the presence of 20 RNA and DNA virus families comprised of 31 distinct viral genera and seven unclassified categories associated with affected and unaffected samples collected from multiple UK farms. These include chicken astrovirus (CAstV), avian nephritis (ANV) 1 & 2, chicken megrivirus, chicken parvovirus, and sicinivirus 1 (a novel picornavirus previously only found in Cork, Ireland). Additionally, evidence has been found indicating the presence of novel organisms. A longitudinal sequencing study was completed identifying a range of viruses associated with good and poor performance farms over a 17 day growth period. Among these include members of the viral families *Astroviridae, Caliciviridae, Picornaviridae,* and *Parvoviridae*. Further quantitative studies have been completed based on the most abundant viral families identified in NGS results in order to understand the temporal expressions of these viruses and their overall role in enteric disease. The use of high-throughput next generation sequencing in this study presents a viable technique for the discovery and characterisation of the complex viral communities present in the gastrointestinal tract of disease-affected and unaffected broiler chickens.

Year Three

Postgraduate Seminar

Improved cattle performance: assessment of new vaccine technologies to address production losses associated with bovine respiratory syncytial virus.

Joanne Lemon

School of Medicine, Dentistry and Biomedical Sciences, Queen's University, Belfast.

Supervisors: Dr. Ultan Power, QUB and Dr. Michael McMenamy, AFBI.

Bovine respiratory disease is a significant threat to UK cattle farming, resulting in losses estimated to be around £60 million per annum. It can be caused by a multitude of viral and bacterial pathogens, augmented by many external stressors and inherent neonatal physiology. Bovine respiratory syncytial virus (bRSV) is the largest cause of lower respiratory tract disease in cattle and is a major contributor to the complex.

BRSV is characterised by incomplete immunity and frequent re-infection in spite of vaccination, leading to the belief that currently licensed vaccines are limited in their efficacy. On top of this, current vaccines can lead to carcass blemishes and subsequent reduced market prices, plus they are unsuitable for calves under six months of age - the period of vulnerability to bRSV.

Considering the inadequacy of current therapeutics, the development of more effective vaccines is paramount. Recent technological advances have enabled this aim to become a reality. This project focuses on reviewing various types of vaccine technologies and assessing their potential for inducing immunity against bRSV in neonatal calves.

Nutritional aspects of cows' milk produced in Northern Ireland.

Maria O'Kane

Northern Ireland Centre for Food and Health (NICHE), University of Ulster.

Supervisors: Dr. Alison Yeates, UU, Dr Kirsty Pourshahidi, UU, Dr. Maria Mulhern, UU and Prof. Sean Strain, UU.

Iodine is an essential trace element and is necessary for the synthesis of thyroid hormones which are required for brain and neurological development in early life. It is important that women of childbearing age and those planning a pregnancy have adequate thyroidal iodine stores. Recent evidence has highlighted the widespread prevalence of iodine deficiency in women of childbearing age. The aim of this PhD project was to: a) assess the level of iodine nutrition knowledge in women of childbearing age; b) quantify the iodine content of cows' milk produced in Northern Ireland; and c) conduct a randomised controlled trial to investigate the effect of milk consumption on iodine status of women of childbearing age.

Results have indicated that iodine knowledge was poor in women of childbearing age and a higher dietary iodine intake was positively associated with greater iodine knowledge ($r=0.107$; $P=0.016$). This PhD provided an updated analysis of the iodine concentration of milk and found that season has an important determining effect on the iodine content of cows' milk. The observed seasonal variation in iodine is likely to reflect the change in animal feeding practices across seasons. As cows' milk is the main dietary source of iodine in the UK and Ireland, the seasonal variation in the iodine content of milk is likely to impact iodine intake and thus status across the year. The results of the randomised controlled trial showed that urinary iodine concentration (UIC) was significantly increased from baseline (78.48µg/l (39.08-126.10µg/l)) to post-intervention (122.78µg/l (86.71-218.35µg/l)) ($P<0.05$). At baseline, 62% of participants were iodine deficient (UIC<100µg/l). Post-intervention, the prevalence of iodine deficiency in the intervention group decreased by 23% to 39% ($P=0.042$).

Public health initiatives to eradicate iodine deficiency should incorporate the promotion of cows' milk and educate women of childbearing age on the importance of iodine nutrition.

Year Three

Postgraduate Seminar

Hedgerow cutting regimes and breeding birds' success.

Siobhán Porter

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Neil Reid, QUB and Prof. Ian Montgomery, QUB.

Hedgerows represent one of the most important semi-natural habitats in our agricultural landscapes, though their biodiversity value is greatly dependent on management. Legislation governing the cutting of hedgerows primarily aims to maximise benefits for wildlife, in particular breeding birds. This project aims to assess the effectiveness of hedgerow management policies in supporting farmland bird populations.

I have addressed this objective through three avenues of investigation.

Firstly, I carried out field studies, comparing bird communities and their food resources on farms representing different hedgerow management choices. Here I compared breeding and overwintering bird communities, invertebrate prey availability, and the nutritional quality of hedgerow food resources, between classes of hedgerows managed under different cutting regimes.

Under current legislation, landowners in the UK and Ireland receiving subsidies under CAP are prohibited from cutting their hedgerows between the 1 March and 31 August. My second field of investigation involved utilising UK wide historical nesting records to explore the appropriateness of these temporal aspects of hedgerow management restrictions. Here I used records from the British Trust for Ornithology's Nest Record Scheme to build models that project when the most likely breeding period is for hedgerow nesting bird species in data poor regions, such as Northern Ireland.

Finally, a questionnaire survey study was included to socially contextualise the ecological components of this project. This work aims to investigate levels of support for the current hedgerow cutting policy, and understanding of the details of this policy among the Northern Irish rural community, relating findings to demographic details, such as farm size, age and management choices.

Postgraduate Seminar

The effects of management strategy on performance and immune function of dairy cows during the transition and early lactation period.

Mark Little

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Conrad Ferris, AFBI and Dr. Niamh O'Connell, QUB.

The transition period is defined as the last three weeks of the dry period and the first three weeks of lactation and is the period of greatest disease risk in the dairy cow's production cycle. This is due to an increased challenge from bacterial infections, together with an immunosupression during this time. There are many changes that the dairy cow must adapt to that contribute to immunosupression, such as management, hormonal and nutritional changes. However, the metabolic challenges during the transition period are of particular importance. The metabolic challenge arises because the dairy cow cannot consume sufficient energy during early lactation to support her energy requirements. This then results in a negative energy balance, which has detrimental impacts on both the extent and duration of immunosupression. Therefore, it is important to implement nutritional strategies that support intakes in early lactation, minimising negative energy balance, with the goal of improving cow health, fertility and farm profitability.

My PhD is being carried out at AFBI Hillsborough and funded by AgriSearch. My studies have examined the effects of nutrition on dairy cows offered a grass silage based diet, two studies during the dry period and two studies during early lactation. During these, measurements of ration intakes, milk production, body tissue changes, health and immune profiles were examined.

AgriSearch NI
Farmer Funded Research

Year Three

Postgraduate Seminar

Competitiveness and resilience of the Northern Ireland total beef supply chain.

Stephanie Brooks

School of Biological Sciences, Queen's University Belfast.

Supervisors: Prof. Moira Dean, QUB, Prof. Chris Elliott, QUB and Prof. Adam Leaver, University of Manchester.

The premise of this research is to explore the competitiveness and resilience of the total beef supply chain in Northern Ireland (NI) from farmer through to retailer, through identifying barriers to optimal performance using the perceptions of farmers, processors, Government and retailers. The Going for Growth strategy for NI identified the need to review the NI total supply chain to highlight risks and opportunities, as well as establishing the need for collaboration in the supply chain to secure a better future for the industry.

Farmer interviews revealed they perceived barriers throughout the beef supply chain: processing; retailing; Government; as well as within their own discipline, farming. The relationships that exist within the supply chain were also identified as a barrier, with these often perceived as adversarial. A questionnaire was disseminated to farmers with the aim of validating these opinions in a larger sample and results indicate it served this purpose.

Interviews with processors revealed similar findings with barriers being identified at processing, retailing, Government and farming levels. At processing level, relationships were perceived, in most cases, to be more favourable than farmers perceived the same relationships. Interviews with Government/research have been completed and are awaiting analysis and interviews with retailers have commenced.

Postgraduate Seminar

Genetic variation in native Irish trees under threat from emergent fungal pathogens.

James Brown

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Jim Provan, Aberystwyth University and Prof. Ian Montgomery, QUB.

The recent emergence of several fungal pathogens of trees, including those which cause ash dieback and larch disease, has the potential to cause considerable ecological damage to woodlands and hedgerows in Ireland. Due to the nature of these diseases, trees will be lost either directly through mortality or due to the clearing of trees to prevent disease. In either event, these trees will need to be restocked.

Currently, the Forestry Commission has drawn up a map of seed zones for Britain with the theory that trees should only be restocked from seeds which are locally adapted. However a study in ash found that it consisted of a single gene pool and so seed zones were not needed.

The overarching aim of this study is to examine four common tree species - hazel, aspen, blackthorn and hawthorn - with varying pollination and seed dispersal mechanisms, to examine large-scale patterns in diversity to inform future policy on conservation via restocking post-disease. Initial results show that extensive pollen and seed-mediated gene flow occurs in populations of hawthorn and hazel, giving rise to high levels of genetic diversity but low levels of genetic differentiation between populations. Results for the two other study species may differ. This is due to aspen demonstrating extensive clonal growth and blackthorn being a tetraploid having four sets of chromosomes rather than two as in the other species.

Year Two

Postgraduate Seminar

An investigation into the competitiveness of a local beef scheme operating as part of the NI food supply chain in an international market.

Jennifer Fegan

Ulster University Business School.

Supervisors: Prof. Gillian Armstrong, UU, Prof. Paul Humphreys, UU and Dr. Lyndsey Hollywood, UU.

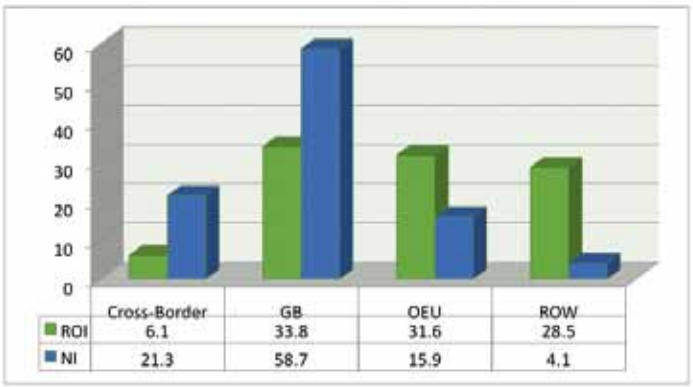
The aim of this research is to identify the unique attributes and dynamic capabilities of successful agri-food international supply chains and to determine how a Northern Irish premium beef supply chain can achieve a competitive advantage in an international market.

The NI agri-food industry has shown continued growth despite the recent recession and there is now a renewed focus on productivity, innovation and export sales. In 2013, the NI Agri-Food Strategy Board's 'Going for Growth' plan highlighted the need to grow sales outside Northern Ireland, especially to new emerging global markets.

There now exists an opportunity in Northern Ireland to create strong agri-food supply chains that are capable of supplying premium high quality food produce to export markets, whilst at the same time securing home-based jobs and employment.

To date models of best practice within Northern Ireland and the Republic of Ireland have been identified. Preliminary research has highlighted a number of key attributes which can be applied to the Northern Irish premium beef product to create a successful international supply chain. This is of practical relevance, as the agri-food sector in Northern Ireland has the potential to contribute greatly to the economic growth and regeneration of the region.

Sales Destinations Context (%, 2013/14)



	Cross-Border	GB	OEU	ROW
ROI	6.1	33.8	31.6	28.5
NI	21.3	58.7	15.9	4.1

Source: A. Soares and M. McTaggart, *A Study of Cross-Border Flows Within The Agri-Food Sector* (Centre for Cross Border Studies, 2016)

Postgraduate Seminar

Trophic impacts of gelatinous zooplankton on commercial fisheries species.

Donal C. Griffin

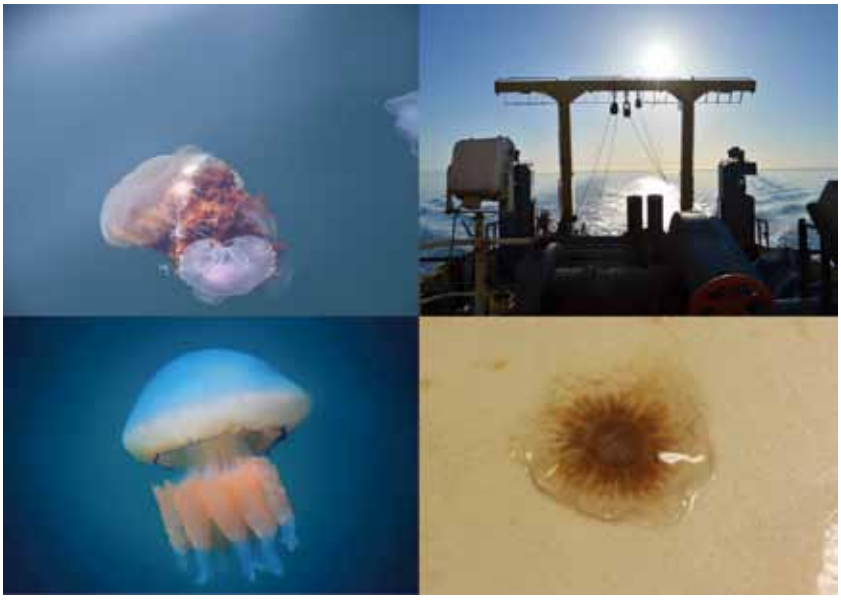
School of Biological Sciences, Queen's University Belfast.

Supervisors: Prof. Mark Emmerson, QUB, Dr. Steven Beggs, AFBI, Dr. Chris Harrod, University of Antofagasta, Chile and Dr. Jonathan Houghton, QUB.

Historically viewed as trophic dead-ends, jellyfish are a conspicuous yet long over-looked component within marine systems. Partly due to their potential for having negative impacts on ecosystems as well as human activity (i.e. fishing industry), less well known are the 'positive' roles that jellyfish can play within marine systems. For example, research has shown an enhanced survival of juvenile fish under jellyfish umbrellas. Using a multi-disciplinary approach this research aims to address both the negative and positive impacts jellyfish can have on fish communities.

Firstly I employed size-spectral analysis to look at historical abundance-body mass trends of jellyfish in the Irish Sea with the over-arching aim of opening the door for their more effective inclusion in ecosystem models in the future. Secondly I used phylogenetic comparative analysis to investigate the evolutionary and selective forces resulting in fish using jellyfish as a development habitat. Lastly, using stable and compound specific isotope analysis I aim to examine trophic linkages between jellyfish and different fish life stages and to quantify how these relationships change temporally.

This work will provide accurate and relevant information on the impact of jellyfish on commercial fisheries and assist with the development of an ecosystem approach to fisheries management.



Year Two

Postgraduate Seminar

Maximising the market and non-market benefits of small, privately owned woodlands through eco-labelling: identification of willingness-to-pay.

Kieran Higgins

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Alberto Longo, QUB, Prof. George Hutchinson, QUB and Dr. Marco Boeri, QUB.

Wooded areas provide us with a variety of market and non-market benefits, including timber, fuel, paper and other wood products, as well as biodiversity, carbon sequestration, and air and water quality improvement. Rising deforestation, contributed to by pressures on landowners to clear forested areas to use as pasture and arable land, may cause the irrevocable loss of these benefits. To combat this, we need to encourage landowners to create or retain wooded areas on their land, as well as manage them sustainably.

A proposed solution is the use of an eco-labelling scheme. Eco-labelling is a process by which distinctive branding is applied to a product to assure a customer that the product is "environmentally-friendly". Customers may be willing to pay more for eco-labelled forest products. Eco-labels allow producers of forest products to differentiate themselves in the market or enter new markets entirely. My work is attempting to determine how much more people are willing to pay for eco-labelled forest products, if at all, and the demographic characteristics of these people. If such a price premium is demonstrable, we may be able to provide a financial incentive to reverse land clearances.

Postgraduate Seminar

The role of higher protein forages and locally grown protein crops within Northern Ireland dairy production systems

David Johnston

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Conrad Ferris, AFBI, Dr. Niamh O'Connell, QUB and Dr. Katerina Theodoridou, QUB.

The milk yield potential of the Northern Ireland dairy herd has increased over the past few decades. These higher yielding cows require higher quality diets, and typically have a protein requirement of approximately 3.5kg DM/cow/day. Much of the protein requirements of dairy cows are met through imported protein feeds, such as soya and rapeseed meal and this has led to a number of issues, including: the high cost of protein ingredients, price fluctuations, sourcing non-genetically modified products, and supply volatility. Consequently, there is increased interest in replacing 'imported protein' with 'locally grown protein', with red clover *(Trifolium pratense)* and field beans *(Vicia faba)* being protein crops of particular interest in Northern Ireland. These two protein sources are currently being examined in my PhD studies at AFBI Hillsborough.

The first study, which involved 28 dairy cows, compared milk production, milk composition and nutrient utilisation, when either a grass silage based diet (GS) or red clover/grass silage (RC) based diet was offered. This 13 week study involved silages made from the first, second and third harvests of these two crops. When examined over the three harvests, total dry matter intake and milk production was increased with the RC diets, in comparison to GS diets. Furthermore, the RC crop had a nitrogen fertiliser saving of 293kg N/ha (equivalent to £195/ha).

The second study, which involved 60 dairy cows, examined the impact of replacing up to 50% of the 'conventional' protein sources in concentrates with field beans (up to 5.0kg field beans/cow/day). Field bean inclusion had no negative effects on milk yield and composition, total dry matter intake, body condition score and liveweight. Furthermore, methane production was unaffected by a field bean inclusion level of up to 5kg/cow/day, while the cost of the concentrates was reduced by approximately £20/t (from £269/t to £249/t) with field bean inclusion.

Outcomes from these studies suggest that the use of both red clover and field beans may allow Northern Ireland dairy farmers to reduce their reliance on imported protein crops.

Year Two

Postgraduate Seminar

Exploiting remote sensing technologies to improve farm animal management and production.

Christina Mulvenna

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Nikki Marks, QUB, Prof. Aaron Maule, QUB, Dr. Lewis Halsey, Roehampton University and Dr Michael Scantlebury, QUB.

Livestock production is facing a new set of challenges. An increasing human population has resulted in a continued demand for high quality but affordable animal protein. Subsequently, the number of sheep and lambs that are slaughtered annually has increased to over 10,500 in June 2016, whereas the value of lamb has decreased by 5.5% during 2015 to 2016. Livestock producers must therefore ensure that best-practice measures are implemented to improve the production efficiency whilst high standards of animal welfare and profit margins are maintained.

These targets can be addressed by determining precise behavioural profiles of individual animals. Recent developments in animal logging technology show great promise in determining animal behaviour and energy expenditure of instrumented animals. Tri-axial accelerometers were attached to sheep which were then allowed to forage freely at pasture. Activity was recorded simultaneously using a video camera. Discrete behaviours such as resting, walking and grazing could be clearly differentiated using the accelerometer data, as confirmed from the video recordings. The potential automated classification of data allows for easier processing of larger datasets and the potential to generate time energy budgets for sheep, which will provide invaluable information to producers regarding how the animals use energy.

Postgraduate Seminar

An evaluation of housing and grouping systems for Northern Ireland beef cattle.

Victoria Murphy

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Denise Lowe, AFBI, Dr. Francis Lively, AFBI and Dr. Niamh O'Connell, QUB.

Grouping animals to create homogeneous groups organised by age, gender, live weight and production stage is common practice in livestock husbandry. There is concern that mixing unfamiliar cattle may increase social stress and risk of disease, which may have implications for lifetime performance. Data were sourced from the Bovine Information System (BovIS), which assimilates slaughter data from local abattoirs, and the Animal and Public Health Information System (APHIS). The lifetime performance of beef cattle which had been finished on the farm of origin was compared with that of those that had two or more residencies in their lifetime. Predicted daily carcass gain of continental steers was 0.51kg for those that were finished on the farm of origin, and 0.48kg for those that had four farm residencies in their lifetime ($P<0.05$).

Concrete slats are a common floor type used to accommodate beef cattle in Northern Ireland. Public perception of concrete slats is that they may subject cattle to poorer welfare standards compared to bedded systems. Previous studies have indicated that 'enhancing' concrete slats with rubber may improve animal welfare. In a study evaluating the impact of floor type on the performance and welfare of beef cattle, results indicate no significant effect on the performance of young bulls accommodated on concrete slats compared to rubber strips during the growing period ($P>0.05$). There was also no significant effect of floor type on the number of steps/day. However, there was a tendency for animals on rubber strips to have a higher number of lying bouts/day ($P=0.057$), and shorter duration bouts of lying ($P=0.087$) and standing ($P=0.099$). These findings would merit further scientific research to more fully evaluate the impact of floor type on the welfare of beef cattle.

Year Two

Postgraduate Seminar

Predicting the interactions between climate change and invasive species and the potential threat to the sustainability of Irish Sea fisheries and aquaculture.

Josie South

School of Biological Sciences, Queen's University Belfast.

Supervisors: Prof. Jaimie Dick, QUB and Dr Julia Sigwart, QUB.

Numerous anthropogenic pressures threaten Irish Sea fisheries; these include fisheries pressure, habitat destruction, and threats that are summarised under the umbrella term of climate change. Climate change refers to a change in temperature, dissolved oxygen concentration, pH and salinity, amongst other things. Indirectly, climate change has an effect on species range, movement and behaviour and therefore mediates interactions between species in an ecosystem.

There is concern that with increasing temperature variability poikilothermic organisms' metabolisms will increase and therefore cause an increased predation rate. However, the success of a particular species within the new ecological parameters depends upon the trade off between the species physiological limits (enzyme denaturing) and the adaptational and ecological constraints, such as resources available and fishing pressure.

A model species *(Lipophrys pholis)* was used to understand how acute temperature change has an effect on the way predators consume resources. Changes in consumption with regards to resource density were studied across a range of temperatures. Results indicate that an increase in temperature facilitates an increase in prey consumption up to a thermal threshold whereupon feeding declines at low prey densities.

Postgraduate Seminar

Investigating the sustainability of the local honey bee population.

Stephen Bell

School of Biological Sciences, Queen's University Belfast.

Supervisors: Prof. Aaron Maule, QUB, Prof. Rob Paxton, Martin-Luther Universtat, Halle-Wittenburg and Dr. Nikki Marks, QUB.

Globally, honey bees are amongst the most important pollinators of agricultural crops and wildflowers. Indeed, without pollination human populations would become unsustainable as 75% of human food crops are reliant on pollinators, including bees. Insect pollinators also contribute to the economic viability of the agri-food sector, e.g. Northern Ireland's (NI) apple industry is valued at ~£7 million.

Colony collapse disorder (CCD) has been attributed to a myriad of factors, including ectoparasites, endoparasites, fungi, viruses, climate change and agricultural practices. Whilst the number of CCD cases, which initially caused a 50% drop in NI bee populations have markedly decreased, there are still significant colony deaths. No single factor has been identified as the main cause of colony death; there may be several factors at work. This project examines the impact of the parasitic mite, *Varroa destructor*, on honey bee populations through direct parasitism and the transfer of viruses. The data generated will directly contribute to NI's agri-food industry and rural economy by providing evidence for policy decisions on the sustainable maintenance of local honeybee populations and the development of novel control methods for the major exotic, emergent pest, the *Varroa* mite.

Year One

Postgraduate Seminar

Effects of land use practices on C sequestration and their implications for tackling GHG emissions for the agri-food sector in Northern Ireland.

Jonathan Blair

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Rodrigo Olave, AFBI, Dr. Beatrice Smyth, QUB, Dr. Erin Sherry, AFBI and Dr. Neil Reid, QUB.

Agriculture accounts for approximately 70% of land use in Northern Ireland. The majority of this is composed of grasslands. Approximately 3% of the land surface in NI is covered with hedgerows. Carbon sequestration is a priority for providing accurate carbon footprints of the agri-food sector. Current calculations of GHG emissions and removals rely on IPCC tier 1 approaches. Emission factors are assigned based on modelling from GB and, arguably, are not representative of Northern Ireland. Carbon sequestration and storage by grass and hedgerows in the landscape will be important for determining a GHG inventory more reflective of local conditions.

This research sets out to provide accurate information for the NI region on sequestration rates. Field measurements will be conducted on the impact of cultivation on the CO_2 exchange and estimation of carbon storage in hedgerows given local conditions. Impacts of sequestration rates on the net carbon footprint of farm production will be determined via carbon footprint calculations. Systematic sensitivity analysis will be used to test the stability of baseline carbon footprints given market and policy shocks. The research will provide a more accurate assessment of the net GHG releases from farming in Northern Ireland.

Instruments used for the measurements of CO_2 exchange in grasslands.

1. The eddy covariance method measures continuous flux.
2. Chamber based methods provide a point based measure of fluxes.

Postgraduate Seminar

Cattle and badger dynamics in relation to the potential transmission of *Mycobacterium bovis*.

Emma Campbell

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Fraser Menzies, DAERA, Dr. Andrew Byrne, AFBI, Dr. Mike Scantlebury, QUB and Dr. Neil Reid, QUB.

The European badger, *Meles meles*, is known to be a maintenance host of *Mycobacterium bovis* infection. By sub-typing strains of infected badger road kill, the same strain of *M. bovis* has been confirmed in badgers and local cattle herds. Research has looked at the risk of close contact between wildlife hosts and cattle which would allow direct aerosol spread; so far no definitive link has been proven. Bacilli have been shown to be excreted in animal urine and faeces, which could mean a possibility of excreta being responsible for indirect disease transmission.

The aim of the current PhD study is to help clarify the factors involved in the spread of bTB. Studies within the 100km^2 area of the 'Test, Vaccinate, Remove' (TVR) project in Co. Down will attempt to answer the following questions:

(1) Do badgers and cattle come into indirect contact at setts, latrines, badger runs, water troughs, feed stores and buildings?

(2) How many days during the grazing season are herds at risk of nose to nose contact with neighbouring cattle?

(3) Do badgers avoid entering fields with cattle present?

(4) Does inquisitive behaviour by cattle (e.g. dominance/age) affect bTB status?

It is hoped this project will contribute to increases in both the efficiency and cost-effectiveness of the bTB programme.

Year One

Postgraduate Seminar

Effects of long-term nutrient fertilization and land use change on the carbon sequestration potential of agricultural grasslands.

David Flynn

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Tancredi Caruso, QUB, and Dr. Dario Fornara, AFBI

Grasslands managed under 'Irish' conditions, might sequester large amounts of carbon in soils but neither their carbon sequestration potential nor the ecological mechanisms behind the carbon sequestration process are well understood. Soil organic matter formation in agricultural grasslands is regulated by the availability of multiple nutrients, whose positive synergistic effects on grassland yields are well known but whether and how these effects might also benefit the soil carbon sequestration process is still highly uncertain. Grasslands account for about 78% of the total farmed area in Northern Ireland and have high economic and societal value. By focussing on the role of grassland soils to act as carbon sinks, this project could have important implications for the carbon footprint of ruminant products and how they are marketed in Northern Ireland. This project also has the potential to aid in reducing the greenhouse gas levels emitted by the agricultural sector of Northern Ireland. Understanding how soil carbon sequestration changes across years is crucial for making predictions on the long-term sustainability of agricultural grassland soils.

Postgraduate Seminar

Aquaculture security: an evaluation of the social and economic threats to aquaculture security.

Michaela Fox

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Katrina Campbell, QUB, Prof. Moira Dean, QUB, Dr. Heather Moore, AFBI and Dr. Matt Service, AFBI.

The aquaculture industry in Northern Ireland is gaining importance as a prosperous producer and exporter of seafood, taking pressure off over-exploited and plateauing wild fisheries. However, it is apparent that the sector suffers great losses and emerging threats are of concern. In particular, aquaculture is highly dependent on its natural environment and with changes in climate there are predictions of new and increased harmful algal blooms and bacterial and parasitic diseases. Moreover, seafood's high value and increasing demand as a healthy alternative protein has increased its vulnerability to fraudulent activities.

To date the socio-economic impacts of these threats have not been addressed. Similarly, there are a number of proposed mitigation strategies but the acceptability, risk ranking and economic viability have not been examined.

The aim of this project is to holistically identify and evaluate the hazards, vulnerabilities and threats facing the sector and the counterbalance of mitigation strategies. Subsequently, sound risk analysis and ranking will allow the construction of a risk management matrix to enhance the sustainability and competitiveness of aquaculture production. Moreover, consumer studies will identity the drivers, influences and concerns of seafood consumption and offer insights into promotional activities for market place dominance.

Year One

Postgraduate Seminar

Characterisation, maintenance and refinement of the unique qualities of Armagh ciders.

Philip Hamill

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. John Hallsworth, QUB and Dr. Mark Mooney, QUB.

Production of artisan ciders is a rapidly expanding part of the fermented products sector in NI. A major component of Armagh Cider Company's ciders is the traditional Armagh Bramley apple which is, in terms of both taste and breeding, distinct from English Bramley apples (which are not used in cider making by any producer). The Armagh Bramley was awarded Protected Geographical Indication (PGI) status from the EU in 2012.

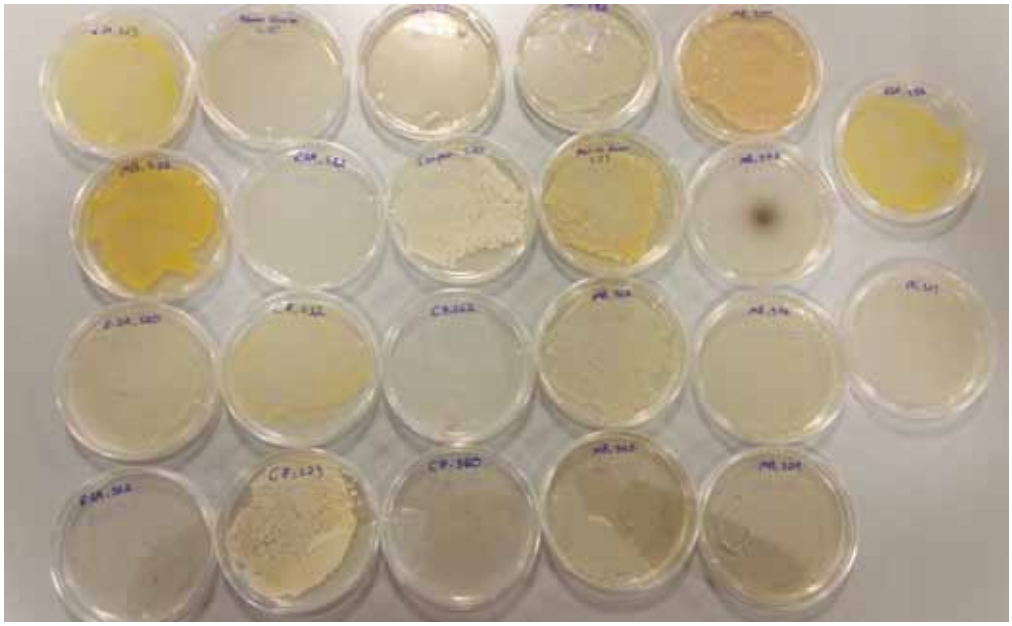
The overarching aim of this project is to characterise the distinctive microbiology of a premium, traditional Northern Ireland cider brand and to ensure the consistency of, and explore potential to further enhance, its quality. Specific aims are to:

1. characterise the cider fermentation and final product;

2. investigate consistency and maintenance of brand quality; and

3. enable manipulation of the microbiological fermentation (and product characteristics).

Preliminary results show that stressor compounds, such as glycerol, can intervene in the biophysical function of microbes under the hostile fermentation conditions and therefore determine the microbial community present during the fermentation process.



Isolation of microbes on diverse types of media.

Postgraduate Seminar

Identifying factors which affect feed efficiency and rumen development of dairy calves throughout rearing, in relation to biological and physical growth and development with possible consequences on first calving age and production efficiency.

Joshua McDowell

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Steven Morrison, AFBI, Dr. Katerina Theodoridou, QUB, Dr Paul Williams, QUB and Dr. Tassos Koidis, QUB.

The effects of calf rearing regimen on first lactation milk yield have been a topic of debate for several decades. Recent research has shown that feeding calves an elevated plane of nutrition has the potential to increase first lactation milk yield. However, there are problems associated with feeding calves large quantities of milk.

The purpose of this project is to address some of those problems, such as latent rumen development and depressed growth rates during the transition from a liquid based diet to a solid based diet. The study will seek to discover potential benefits of introducing various forage types to calves on an accelerated or conventional milk regimen at diverse time points in an attempt to mitigate such problems. The study will monitor concentrate, water and forage intakes throughout the milk rearing phase. Blood samples will also be analysed for various blood metabolites and rumen fluid samples will be collected for pH analysis, volatile fatty acid profiling and analysis of micro bacteria.

An additional component of this project will examine greenhouse gas emissions from dairy heifer replacements at various growth stages alongside nitrogen and energy utilisation to gain a greater understanding of possible influences of calf rearing on these outcomes. The project will seek to provide information on the nutritional requirements of calves both in the pre-weaning and post-weaned development stages.

Calves on production study

Calorimeter Chambers

Year One

Postgraduate Seminar

Investigation into the effects of fatty acids in the diet of swine on immune response and microfauna.

Robyn McKenna

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. John McKillen, AFBI, Dr. Mark Robinson, QUB and Prof. Gordon Allan, QUB.

Pig farming is one of the most significant agricultural activities across the European Union and is of considerable importance to the economy here in Northern Ireland. In 2006 an EU wide ban prohibiting the use of antibiotics as growth promoters was implemented and has since resulted in the urgent requirement for an innovative and long-term alternative that will not only boost pig performance and efficiency but will also direct the safe and sustainable production in this post-antibiotic era. The objective of this project is to collaborate with the feed industry with a view of investigating the link between swine health and nutrition; more specifically the aim is to produce industry-relevant information regarding the strategic use of fatty acids as a swine health supplement. The project can essentially be broken into four main research areas, each investigating various immunological pathways:

1. In vitro immunological effect of fatty acids on porcine cells;
2. The effect of fatty acids on porcine immunology in vivo;
3. Antiviral properties of fatty acids in swine; and
4. Antibacterial effects of fatty acids in swine.

This research will ultimately evaluate the effects of fatty acids on swine immunology, virology and microbiology in order to create a safe, wholesome feed product with advantages to animal health and welfare as well as benefits that will reverberate through the supply chain and help improve the performance and sustainability of the agri-food sector here in Northern Ireland.

Postgraduate Seminar

Linking Northern Ireland milk quality to farming landscape: elemental nutrient and microbial signatures.

Claire McKernan

School of Biological Sciences, Queen's University Belfast.

Supervisors: Prof. Andrew Meharg, QUB, Dr. Caroline Meharg, QUB and Dr. Irene Grant, QUB.

Milk is a primary source of trace elements iodine and selenium. Iodine forms an integral part of the thyroid gland hormones, Thyroxine (T4) and 3, 5, 3'- Triiodothyronine (T3), and is therefore important in the function of the thyroid gland in regulating the body's functions. Selenium is fundamental as it forms a portion of 25 selenoproteins involved in various biochemical functions within the body.

Dietary intakes of selenium and iodine are insufficient and the UK is among the top ten countries worldwide having issues concerning iodine.

Pathogenic and spoilage bacteria are normally present in milk. However, milk also contains beneficial bacteria including probiotic bacteria *(Lactobacilli)*, and fermenting bacteria *(Lactococcus, Lactobacillus)* important for the development of dairy products.

The aim of this project is to determine if milk product quality will vary at a landscape scale, directly related to the soils that pasture fed cows are grazed on, analysing geochemical and microbial components.

Samples of milk, soil, silage and grass have been collected from 71 farms across Northern Ireland. The selenium and iodine levels will be quantified using inductively coupled plasma-mass spectroscopy (ICP-MS). In addition, microbial analysis will be completed using PCR to determine and compare the microbial diversity in milk samples.

Year One

Postgraduate Seminar

Noise pollution as an emerging threat to fisheries: a case study using the Norway lobster *(Nephrops norvegicus)*.

Lorraine McLean

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Hansjoerg Kunc, QUB, Dr. Jonathan Houghton, QUB, Dr. Adam Mellor, AFBI and Dr. Paul Mensink, QUB.

Anthropogenic noise is a global pollutant in both terrestrial and marine environments. Oceans have become increasingly busy through human activities such as shipping, construction, acoustic surveys and removal of resources, thus marine fauna is now subject to higher noise levels than ever before. To protect the ocean from increasing noise levels there is a requirement to monitor and limit noise levels in the ocean. However, defining sustainable levels is difficult when thresholds that cause harm are unknown, especially in the understudied invertebrates.

Previous work has concentrated on marine mammals and fish, but some recent studies suggest that crustaceans are also sensitive to anthropogenic noise. Using both tank based and *in situ* experiments, this project will investigate how a commercially important species, *Nephrops norvegicus*, is affected by changes in the acoustic environment. The Nephrops fishery is the largest, single, local sea fishery in Northern Ireland, so it is of commercial and ecological importance to establish thresholds above which *Nephrops norvegicus* may respond in a way that is detrimental to their fitness or that influences their catchability.

Postgraduate Seminar

Commercial and ecological impacts relating to the banning of discards.

Paul Mayo

School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Steven Beggs, AFBI, Dr. Jonathan Houghton, QUB and Dr. Paul Mensink, QUB.

Fishing activity (i.e. trawling) has many ecological consequences, including the destruction of benthic habitats and generating large amounts of bycatch and discards. However, these actions can be beneficial to some species through the provision of food in the form of discards or exposing benthic prey in the aftermath of a trawl. This type of anthropogenic 'benefit' has been shown to alter foraging behaviour in marine scavengers with demersal elasmobranchs often found in close association with trawling sites. Exactly how trawling influences the distribution of demersal elasmobranchs has yet to be explored, and in light of a recent change to the common fisheries policy, the current response to fishing activity should be fully assessed to determine how future fisheries practices may affect the distribution of demersal predators.

This project aims to provide an overview of how current fishing activities in the Irish Sea affect the foraging behaviour and distribution of demersal elasmobranchs. I will use the lesser spotted dogfish *(Scyliorhinus canicula)* as a model species due to its resilience to trawling activity, high relative abundance and widespread distribution throughout the Irish Sea. To investigate the response of dogfish to trawling I will:

(1) spatially model how dogfish biomass and distribution is altered by fishing intensity;

(2) use mesocosm-based experiments to show whether dogfish redirect foraging efforts from naturally occurring putative prey (e.g. *Nephrops*) to introduced immobile prey (i.e. discards); and

(3) validate findings from mesocosm experiments and investigate the succession of demersal scavengers to introduced food sources with the use of *in situ* baited remote underwater video (BRUVs).

Year One

Postgraduate Seminar

Development and assessment of potential diagnostic and biocontrol measures against soft rot in vegetables.

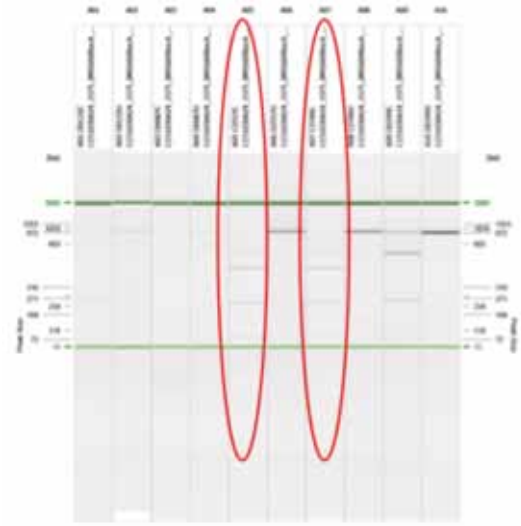
Maja Zaczek-Moczydlowska

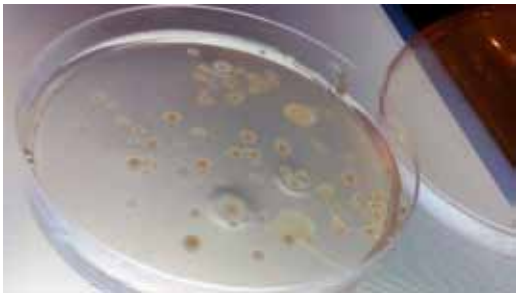
School of Biological Sciences, Queen's University Belfast.

Supervisors: Dr. Gillian Young, AFBI, Dr. Katrina Campbell, QUB and Dr Colin Fleming, AFBI.

Soft rot caused by *Pectobacterium* spp. is one of the most devastating and difficult to control diseases of crops, causing severe post-harvest losses on a wide range of vegetables, fruits and ornamentals. Of these, *P. carotovorum* is perhaps most virulent and widespread, and has been assigned to the top 10 most economically important plant pathogenic bacteria. Although difficult to assess, it has been well documented that few other phytopathogenic organisms can produce greater economic losses. There is currently no treatment for soft rot, and control is largely based on the use of sanitary growing and storage practices. Losses vary between countries and regions, but are estimated to be 15-30% of harvested crops overall, representing serious economic loss to producers.

2015/2016 is the first year of a three-year DAERA-funded PhD project which aims to show that soft rot can be controlled, at least partially, though the use of 'green' biocontrol technologies. Two novel biocontrols against soft rot in potato, carrot and onion are being developed and assessed through greenhouse, field trial and aeroponic experiments: bacteriophages (viruses that infect and kill bacteria); and bacteria that are known to be capable of secreting antibacterial compounds (for example, *Pseudomonas* and *Bacillus*).





New student research topics - due to commence 1 October 2016

- ## Development of a dynamic mathematical model to assess spread and control of bovine tuberculosis integrating both domestic and wild host dynamics.

Emma Brown
Supervisors: Dr. Andrew Byrne, AFBI, Prof. Adele Marshall, QUB and Dr. Karen Cairns, QUB.

The cattle industry in Northern Ireland is worth over £1 billion per year. Bovine Tuberculosis (bTB) has a significant impact on this industry as it restricts access to export markets. The difficulty of eradicating this disease is due to the complex way that cattle can be infected, either from another infected animal or contaminated environments. Modelling the disease's spread and density could lead to decreased disease levels through prediction of disease outbreaks and application of effective preventive methods.

- ## Early detection of plant diseases using remote sensing.

Ciarán Carlin
Supervisors: Dr. Gillian Young, AFBI, Dr. Katrina Campbell, QUB and Dr. Colin Fleming, AFBI.

The forestry industry in Northern Ireland is worth £175 million annually, with an estimated 5,500 jobs and exports an estimated 11.5 million tonnes of wood. This project aims to reduce the impact of diseases on plant populations by producing earlier detection methods through the creation of a technical road map and mapping using remote sensing and geospatial analysis. It is proposed that this work will allow more efficient management and eradication of new disease outbreaks.

- ## Rural social exclusion in Northern Ireland: identifying the key social issues.

Lorraine Holloway-McCarney
Supervisors: Prof. Sally Shortall, QUB and Dr. Ruth McAreavy, QUB.

There are still gaps evident in our understanding of rural social exclusion/inclusion in rural Northern Ireland. This research will examine what we mean by social exclusion/inclusion. It will consider how rural development programmes do, or might, address the issue of social exclusion. Rural development programmes regionally and across the EU will be examined. The intention is to provide some recommendations that may inform rural development policy.

- ## Perception predominates preparedness: how perceived climate change effects affect agriculture practices.

Emma-Louise Kells
Supervisor: Dr. Roy Nelson, CAFRE.

Previous investigations of farmers' perceptions regarding climate change demonstrated a need to ascertain how perception affects both decisions and actions concerning climate change preparedness, or adaptation, in Northern Irish Agriculture. This project aims to develop a predictive model identifying the complex decision making processes undertaken by farmers related to the 'threat' of climate change and accompanying industry pressures. The findings could aid policy formulation, education and training for further future adaptation helping to safeguard sustainability throughout the agri-food supply chain.

- ## Rural poverty and social isolation: an analysis of policy effectiveness using natural experiment within Northern Ireland.

Ryan McGuire
Supervisors: Dr. Alberto Longo, QUB, Dr. Judith Stephens, QUB and Prof. George Hutchinson, QUB

DAERA's Tackling Rural Poverty & Social Isolation (TRPSI) Framework (2011-2017) aimed to mitigate rural deprivations. There have been many beneficiaries from TRPSI, but its impact needs to be measured. This is the overall objective of this research and will do so by using natural experiment and statistical econometrics (analysis). The results will provide an official review of the effect of TRPSI and will inform future policies with the potential to ameliorate rural deprivations.

- ## Microbial ecology of bee pathogens: averting the threat to the Irish bee.

Conor McKinley
Supervisor: Dr. John Hallsworth, QUB.

Bees, as pollinators of plants, play a crucial role in maintaining Northern Ireland's scenic landscape. This study will characterise the ecology of *Paenibacillus larvae (American foulbrood)* and *Melissococcus plutonius (European foulbrood)* in order to prevent disease in, and destruction of, bee populations. It will identify where these bee pathogens multiply; characterise modes of transmission from environment to bees; determine risk factors which give rise to disease outbreaks; design protocols to prevent epidemics; and use knowledge-based insights and innovative approaches to safeguard the sustainability of bees across Ireland.

- ## Remediation of agricultural wastes to grow algal biomass for nutritional supplements in animal feed.

Clare Maguire
Supervisors: Dr. Pamela Walsh, QUB, Dr. Gary Sheldrake, QUB and Prof. Jaimie Dick, QUB.

Industrial supervisor: Thomas Cromie, Agri AD Ltd.

Currently algal biotechnology is unexploited in N. Ireland. However, algae are around twice as productive as terrestrial plants (e.g. maize), do not compete for land with food crops, and can be integrated with nutrient resource management systems currently being developed in N. Ireland. They are rich in nutritional lipids, e.g. omega-3, which are an important dietary requirement currently deficient in our diets. This project will investigate the ability to produce a sustainable source of omega-3 and other high value supplements from the bioremediation nutrients from AD digestate.

- ## Evaluating the role of sediment and physical catchment characteristics on aquatic ecosystems and their impact on the recovery of biological water quality in Northern Irish river systems.

Andrew Rice
Supervisors: Dr. Rachel Cassidy, AFBI, Dr. Yvonne McElarney, AFBI, Dr. Joerg Arnscheidt, UU and Prof. Phil Jordan, UU.

In the 2012 assessment under the EU Water Framework Directive only 21.7% and 0.5% of NI Rivers reached good or high status, respectively. Siltation has been identified as an important stressor for these aquatic environments and can be anticipated to rise with the intensification of land use required to achieve the targets for increased agricultural production. But a lack of quantitative data remains. Therefore, this project will identify siltation hotspots and mitigation options through a quantitative investigation of fine solids in selected Northern Ireland rivers with regards to catchment sources, transfers and impacts upon stream ecology.

• Development of systems to improve dairy beef young stock health and performance.

Naomi Rutherford
Supervisors: Dr. Francis Lively, AFBI and Dr. Gareth Arnott, QUB.

Dairy-origin beef production represents over 50% of prime beef produced in Northern Ireland. Calf mortality and morbidity is a major challenge and cost for producers while antibiotic usage in agriculture is a major concern for consumers. This project will evaluate the impact of prophylactic antibiotic treatment on lifetime antibiotic usage and will evaluate alternatives to antibiotics (including calf jackets, essential oils and level of milk replacer) for improving calf health and efficiency of beef production.

• High-value functional dairy products from low-value whey proteins: proving the concept.

Joanna Shooter
Supervisors: Dr. Brian Green, QUB, Dr. Michelle McKinley, QUB,
Prof. Jayne Woodside, QUB and Dr. Stephen Hunter, Royal Victoria Hospital.

The dairy industry has long been a key component of the local agri-food sector. This research will seek to prove that whey, a low value by-product of several dairy food processes, can become the base source for high value functional foods, thereby meeting the long-standing aim of continually extracting greater value from the supply chain. The overall project aim is to investigate the effect of whey protein on metabolic health when delivered in isolation or within the dairy matrix.

- ## Legacy P in Lough Neagh sediments, understanding the characteristics and estimating timescales of recovery.

Emma Smyth
Supervisors: Prof. Brian Rippey, UU, Dr. Richard Douglas, UU, Dr. Yvonne McElarney, AFBI and Dr. Rachel Cassidy, AFBI.

The history of water quality in Lough Neagh is well known, with the key events being deterioration from the early 1900s, due to increasing concentrations of phosphorus and then nitrogen, and a sudden increase in the release of phosphorus from the sediment in the late 1960s. While the lake has improved recently, sediment phosphorus release will delay further recovery and so the aim of this project is to use the sedimentary record to estimate the timescale of recovery and the role of midge larvae in the release.

- ## How can Northern Ireland more effectively deliver plant health protection to contribute to the DAERA vision of a thriving and sustainable rural economy?

Rebecca Stevenson
Supervisor: Dr. Brian Jack, QUB.

This research project will contribute to DAERA's vision to establish a thriving and sustainable rural economy, community and environment in Northern Ireland by ensuring appropriate controls are in place to protect agricultural and horticultural production, forestry and woodlands from pest and disease risks. This research will contribute to DAERA's goal to enhance animal, fish and plant health and welfare. This will aid the 'Growing for Growth Strategy' by assessing and advocating the appropriate controls to protect Northern Ireland's trading position.

Notes

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